EXAMINATION PRACTICE GUIDELINES BY TECHNOLOGY FIELD

March 2026

Ministry of Intellectual Property
Republic of Korea

(Note) This English version of the Ministry of Intellectual Property's Examination Practice Guidelines by Technology Field is based on the Korean-language Guidelines published in March 1, 2026. In the event of any discrepancy or ambiguity between the Korean and English versions, the Korean version shall prevail.

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Chapter I Examination Practice Guidelines in the Artificial Intelligence Field

(Drafted · Amended by Artificial Intelligence/Big Data Examination Division)

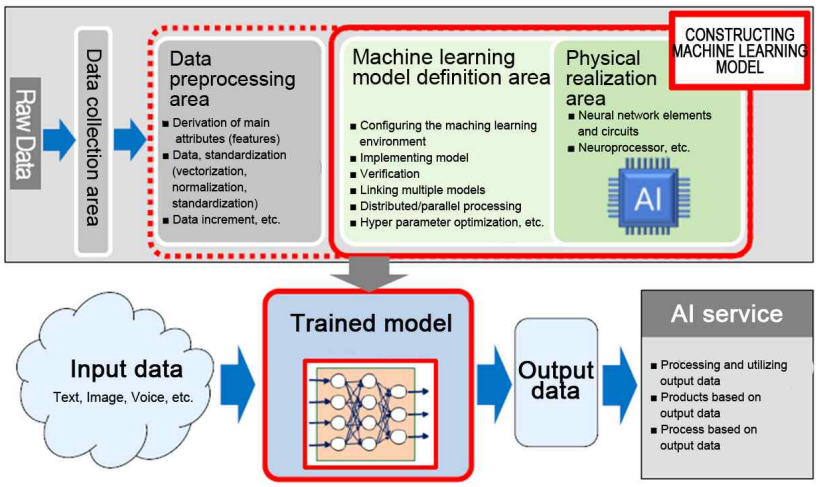
AI Field Examination Guidelines, Established in December 2020
AI Field Examination Guidelines, Amended in December 2021
AI Field Examination Guidelines, Amended in May 2023
AI Field Examination Guidelines, Amended in January 2026

1. Introduction

This chapter provides examination guidelines for inventions whose implementation requires artificial intelligence (AI) technologies based on machine learning (hereinafter referred to as “AI-related inventions”).

Matters not specifically addressed in this chapter shall be examined in accordance with the Examination Guidelines for Patents and Utility Models or the Examination Guidelines for Computer-Implemented Inventions, as applicable.

※ Overview of AI-Related Inventions Used in this Examination Guidelines



[Note]

The examples of claims, descriptions of the invention, drawings, etc., contained in this chapter have been edited in a simplified and concise form to illustrate the assessment of patentability requirements.

1.1 Explanation of Terminology Used in Examination Cases

Key terminology used in this guidelines has meanings as follows:

• Artificial Neural Networks (ANNs)

An artificial neural network (ANN) is a type of machine learning model having a network architecture in which multiple neuron layers are interconnected by weighted connections (synaptic weights), designed to simulate the manner in which the human brain processes and analyzes information. A representative structure of an ANN is a multi-layer perceptron (MLP) comprising an input layer, an output layer, and one or more hidden layers arranged between the input layer and the output layer.

• Convolutional Neural Networks (CNNs)

A convolutional neural network (CNN) is a type of deep neural network (DNN) comprising one or more convolutional layers, optionally one or more pooling layers, and one or more fully connected layers. The architecture of a CNN is particularly well suited for learning from two-dimensional (2D) data, such as images. A CNN may be trained using a backpropagation algorithm in conjunction with a loss function and an optimization procedure.

CNNs are among the most representative models of deep neural networks and are widely used in various technical fields, including image classification, object detection, and related computer vision applications.

• Recurrent Neural Networks (RNNs)

A recurrent neural network (RNN) is a type of deep learning model designed to learn from sequential or time-dependent data, such as time-series data. An RNN includes recurrent connections in which outputs from previous time steps are fed back into the network, thereby enabling

the model to maintain contextual information over time. As a representative architecture addressing issues such as vanishing or exploding gradients in conventional deep neural networks applied to sequential data, long short-term memory (LSTM) networks —a type of recurrent neural network— may be used.

2. Description Requirements

2.1 Description of the Invention

2.1.1 Enablement Requirement

The enablement requirement for AI-related inventions shall be determined in accordance with 『Requirement for Written Description, Chapter 3, Part II』 of the Patent and Utility Model Examination Guidelines, as applicable.

The specification shall describe the invention in a manner that is clear and sufficiently detailed to enable a person skilled in the art to carry out the subject matter defined in the claims, based on the common general knowledge at the time of filing.

In particular, where artificial intelligence technologies are applied in a claimed invention, the specification shall describe the relevant AI-related technical features in such a way that a person skilled in the art can clearly understand the specific technical means employed, the technical problem to be solved, and the technical solution for solving the problem, thereby enabling the skilled person to implement the AI-related invention without undue burden.

Specific technical means for implementing an AI-related invention may include, for example, training data, data preprocessing methods, the structure of a learning (machine learning) model, a loss function, etc.

However, where a person skilled in the art would clearly understand a particular implementation means in view of the common general knowledge at the time of filing, the absence of an explicit description of such means in the

specification or drawings shall not, by itself, result in a finding of lack of enablement.

2.1.2 Examples of Violations of the Enablement Requirement

(1) Where the description merely recites, in abstract or functional terms, technical steps or functions corresponding to those defined in the claims, but fails to disclose how such steps or functions are implemented by specific hardware or software, and a person skilled in the art cannot clearly understand the implementation—even in view of common general knowledge at the time of filing—and therefore cannot carry out the claimed invention without undue experimentation

(Ex) The claims relate to generating a trained model (in inference mode) for disease prediction using a plurality of artificial neural networks (ANNs) arranged in an ensemble. However, the description does not specify the structure or configuration of the multiple ANNs constituting the ensemble, does not disclose the specific means or process for generating the trained disease prediction model using the ensemble, and does not provide sufficient detail enabling the skilled person to understand such means or process, even in light of common general knowledge at the time of filing.

(2) A specification does not satisfy the enablement requirement where it fails to specifically describe the correlation between the input data and the output data of a trained model as part of the technical means for implementing the AI-related invention.

A sufficient description of such correlation generally requires that ①the training data are clearly identified and defined; ②a correlation exists between characteristics of the training data that contributes to solving the technical problem addressed by the claimed invention; ③the learning model structure and/or training method used with the training data is specifically described; and ④a trained model is generated, using the specified training

data and training method, for solving the technical problem of the claimed invention.

If, however, a person skilled in the art can reasonably infer or understand such a correlation from embodiments described in the specification, taking into account the common general knowledge at the time of filing, the enablement requirement shall be considered satisfied.

(Ex) The claims relate to automatically controlling the temperature of a house using a machine learning model trained with weather data (e.g., temperature, humidity) and environmental data (e.g., fine dust information). The specification specifically describes a correlation between weather data and control information for automatically regulating the house temperature using the machine learning model. However, although environmental data are listed as input data, the specification does not describe any correlation between the environmental data and the output data (i.e., temperature control information). In such a case, the description fails to satisfy the enablement requirement, unless a person skilled in the art would reasonably infer such correlation in view of the embodiments and common general knowledge at the filing date.

(3) Where the specification explains hardware or software implementing the claimed invention only by means of general 「functional block diagrams」 or 「flow charts」, without disclosing how the hardware or software is concretely configured or programmed, and a person skilled in the art cannot clearly understand the technical implementation—even in view of common general knowledge at the time of filing—and thus cannot carry out the claimed invention without undue experimentation

2.1.3 Notes

(1) Where the subject matter defined in a claim is characterized by the application of machine learning, and the technical problem can be solved by relying on a general-purpose machine learning technique[1)], the

enablement requirement shall not be deemed unsatisfied solely because the specification does not describe a specific learning model architecture or detailed training procedure.

(2) Certain AI-related inventions based on machine learning are characterized by specific data preprocessing techniques for transforming collected raw data into training data. In such cases, the enablement requirement is not satisfied where the specification fails to describe (i) how the data preprocessing steps or functions are performed to convert collected raw data into training data, including any generation, modification, augmentation, or deletion of raw data; and (ii) the technical correlation between the collected raw data and the resulting training data used for model training. However, if a person skilled in the art would clearly understand the data preprocessing subject matter based on the embodiments described in the specification, taking into account the common general knowledge at the time of filing, the enablement requirement shall be deemed satisfied.

(3) For inventions based on reinforcement learning, the specification should describe the reinforcement learning framework with sufficient technical detail, including the correlation among the agent, the environment, the state, the action, and the reward. If the specification does not specifically provide such relationships and a person skilled in the art cannot clearly understand how the reinforcement learning process is implemented, the enablement requirement is not satisfied. Conversely, if the skilled person can clearly understand the reinforcement learning subject matter based on the embodiments disclosed in the specification, in light of common general knowledge at the filing date, the enablement requirement shall be considered satisfied.

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1) In conventional machine learning techniques, convolutional neural networks (CNNs) have been widely employed in pattern recognition fields, such as character recognition and speech recognition, whereas recurrent neural networks (RNNs) have been widely utilized in automatic translation and natural language processing. Further, mean squared error and cross-entropy are commonly adopted as loss functions in machine learning. In order to determine optimal model parameters, back-propagation and stochastic gradient descent (SGD) are typically employed, along with optimization algorithms such as AdaGrad and AdaDelta.

(4) Where an invention applying AI technology relates to a chemical substance invention or a medical use invention, and the claimed subject matter is directed to the substance itself (including pharmaceutical compositions), examination shall be conducted in accordance with the examination guidelines applicable to chemical substance inventions or medical use inventions

(※ Refer to 『2.3.2 Handling of Special Cases, Chapter 3 Description of Invention, Part II』 of the Patent and Utility Model Examination Guidelines and 『Chapter 2 Description Requirements』 of the Medical Field Examination Guidelines).

2.2 Claims

2.2.1 Support by the Description

2.2.1.1 Description Requirement

For AI-related inventions, whether the claims are supported by the description shall be assessed in accordance with the requirements set forth in 『Claims, Chapter 4, Part II』 of the Patent and Utility Model Examination Guidelines. In particular, the requirement that the claims be “supported by the description” shall be examined with due consideration of the specific characteristics of AI-related inventions.

2.2.1.2 Cases Where the Claims Are Not Supported by the Description

The following are representative cases in which the subject matter defined in a claim is not supported by the description.

(1) Where the technical features corresponding to the ones recited in a claim or claims are neither explicitly disclosed in the description nor implicitly derivable by a person skilled in the art from the disclosure

(2) Where a claim defines an invention in terms of a ‘means’ or ‘step’ for performing a specified function, but the description does not disclose specific

technical features corresponding to such means or step

(3) Where the matters disclosed in the description cannot be reasonably generalized to the full scope of the claimed invention in view of the common general knowledge at the filing date

2.2.2 Clear and Concise Description of the Claimed Invention

2.2.2.1 Claim Description Requirements

The description requirements for claims directed to an AI-related invention shall be assessed in accordance with 『Description Requirements of Claims, Part II, Chapter 4』 of the Patent and Utility Model Examination Guidelines. In particular, with respect to AI-related inventions, special attention shall be given to compliance with the requirement that the claims clearly and concisely define the invention.

2.2.2.2 Categories of AI-Related Inventions

An AI-related invention shall be claimed in one of the recognized statutory categories, including a method (process) invention or a product (apparatus or system) invention.

(1) Method (Process) Invention

An AI-related invention may be claimed as a method by reciting a sequence of technical steps performed in a time-ordered manner.

(2) Product (Apparatus or System) Invention

Where the AI-related invention can be expressed as a plurality of functional components configured to perform specific technical operations, the invention may be claimed as an apparatus or system defined by those functional features.

In addition, AI-related inventions implemented by software may be claimed in

the following forms: ①a claim directed to a computer-readable storage medium; ②a claim directed to a computer program recorded on a computer-readable storage medium; ③a claim directed to a computer program recorded on a computer-readable storage medium. Where the invention relates to a trained model or to an apparatus utilizing the trained model, the claim may be drafted as (i) a computer-readable storage medium claim directed to a computer program for implementing a trained model, or (ii) an apparatus claim directed to an apparatus configured to use a trained model.

① Claim Directed to a Computer-Readable Storage Medium

A computer-readable storage medium storing a computer program, i.e., a computer-readable storage medium on which a computer program is recorded (stored) and which is used for installing, executing, or distributing the computer program, may be claimed as a product invention.

(Ex1) A non-transitory computer-readable storage medium storing instructions that, when executed by a computer, cause the computer to perform Step A, Step B, Step C, ...

(Ex2) A non-transitory computer-readable storage medium storing instructions that, when executed by a computer, cause the computer to function as Means A, Means B, Means C, ...

(Ex3) A non-transitory computer-readable storage medium storing instructions that, when executed by a computer, cause the computer to perform Function A, Function B, Function C, ...

② Claim Directed to a Computer Program Recorded on a Computer-Readable Storage Medium (Combined with Hardware) (Applicable to applications filed on or after July 1, 2014)

(Ex) A computer program stored on a non-transitory computer-readable storage medium for causing a computer to perform Step A, Step B, Step C, ...

※ In contrast, a claim directed to a computer program per se, i.e., not embodied in a computer-readable storage medium, is not allowable.

(Ex) A computer program that, when executed by a computer, causes the computer to perform Step A, Step B, Step C, ...

③ Claim Directed to a Computer Program Recorded on a Computer-Readable Storage Medium

A claim may be drafted as a product invention directed to a computer-readable recording medium storing a data structure, where the data structure defines processing to be performed by a computer.

(Ex) A computer-readable recording medium storing a data structure defining structure A, structure B, and structure C, wherein the data structure controls operation of a computer to perform a specified process.

④ Computer Program Claim Stored on a Recording Medium Implementing a Trained Model

A “trained model” refers to a model generated through a training process executed by a computer using training data and a defined learning mechanism. When claiming an invention involving a trained model, the claim shall define, in addition to the trained model itself, specific technical means that implement the artificial intelligence-related invention. Such specific technical means may include, for example: training data or characteristics thereof, data preprocessing techniques, a loss function, or other learning-related technical features.

The model may be defined based on the fundamental structure of a machine learning architecture. For example, in the case of a neural network, the claim may specify a structure comprising: an input layer, an output layer, and one or more hidden layers disposed between the input and output layers, in combination with at least one of the above-mentioned learning-related technical means. Examples of models include, but are not limited to: convolutional neural networks (CNNs), recurrent neural networks (RNNs), and other neural network architectures.

In the example below, the claim recites the basic structure of a neural

network as well as learning-related elements such as a loss function and training data (see parentheses). However, it is sufficient that at least one specific technical means required for training be included in the claim.

Nevertheless, even in such a case, in order to satisfy the written description requirement, the description of the invention must disclose, in addition to the structure of the trained model, concrete learning-related means required for the trained model to function, such as the loss function and the training data.

(Ex) Claim Based on a Program Stored on a Recording Medium

[Claim] A non-transitory computer-readable storage medium storing instructions that, when executed by a processor, cause the processor to implement a trained model comprising an input layer, one or more hidden layers, and an output layer, wherein the input layer comprises a plurality of input nodes configured to receive a training data image including a plurality of objects and locations of the plurality of objects; wherein the one or more hidden layers comprise a plurality of hidden nodes configured to extract feature information relating to the plurality of objects and the locations of the plurality of objects; and wherein the output layer is configured to output, based on the extracted feature information, a probability value indicating that the plurality of objects are located at a specific place; and (wherein the trained model is configured to be trained through backpropagation so as to optimize a loss using a loss function (cost function)).

[Prerequisite Condition] The matter described in parentheses above exemplifies specific learning-related technical means that may be additionally recited to satisfy other patentability requirements. The claim is required to include at least one specific technical means necessary for training.

※ In the expression “a program implementing a trained model,” the term “trained model” may alternatively be expressed as an “AI model,” an “artificial intelligence model,” or a “deep learning model.”

⑤ Apparatus (Device) Claim Using a Trained Model

(Ex) A claim applicable to various artificial intelligence products utilizing a trained model

[Claim] An AI speaker comprising a voice processing unit configured to process voice signals using a trained model comprising an input layer, one or more hidden layers, and an output layer, each including one or more nodes associated with one another by weights,

wherein the input layer comprises a plurality of input nodes configured to receive training data including user voice information and emotional content information corresponding to the voice information;

wherein the one or more hidden layers comprise a plurality of hidden nodes configured to extract feature information relating to the user voice information;

wherein the output layer is configured to output corresponding content information based on the extracted feature information; and (wherein the trained model is configured to be trained through backpropagation so as to optimize a loss using a loss function (cost function)).

[Prerequisite Condition] The matter described in parentheses above exemplifies specific learning-related technical means that may be additionally recited to satisfy other patentability requirements. Instead of the AI speaker, various application products may be recited as the claimed subject matter, together with their respective functional components (e.g., the voice processing unit in this example).

※ In addition to an “AI speaker,” where the trained model is applied to other use cases such as a prediction model or a classification model, the claim may be drafted in the form of: a non-transitory computer-readable storage medium storing a program implementing a prediction model using a trained model; or a non-transitory computer-readable storage medium storing instructions for implementing a classification model based on a trained model.

2.2.2.3 Examples of Indefinite or Unclear Claims

(1) Where It Is Unclear Who Performs the Claimed Processing

Where a claim merely recites the realization of “calculation or processing of specific information according to a purpose of use,” but the specification does not make clear which entity (e.g., hardware component or processor) performs the processing, the claim fails to clearly define the invention.

(2) Where the Subject Matter of the Claim Is Not Clearly Defined

Where a claim concludes with expressions such as “program product” or “program outcomes,” and it is unclear whether the claimed subject matter is directed to: a non-transitory computer-readable medium storing a program, or a computer system having a program stored therein, the invention category and technical features are not clearly defined, and the claim lacks clarity.

(Ex) “… an artificial neuron (architecture, framework, API engine, etc.) stored on a non-transitory computer-readable medium, including an input layer, a hidden layer, and an output layer …”

☞ In the above example, the subject matter of the invention is not clearly defined, as the artificial neuron or the like composed of an input layer, a hidden layer, and an output layer does not clearly indicate a statutory invention category.

(3) Where the Category of the Claimed Invention Is Unclear

Where a claim concludes with expressions such as “program signals” or “program signal sequence,” and it is unclear whether the claim is directed to a product or a method, the statutory category of the invention is not clearly defined.

(Ex) “… an algorithm including an input layer, a hidden layer, and an output layer, stored on a computer-readable storage medium …”

☞ The above example is interpreted as an algorithm composed of an input layer, a hidden layer, and an output layer, and therefore fails to clearly define the category of the invention.

(4) Other Cases Where the Invention Is Not Clearly Defined

(Ex) “… a recording medium storing a program composed of an input layer, a hidden layer, and an output layer.”

☞ In the above example, the input layer, hidden layer, and output layer are not appropriate as constituent elements of a program.

(Ex) “… an apparatus (e.g., an AI speaker) including an input layer, a hidden layer, and an output layer.”

☞ In the above example, the input layer, hidden layer, and output layer are not suitable or are difficult to specify as constituent elements of a physical apparatus.

2.2.2.4 Notes

(1) If, even when the claims are considered as a whole, it remains unclear which entity (e.g., hardware component or processor) performs the claimed processing, attention should be given to whether: the claims fail to define specific technical means—such as cooperation between hardware and software—for performing computation or processing of particular information according to a stated purpose of use (see Section 3.1.2, “Specific Method of Assessment,” under Section 3.1, “Subject Matter Eligibility,” AI Field Examination Guidelines); and the claims fail to clearly define the invention (see Section 2.2.2.3, “Examples of Indefinite Claims,” under Section 2.2.2, “Clear and Concise Description of the Claimed Invention,” AI Field Examination Guidelines).

If a single office action is sufficient to address multiple grounds of rejection simultaneously, the examiner need not issue separate office actions, in order to promote procedural efficiency and ensure prompt and accurate examination. For example, where a rejection for failure to satisfy the claim description requirement (e.g., lack of clarity) sufficiently addresses issues relating to subject matter eligibility, a separate rejection on subject matter eligibility need not be issued. Conversely, where a rejection on subject matter eligibility adequately resolves overlapping issues, an additional rejection for lack of clarity is not required.

3. Patentability Requirements

This section explains the requirements for subject matter eligibility and for novelty and inventive step, which are particularly important in the assessment and examination of patent applications relating to AI-related inventions.

3.1 Requirements for Subject Matter Eligibility

3.1.1 General Principles

An AI-related invention is generally a computer-implemented invention based on information processing by software. Accordingly, the criteria for determining subject matter eligibility of an AI-related invention are, in principle, the same as those applied to computer- or software-related inventions.

To qualify as statutory subject matter under the Patent Act, an AI-related invention must constitute “a creation of technical ideas utilizing a law of nature.” Where information processing by software is specifically implemented through hardware in an AI-related invention, the following may qualify as statutory inventions: an information processing apparatus operating in cooperation with software; a method implemented by such cooperation; a computer-readable storage medium storing a program; or a computer program product stored on a computer-readable storage medium. However, a computer program per se, as a mere set of instructions, does not constitute a creation of technical ideas utilizing a law of nature and therefore does not qualify as a statutory invention.

3.1.2 Specific Method of Assessment

The assessment of whether the claimed invention constitutes statutory subject matter under the Patent Act shall proceed as follows:

(1) The claimed invention shall be understood based on the claim language as a whole, in light of the specification.

(2) It shall be examined whether the claimed invention, considered as a whole, is directed to a creation of technical ideas utilizing a law of nature, in accordance with “Patent Eligibility of an Invention,” Paragraph 4, Chapter 1, Part III of the Patent and Utility Model Examination Guidelines.

① Whether an invention utilizes a law of nature shall be determined based on the claim as a whole. Even if certain elements of the claim involve a law of nature, where the claim as a whole does not utilize a law of nature, it shall not be regarded as a statutory invention under the Patent Act.

② Where the claimed invention: (i) relies on laws other than laws of nature; (ii) is based on arbitrary or artificial rules; (iii) constitutes or merely involves mental activities of a human being; or (iv) merely presents information, the claimed subject matter does not constitute a creation of technical ideas utilizing a law of nature and therefore is not a statutory invention. (See Supreme Court Decisions 2001Hu3149, 2002Hu277, 2009Hu436; IP High Court Decisions 2000Heo5438, 2001Heo3453, 2006Heo8910.)

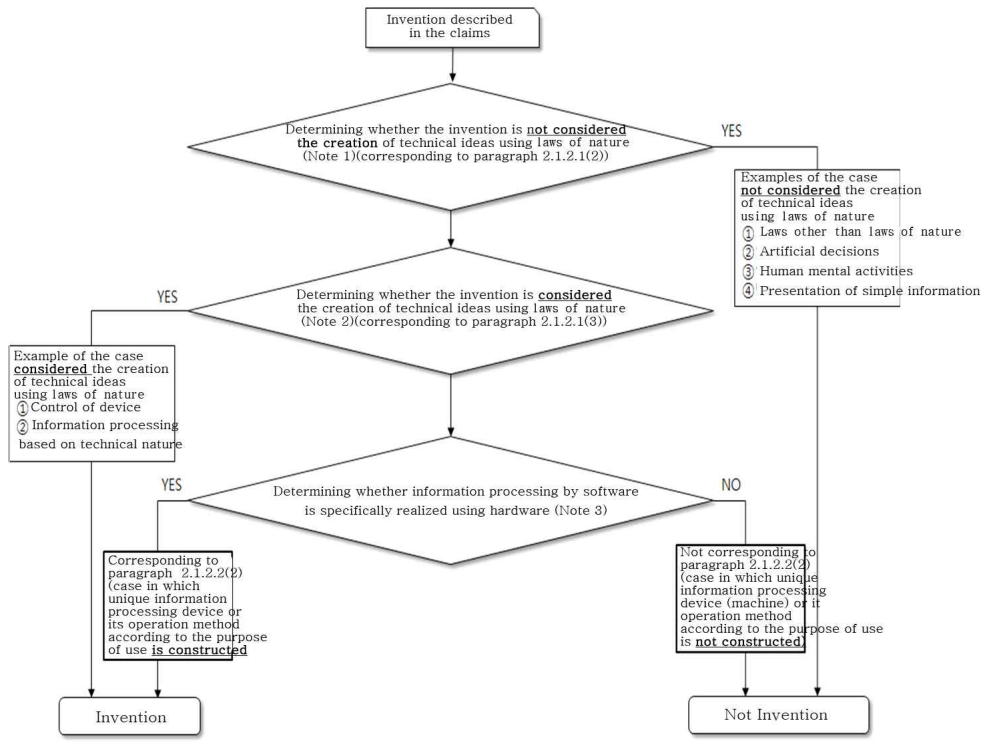
③ Where the invention specifically (i) controls a device or implements necessary controlling process, or (ii) implements information processing based on the technical nature of the subject matter, it is directed to an invention, as it is technical ideas using a law of nature.

(3) Where the claimed invention does not clearly fall under items ② or ③ of paragraph (2) above, it shall be further examined whether the invention corresponds to a case in which information processing by software is specifically implemented by means of hardware (see Supreme Court Decisions 2001Hu3149, 2007Hu265, 2007Hu494; IP High Court Decisions 2005Heo11094, 2006Heo1742).

① Where information processing performed by software is concretely realized through cooperation between software and hardware—namely, where specific technical means or a specific process implemented by such cooperation performs computation or processing of particular information according to a defined purpose of use—and the claim defines: a specific information processing apparatus (device), or a specific operational process

of such apparatus, the claimed invention constitutes a creation of technical ideas utilizing a law of nature and therefore qualifies as statutory subject matter.

② Conversely, where the claimed invention does not specify concrete technical means demonstrating cooperation between software and hardware, and merely recites abstract information processing or algorithmic operations, it does not constitute a creation of technical ideas utilizing a law of nature.



<Fig.> Flowchart of Assessment Process of Patent Eligibility of a Computer·Software-related Invention

(Note1) Where the claimed invention either uses (i) any laws other than a law of nature, (ii) artificial determination, or belongs to (iii) mental activity of a human being or uses it or (iv) suggests simple information, it does not belong to an invention, as it is not directed to a creation of technical ideas utilizing a law of nature.

(Note2) Where the claimed invention (i) specifically controls an apparatus or implements a necessary process for controlling, or (ii) specifically implements information processing based on the technical nature of the subject matter, it does belong to an invention, as it is a creation of technical ideas utilizing a law of nature.

(Note3) It shall be assessed whether the claimed invention discloses a specific information processing apparatus(device) or its working process in accordance with the purpose of use to determine that said invention is directed to the case where information processing by software is specifically implemented by means of hardware.

3.1.3 Specific Cases for Assessment

3.1.3.1 Case Assessment in Compliance with 『Patent Eligibility, Section 4, Chapter 1, Part III』 of Patents · Utility Models Examination Guidelines

(1) Cases where the invention is not a creation of technical ideas using a law of nature

The claimed invention does not constitute “a creation of technical ideas utilizing a law of nature” in the following cases:

① Laws other than a law of nature

(Ex: economic law, mathematical formula, etc.)

② Artificial decision

(Ex1) A method for creating a password by combining characters, numbers, symbols, etc.

(Ex2) [Claim] A method for forming a phonetic alphabet for foreign languages comprising: altering the shape of the throat and the sound produced in the pronunciation of such characters according to pronunciation changes and the shape of the lips.

☞ In order for a particular symbol determined in the invention to function as a writing system, it must be agreed within a linguistic community that the symbol corresponds to a specific pronunciation

and must be used in accordance with such agreement. Since the invention merely defines an artificial rule or convention independent of a law of nature, it constitutes an artificial determination rather than a technical idea utilizing a law of nature. Accordingly, the claimed invention does not qualify as an “invention” under the Patent Act (IP High Court Decision 2001Heo3453).

③ Human Mental Activity or Offline Activities

(Ex) [Claim] A method for comprehensively managing household waste recycling comprising: distributing barcode stickers containing a disposer’s personal information and a marked calendar; requiring waste to be discharged in regulated garbage bags with attached barcode stickers; collecting and classifying the waste into recyclable, landfill, or incineration categories; managing the waste based on accumulated statistical data by reading barcodes attached to misclassified garbage bags.

☞ Although the invention involves hardware and software components (e.g., barcode stickers, computers), these elements merely serve as tools to facilitate administrative management. The essential nature of the invention lies in human decision-making and administrative processing, and each step is carried out offline rather than through technical information processing. Therefore, the invention does not utilize a law of nature and does not qualify as a statutory invention (Supreme Court Decision 2001Hu3149; IP High Court Decision 2000Heo5438).

(Ex) [Claim] A method for travel management utilizing a computer reservation system comprising: submitting a travel request; obtaining approval of a travel plan; preparing and approving a cost report; completing a travel reservation through a travel management system.

☞ Although a hardware component (travel management system) is recited, the claim does not clearly define a specific cooperative relationship between software and hardware. In particular, the

correlation between human approval actions and system operations is unclear. The claim as a whole merely utilizes general functions of a computer or the Internet without specifying concrete technical means for achieving a technical purpose. Accordingly, the invention is directed to human activity assisted by general-purpose computing tools rather than a creation of technical ideas utilizing a law of nature (IP High Court Decision 2006Heo8910).

④ Mere Presentation of Information

Where the essential technical feature of a claimed invention lies solely in the content of information presented—namely, where the primary purpose of the invention is the presentation of information—it does not constitute an invention under the Patent Act.

(Ex1) A manual explaining how to operate an apparatus or use chemical substances
(Ex2) A CD characterized only by recorded music
(Ex3) Video data captured by a digital camera
(Ex4) An athletic training program described in writing
(Ex5) A computer program listing

If the manner of presenting the information involves novel technical features, the apparatus (means) used for presentation and the technical process of presentation may qualify as an invention.

(Ex) A plastic card embossed with characters, figures, or symbols.

☞ The technical process of embossing information onto the plastic card constitutes a technical means utilizing a law of nature. Therefore, such subject matter may qualify as an invention.

(2) Creation of Technical Ideas Utilizing a Law of Nature

A claimed invention constitutes a creation of technical ideas utilizing a law of

nature where it falls under any of the following categories.

① Controlling an apparatus (e.g., rice cooker, washing machine, engine, hard disk drive, chemical reactor) or performing processing necessary for such control

(Ex) Controlling an 「apparatus」 to implement an action in accordance with the purpose of use

(Ex) Controlling a target device based on the structure, components, configuration, operating principles, functions, or technical characteristics of the 「control target」 and/or 「peripheral devices related to the control target」

(Ex) Comprehensively controlling an overall system composed of multiple technically interrelated devices

② Performing information processing based on the physical, chemical, biological, electrical, or other technical properties (e.g., engine rotation rate, rolling temperature, physicochemical correlation of substances, correlation between a genetic sequence and phenotypic expression)

(Ex) Performing computation or processing based on technical properties in order to obtain information (e.g., numerical values, images, etc.) representing such properties

(Ex) Conducting information processing using a technical correlation between an object's condition and a corresponding physical or natural phenomenon.

3.1.3.2 Where 「Information Processing by Software Is Specifically Implemented by Means of Hardware」

(1) Basic Concept

Where, in an AI-related invention, information processing performed by

software is specifically implemented using hardware resources, an information processing apparatus operating in cooperation with the software, a method performed by such apparatus, a computer-readable medium having a program recorded thereon, and a computer program stored in a medium constitute creations of technical ideas utilizing a law of nature. Accordingly, such subject matter falls within the category of statutory inventions under the Patent Act.

The phrase 「information processing by software is specifically implemented using hardware resources」 refers to circumstances in which software, when executed by a computer, cooperates with hardware to realize specific means or steps that establish an information processing apparatus or method for achieving an intended purpose by performing computations or processing specific information. An information processing apparatus or method that is concretely configured in accordance with its intended purpose in this manner constitutes a creation of technical ideas utilizing a law of nature and therefore qualifies as an invention.

(2) Case Where 「Information Processing by Software Is Specifically Implemented by Means of Hardware」

(Ex) Title of the Invention

A PREFERENCE PREDICTION APPARATUS

What is claimed is:

[Claim] A preference prediction apparatus comprising:

a similar user information receiving unit that receives a list of similar users for a user from a server that stores content usage information collected for content and homogeneous content;

a preference prediction unit that predicts the user's preference for content by using preference information form users listed in a list of similar users as input to machine learning algorithms and learning the feature set of contents contained in preference information by machine learning algorithms

☞ A computing or processing of unique information is specifically implemented to predict a user's preference for contents by inputting users' preference information contained in a list of similar users to machine learning algorithm of a preference prediction apparatus and by learning a feature set of contents contained in users' preference information through machine learning algorithms of a preference prediction apparatus for achieving the purpose of the invention to accurately predict users' preference for contents. Accordingly, the invention disclosed in the claim does fall under invention as a creation of technical ideas using a law of nature, as information processing by software is specifically implemented by means of hardware.

(3) The case shall not be deemed to be directed to 「information processing by software is concretely realized using hardware resources」

(Ex) [Claim] A computer configured to calculate the minimum value of the formula $y = F(x)$ within the range $a < x < b$.

☞ It cannot be concluded that the information processing for calculating the minimum value of $y = F(x)$ is specifically implemented merely because the claim recites "a computer configured to calculate the minimum value of $y = F(x)$ within the range $a < x < b$." The claim does not specify how the computer cooperates with software to perform particular processing steps for calculating the minimum value. Merely stating the intended result—"to calculate the minimum value"—does not establish that the information processing is concretely implemented through cooperation between software and hardware resources. Accordingly, the claimed invention does not constitute a creation of technical ideas utilizing a law of nature and therefore does not qualify as statutory subject matter, as the information processing by software is not specifically implemented using hardware resources.

(Ex) [Claim] A computer comprising: an input means configured to receive

document data; a processing means configured to process the received document data; and an output means configured to output the processed document data; wherein the computer prepares a summary of the received document using the processing means.

☞ Although the claim describes a general flow of information processing—input, processing, and output—it does not specify how the processing means cooperates with software to perform particular steps for generating the summary. The mere statement that the computer "prepares a summary" does not demonstrate that specific information processing for summarization is concretely implemented through cooperation between software and hardware resources. Accordingly, the claimed invention does not constitute a creation of technical ideas utilizing a law of nature and therefore does not qualify as statutory subject matter, as the information processing by software is not specifically implemented using hardware resources.

3.1.4 Notes

(1) Because patent eligibility is assessed based on the subject matter as defined in the claims, even where the description of the invention or the drawings demonstrate that information processing by software is specifically implemented using hardware resources, the claimed subject matter does not constitute a statutory invention under the Patent Act if the claim itself does not define such specific implementation.

(2) Even where a claim merely recites hardware components such as a "computer," "processor," or "memory," if it does not specify particular means or processes in which software and hardware cooperate to perform a computation or processing of specific information in accordance with the purpose of use—for example, where it is unclear how hardware resources are used to specifically implement a software algorithm (see IP High Court Decision 2011Heo9078)—the examiner should note that the claimed

invention may not constitute a creation of technical ideas utilizing a law of nature.

Conversely, where the claim specifically defines a computation or processing of particular information in accordance with the purpose of use, such computation or processing may be regarded as being implemented as claimed, even if only a general-purpose “computer,” rather than a specific information processing apparatus tailored to the purpose of use, is recited as hardware. In such cases, common general knowledge at the time of filing shall be taken into account.

(3) Whether an invention disclosed in a claim constitutes a creation of technical ideas utilizing a law of nature shall be determined through interpretation of the meanings of the terms used to specify the claimed invention, irrespective of the category of the invention (i.e., whether it is claimed as a method or as a product).

(4) Where a claimed invention merely refers to a “program list” per se and is therefore considered to be no more than a presentation of information, it is not directed to a creation of technical ideas utilizing a law of nature and thus does not constitute an invention.

(5) An AI-related invention shall be assessed as to whether it is directed to a creation of technical ideas utilizing a law of nature by examining whether the claim describes specific means or methods through which software and hardware cooperate to implement a computation or processing of unique information in accordance with the intended purpose of use, such that the same effect can be repeatedly achieved without reliance on the mental activity of a human being.

3.2 Novelty and Inventive Step

3.2.1 Basics

The novelty and inventive step of an AI-related invention shall, in principle, be

determined in accordance with『Part III, Chapter 2 (Novelty) and Part III, Chapter 3 (Inventive Step)』of the Patent and Utility Model Examination Guidelines.
The following considerations are particularly relevant when assessing novelty and inventive step for AI-related inventions:

(1) Novelty and inventive step shall be assessed based on the subject matter defined in the claims. Where the claimed invention comprises multiple features that are organically combined, the subject matter shall be understood as a whole rather than by separately analyzing each individual feature.

(2) Whether the claimed invention is identical to a cited invention shall be determined by identifying corresponding features of each and clarifying commonalities and differences, taking into account specific means for implementing AI-related inventions (e.g., training data, data preprocessing techniques, learning models, loss functions, etc.). If the claimed invention and the cited invention differ in technical features, they are not identical. Conversely, where no technical difference exists, the inventions are considered identical. “Identity” in this context includes substantial identity.

(3) Inventive step shall be assessed by: Identifying the subject matter of the claimed invention; ①Specifying a cited invention that is in the same technical field and addresses the same technical problem, from the perspective of a person skilled in the art; ②Selecting the closest prior art, comparing it with the claimed invention, and ③Clarifying commonalities and differences; and ④Determining whether, in view of other cited inventions, common general knowledge at the time of filing, and ordinary technical experience, a person skilled in the art could have easily arrived at the claimed invention from the closest prior art despite the identified differences.

(4) A “person skilled in the art” refers to a hypothetical person who: possesses common general knowledge in the technical field to which the claimed

invention pertains; is capable of using ordinary technical means for research and development (including experimentation, analysis, and implementation); can exercise ordinary creativity, including routine design modifications; and is able to comprehend the state of the art at the time of filing based on such knowledge and skills.

(5) In the field of AI technology, it is common practice to combine known methods or means from various technical fields or to apply them to a particular field in order to achieve a desired purpose. Accordingly, the mere combination of technologies used in multiple fields or their application to a specific field generally falls within the scope of ordinary creativity of a person skilled in the art. Where no technical difficulty or technical obstacle exists in such combination or application, inventive step shall not be acknowledged unless there are exceptional circumstances, such as an unexpected technical effect.

(6) Effects such as “rapid processing,” “processing large volumes of data,” “error reduction,” or “accurate prediction” often naturally result from the implementation of AI technology. In assessing inventive step, such effects should not, in themselves, be regarded as indicative of an inventive contribution unless they are shown to be outstanding from the perspective of a person skilled in the art.

3.2.2 Examples of Ordinary Creative Activity Expected of a Person Skilled in the Art

(1) Simple Addition of AI Technology Known Prior to Filing

Where a claim merely recites “using AI technology” without specifying technical features necessary to implement the AI-related invention (e.g., data preprocessing techniques, learning models, training configurations, etc.), such recitation is treated as a mere addition of AI as a problem-solving tool. In such cases, the claimed invention may fall within the scope of ordinary creativity of

a person skilled in the art.

(Ex) In a method for providing stock price information using an AI-based chart that displays different colors depending on whether an AI algorithm determines that a stock price will rise or fall: If the “criteria for determining a rise or fall in stock price” and the use of color differentiation according to such determination are well-known techniques widely used in stock investment or chart analysis, then displaying different colors based on an AI algorithm that determines price fluctuation falls within the scope of ordinary creative activity of a person skilled in the art. Absent any specification of particular information processing achieved through a trained model that solves a technical problem, the claim merely reflects the implementation of well-known techniques using AI technology. Accordingly, the claimed invention lacks inventive step. (See Patent Court Decision 2013Heo1788.)

[Claim]
An apparatus for recommending content using artificial intelligence, configured to predict a user’s field of interest based on terms used by the user for online searches during a specific period of time, and to recommend content related to the predicted field of interest of the user.

[Cited Invention]
A user preference–based content recommendation apparatus configured to analyze user preferences based on search terms input by a user on a social networking service (SNS) during a specific period of time, and to recommend content related to the analyzed user preferences.

☞ Although the difference between the claimed invention and the cited invention lies in the use of “artificial intelligence,” the claim does not specifically define how the artificial intelligence technology is implemented to solve the technical problem (i.e., predicting the user’s field of interest

and recommending related content). In view of the state of the art at the time of filing, the claimed invention merely adds a generally known artificial intelligence technique to the cited invention as a means for predicting a user's field of interest, without specifying any concrete technical implementation. Accordingly, such a difference does not go beyond the ordinary creative abilities of a person skilled in the art, and therefore the claimed invention may be regarded as lacking an inventive step.

(2) Simple Systemization of Human Activities or Business Methods Using Disclosed AI Technologies

In some cases, a claimed invention does not specifically define how activities performed by a human being or business methods are systemized through technical features of artificial intelligence (e.g., preprocessing of training data, learning models, training configurations, etc.), but merely states that such activities are implemented using AI technology. Meanwhile, a cited invention may disclose the systemization of such human activities or business methods using conventional computer technology in the same field. In such circumstances, the mere substitution of previously disclosed AI technology for a conventional computer in order to systemize the same human activity or business method generally falls within the scope of ordinary creativity of a person skilled in the art.

[Claim] Artificial intelligence (AI) based credit rating system that determines credit rating of loan applicants through an artificial neural network (ANN) on the basis of financial transactions history of loan applicants as input data

[Cited invention] A method of determining the current credit rating of loan applicants by a credit rating system on the basis of financial transactions history

☞ The claimed invention does not specifically recite how the method of determining credit rating of loan applicants is systemized through an artificial neural network(ANN), and the cited invention discloses a business method of determining the current credit rating based on financial transactions history of loan applicants. In this case, it falls into the category of ordinary creativity of a person skilled in the art to simply systemize an ANN disclosed before the filing of the application in replace of a computer, etc. to systemize the method of determining credit rating of loan applicants.

(3) Simple Design Change Resulting from the Application of Known AI Technology

Where a claimed invention is directed to the same technical concept as a cited invention, and the difference in means for solving the technical problem merely results from replacing one known AI learning model with another disclosed prior to the filing date, such difference is generally regarded as a simple design modification. In the absence of any demonstrated superior technical effect over the cited invention, such modification falls within the scope of ordinary creativity of a person skilled in the art, unless special circumstances are present. However, if the difference in the learning model produces a distinct technical outcome and such effect is recognized as superior beyond what would have been predictable to a person skilled in the art, inventive step may be acknowledged.

[Claim] An automatic classification method of documents, comprising steps of receiving a camera captured document image by a computer; inferring a document area by using a convolutional neural network (CNN); classifying documents by title contained in said document area by using a convolutional neural network (CNN)

[Cited invention] A method of automatically classifying documents, comprising steps of reading a document by a computer through a scanner; identifying a document area only; extracting characteristics from said document area by using a recurrent neural network (RNN)

☞ The claimed invention and the cited one are identical in the art field and training data as the both inventions automatically classify documents from document image. The claimed invention selects a convolutional neural network (CNN) as a training model, while the cited one does a recurrent neural network (RNN) as a training model. In this regard, the both inventions are different in the training model. The claimed invention, however, does not specifically provide for a convolutional neural network (CNN), and it falls into the category of simple design change from the viewpoint of a person skilled in the art to replace a recurrent neural network (RNN) with a convolutional neural network (CNN), and the claimed invention does not bring any superior effect over the cited one. Therefore, as it is determined that the claimed invention can be easily implemented by a person skilled in the art from the cited invention, an inventive step is not acknowledged.

[Claim] A power prediction system, composed of a data collection unit for collecting weather data and power usage data around a power facility; and a prediction unit for predicting power usage of said power facility through weather data and power usage data collected by said data collection unit

[Cited invention] A prediction system of future power demand by using multiple regression analysis on the basis of a correlation between weather data and power demand data

☞ The claimed invention and the cited one are identical in the art field and input data as the both inventions predict power usage on the basis of weather data and power usage data. The claimed invention applies an artificial neural network (ANN) as a training model, while the cited one applies multiple regression analysis as the same. In this regard, the both inventions are different in the training model. The claimed invention, however, does not specifically provide for an artificial neural network (ANN), and it falls into the category of simple design change from the viewpoint of a person skilled in the art to replace multiple regression analysis with an artificial neural network (ANN) in power usage prediction field, and the claimed invention does not bring superior effect to predictable one from the cited invention. Therefore, as it is determined that the claimed invention can be easily implemented by a person skilled in the art from the cited invention, an inventive step is not acknowledged.

(4) Simple Addition of Well-Known or General Means, or Replacement with an Equivalent

(Ex) An image data input method for an artificial intelligence training model, comprising: binarizing camera image data in an AI-based road surface recognition system; and inputting the binarized image data into an artificial intelligence learning model.

☞ Where the structural difference between the claimed invention and the

cited invention resides in the data preprocessing step of binarizing camera image data, the configuration of binarizing color image data merely constitutes a well-known or customary technical means for reducing computational load in view of the state of the art at the time of filing. Accordingly, such configuration falls within the scope of ordinary creativity of a person skilled in the art.

3.2.3 Notes

3.2.3.1 Subject Matter Having Distinctive Technical Features for Implementing an AI-Related Invention

Where a claim specifically defines technical features for implementing an AI-related invention—such as data preprocessing techniques, a particular machine learning method, or a trained model—and such technical features produce a superior technical effect over a cited invention, the claimed invention does not fall within the scope of ordinary creativity of a person skilled in the art.

3.2.3.1.1 Subject Matter Characterized by Data Preprocessing

Where the claimed invention specifically defines data preprocessing techniques, and such techniques yield a superior technical effect over the cited invention, the claimed invention does not fall within the scope of ordinary creativity of a person skilled in the art.

“Specifically defining data preprocessing,” as used herein, refers to concretely describing technical features such as: extracting key characteristics from input data; generating standardized training data (e.g., vectorization, normalization, standardization); or other defined transformations that meaningfully structure the training data.

By contrast, where a machine learning-related invention merely recites “performing data preprocessing” without specifying the technical manner in which such preprocessing is carried out, such recitation constitutes no more than a routine application of AI techniques disclosed prior to the filing date. In such circumstances, the claimed invention falls within the scope of ordinary creativity of a person skilled in the art.

[Claim] An artificial intelligence based security assurance system, comprising receiving CCTV footage; applying a feature vector of ‘motion tracking’ as training data; and recognizing an image object by using a CNN training model

[Preconditions] Technology of performing a function of ‘motion tracking’ analysis based on an image collected by CCTV is presumed not to be disclosed.

[Cited invention] An artificial intelligence based video system, comprising applying CCTV footage as training data; and identifying an image object by using an ANN training model

☞ The claimed invention and the cited one are identical in the art field and a training model (CNN is just one kind of ANN). Data pre-processing of ‘motion tracking’ in CCTV footage is added to the claimed invention, and thereby improving accuracy for object recognition enough to figure out the motion of the object in video image. As this is determined to be superior effect over the cited invention, an inventive step is acknowledged.

[Claim] A system error prediction device, comprising analyzing an event syntax as a regular expression formula for system log data to predict a system error; classifying said event; performing data pre-processing for filtering duplicative events in accordance with a correlation between events; inputting the outcome to an ANN for error prediction; and learning and inferring

[Cited invention] A system error prediction device, comprising analyzing system log data by event; classifying said data; inputting said classified system log data to an ANN for error prediction; and learning and inferring

☞ Where a difference in features between the claimed invention and the

cited one is shown in ‘data preprocessing of input data for system error prediction’ and performance improvement in accuracy, reproduction, etc. is expected in learning/inferring outcome by an ANN, it does not fall into the category of ordinary creativity of a person skilled in the art.

3.2.3.1.2 Subject Matter Characterized by the Learning Model Itself

Where the claimed invention specifically defines a particular learning model, and such model produces a superior technical effect over a cited invention—such as improved training efficiency, faster model convergence, or enhanced prediction accuracy—the claimed invention does not fall within the scope of ordinary creativity of a person skilled in the art.

“Specifically defining a learning model,” as used herein, refers to concretely describing technical features such as: a defined learning environment or training configuration; validation or evaluation mechanisms for the learning model; structured interconnections between multiple learning models; distributed or parallel processing architectures; or specific implementation of hyperparameter optimization algorithms.

By contrast, where a machine learning-related invention merely recites the use of a learning model in general terms, without specifying the technical manner in which the model is structured, trained, or optimized, such recitation constitutes no more than the routine application of AI technology disclosed prior to the filing date. In such circumstances, the claimed invention falls within the scope of ordinary creativity of a person skilled in the art.

[Claim] A method of optimizing neural network parameter implemented by a neural network computational apparatus, comprising shaping existing parameters of a neural network into size parameters with a single value per channel and sign parameters by using a sign parameter transformer and a size parameter transformer that make up a parameter optimizer unit; generating optimized parameters by pruning said size parameters that are converted as above by using a parameter pruning unit that makes up said parameter optimizer unit;

wherein said parameter pruning unit comprises setting a reference value by

multiplying the average value of said size parameters by input and output channels with a constant by layer reflecting the distribution of size by channel; and omitting said channel's convolution operation by making a size parameter value that is less than the set reference value as 0.

[Cited invention] A neural network acceleration process carried out by a neural network computing apparatus, comprising computing sizes of parameters regarding a connection between a multiple of artificial neurons; setting parameters of said multiple of connections to 0 where sizes of said parameters are less than threshold value; and maintaining parameters of said connection where sizes of said parameters are not less than said threshold value.

☞ The claimed invention and the cited one are identical in a problem to be solved as the both inventions are related to pruning technology for parameters optimization of a deep neural network (DNN). As the claimed invention, however, sets threshold value as the average one of size parameters by input and output channels multiplied by a constant by layer reflecting size distribution by channel, the both inventions are different in threshold value. Also, the claimed invention contributes to the effect of improving computing speed within limited hardware resources, and this is determined to be superior effect over the cited invention. Therefore, an inventive step is acknowledged.

3.2.3.2 Subject Matter Characterized by the Application of Learning Outcomes (Output Data) of AI-Related Inventions

Where a claim specifically defines the technical manner in which the learning outcomes (output data) of an AI-related invention are applied, and such technical features produce a superior technical effect over a cited invention, the claimed invention does not fall within the scope of ordinary creativity of a person skilled in the art.

“Specifically defining the application of learning outcomes,” as used herein, refers to concretely describing technical features such as: a defined technical

use of output data generated by a trained model; products or apparatuses configured based on such output data; control processes or operational steps implemented using such output data; or further technical processing performed on the output data to achieve a particular technical purpose.

By contrast, where a claim merely recites the application of learning outcomes in general terms, without specifying the technical manner in which such outcomes are utilized, such recitation constitutes no more than a routine design modification reflecting the ordinary application of known AI technology. In such circumstances, the claimed invention falls within the scope of ordinary creativity of a person skilled in the art.

[Claim] An automatic repair costs estimation system for an accident vehicle, composed of an input unit for receiving several camera captured images for an accident vehicle; a learning model output unit for detecting at least one part corresponding to a damaged part by inputting said several images to a CNN layer and outputting a damage level of said detected each part; a final projected costs calculation unit for calculating costs by repair type from said output damage level, deriving estimates of changes in user insurance rates, on presumption that costs by said repair type are insurance covered, by referring to an accidents record of a user and providing to a user's terminal with final estimation costs by repair type reflecting prediction of insurance rate changes to costs by repair type; and a repair costs providing unit for transmitting said output damage level and said final estimation costs receiving from said user's terminal to a server of a maintenance plant

[Cited invention] An insurance company's server for outputting a damaged part and a damaged level by part by inputting a car accident video filmed by a customer of an auto-insurance company to a deep learning model

☞ The claimed invention and the cited one are identical in training data and learning model as the both inventions relate to detecting a damaged part by inputting a car accident video to a deep learning model and

outputting a damage level. A subject matter of the claimed invention, however, is different from the one of the cited invention in that it relates to a feature providing final estimation costs by repair type to a user's terminal by reflecting prediction of insurance rate changes on account of an accidents record of a user to costs by repair type that are calculated from a damage level (output data) and transmitting said final estimation costs receiving from said user's terminal to a server of a maintenance plant. A subject matter of the claimed invention brings superior effect to predictable one from the cited invention in that it allows a user to anticipate increases in insurance premiums depending on the type of repair chosen, and thereby promoting convenience of a user. Therefore, an inventive step is acknowledged.

3.2.3.3 Subject Matter Applied in Various Industries

An AI-related invention, including one comprising a trained model, may produce different outcomes or technical effects depending on the industry in which it is applied. Where the application of the AI-related invention to a particular industry alleviates industry-specific technical problems, overcomes technical difficulties, or produces a superior technical effect in that industry, care should be taken not to deny novelty or inventive step solely on the ground that there is no apparent difference in technical features between the claimed invention and the cited invention.

A person skilled in the art should be able to recognize such superior technical effect based on objective evidence or specific embodiments disclosed in the description.

3.2.3.4 Subject Matter Characterized by Training Data

The performance and output of a learning model in an AI-related invention may vary depending on the training data used. Where the claimed invention is characterized by particular training data, inventive step cannot generally be acknowledged solely on the basis of a difference in training data between the claimed invention and a cited invention.

Rather, novelty and inventive step should be determined in view of whether:

the claimed invention specifically defines unique technical processing or selection of the training data; or the difference in training data produces a superior technical effect over the cited invention.

[Claim] An emotion recognition device from a user's conversation, composed of a voice data collection unit for collecting a user's conversation through a mobile device; a characteristics extraction unit for extracting rhythmic data (pitch, size, accent) and speech language data and non-verbal data (sighs, laughter, etc.) from said voice data; and a deep learning training unit for learning a user's emotion using a LSTM model by applying data extracted from said characteristics extraction unit as learning data

[Preconditions] Technology for extracting rhythmic data (pitch, size, accent) and non-verbal data (sighs, laughter, etc.) from voice data as characteristics is presumed not to be disclosed before the filing of the application.

[Cited invention] An apparatus for extracting emotional words only from sentence(s) or document(s) disclosed by a user on SNS and determining a user's emotion through LSTM model by applying said emotional words as learning data

☞ The claimed invention and the cited one are identical in the art field in that the both inventions extract a user's emotional information from input information and use LSTM model as a learning model alike. The claimed invention and the cited one show a difference in a technical feature in that the claimed invention applies rhythmic data and non-verbal data, a characteristics unique to a user's voice data, as training data, while the cited invention applies emotional word text recognized from a text message as learning data. Further, as the claimed invention causes the effect of improving emotion recognition by learning the characteristics of voice data and said effect is determined to be superior to predictable one from the cited invention, an inventive step is acknowledged.

[Claim] An automatic identification apparatus for tomato's marketability, composed of an input unit for receiving a tomato's video clip; a maturity discriminator for outputting classification value of a tomato's maturity respectively by inputting a tomato's hue, chroma and shape information extracted from said tomato's video clip to a deep learning model; and a marketability evaluation unit for finally classifying marketability of a tomato by putting each of said maturity classification values together

[Cited invention 1] A classification apparatus of strawberries' maturity by inputting hue and chroma data of strawberries computed from strawberries captured images to deep learning models and combining each of output values

[Cited invention 2] A classification method of tomatoes' marketability by a computer, comprising extracting shape information from tomato's video clip based on tomato's edge and classifying marketability by grade of flatness, dimorphism and deformity

☞ The claimed invention and cited invention 1 are identical in the art field and the learning model in that the both inventions determine produces' qualities by using deep learning models from image data of produces. As the claimed invention applies hue, chroma and shape data as training data and cited invention 1 does hue and chroma data as the same, the both inventions are different in whether shape image is used as training data, but cited invention 2 discloses a feature of classifying tomatoes' marketability by using shape data. Also it is determined that a person skilled in the art may easily arrive at combination between features of claims 1 and 2 through claim 1 in view of technology level as filed and there is no outstanding difference in the effects. Therefore, as the claimed invention can be easily implemented by a person skilled in the art in combination between cited inventions 1 and 2, it is determined that an inventive step is not acknowledged.

4. Examination Cases

This Chapter provides illustrative examination cases relating to machine learning-based AI inventions. A machine learning-based AI invention refers to a computer-implemented or software-related invention characterized by implementing specific functions through AI training. Such inventions may generally be categorized into: AI learning model inventions, and AI application inventions.

An AI learning model invention is characterized by generating a trained model based on training data (i.e., raw data collected for training purposes) and a defined learning model (including training methods such as learning algorithms and/or data preprocessing techniques). Examples include: methods for accelerating computation in a learning model; data regularization methods; and methods for generating or optimizing a learning model.

An AI application invention is characterized by performing a specific function by applying training data and/or a trained model to solve a technical problem in a particular technical field. Such inventions are typically defined in relation to a device or hardware configured to implement the claimed steps in accordance with the intended purpose of use. Examples include: AI-based autonomous robots; AI-based medical devices; and business method (BM) inventions relying on AI.

[Note]

The examination cases presented in this Chapter have been edited in a simplified and concise manner with respect to the claims, descriptions, and drawings for the purpose of explaining the assessment of patentability requirements. Furthermore, references to well-known or general technical knowledge and cited inventions used in the inventive step analysis have been adapted for explanatory purposes and may differ from those applied in actual examination practice.

[List of Cases]

Title of the Invention	Relevant Legislations (KPA)		Assessment
1. Method for Detecting Cracks in Structures (2.1.2 (1))	§42(3)(1)		X
2. Automatic Control System of a House's Temperature based on Machine Learning (2.1.2 (2))	§42(3)(1)		X
	§42(4)(1)		X
3. Method for Generating Fused Data Using Artificial Intelligence (2.1.3 (2)(i))	§42(3)(1)		X
4. Pharmaceutical Composition for Treating Alzheimer's Disease (2.1.3 (4))	§42(3)(1)	[Claim 1]	○
		[Claim 2]	X
5. Computer Program for Classifying Input Data Using a Classification Model (3.2.1 (5)(6))	§29(2)		X
6. Method for Controlling a Robot Vacuum Cleaner (3.2.2 (3))	§29(2)	[Claim 1]	X
		[Claim 2]	○
7. Bone Age Reader based on Machine Learning Algorithm (3.2.2 (3))	§29(2)	[Claim 1]	X
		[Claim 2]	○
8. Method for Generating Defect Images (3.2.2 (4))	§29(2)		X
9. Apparatus for Training Images to be Inspected (3.2.2)	§29(2)		X
10. System for Predicting Urban Traffic Speed (3.2.3.1)	§29(2)		○
11. Method for Providing Professional Answers Using an Artificial Intelligence Speaker (3.2.3.1.)	§29(2)	[Claim 1]	X
		[Claim 2]	○
12. Method for Controlling a Serving Robot (3.2.3.1.2)	§29(2)	[Claim 1]	X
		[Claim 2]	○
		[Claim 3]	○
13. AI-based Logo Image Generation and Distribution Method (3.2.3.2)	§29(2)	[Claim 1]	X
		[Claim 2]	○
14. Method for Warning Entry into an Operating Area of Equipment (3.2.3.2)	§29(2)	[Claim 1]	X
		[Claim 2]	○
15. Real-time Welding Quality Inspection Device (3.2.3.4)	§29(2)		X

4.1 Case 1

TITLE OF THE INVENTION

Method for Detecting Cracks in Structures

GUIDELINE

Although the description of the invention discloses a configuration in which different artificial intelligence algorithms are combined to detect cracks in a structure, it merely lists multiple heterogeneous AI algorithms and presents only a high-level conceptual idea. Where the description fails to specify in concrete terms how the input and output data of each artificial intelligence algorithm are functionally and organically combined, and where a person skilled in the art would have difficulty deriving or understanding such interrelationships based on the examples disclosed in the specification in light of the common general knowledge at the filing date, the invention may be considered not to satisfy the enablement requirement.

CLAIM

A method for detecting cracks in a structure, comprising:

- an input step of receiving captured image data; and
- a processing step of detecting cracks in the structure using the captured image data and finally determining the location and size of the cracks, wherein the processing step uses a composite network comprising a deep learning network, an explainable artificial intelligence (XAI) network, and a reinforcement learning network to detect cracks in the structure, explain the reasons for estimating the crack locations, and finally extract crack location coordinates.

DESCRIPTION OF THE INVENTION

Conventionally, in order to identify abnormal conditions such as cracks in structures including buildings, inspectors have been required to visually inspect the structures in person, resulting in a significant amount of time being needed to assess the structural condition. Moreover, fine cracks are difficult to detect through visual inspection alone.

An object of the present invention is to accurately determine the presence of

cracks in a structure using image data captured from the structure through artificial intelligence algorithms.

According to the present invention, cracks in a structure can be rapidly and accurately inspected, the inspection results can be output, and explanations regarding the causes and processes can be provided.

A method for detecting cracks in a structure according to an embodiment of the present invention, based on captured image data, deep learning, explainable artificial intelligence, and reinforcement learning algorithms, includes an input step of receiving captured image data and a processing step of detecting cracks in the structure using the captured image data and finally determining the location and size of the cracks. The processing step includes a composite network comprising a deep learning network, an explainable artificial intelligence network, and a reinforcement learning network. A point-cloud-based artificial intelligence deep learning network is used to analyze the captured image data, detect cracks in the structure, and measure the cracks. Conventional deep learning technologies are structured as black-box models that do not provide justification for the inference process and do not allow users to observe the internal processing steps, which limits their ability to improve accuracy and detect errors in advance.

The point-cloud-based artificial intelligence deep learning network performs a deep learning process based on point cloud data using CNN1 and CNN2.

The processing step performs crack detection based on explainable artificial intelligence (XAI), which is a trust-based technology that provides explanations to users in order to enhance the reliability of the results and allow users to identify errors in the deep learning algorithm. Such an XAI algorithm is configured as a network that provides textual explanations regarding the process, reasons, and key features involved in detecting cracks in the structure.

In addition, the processing step includes a reinforcement learning network, which estimates candidate crack locations and reduces the number of target candidates through estimation optimization of crack likelihood, thereby determining final crack location coordinates.

[*Remaining description omitted*]

DRAWING

ASSESSMENT

The description of the invention may be determined not to be described in a manner that is sufficiently clear and complete to enable a person skilled in the art to readily carry out the invention in light of the common general knowledge at the filing date.

REASONS FOR ASSESSMENT

(*Article 42(3)(i) of the Korean Patent Act — Enablement Requirement*)

The description of the invention discloses a process for detecting cracks in a structure by combining three different artificial intelligence algorithms, namely a deep learning network, an explainable artificial intelligence network, and a reinforcement learning network. However, it merely enumerates multiple heterogeneous AI algorithms and presents the processing steps in an abstract manner, without specifically describing how the input and output data of each artificial intelligence algorithm are functionally combined and interrelated.

Where the interrelationships among the input and output data of the respective artificial intelligence algorithms are not specifically described, it is difficult to conclude that the description of the invention is sufficiently clear and complete to enable a person skilled in the art to readily carry out the technical steps or functions of the invention. However, this does not apply where a person skilled in the art could understand how to execute or implement the steps or functions based on the embodiments disclosed in the description in light of the common general knowledge at the filing date.

(*Possible Amendment*)

Unless the description is amended to specifically describe the interrelationships among the input and output data of the deep learning network, the explainable artificial intelligence network, and the reinforcement learning network, the

rejection cannot be overcome.
However, attention should be paid to the fact that adding embodiments that newly specify the input/output data relationships among the deep learning network, the explainable artificial intelligence network, and the reinforcement learning network in an amendment may constitute the introduction of new matter.

(*Points to Note*)
The invention as recited in the claims merely describes using a composite network comprising a deep learning network, an explainable artificial intelligence network, and a reinforcement learning network to detect cracks in a structure, explain the reasons for estimating crack locations, and finally extract crack location coordinates. It does not specifically describe how the respective input and output data are combined, and such relationships cannot be regarded as self-evident even in view of the common general knowledge at the filing date.
Accordingly, in addition to the enablement rejection, a rejection for failure to satisfy the claim clarity and support requirement (Article 42(4)(i) of the Korean Patent Act) may also be raised against the claimed invention.

4.2 Case 2

TITLE OF THE INVENTION

Automatic Control System of a House's Temperature based on Machine Learning

GUIDELINE

1. *The description of the invention just recites training data, but does not specifically define the correlation between input data and output data of a trained model, and it may be hard for a person skilled in the art to assume (understand) the correlation through an embodiment described in the description of the invention or in view of common general technical knowledge as of the filing. It is determined, thus, the embodiment requirement is not satisfied.*

2. *The description of the invention does neither describe a specific feature corresponding to the claim nor be extended to the whole scope of claims nor be generalized in view of common general technical knowledge. It is determined, thus, the claim is not be supported by the description of the invention.*

PREMISE

It is premised that there is no correlation between data on a building's temperature control and fine dust concentration amongst outside environmental information.

CLAIM

An automatic temperature control system for a house based on a machine learning algorithm comprising:

a storing unit for storing historical records of daily weather information and information on temperature control for a house;

a learning model generation unit for generating a machine learning model using at least one or more daily weather information among the stored temperature, humidity, wind speed, cloud amount, fine mist concentration and the temperature control information for a house as training data;

a collection unit for collecting at least one or more current weather

information among temperature, humidity, wind amount, fine dust concentration information from a server of Korea Meteorological Administration; and

an output unit for outputting information on the automatic temperature control of a house that is predicted from the current weather information input in said collection unit, by using the machine learning model generated in accordance with said learning model generation unit.

DESCRIPTION OF THE INVENTION

The purpose is to automatically control a house's temperature by using the correlation between weather information and a house's temperature.

The present disclosure gives rise to the effect of reducing a house's energy consumption cost, comprising using a house's temperature control information and daily weather information collected from a server of Korea Meteorological Administration and outputting a house's automatic temperature control information by using a machine learning model.

Daily weather information, such as temperature, humidity, wind speed, wind amount, fine dust concentration information, etc., collected from a server of Korea Meteorological Administration is contained.

According to the house's autonomous temperature control system described in the present disclosure, the storing unit stores historial records of daily weather information and a house's temperature control information and the learning model generation unit generates a machine learning model using a house's temperature control information and daily weather information stored in said storing unit as a training dataset.

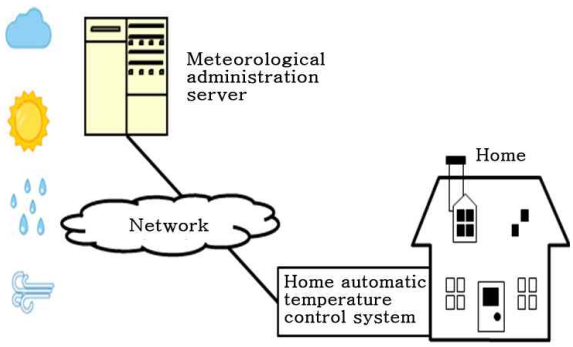
The machine learning model of the present disclosure may use an artificial neural network (ANN) as a disclosed machine learning model. The collection unit collects current weather information from a server of Korea Meteorological Administration and the output unit outputs a house's automatic temperature control information predicted from the current weather information input in said collection unit, by using a learning model in accordance with said learning model generation unit.

According to an embodiment, the house's automatic temperature control system compares temperature data amongst the current weather information

collected from a server of Korea Meteorological Administration with temperature data amongst historical records of daily weather information, but outputs a house's temperature control information predicted from the current weather information data based on the machine learning model. <*Hereinafter omitted*>

According to a specific embodiment, the house's automatic temperature control system compares humidity data amongst the current weather information collected from a server of Korea Meteorological Administration with humidity data amongst historical records of daily weather information, but outputs a house's temperature control information predicted from the current humidity data based on the machine learning model. <*Hereinafter omitted*>

DRAWING



ASSESSMENT

1. It is determined that the description of the invention would have been described clearly or in detail so as for a person skilled in the art to easily embody the invention of claim 1 in view of common general technical knowledge as of the filing.
2. It is determined that the invention of claim 1 is not be supported by the description of the invention.

REASONS FOR ASSESSMENT

(*Article 42(3)(i) of the Korean Patent Act — Enablement Requirement*)

The description of the invention describes the correlation between some input data, such as temperature and humidity information, and output data of a trained model, such as information on a house's automatic temperature control, but does not describe the correlation between other input data, such as wind speed, wind amount and fine dust concentration information, and output data of the trained model.

Also, the description of the invention describes an embodiment regarding some input data, such as temperature and humidity information, but does not describe an embodiment regarding other input data, such as wind speed, wind amount, fine dust concentration information.

If the correlation between input data and output data of the trained model is not specifically described, it cannot be considered that the description of the invention is clearly and in detail described so as for a person skilled in the art to easily implement information processing by using a technical correlation, provided, however, that if a person skilled in the art can assume (understand) the correlation through an embodiment as described in the description of the invention or in view of common general technical knowledge as of the filing, it is not the case.

Since a person skilled in the art can assume (understand) the correlation through an embodiment as described in the description of the invention or in view of common general technical knowledge as of the filing, even if the description of the invention does not specifically describe the correlation between weather information, such as temperature, humidity, wind speed and wind amount, amongst training data, and a house's temperature control information, there is no difficulty in working the invention.

Since the description of the invention does not, however, specifically describe the correlation between fine dust concentration data and a house's automatic temperature control information, it is not obvious to a person skilled in the art that there is the correlation between fine dust data and a house's automatic temperature control information in view of common general technical knowledge as of the filing.

Also, since the description of the invention does not suggest an embodiment (experimental case) for automatically controlling a house's temperature to get a person skilled in the art to obtain proper temperature control information from the trained model only based on fine dust concentration information, it is not considered that the description of the invention satisfies the embodiment requirement.

Accordingly, it is determined that the description of the invention is not clearly and in detail described so as for a person skilled in the art to easily carry out the invention in view of common general technical knowledge and based on the specification and brief description of the drawing(s).

(*Possible Amendment*)

If an amendment together with a written argument does not support the「correlation between fine dust concentration data and a building's temperature control data or the effect of reducing energy consumption cost by automatically controlling a house' temperature through machine learning based on fine dust concentration information」, the objection cannot be overcome.

If「an embodiment for supporting the effect of reducing energy consumption cost by automatically controlling a house' temperature through machine learning based on fine dust concentration information」is added to the amendment, attention should be paid that it can be considered as addition of a new matter.

For a reference, the patent applicant can consider a measure for overcoming the objection by deleting find dust concentration information amongst weather information that is used in a machine learning model from an amendment.

(*Article 42(4)(i)*)

The invention of claim 1 describes a learning model generation unit for generating a machine learning model using weather information (temperature, humidity, wind speed, wind amount and fine dust concentration information) and a house's temperature control information as learning data as a characteristic feature.

The description of the invention, however, does only describe a learning model generation unit using temperature and humidity information as learning

data as a specific feature corresponding to said learning model generation unit, but does not describe the learning model generation unit using fine dust concentration information as training data. Further, it is not obvious to a person skilled in the art even as considering common general technical knowledge as of the filing.

Accordingly, the description of the invention does describe neither a specific feature corresponding to the invention of claim 1 nor be extended to the whole scope of claims (weather information including fine dust information) nor be generalized in view of common general technical knowledge.

It is determined, thus, the invention of claim 1 cannot be supported by the description of the invention.

4.3 Case 3

TITLE OF THE INVENTION

Method for Generating Fused Data Using Artificial Intelligence

GUIDELINE

In machine-learning-based artificial intelligence inventions, where data preprocessing—by which collected raw data is converted into training data—constitutes the core technical feature of the invention, a failure to describe how the preprocessing steps or functions are executed or implemented in order to generate, modify, add, or delete training data from the collected raw data may result in a determination that the enablement requirement is not satisfied.

CLAIM

A method for generating training data for an artificial intelligence model, comprising:

acquiring data including data-based knowledge and expert-based knowledge;

determining a preprocessing algorithm for the data, preprocessing the data, and extracting rules from the data; and

fusing at least one or more of the preprocessed data based on the extracted rules.

DESCRIPTION OF THE INVENTION

Data related to a given service may include data pertaining to data-based knowledge and data pertaining to expert-based knowledge.

Data-based knowledge refers to knowledge obtained based on data capable of providing various types of information used for the service, while expert-based knowledge data may include knowledge data based on the knowledge or experience of experts related to the service.

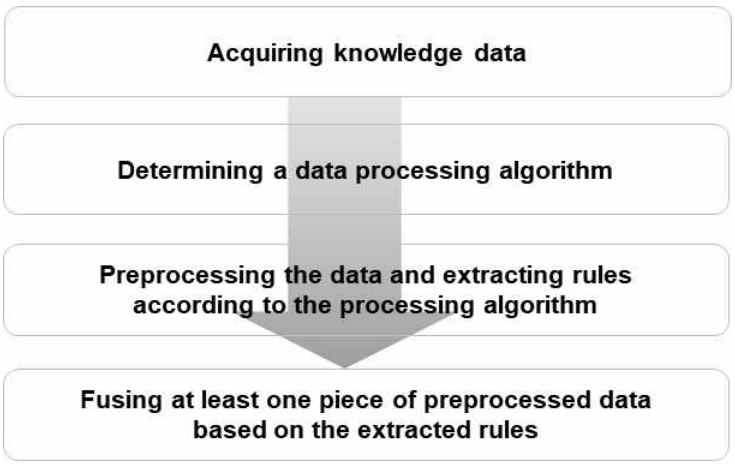
Depending on the type, form, or content of the knowledge data used for training an artificial intelligence model, an algorithm for processing the data may be determined, and the data may be preprocessed and rules may be extracted according to the determined processing algorithm.

Based on the extracted rules, at least one or more pieces of preprocessed data may be fused. Specifically, a fact type of the extracted rules may be identified, at least one service type may be generated based on the identified fact type, and the data may be fused by mapping the extracted rules to at least one service case.

Knowledge is extracted from various data sources, and knowledge is acquired from domain experts related to the service and fused into a database in a uniform format. Conditions of rules are verified with respect to the input data, appropriate rules corresponding to the data are extracted, and the extracted rules are stored in a knowledge database.

Service cases generated based on the stored rules are connected to fuse data, the fused data is used to train an artificial intelligence model, and when a new service case is input, a rule most suitable for the service case and an operator for the rule are identified and applied to the input service case so as to be used for generating fused data.

DRAWING



ASSESSMENT

The description of the invention may be determined not to be described with sufficient clarity and completeness to enable a person skilled in the art to readily carry out the invention in light of the common general knowledge at the filing date.

REASONS FOR ASSESSMENT

(*Article 42(3)(i) of the Korean Patent Act — Enablement Requirement*)

Contrary to the common general knowledge in the relevant technical field, in which the entire process up to the generation of training data is typically regarded as a preprocessing process, the description of the invention characterizes preprocessing as including the extraction of rules from data containing various types of knowledge based on predetermined algorithms. However, the description does not explicitly specify what rules are extracted through the preprocessing process or how such rules are extracted. Even when taking into account the average level of knowledge of a person skilled in the art in the relevant technical field, the method of extracting the rules and the nature of the extracted rules cannot be specifically identified.

In particular, although the description states that an algorithm to be applied is determined depending on the type, form, or content of the data, and that rules are extracted from the preprocessed data according to the determined algorithm and selectively applied to the data, data can generally be classified into structured data and unstructured data depending on the presence or absence of a defined format. Moreover, depending on the content or type, data may take various forms such as personal information, text, speech, images, measurement data, and the like. In addition, the present invention includes, as preprocessing targets, data based on domain expert knowledge. Accordingly, in order to generate training data in a uniform format from such diverse data types and forms, it is necessary to specify concrete preprocessing techniques. Even assuming that preprocessing algorithms corresponding to the type, form, or content of the data are widely known and could be selected by a person skilled in the art, the preprocessing process itself must still be specified in order to identify what rules are extracted and how such rules are extracted from the preprocessed data for solving the technical problem addressed by the present invention.

However, the description of the invention does not concretely describe how the steps recited in the claims—namely, determining a data preprocessing algorithm, extracting rules, and applying the extracted rules—are executed or implemented. Even in view of the technical level at the filing date, a person

skilled in the art cannot clearly understand the invention, and therefore cannot readily carry it out. Accordingly, the invention is determined not to satisfy the enablement requirement.

(*Possible Amendment*)

In order to generate fused data according to the present invention, it is necessary to amend the description such that data processing or preprocessing steps for extracting rules required for each data type are specifically defined. In doing so, amendments must be made only within the scope of matters that would have been self-evident to a person skilled in the art in light of the common general knowledge at the filing date, and care must be taken not to introduce new matter.

(*Points to Note*)

The invention as recited in the claims merely describes processing or preprocessing data to extract rules and generating fused data based on the extracted rules, without specifically describing how the data is preprocessed in order to extract the necessary rules, or what rules are extracted and how they are extracted. Such matters cannot be regarded as self-evident even when considering the common general knowledge at the filing date.

Accordingly, in addition to an enablement rejection, a rejection for failure to satisfy the claim clarity and support requirement (Article 42(4)(i) of the Korean Patent Act) may also be issued against the claimed invention.

4.4 Case 4

TITLE OF THE INVENTION

Pharmaceutical Composition for Treating Alzheimer's Disease

GUIDELINE

1. This is a case in which the enablement requirement is considered satisfied because the specification discloses experimental examples in which compounds recited in the claims, whose properties were predicted by artificial intelligence, were actually tested to confirm that the predicted properties produce the asserted technical effects.

2. This is also a case in which, where the specification merely describes properties of compounds predicted by artificial intelligence without providing experimental examples, and where such properties and corresponding effects cannot be derived as self-evident by a person skilled in the art, the invention is considered to fail to satisfy the enablement requirement.

※ *For inventions directed to pharmaceutical uses of compounds predicted by artificial intelligence, examination should be conducted with reference to the "Examination Guidelines for Biotechnology," the "Examination Guidelines for Pharmaceutical Inventions," and the "Examination Guidelines for Chemical Inventions" as well as the "Examination Guidelines for AI-Related Inventions"*

CLAIMS

[Claim 1]

A pharmaceutical composition for treating Alzheimer's disease, comprising, as an active ingredient, a compound represented by Chemical Formula 1 or a pharmaceutically acceptable salt thereof.

[Claim 2]

A pharmaceutical composition for treating Alzheimer's disease, comprising, as an active ingredient, a compound represented by Chemical Formula 2 or a pharmaceutically acceptable salt thereof.

DESCRIPTION OF THE INVENTION

Several compounds known to reduce symptoms of Alzheimer's disease are reported to bind to protein M and suppress the expression of protein M. Based on this observation, an artificial intelligence model was used to identify new compounds having a high likelihood of binding to protein M. [Omitted]

(*Embodiment 1*) Identification of novel compounds predicted to bind to protein M using a machine learning model

Compounds that bind to protein M and suppress its expression are referred to as 'protein M-binding compounds'. A machine learning model, such as ensECBS, was used to identify such compounds.

Training data were generated using known protein M-binding compounds and non-binding compounds, including information on compounds, the target protein, and binding status, and the machine learning model was trained accordingly.

The trained model received compound data as input and output a probability indicating the likelihood of binding between the compound and protein M. Compounds in a compound database were evaluated, and two candidate compounds having the highest predicted binding probabilities were selected, namely a compound represented by Chemical Formula 1 and a compound represented by Chemical Formula 2.

(*Embodiment 2*) Confirmation of binding between the compound of chemical formula 1 and protein M

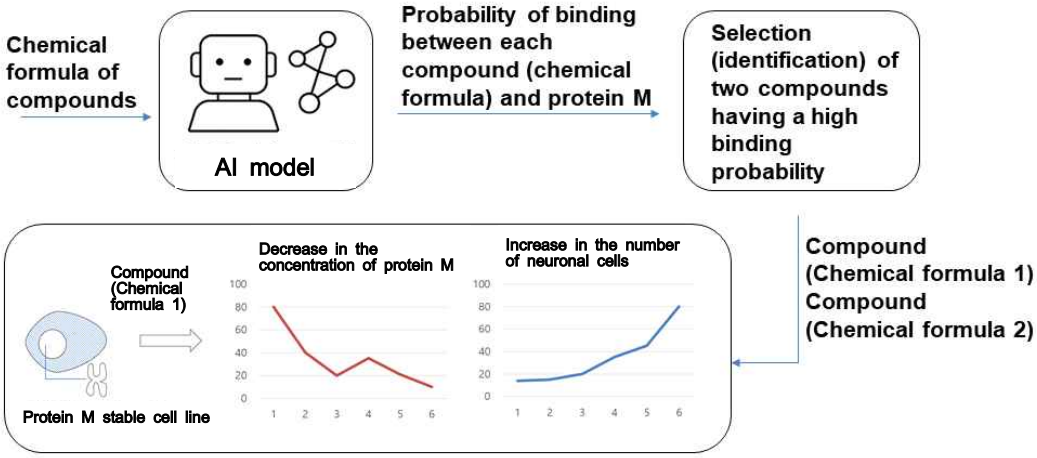
A stable cell line expressing protein M-EGFP was established by linking EGFP to the C-terminus of protein M. [Omitted] The compound represented by Chemical Formula 1 was administered to the stable cell line, and as a result, the compound was confirmed to bind to protein M and effectively reduce the concentration of protein M.

(*Embodiment 3*) Evaluation of the therapeutic effect of the compound of chemical formula 1 on Alzheimer's disease

The compound represented by Chemical Formula 1 was intraperitoneally injected into Alzheimer's disease model mice. Behavioral tests, including

Y-maze, novel object recognition (NOR), passive avoidance (PA), three-chamber test (3CT), open field (OF), and rotarod tests, were conducted using known methods. [Omitted] Amyloid plaque levels and immunohistochemical analyses of mouse brain tissue were also evaluated. [Omitted] Based on these results, the compound represented by Chemical Formula 1 was confirmed to effectively treat Alzheimer's disease by, inter alia, increasing neuronal cells in the brains of Alzheimer's disease model mice.

DRAWING



Experimental results demonstrating binding to protein M and a therapeutic effect for Alzheimer's disease: Compound (Chemical Formula 1)

PREMISE

It is assumed that, as of the filing date, the pharmacological mechanism by which a compound binds to protein M, suppresses the expression of protein M, and thereby alleviates symptoms of Alzheimer's disease had not been clearly established.

ASSESSMENT

The description of the invention relating to Claim 1 is considered to be sufficiently clear and complete to enable a person skilled in the art to readily

carry out the invention in light of the common general knowledge at the filing date.

The description of the invention relating to Claim 2 is considered not to be sufficiently clear and complete to enable a person skilled in the art to readily carry out the invention.

REASONS FOR ASSESSMENT

(*Article 42(3)(i) of the Korean Patent Act — Enablement Requirement*)

Claims 1 and 2 are directed to new pharmaceutical uses for treating Alzheimer's disease based on the feature that the compounds represented by Chemical Formulae 1 and 2 bind to protein M.

In chemical and pharmaceutical inventions, due to limited predictability and reproducibility, it is generally difficult for a person skilled in the art to clearly understand and readily reproduce the asserted effects of an invention unless experimental examples supported by data are disclosed (Refer to Supreme Court Decision, November 30, 2001, Case No. 2000Hu2958, Supreme Court Decision, December 23, 2004, Case No. 2003Hu1550, Supreme Court Decision, March 30, 2007, Case No. 2005Hu1417).

In particular, for pharmaceutical use inventions, unless there are special circumstances such as a well-established pharmacological mechanism disclosed in the specification as of the filing date, it is necessary to describe test examples demonstrating pharmacological effects, such as pharmacological data, or to provide a description sufficiently concrete to substitute for such data.

In the present specification, artificial intelligence was used to predict that compounds represented by Chemical Formulae 1 and 2 have favorable binding properties to protein M. Among these, only the compound represented by Chemical Formula 1 was experimentally confirmed to bind to protein M and to reduce the concentration of protein M. However, since it was not clearly established as of the filing date that binding to protein M and reducing its concentration directly result in a therapeutic effect for Alzheimer's disease, such binding alone cannot be regarded as direct evidence of a pharmacological effect for treating Alzheimer's disease. Accordingly, experimental verification of the therapeutic effect is required. For the compound represented by Chemical

Formula 1, experimental examples confirming the therapeutic effect on Alzheimer's disease were provided.
In contrast, for the compound represented by Chemical Formula 2, no experimental results were disclosed demonstrating binding to protein M, reduction of protein M concentration, or therapeutic efficacy for Alzheimer's disease, nor was a description provided that could substitute for such experimental data.
For these reasons, the invention according to Claim 1 is considered to satisfy the enablement requirement, whereas the invention according to Claim 2 is considered not to satisfy the enablement requirement.

(*Points to Note*)
This case illustrates the application of Article 42(3)(i) of the Korean Patent Act (enablement requirement) only, and no determination was made regarding other possible grounds for rejection.
Terms such as Chemical Formulae 1 and 2 and protein M are simplified for ease of understanding of the case.

4.5. Case 5

TITLE OF THE INVENTION

Computer Program for Classifying Input Data Using a Classification Model

GUIDELINE

This is an example in which the technical field and the purpose of the claimed invention are identical to those of the cited invention. Although the claimed invention explicitly specifies the use of labeled training data, whereas the cited invention merely discloses that a classifier is trained, the use of labeled training data in supervised learning is commonly adopted in the field of artificial intelligence. Accordingly, inventive step may be denied.

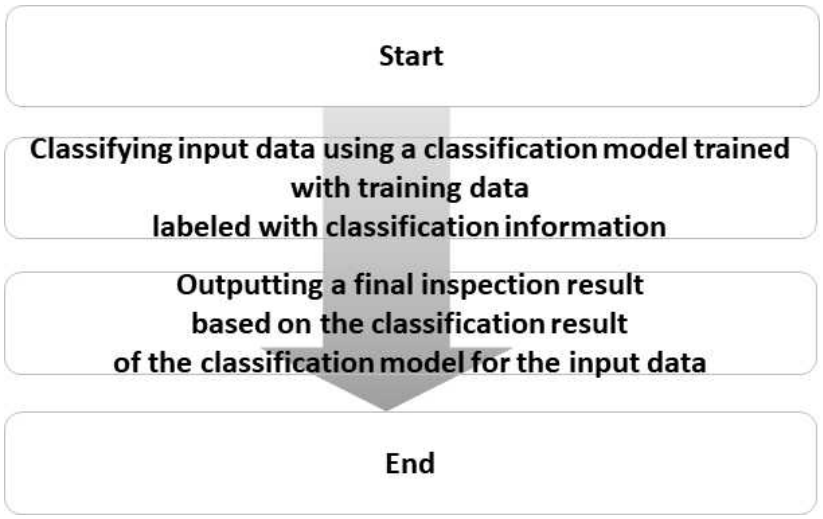
CLAIM

A computer program stored on a computer-readable storage medium,
wherein, when the computer program is executed by one or more processors of a computing device, the computer program causes the computing device to perform the following operations for input data inspection:
classifying input data using a classification model trained with training data labeled with classification information; and
outputting a final inspection result based at least in part on a classification result of the classification model for the input data.

PROBLEM TO BE SOLVED

The claimed invention relates to an anomaly detection method. By classifying input data using a classification model and outputting a final inspection result based on the classification result, the invention aims to improve the accuracy and computational efficiency of anomaly detection.

DRAWING



CITED INVENTION

An object detection method, comprising:
in a training stage, cascade training a plurality of classifiers; and
in an inference stage,
applying a first classifier to an input image to obtain a first classification result,
applying a second classifier cascade-combined with the first classifier to obtain a second classification result, and
terminating the classification process or performing further classification based on the result of the second classifier.

ASSESSMENT

The claimed invention may be considered to lack inventive step in view of the cited invention.

REASONS FOR ASSESSMENT

(*Common Features*)

Both the claimed invention and the cited invention share the same technical purpose in that they classify input images using trained classifiers and output a final result and include a configuration in which a classification model trained

using training data is employed to classify input data and to output a final inspection result.

(*Distinguishing Feature*)

The claimed invention explicitly specifies that the classification model is trained using labeled training data, whereas the cited invention merely discloses that “a plurality of classifiers are cascade-trained” and does not explicitly state whether labeled training data are used.

(*Assessment of the Distinguishing Feature*)

The use of “labeled training data” corresponds to “supervised learning”, which constitutes common general knowledge in the field of artificial intelligence.

In view of the state of the art at the filing date, a person skilled in the art would readily employ labeled training data when training the classifiers of the cited invention for classifying input data (images) and outputting a final result. Such an addition merely represents a routine design choice, and does not involve any particular technical difficulty nor produce any unexpected or remarkable technical effect.

Accordingly, the claimed invention could be easily derived by a person skilled in the art from the cited invention, and therefore does not involve an inventive step.

(*Points to Note*)

This inventive-step assessment is a modified and simplified example prepared solely for illustrative purposes. In actual examination practice, where the claims specifically define the training data, training method, or model architecture, and where such specific technical features provide effects exceeding those predictable from the cited invention, the invention may not be regarded as obvious to a person skilled in the art.

4.6. Case 6

TITLE OF THE INVENTION

Method for Controlling a Robot Vacuum Cleaner

GUIDELINE

1. *Where the claimed invention is identical with the cited invention in the technology field and the training data, but the difference in the learning models corresponds to a simple design modification by a person skilled in the art, it is determined that the claimed invention does not involve an inventive step*
2. *Where there is a difference in a specific feature besides training data and a learning model, and the claimed invention has an advantageous effect over the cited invention, it is determined that the claimed invention involves an inventive step*

CLAIMS

[Claim 1]

A control method of a robot vacuum cleaner comprising:

a step in which said robot vacuum cleaner drives each area and collects surrounding images;

a step in which said collected surrounding images and an area identifier that is corresponding to said collected surrounding images are set and training data thereof are generated;

a step in which a convolutional neural network (CNN) is trained by using said training data;

a step in which cleaning motion of said robot vacuum cleaner is activated;

a step in which said robot vacuum cleaner acquires surrounding images at the present location;

a step in which an area identifier of the present location is assumed by reading surrounding images acquired at said present location in said trained CNN; and

a step in which driving paths of said robot vacuum cleaner are reset on

the basis of the assumed area identifier of said present location.

[Claim 2]

The control method of a robot vacuum cleaner described in claim 1 further contains:

prior to the step where cleaning motion of said robot vacuum cleaner is activated,

a step where a cleaning area where said robot vacuum cleaner performs cleaning and a charging area where a battery charger of said robot vacuum is located are designated by using said area identifier.

The step where said driving path is reset, as described in claim 1, further contains:

a step where said robot vacuum cleaner measures the current battery remaining volume;

a step where if said battery remaining volume are below the threshold, the driving path is reset to said battery charging area; and

a step where if said battery remaining volume exceeds said threshold, the driving path is reset to get said robot vacuum cleaner to move to said battery charging area passing said cleaning area on the basis of said cleaning area and average battery consumption data by cleaning area.

PROBLEM TO BE SOLVED

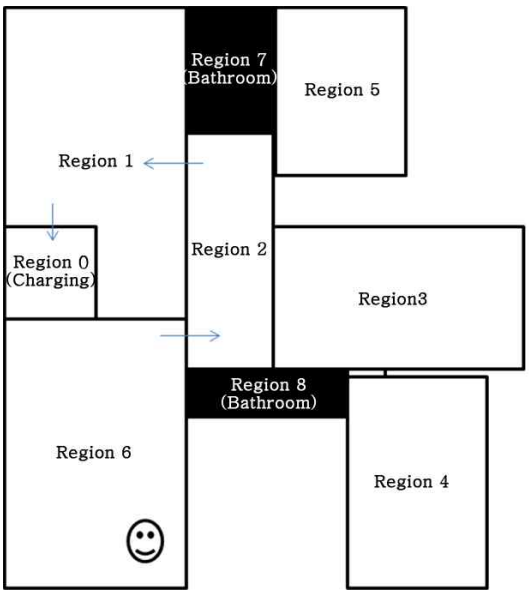
The purpose is to provide a control method of a robot vacuum cleaner performing cleaning and the “return to charge” (RTC) by making the robot vacuum cleaner clearly figure out the present location through a computer vision technology and compute an efficient path for cleaning and the return path to a battery charger through the reset of the driving path based on the present location.

MEANS FOR SOLVING THE PROBLEM

In the learning step, a robot vacuum cleaner drives all the cleaning areas and collects surrounding images separately for each area. Training data, however, are collected by adding an area identifier to the collected images at each area. A convolutional neural network within the robot vacuum cleaner are trained by utilizing the collected training data. A specific training method of image data through the convolutional neural network is to be described hereafter. Also, a user can designate both a cleaning area where said robot vacuum cleaner performs cleaning and a battery charging area where a battery charger of said robot vacuum is located by using said cleaning area identifier. A robot vacuum cleaner for which the training for the convolutional neural network is completed for recognizing a cleaning area is charged at the battery charger and waits for activation of the cleaning function based on the user's cleaning command or schedule. If the robot cleaner receives the user's cleaning command or the cleaning function is activated in accordance with schedule, it collects surrounding images at the present location. The robot vacuum cleaner computes a presumed identifier for a cleaning area by reading the input images in a deep-learning model. The robot cleaner resets the driving path by using the presumed cleaning area identifier as the starting point.

The step where the driving path is reset may include a feature for resetting the driving path to said battery charging area if the battery remaining volume is below the threshold based on the measurement of the battery remaining volume. Also, if the battery remaining volume of the robot cleaner exceeds the threshold, a feature for resetting the driving path to get the robot cleaner to move to said charging area passing the cleaning area, based on the cleaning area and average battery consumption data by cleaning area.

DRAWING



Region identifier	Object to be cleaned	Charger
0	1	1
1	1	0
2	1	0
3	1	0
4	1	0
5	1	0
6	1	0
7	0	0
8	0	0
9	1	0

Current location	6
Remaining battery level	15%
Traveling route	6, 2, 1, 0

COMMON GENERAL TECHNICAL KNOWLEDGE AS OF THE FILING

Selective application of artificial neural networks (ANNs), convolutional neural networks (CNNs) and recurrent neural networks (RNNs) is merely design modification for a person skilled in the art, as applying a machine learning model.

CITED INVENTION

A driving control method of an automatically driving vacuum cleaner using an artificial neural network comprising:

a cell image collection step in which a certain area around a vacuum cleaner is divided into multiple cells and image information by said cell is generated by collecting image data through photographing;

an intelligent neural network training step in which the image information for each cell of the above cells is divided into cleanable, non-cleaning areas and training data are generated by numbering each cell and an artificial neural network is trained by using said generated training data;

a step in which said vacuum cleaner photographs the present location and inputs the image information to said trained artificial neural network through

said artificial neural network training step;

a step in which the cell number of the present location is identified through said trained artificial neural network; and

a vacuum cleaner driving step in which the vacuum cleaner drives along a certain path arranged by sequential listing of the cell numbers specified as the cleaning area, with the cell number of the above present location as the starting point.

ASSESSMENT

1. It is determined that the invention of claim 1 does not involve an inventive step over the cited invention.
2. It is determined that the invention of claim 2 involves an inventive step over the cited invention.

REASONS FOR ASSESSMENT (INVENTION OF CLAIM 1)

(*Common Features*)

The invention of claim 1 and the cited invention have an identical purpose in that a robot vacuum cleaner identifies, by itself, an information of the present location through a machine learning model on the basis of visual information collection and is controlled for the driving on the basis of it.

Also, the invention of claim 1 and the cited invention are identical in a feature of generating training data for dividing areas by collecting the visual information (picture or image) of said divided area after dividing surrounding areas of the vacuum cleaner into several areas and in a feature where training data are trained through a machine learning model on the basis of the artificial neural network, visual information of the present location is input to said learned machine learning model, the information of the current area is derived, cleaning areas are recognized and the vacuum cleaner's driving is set by using it.

(*Distinguishing Features*)

The invention of claim 1 selects a convolutional neural network (CNN) as a learning model, whereas the cited invention does an artificial neural network

(ANN) as the same. Accordingly, the both inventions are different in learning models.

(*Assessment for the Distinguishing Features*)

The invention of claim 1 selects a convolutional neural network (CNN) as a learning model, whereas the cited invention does an artificial neural network (ANN) as the same. Accordingly, the both inventions are different in learning models. Even if the description of the invention is referred to, however, it does not specifically define a convolutional neural network (CNN) as described in claim 1. Further, in an image recognition technology field, it is a mere design modification for a person skilled in the art in accordance with a specific application to simply replace an artificial neural network (ANN) with a convolutional neural network (CNN).

Also, it cannot be considered that the invention of claim 1 has an advantageous working effect over the cited invention.

Therefore, since it is determined that the invention of claim 1 is easily embodied by a person skilled in the art from the cited invention, it is concluded, thus, that the invention of claim 1 does not involve an inventive step.

REASONS FOR ASSESSMENT (INVENTION OF CLAIM 2)

(*Common Features*)

Common features are already described in the aforementioned reason for the determination – Invention of claim 1.

(*Distinguishing Features*)

The invention of claim 2 is different from the cited invention in that it discloses a specific feature where the driving path of the robot vacuum cleaner is reset by taking the output data of the learned convolutional neural network learning model as the landmark position and taking into account the current remaining battery volume data of the robot vacuum cleaner.

(*Assessment for the Distinguishing Features*)

The cited invention discloses a feature of setting the driving path of a robot vacuum cleaner on the basis of the output data of a neural network learning model but does not disclose a feature of taking the output data of the learned convolutional neural network learning model as the landmark position and taking into account the current remaining battery volume data of the robot vacuum cleaner for resetting the driving path of the robot vacuum cleaner, as described in the invention of claim 2.

Also, it is determined that the invention of claim 2 has an advantageous effect over the cited invention in that a robot vacuum cleaner recognizes the present location through the learned convolutional neural network and resets the driving path on the basis of the current remaining battery volume, and thereby preventing a robot vacuum cleaner from returning to a battery charging area.

Therefore, since it is determined that the invention of claim 2 cannot be easily embodied by a person skilled in the art from the cited invention, it is concluded, thus, that the invention of claim 1 involves an inventive step.

4.7 Case 7

TITLE OF THE INVENTION

A Bone Age Reader based on Machine Learning Algorithm

GUIDELINE

1. *The claimed invention and the cited inventions are identical in the technology field and the training data, but different in learning models between the claimed invention and cited invention 1. However, in the cited invention 2, the corresponding feature is disclosed, and there is no difference in the working effect. In this case, it is determined that the claimed invention does not involve an inventive step.*
2. *The claimed invention and the cited inventions are identical in the technological field and the training data, but a learning model of the claimed invention is different from the one of cited invention 1, and the difference is neither disclosed nor implicated in cited invention 2. Further, the working effect of the claimed invention is different from the one of the cited inventions. In this case, it is determined that the claimed invention involves an inventive step.*

CLAIMS

[Claim 1]

A bone age reader comprising:

a bone image input unit for inputting a hand bone (手骨) image;

a region of interest (ROI) extraction unit for extracting a plurality of regions of interest from the input hand bone (手骨) image;

a bone grade classification unit for classifying a bone grade by applying a convolutional neural network (CNN) to an image of said extracted regions of interest each; and

a bone age reading unit for reading a bone age by using the classified bone grade by the bone grade classification unit.

[Claim 2]

A bone age reading method by a bone age reader comprising:

a step in which a bone image input unit inputs a hand bone (手骨) image;

a step in which a region of interest (ROI) extraction unit extracts a plurality of regions of primary interest from the input hand bone image;

a step in which the region of interest extraction unit extracts a plurality of regions of secondary interest from said extracted region of primary interest;

a step in which a bone grade classification unit classifies a bone grade by applying a convolutional neural network (CNN) to said extracted regions of secondary interest each;

a step in which a bone age reading unit reads the bone age by using the bone grade of said classified region of secondary interest;

wherein said region of secondary interest extraction step further comprising:

an extraction step for extracting a feature map through the convolutional neural network from the input region of primary interest; and

an extraction step for extracting said plurality of regions of secondary interest from said plurality of regions of primary interest based on a predictable score.

wherein the computation of the predictable score comprising:

a step in which a feature vector is generated by implementing the computation of each location by applying the sliding window method to said feature map; and

a step in which a predictable score is computed for the location and the size of a candidate region and a candidate region on the regions of secondary interest by using the generated feature vector.

DESCRIPTION OF THE RELATED ART

Hand bone age reading helps to confirm whether a young child is normally developed by comparing a bone age with a physical age through reading his/her x-ray image and to predict how much more he or she can grow in the future.

PROBLEM TO BE SOLVED

Correct and reliable bone age reading is implemented by using image processing based on a machine learning algorithm for a hand bone image.

MEANS FOR SOLVING THE PROBLEM

A bone age reader can output by reading a bone age through machine learning with an input image including a human being's hand bone (手骨). A bone age reader comprises a bone image input unit for inputting a hand bone (手骨) image; a region of interest (ROI) extraction unit for extracting a plurality of regions of interest from the input hand bone (手骨) image; a bone grade classification unit for classifying the bone grade by applying a convolutional neural network (CNN) to an image of said extracted regions of interest each and a bone age reading unit for reading a bone age by using the classified bone grade by the bone grade classification unit.

A bone image input unit is input with an image including a human being's hand bones or inputs the human being's hand bones by capturing a human being's hand bones. A region of interest (ROI) extraction unit extracts a plurality of regions of interest from the input hand bones image.

Said region of interest includes the ones of the wrist, a thumb, a middle finger and a ring finger. Specifically the ROI of the wrist sets the two X coordinates closest to the center of the wrist to the left and right boundaries and extracts the region of interest in the wrist using the upper and lower boundary of the wrist and the left and right contours of the wrist; for example, the convex hull method may be utilized.

When it comes to the region of interest in the finger, the bone image using a feature point of a finger tip portion and a bone feature point between fingers is rotated; the upper and lower boundaries are set by using the feature point of the finger tip and the center point of the hand; the bone features on both sides of the finger are set to the left and right boundaries, and thereby the regions of interest of a thumb, a middle finger and a ring finger are extracted.

According to an embodiment of the present disclosure, a bone age reading method by a bone age reader comprises a step where a bone image input unit inputs a hand bone (手骨) image; a step where a region of interest extraction unit extracts a plurality of regions of primary interest from the input hand bone image; a step where a region of interest extraction unit extracts a plurality of regions of secondary interest from said extracted region of primary interest; a step where a bone grade classification unit classifies the bone grade by

applying a convolutional neural network (CNN) to an image of said extracted regions of secondary interest each and a step where a bone age reading unit reads the bone age by using the bone grade of said classified regions of secondary interest.

According to an embodiment, a bone age reading device extracts, in the regions of primary interest (ROI) extraction step, regions of interest of the wrist, a thumb, a middle finger and a ring finger as the regions of primary interest from the input hand bone image.

According to an embodiment, a bone age reader can extract a plurality of regions of secondary interest from each of the region of primary interest in the following ways: it can extract radius and ulna regions of interest from the region of interest of the wrist, a first distal phalanx, a first proximal phalanx and a first metacarpal from the region of interest of a thumb, a third distal phalanx, a third middle phalanx, a third proximal phalanx, a third metacarpal from the region of interest of a middle finger, a fifth distal phalanx, a fifth middle phalanx, a fifth proximal phalanx and a fifth metacarpal from the region of interest of a ring finger.

According to an embodiment, the bone age reader further contains CNN application on feature map extraction, the regions of secondary interest (ROI) training and the region of secondary interest (ROI) extraction in the regions of secondary interest (ROI) extraction step.

In said CNN application on feature map extraction, a bone age reader extracts a feature map through the CNN from the input hand bone image of the region of primary interest. Here the CNN may apply various kinds of neural networks; for example, ZFNet may be applied.

Said region of secondary interest (ROI) training step uses said region of primary interest by part as training data for extracting a plurality of regions of secondary interest from a plurality of regions of primary interest. Here the training data can rely on the upper left and lower right coordinates in the image of the region of primary interest by part.

Said regions of secondary interest (ROI) extraction step comprises applying the sliding window method to said feature map that is extracted in said CNN application on feature map extraction, generating a feature vector by

implementing a computation for each location and extracting said plurality of regions of secondary interest from said plurality of regions of primary interest based on a predictable score that is calculated for a candidate region and the location and size of a candidate region in the region of secondary interest by using the generated feature vector.

According to an embodiment, a bone age reader sets an anchor box as taking each sliding window into account for its scale and aspect ratio relative to the center of the feature map; for example, the scale is 128, 256 and 512, and the aspect ratio is 1:1, 1:2, and 2:1 for each window, with nine anchor boxes available for each window.

The bone age reader calculates the location and size of the candidate region in the regions of secondary interest and the predictable score thereof through the two full connected layers of the feature vectors generated each. The bone age reader excludes overlapping candidate regions by setting the intersection width between regions and the intersection of union (IoU) between regions based on candidate regions with a high predictive score, for example, to 0.7 as a preset criterion.

The bone age reader sets the top N candidate regions based on the predictable score for the remaining candidate regions. The bone age reader extracts a certain size feature vector through the ROI pooling of the candidate region in the regions of secondary interest.

According to an embodiment, the bone age reader classifies a bone grade by setting up the convolution neural network (CNN).

Here the CNN can apply various kinds of neural networks; for example, the Alex net and the VGG net may be applied.

According to an embodiment, the bone age reading unit calculates Radius, Ulna and Short bones (RUS) scores by using the predicted bone grades of the four regions of interest based on TW3 techniques and translates them into bone ages.

DRAWINGS

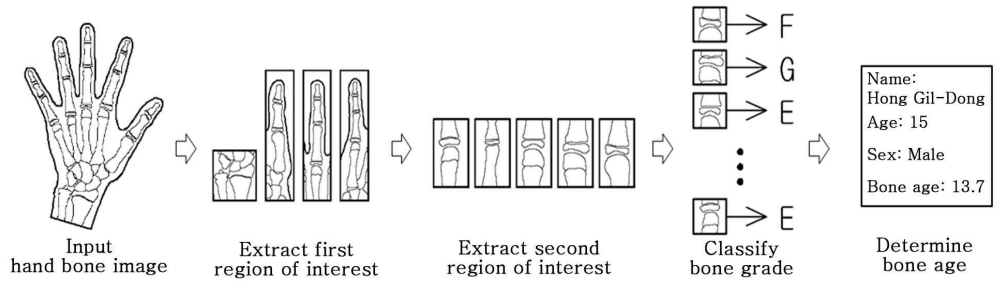


FIG1: The concept of bone age reading in accordance with an embodiment

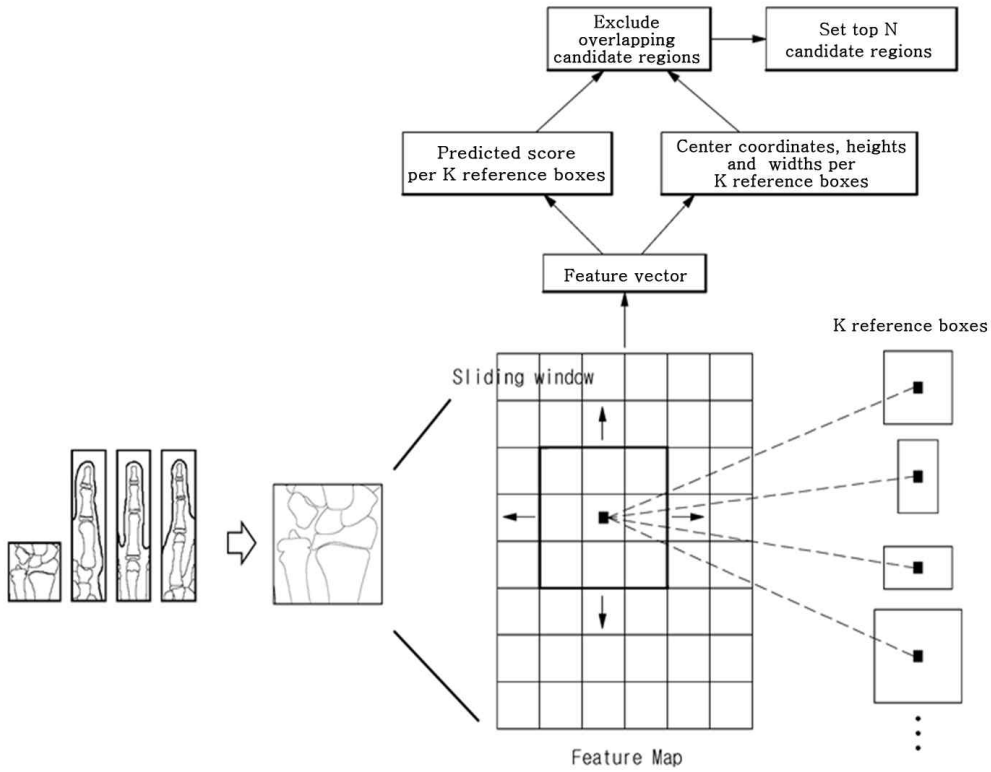


FIG2: The CNNs for extracting a feature vector on each location of an image by applying a sliding window method in accordance with an embodiment

COMMON GENERAL TECHNICAL KNOWLEDGE AS OF THE FILING

According to the Atlas matching method or the Tanner and Whitehouse 2 (TW2) method, a bone age can be evaluated by measuring the similarity

between image data for a young child's left hand X-ray or bone image data by detailed parts of a finger and patterned images that are databased by age and gender.

CITED INVENTION 1

The invention relates to an automated bone age measuring algorithm using a pattern recognizing technique. The algorithm disclosed in the invention comprises automatically classifying each part of finger bones on the X-ray image; extracting a standardized feature model from the classified bone image and measuring a bone age from the standardized feature model. According to an embodiment, a background and a hand area are divided through pre-processing in an x-ray image taken for the left hand of the subjects aged from 5 to 15 and the epiphyseal plate and finger bones are each extracted from an index finger, a middle finger and a ring finger by using a subordinate model segmentation algorithm.

In generating a feature model of said three finger bones, an active shape model (ASM) algorithm is applied to improve accuracy in extraction of feature values used in age measurement. Several points of contours having morphological characteristic in finger bones and the epiphyseal plate are utilized for landmarks used in training the active shape model (ASM). If one finger model is generated, a feature vector composed of the length and ratio of each part of the pelvic and finger bone of this invention can be extracted.

Each finger age is diagnosed through a machine learning algorithm, including a support vector machine (SVM), etc., by using said three feature vectors that are extracted from each of the three fingers to classify the bones ages. A conventional technology (E. Pietka method) shows 1.13 age error, while the present disclosure does 0.679 age diagnostic error. This proves a high reliability of the present disclosure.

CITED INVENTION 2

The invention suggests a system using image patterning based on the CNN for reading a medical image. An image input unit reads in an input image and a patterning module generates input images received from the image input unit

into a plurality of pattern images. A CNN training unit learns the input image received from the image input unit and pattern images received from the patterning module based on the CNN, and if a CNN operation unit is transmitted with training information from the CNN training unit and with input images from the image input unit, a final classification unit receives image information from the CNN operation unit and classifies the objects in the image information by type. The present disclosure gives rise to the working effect as such: an image is input through various kinds of routes and massive image data with various kinds of features are generated by patterning and combining input images. Accordingly, image training data of high precision can be obtained.

ASSESSMENT

1. It is determined that the invention of claim 1 does not involve an inventive step over the combination of cited inventions 1 and 2.
2. It is determined that the invention of claim 2 involves an inventive step over the combination of cited inventions 1 and 2.

REASONS FOR ASSESSMENT (INVENTION OF CLAIM 1)

(*Common Features*)

The invention of claim 1 and cited invention 1 are substantially identical in that the regions of interest by part are extracted from hand bone image data and the bone age is read by using the bone grade data classified though image processing based on a machine learning algorithm by using the extracted image data of regions of interest by part.

The invention of claim 1 and cited invention 2 are substantially identical in that characteristic image data are generated by patterning and combining input images and classified through the CNN in the image recognition technological field.

(*Distinguishing Features*)

The invention of claim 1 classifies a bone age grade by applying the CNN to hand bone (手骨) image data. Meanwhile, cited invention 1 diagnoses a finger

age through SVM. Accordingly, the both inventions show a difference in a learning model (data pre-processing method included).

(*Assessment for the Distinguishing Features*)

The invention of claim 1 extracts the region of interest from hand bone image data and classifies the bone age grade by applying the CNN. Meanwhile, cited invention 1 diagnoses a finger age through the SVM by using each of the three feature vectors extracted from any interested three fingers. Accordingly, the both inventions show a difference in a learning model.

The invention of claim 1 does not specifically define the CNN learning model, but a person skilled in the art may easily derive said difference from the learning model disclosed in cited invention 2. As said before, according to the learning model of cited invention 2, the CNN learns the input image received from an image input unit and pattern images received from a patterning module based on the CNN, the CNN operation unit is transmitted with training information from the CNN training unit and with input image from the image input unit, and then a final classification unit receives image information from the CNN operation unit and classifies the objects in the image information by type.

Also, it is determined that there is no difficulty in combining the feature of cited invention 2 to cited invention 1 through implication of cited invention 1 in view of the technological level as filed and no noticeable difference in the working effect.

Therefore, since the invention of claim 1 can be easily implemented by a person skilled in the art in combination of cited inventions 1 and 2, it is determined that the invention of claim 1 does not involve an inventive step.

REASONS FOR ASSESSMENT (INVENTION OF CLAIM 2)

(*Common Feature*)

Common features are already described in the aforementioned reason for the determination- Invention of claim 1.

(*Distinguishing Feature*)

The invention of claim 2 extracts a plurality of regions of secondary interest by using the feature vector extracted from the region of primary interest and classifies a the bone age grade by applying the CNN. Meanwhile, cited invention 1 diagnoses a finger age through the SVM by using each of the three feature vectors extracted from the pre-set interested three fingers. Accordingly, the both inventions show a difference in a learning model.

(*Assessment for the Distinguishing Feature*)

The invention of claim 2 is characterized in that a feature vector is generated by implementing a calculation for each location by applying the sliding window method to the feature map of the region of primary interest of a hand bone image; a plurality of regions of secondary interest are generated on the basis of the predictable score calculated for a candidate area and the location and size of the candidate area of the regions of secondary interest by using the generated feature vector; and the bone grade is classified by applying the CNN to the image of each of the extracted regions of secondary interest.

Cited invention 1 discloses extracting a feature vector by using an active feature model algorithm to the pre-set three fingers and diagnosing finger age through the support vector machine (SVM) algorithm. Meanwhile, cited invention 2 discloses that the CNN training unit learns an input image and a pattern image received from a patterning module based on the CNN.

A person skilled in the art may derive a feature of classifying a bone grade by applying the CNN based on a hand image from cited inventions 1 and 2, but it is determined that the invention of claim 2, that is, the CNN is applied to the regions of secondary interest extracted from the region of primary interest and classifies the bone grade accordingly, cannot be derived from cited inventions 1 and 2. Further, it cannot be considered that cited inventions 1 and 2 suggest or imply the specific feature.

Accordingly, the feature disclosed in the invention of claim 2, that is, a plurality of regions of secondary interest are extracted by using the feature vector extracted from the region of primary interest and the bone age grade is classified by applying the CNN, is different from cited invention 1 or 2.

From the viewpoint of the working effect, it is determined the invention of claim 2 gives rise to an advantageous effect over cited inventions 1 and 2 in that a feature vector is generated by implementing a calculation of each location of an image of the region of primary interest; the region of secondary interest is generated from a plurality of regions of primary interest based on the predicted score calculated for the location and the size of a candidate region and a candidate region in the regions of secondary interest by using the generated feature vector; the bone grade is classified by applying the CNN to the image of the region of secondary interest, and thereby more accurate and reliable bone age reading is enabled.

Therefore, since a person skilled in the art cannot easily arrive at the invention of claim 2 in view of the combination of cited inventions 1 and 2, it is determined that the invention of claim 2 involves an inventive step.

4.8 Case 8

TITLE OF THE INVENTION

Method for Generating Defect Images

GUIDELINE

This is an example in which the technical field and the learning model of the claimed invention and the cited invention are identical.

Although there is a difference between the claimed invention and the cited invention with respect to binarization processing of image data, binarization constitutes a well-known and commonly used image preprocessing technique in the field of image recognition, which is generally applied to reduce computational complexity. Accordingly, inventive step may be denied.

CLAIM

A method for generating a defect image, comprising:

receiving a normal image (110) and a masking image (120) for covering a defect;

aligning the masking image (120) with the normal image (110) to generate a mask-applied image (130); and

generating a defect image (140) by inputting the mask-applied image (130) into a trained learning model for defect image generation,

wherein the masking image (120) is implemented as a binary image.

PROBLEM TO BE SOLVED

Inspection for the occurrence of defects during the manufacturing process of printed circuit boards (PCBs) or semiconductor wafers is a critical process closely related to product quality. In particular, training an artificial intelligence model for automated defect detection requires a large number of defect images; however, it is difficult to easily obtain a sufficient defect dataset due to the characteristics of defects and confidential business information.

Accordingly, the object of the present invention is to provide a method for generating defect images capable of securing a large number of defect images

as training data for a learning model, thereby improving defect detection performance in PCB inspection.

MEANS FOR SOLVING THE PROBLEM

A defect image generation apparatus may receive a normal image (110) and a masking image (120) representing a defect shape (121) covering a defect.

A mask-applied image (130), in which the defect shape (121) is aligned and applied to the normal image (110), is input to a learning model implemented as an artificial intelligence model, thereby generating a defect image (140).

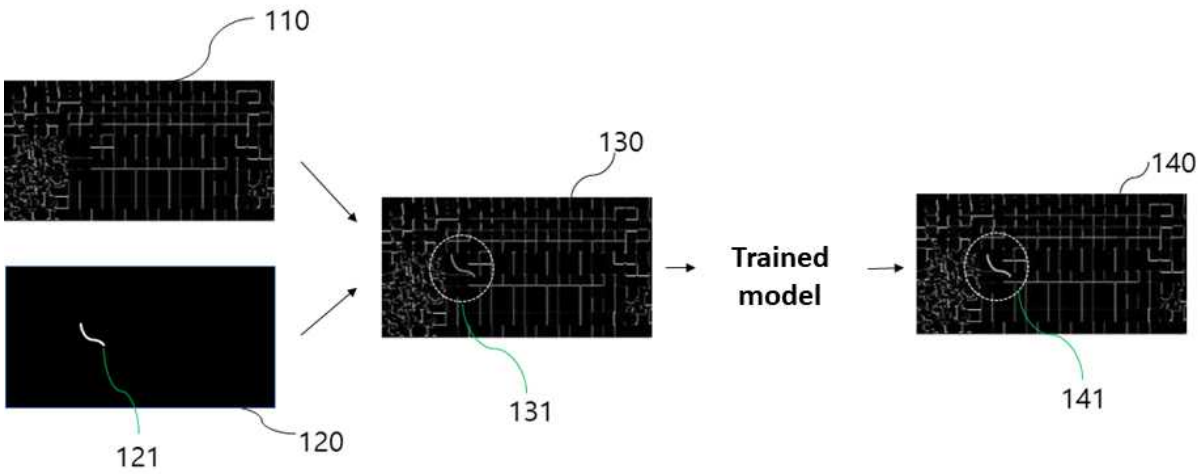
Accordingly, the defect image generation apparatus may output a defect image (140) in which a defect shape (141) is formed, using the normal image as input.

The masking image (120) is represented as a binary image in which defect regions and non-defect regions are indicated in black and white, thereby enabling high-speed processing with reduced computational load.

The learning model is trained using images to which defect shapes are applied and defect sample images as training data, and learns defect regions of the defect sample images.

The learning model may be implemented using an artificial neural network, such as a convolutional neural network (CNN).

DRAWING



COMMON GENERAL KNOWLEDGE AT THE FILING DATE

In general, rather than directly processing color images or grayscale images, it is widely practiced to apply binarization processing as a preprocessing step, as it involves a relatively small amount of information, enables high-speed processing, and facilitates algorithmic processing.

CITED INVENTION

A method for generating defect data, comprising:
generating data in which an arbitrarily shaped first mask for covering a defect is applied to normal data; and
generating defect data by inputting the data to which the first mask is applied into an artificial intelligence–based restoration algorithm,
wherein the normal data and the defect data are image data.

ASSESSMENT

The claimed invention may be considered to lack inventive step in view of the cited invention.

REASONS FOR ASSESSMENT

(*Common Features*)

The claimed invention and the cited invention share the same technical purpose, in that defect data are generated using an artificial intelligence model. Furthermore, both inventions include a configuration in which mask-applied data are input into an artificial intelligence model to generate defect data (images).

(*Distinguishing Feature*)

The claimed invention specifies that the masking image (120) is a binarized (binary) image, whereas the cited invention does not explicitly disclose any particular preprocessing, including binarization, for the data to which the first mask is applied.

(*Assessment of the Distinguishing Feature*)

The claimed invention employs a binary masking image; however, the cited

invention merely discloses data to which a first mask is applied, without further specification. Nevertheless, applying binarization processing to color image data as a preprocessing step in order to reduce computational load and enable high-speed processing is a well-known and commonly used technique in the field of image recognition.
In view of the state of the art at the filing date, a person skilled in the art would readily add such a widely known binarization preprocessing technique to the configuration of the cited invention, without encountering any particular technical difficulty. Furthermore, the distinguishing feature does not give rise to any unexpected or remarkable technical effect beyond what could be predicted.
Accordingly, the claimed invention could be easily implemented by a person skilled in the art on the basis of the cited invention, and therefore does not involve an inventive step.

(*Points to Note*)
This inventive-step assessment is a modified and simplified example prepared solely for illustrative purposes. In actual examination practice, where the claims specifically define the training data, training method, or learning model, and where such specific technical features provide technical effects exceeding those predictable from the cited invention, the invention may not be regarded as obvious to a person skilled in the art.

4.9 Case 9

TITLE OF THE INVENTION

Apparatus for Training Images to Be Inspected

GUIDELINE

This is an example in which the technical field and the learning model of the claimed invention and the cited invention are identical. Although the claimed invention differs from the cited invention in that the same images are used both for training and for testing, whereas the cited invention separates training data from test data, a learning model that is trained and evaluated only on the same dataset is inherently prone to overfitting. Accordingly, inventive step may be denied.

CLAIM

An apparatus for training images to be inspected, comprising:
an image acquisition unit configured to receive a plurality of images; and
a training unit configured to perform training on each of the plurality of images and, after training, to perform testing on each of the same plurality of images.

PROBLEM TO BE SOLVED

When training an artificial intelligence model for determining whether an inspection target is defective, separating training images and test images may result in difficulties in securing defective product images, as well as increased time and cost.
Accordingly, an object of the present invention is to provide a method capable of improving test accuracy by performing both training and testing without separately dividing training images and test images.

MEANS FOR SOLVING THE PROBLEM

The apparatus for training images to be inspected includes an image acquisition unit and a training unit. When the image acquisition unit receives a plurality of images captured from inspection targets, the training unit learns image feature information of the inspection target and, while reflecting the training results, performs testing on each of the plurality of images. Based on

the testing results, the training unit continuously updates the training process while performing training and testing concurrently.

The training unit may be implemented using an artificial neural network, such as a convolutional neural network (CNN), as a learning model that outputs feature information of non-defective images and defective images.

The learning model may be trained using non-defective images to learn features of non-defective products, or using defective images to learn features of defective products, and thereafter determines whether an input image represents a defective product.

COMMON GENERAL KNOWLEDGE AT THE FILING DATE

When a learning model is trained so as to fit only a specific training image set, the prediction accuracy for new samples introduced in actual operation becomes very low. This phenomenon is generally referred to as overfitting, meaning a state in which the model exhibits excessively high accuracy for the training data but shows a significant degradation in performance for unseen data.

CITED INVENTION

An image inspection apparatus, comprising:

an input unit configured to receive images of a plurality of inspection target products; and

a training unit configured to train using the plurality of inspection target product images as training images,

wherein the training unit is configured to test the inspection target using images for determination (test images).

ASSESSMENT

The claimed invention may be considered to lack inventive step in view of the cited invention.

REASONS FOR ASSESSMENT

(*Common Features*)

The claimed invention and the cited invention share the same technical purpose, in that a learning model (training unit) is used to determine whether an inspection target is defective.

Furthermore, both inventions include a configuration in which the training unit trains on images of inspection targets.

(*Distinguishing Feature*)

The claimed invention performs both training and testing on the same images, whereas the cited invention distinguishes between training images and images for determination (test images).

(*Assessment of the Distinguishing Feature*)

The claimed invention differs from the cited invention in that the same images are used for both training and testing.

However, it is common general knowledge at the filing date that training a learning model solely on the same image data inevitably leads to satisfactory results for that dataset, while making it impossible to properly evaluate the model's performance. It is also well known that meaningful evaluation of a learning model requires that training data and test data be different.

In view of the state of the art at the filing date, a person skilled in the art would readily recognize that a learning model trained only on a specific training image set would suffer from overfitting, resulting in inappropriate performance in practical use. Accordingly, the skilled person would predictably and routinely separate training images from test images in order to avoid such overfitting. The distinguishing feature does not present a previously unrecognized technical problem, nor does it produce any unexpected or remarkable technical effect. Rather, the claimed invention may be regarded as a retrogressive modification compared to the cited invention.

Therefore, the claimed invention does not involve an inventive step.

(*Points to Note*)

This inventive-step assessment is a modified and simplified example prepared solely for illustrative purposes. In actual examination practice, where the claims specifically define the training data, training method, or learning model, and where such specific technical features provide technical effects exceeding those predictable from the cited invention, the invention may not be regarded as obvious to a person skilled in the art.

4.10 Case 10

TITLE OF THE INVENTION

An Urban Traffic Speed Prediction System

GUIDELINE

The invention of claim 1 is identical with the cited invention 1 in the technology field and the trained data. Since, however, there is a difference in the trained model, but the invention of claim 1 involves an advantageous effect over the cited invention 1, it is determined that the invention of claim 1 involves an inventive step.

CLAIMS

[Claim 1]

An urban traffic speed prediction system comprising:

an information extraction unit for extracting historical records with respect to geographic information, weather information, construction information and the changes in traffic volume by time of day;

a learning model unit for implementing an artificial neural network (ANN) training algorithm to find out the functional relationship between the road pattern and an average speed by section after a road pattern is generated in accordance with the extracted historical records;

a traffic prediction unit (TPU) for predicting average speed by section by using the local ANN corresponding to the member cluster of an input pattern vector for prediction;

wherein said learning model unit comprises an input pattern vector generation unit for generating an input pattern vector by combining the extracted historical records and detection information for the road concerned; a data partitioning unit for estimating a lattice-structured cluster by clustering data with similar patterns by applying clustering to the dataset of the input pattern vector and generating the estimated cluster boundary; an ANN learning unit for separately implementing an ANN learning to the input pattern vector within each of said estimated cluster generated in the data partitioning unit; and

a model structure database (DB) for storing the estimated cluster

boundary that is generated in said data partitioning unit and said learned ANN in the input pattern vector within each of said estimated clusters in said ANN learning unit.

PROBLEM TO BE SOLVED

The purpose is to provide an urban traffic speed prediction system that additionally considers environment variables affecting traffic congestion and detection variables of an intelligent traffic system (ITS) to exactly predict road traffic speed.

MEANS FOR SOLVING THE PROBLEM

The invention of claim 1 comprises an information extraction unit for extracting historical records with respect to geographic information, weather information, construction information and the changes in traffic volume by time of day that are provided by an intelligent traffic system (ITS), a geographic information system and a weather information system, a learning model unit for implementing an artificial neural network (ANN) training algorithm to find out the functional relationship between the road pattern and an average speed by section after a road pattern is generated in accordance with the extracted historical records after generating an input pattern vector by standardizing data values in accordance with historical records extracted from the information extraction unit and a traffic prediction unit for predicting an average speed by section by using a local ANN corresponding to the member cluster of an input pattern vector for prediction through the same pre-processing with said learning model unit.

The learning model unit comprises an input pattern vector generation unit for generating an input pattern vector by combining with detection information of the road concerned through standardization of data values in accordance with historical records extracted from the information extraction unit, a data partitioning unit for estimating a lattice-structured cluster by clustering data with similar patterns by applying clustering to the data set of the input pattern vector and generating the estimated cluster boundary, an ANN learning unit for separately implementing an ANN learning to the input pattern vector within

each of said estimated cluster generated in the data partitioning unit and a model structure database (DB) for storing the estimated cluster boundary that is generated in said data partitioning unit and said learned ANN in the input pattern vector within each of said estimated clusters in said ANN learning unit.

Training data are clustered by time for each road and by similarity characteristic for each road. In this case, if each ANN training is implemented for data as a whole and the result is used for prediction, high-quality predictive performance may not be expected. This is because the different characteristics of each cluster are standardized, with they being treated as mean square errors. Of course, even if the pattern of cluster of data sets may be closely reflected by adjusting the parameters, it may cause an over-fitting problem.

Accordingly, the present disclosure implements ANN learning separately to an input pattern vector within each of the generated cluster. The range of the generated cluster and the trained ANN are each stored in a model structure database (DB).

As the next step, traffic speed by section is predicted by utilizing a local ANN corresponding to the member cluster of an input pattern vector for prediction that is identified through the same pre-processing with said pre-processing. In the prediction process, an input pattern vector for prediction is generated through the same pre-processing for new data and the member cluster of said generated input pattern vector for prediction is identified. And then an average speed by section is predicted by using a local ANN corresponding to the member cluster of said identified member cluster.

A specific training method for predicting an average speed by section based on a local ANN is described hereafter.

DRAWINGS

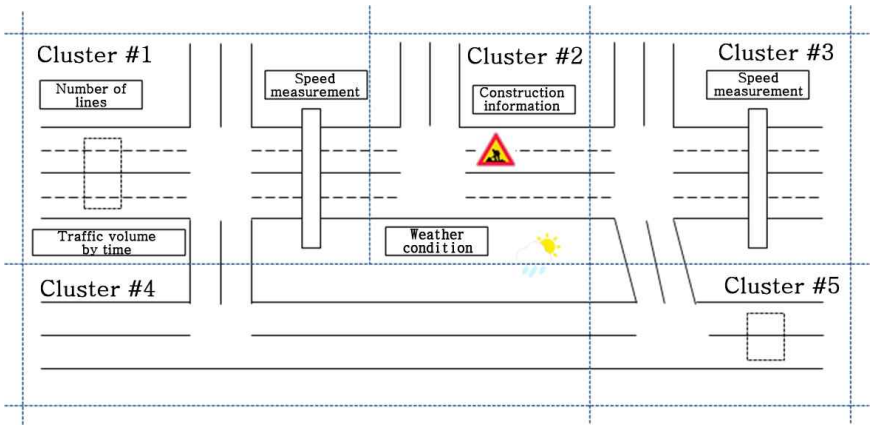


FIG. 1: Concept of clustering in accordance with an embodiment

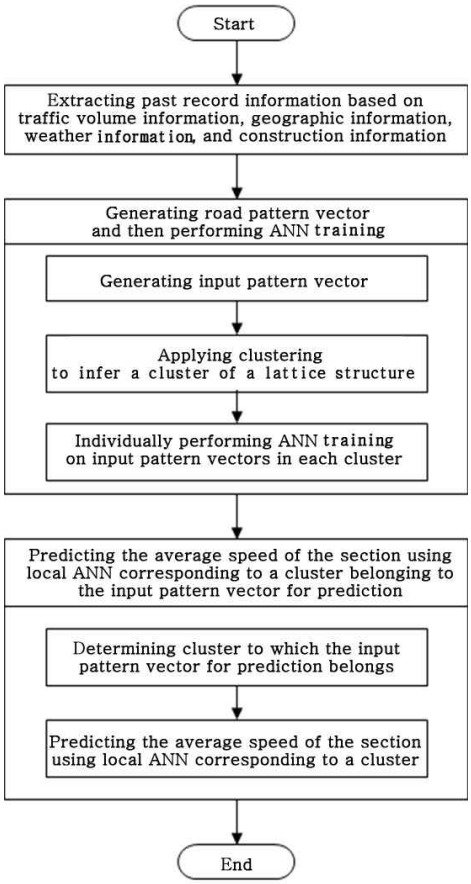


FIG. 2: Operation method of an urban traffic speed prediction system

COMMON GENERAL TECHNICAL KNOWLEDGE AS OF THE FILING

An artificial neuron network (ANN) and multi-layer perceptron (MLP) are substantially the same each other, only different in the expression of the terms.

[*State of the Art (Prior Art, Well-Known Art, etc.)*]

The cited invention relates to a traffic prediction method on the basis of multi-layer perceptron (MLP) for predicting congestion of the downtown areas of the city by relying on a neural network, as taking into account time-related factors affecting congestion, i.e., day information, time information, precipitation, share, traffic volume, incoming and outgoing traffic of the lanes, the number of intersections·crosswalks, bus stop information, construction information, etc., in heavy traffic downtown area and various factors depending on the environment of a road section.

The cited invention relates to a multi-layer perceptron structure. It selects various factors affecting traffic congestion as input variables for predicting an average speed by hour and do traffic volume as output variables. Input data, including at least one among day characteristic, time characteristic, traffic volume, share, construction area and precipitation, are collected and pre-processing is implemented on the basis of the collected data. Training and training completion conditions are determined for the pre-processed data. The pre-processing step is implemented for deleting unnecessary information and for standardizing input variables related to traffic volume before neural network algorithms are constructed. Initial synapses of multi-layer perceptron are randomly set and the final synapses are confirmed in accordance with back propagation algorithm and then used for training.

ASSESSMENT

It can be determined, thus, the invention of claim 1 involves an inventive step over the cited invention.

REASON FOR THE ASSESSMENT

(*Common Feature*)

The invention of claim 1 and the cited invention substantially have the same

purpose of predicting traffic information in downtown area on the basis of information related to conditions of roads. The both inventions substantially have the same training data including traffic volume information by time, geographic information, weather information and construction information used in the machine training for predicting traffic information.

(*Distinguishing Feature*)

The invention of claim 1 is different from the cited invention in a learning model (processing of training data and layout of artificial neural network system), especially in that it clusters data with similar patterns by applying clustering to training data and predicts an average speed by section by implementing a local ANN training separately to an input pattern vector within each of the clusters.

(*Assessment for the Distinguishing Feature*)

The cited invention discloses a prediction method of traffic volume by using a learning model based on multi-layer perceptron (MLP), but does not describe the feature of training a local artificial neural network (ANN) corresponding to each of the clusters or of clustering input pattern data.

It is determined that a person skilled in the art may not easily arrive at the feature of training a local ANN corresponding to each of the clusters by clustering input patter data that is disclosed in the invention of claim 1, starting from the features of standardizing input values and of implementing pre-processing for deleting unnecessary information, as specified in the cited invention.

In view of the working effect, it is recognized that the invention of claim 1 can more exactly predict an average speed of a certain section through a local ANN algorithm corresponding to the member cluster.

Therefore, since it is determined that a person skilled in the art may not easily arrive at the invention of claim 1 from the cited invention, it is concluded that the invention of claim 1 involves an inventive step over the cited invention.

4.11 (Case 11)

TITLE OF THE INVENTION

Method for Providing Professional Answers Using an Artificial Intelligence Speaker

GUIDELINE

1. Where the claimed invention merely uses generative AI as such, without any specific technical features in the training model or training data, and where the differences over a cited invention having the same technical field and purpose amount only to the use of generative AI, such differences may be regarded as a mere design modification obvious to a person skilled in the art. In such a case, inventive step may be denied.

2. By contrast, where there are specific differences in the configuration for generating input data for generative AI (e.g., query data, instructions, or prompts), and such differences give rise to distinct technical effects, inventive step may be acknowledged.

CLAIMS

[Claim 1]

A method for providing professional answers using an artificial intelligence speaker, comprising:

receiving a user's voice and converting the voice into a query term;

acquiring classification information for the query term through a front AI model configured to classify the query term into a professional domain;

selecting, from among a plurality of expert AI models, each being a large language model fine-tuned for a respective professional domain, an expert AI model corresponding to the acquired classification information, and transmitting the query term to the selected expert AI model;

receiving an answer corresponding to the query term from the selected expert AI model; and

converting the received answer into a voice signal and outputting the voice signal through a speaker.

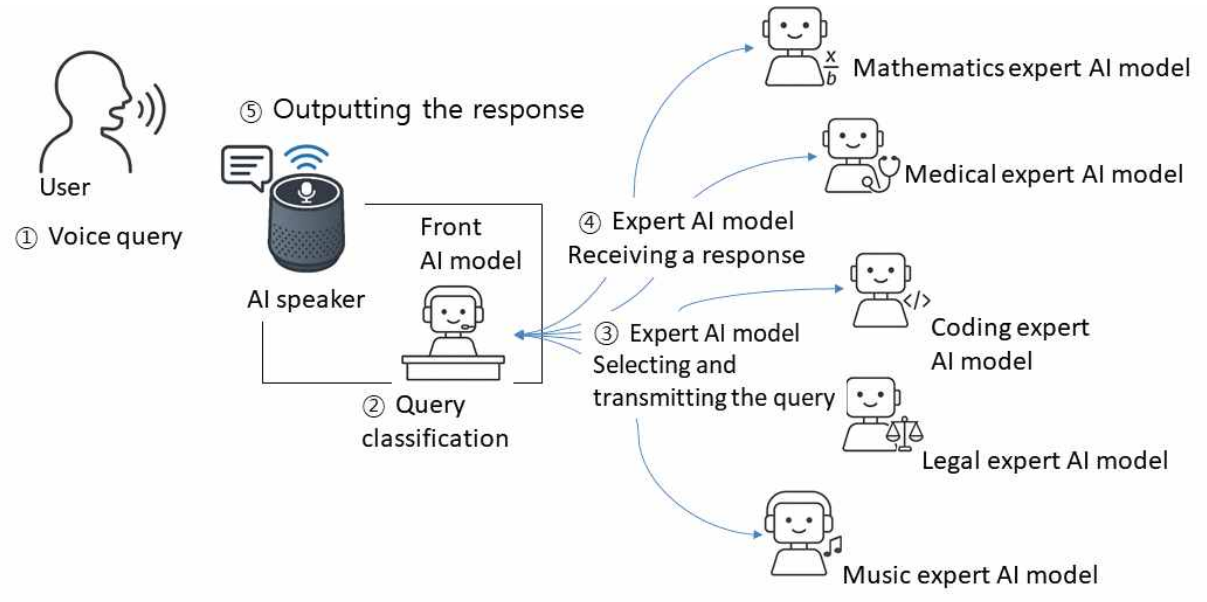
[Claim 2]
The method according to claim 1, wherein transmitting the query term to the selected expert AI model comprises:
recognizing the user based on the user's voice and acquiring age-group information of the user from recognized user information;
when the age-group information can be acquired, calling a query-writing prompt layout corresponding to the age-group information and the selected expert AI model, and when the age-group information cannot be acquired, calling a minor-protection query-writing prompt layout corresponding to the selected expert AI model;
converting the query term so as to correspond to the called prompt layout; and
transmitting the converted query term to the expert AI model.

PROBLEM TO BE SOLVED

An object of the present invention is to provide professional answers using an artificial intelligence speaker, by inputting a user query into a front AI model to obtain classification information for the query, selecting an expert AI model corresponding to the classification information, and transmitting the query to the selected expert AI model, thereby obtaining and providing more professional answers to the user.
In addition, the invention aims to protect minors and simultaneously obtain more professional answers from expert AI models by utilizing query-writing prompt layouts corresponding to the user's age group and the selected expert AI model, thereby converting the query in consideration of both the user's age group and the characteristics of the expert AI model.
The front AI model may be implemented using a deep learning model or a general-purpose large language model (LLM), and the expert AI models may be implemented using large language models fine-tuned for respective professional domains.
The query-writing prompt layouts corresponding to the user's age-group information and the selected expert AI model are predefined prompt templates configured to generate prompts appropriate for the user's age group and suitable for queries directed to the selected expert AI model. Accordingly,

prompts reflecting both the user's age group and the characteristics of the expert AI model are generated, thereby enabling age-appropriate and domain-specific responses. Where the user's age-group information cannot be acquired, a prompt layout including minor-protection wording is used to prevent inappropriate answers from being provided to minors.

DRAWING



COMMON GENERAL KNOWLEDGE AT THE FILING DATE

To a person skilled in the art, replacing a text-based input/output user interface implemented through online chat with a voice-based input and audio output interface implemented through an artificial intelligence speaker constitutes a mere design modification.

Further, replacing a machine-learning model for classifying input sentences (e.g., Naïve Bayes, SVM) with a deep learning model or with a large language model for classification also constitutes a mere design modification.

By contrast, it is assumed that the specific configuration recited in Claim 2—namely, recognizing a user based on voice, acquiring age-group information, calling a prompt layout corresponding to the age group and the selected expert AI model, or calling a minor-protection prompt layout where age-group

information cannot be acquired, and converting the query accordingly—does not form part of common general knowledge at the filing date.

CITED INVENTION

A chat-based service for providing professional question-and-answer functionality through a computer system, comprising:

receiving a user's question through an online chat window and generating a query term from the received question;

acquiring professional-domain classification information for the query term using a machine-learning model;

deriving, from an expert database, a list of experts corresponding to the classification information, and selecting an expert terminal that is indicated as being available for answering;

transmitting the query term to the selected expert terminal to request an answer;

receiving an answer input from the selected expert terminal; and

outputting the answer together with expert information of the selected expert terminal in the chat window.

ASSESSMENT

1. The invention according to claim 1 may be considered to lack inventive step in view of the cited invention.

2. The invention according to claim 2 may be considered to involve an inventive step over the cited invention.

REASONS FOR ASSESSMENT (CLAIM 1)

(*Common Features*)

The invention according to claim 1 and the cited invention share the same technical purpose, in that professional-domain classification is performed on a user query and a corresponding professional answer is provided.

Both inventions include a configuration in which a user query is received, classification information for the query is acquired using a trained model, and a professional answer corresponding to the classification information is obtained

from a selected recipient and provided to the user.

(*Distinguishing Features*)
The invention according to Claim 1 differs from the cited invention in that:
input is received via voice and output is provided via a speaker, rather than through text-based input/output in an online chat window; and
a front AI model implemented using a deep learning model or a general-purpose LLM, and expert AI models implemented using fine-tuned LLMs, are used instead of a machine-learning model and human experts.

(*Assessment of the Distinguishing Features*)
Although the invention according to claim 1 differs from the cited invention in terms of using voice input and audio output, online chat constitutes a form of communication between users via text, and voice-based communication services are generally well known. Accordingly, replacing a text-based user interface with a voice-based user interface implemented through an artificial intelligence speaker represents a design choice readily available to a person skilled in the art, and constitutes a mere design modification.
Further, while the invention according to Claim 1 adopts a front AI model implemented using a deep learning model or a general-purpose LLM, whereas the cited invention adopts a machine-learning model, replacing one known classification model with another known classification model (e.g., replacing Naïve Bayes or SVM with a deep learning model or an LLM) is well within the routine implementation choices of a person skilled in the art.
Moreover, although the invention according to Claim 1 adopts expert AI models instead of human experts, this merely constitutes automating tasks previously performed by humans using AI, without introducing any specific technical difficulty or unexpected technical effect.
There is also no evidence that the effects achieved by the invention according to Claim 1 exceed those that would be expected from the cited invention.
Accordingly, the invention according to Claim 1 could be readily derived by a person skilled in the art from the cited invention and therefore does not involve an inventive step.

REASONS FOR ASSESSMENT (CLAIM 2)

(*Common Features*)

The common features are the same as those discussed in the assessment of claim 1.

(*Distinguishing Feature*)

The invention according to claim 2 differs from the cited invention in that it recognizes the user based on voice, acquires age-group information of the recognized user, calls a query-writing prompt layout corresponding to the age-group information and the selected expert AI model, or, where age-group information cannot be acquired, calls a minor-protection query-writing prompt layout corresponding to the selected expert AI model, and converts the query term in accordance with the called prompt layout before transmitting it to the expert AI model.

(*Assessment of the Distinguishing Feature*)

The cited invention merely discloses transmitting a query term to a selected expert terminal and does not disclose or suggest considering the user's age-group information or converting the query using prompt layouts corresponding to both the user's age group and the selected expert AI model.

By contrast, the invention according to Claim 2 converts the query using prompt layouts that take into account the user's age group and the characteristics of the selected expert AI model, thereby transmitting to the expert AI model a prompt that reflects these considerations.

As a result, the invention achieves the technical effect of inducing age-appropriate and domain-optimized responses from the expert AI model.

Furthermore, where age-group information cannot be acquired, the use of a minor-protection prompt layout prevents inappropriate answers from being provided to minors, thereby achieving an additional technical and social effect.

Accordingly, the invention according to claim 2 cannot be readily derived by a person skilled in the art from the cited invention and therefore involves an inventive step.

4.12 Case 12

TITLE OF THE INVENTION

Method for Controlling a Serving Robot

GUIDELINE

1. Where a claimed invention merely deploys, to a device, an AI model disclosed prior to the filing date by simply applying model compression techniques generally known to a person skilled in the art, and where, in comparison with a cited invention having a similar technical field and purpose, the differences merely amount to adding generally known techniques associated with using an AI model on a specific device, inventive step is not acknowledged.

2. Where there are specific differences in the concrete configuration for compressing a trained model for deployment to a device, and such differences result in distinct technical effects, inventive step may be acknowledged.

3. Where there are specific differences in the configuration for compressing and deploying a trained model in accordance with characteristics of the device or its operating environment, and such differences result in distinct technical effects, inventive step may be acknowledged.

CLAIMS

[Claim 1]

A method for object recognition of a serving robot, comprising:

requesting, by the serving robot, a Dilated Convolutional Neural Network (CNN) model trained to generate a depth map from an RGB image, from a server;

generating, by the server, in response to the request, a lightweight Dilated CNN model by quantizing weights of the trained Dilated CNN model;

receiving, by the serving robot, the lightweight Dilated CNN model from the server;

generating, by the serving robot, a depth map of an operating space by inputting an RGB image received from a single camera into the lightweight Dilated CNN model; and

recognizing objects in the operating space based on the generated depth map and the RGB image.

[Claim 2]
The method according to claim 1, wherein generating the lightweight Dilated CNN model comprises:
extracting, from weight matrices included in each of a plurality of layers of the Dilated CNN model, threshold values for determining importance of weights;
generating, based on the extracted threshold values, a binary mask indicating whether individual weights in the weight matrices are to be retained or removed;
applying the generated binary mask to the weight matrices to generate sparse weight matrices in which weights having importance lower than the threshold values are removed;
performing quantization on the sparse weight matrices; and
updating parameters of the Dilated CNN model using the quantized sparse weight matrices.

[Claim 3]
The method according to claim 1, wherein requesting the Dilated CNN model from the server further comprises:
collecting operating environment data, including illuminance and the number of customers, by the serving robot;
selecting one of an “object recognition speed-priority mode,” “object recognition accuracy-priority mode,” or “balanced mode” based on the collected operating environment data; and
transmitting information on the selected mode to the server,
and wherein generating the lightweight Dilated CNN model comprises:
generating the lightweight Dilated CNN model by adjusting a degree of quantization according to the selected mode.

PROBLEM TO BE SOLVED

An object of the present invention is to enable object recognition in a low-cost

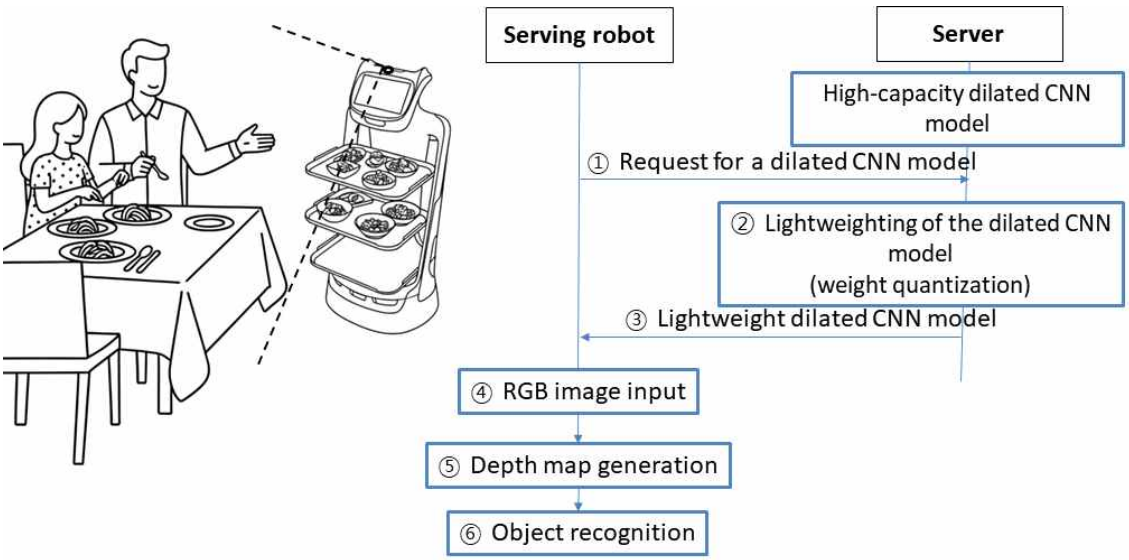
serving robot without additional distance-measuring sensors such as LiDAR, by using only a single camera.

Specifically, by using a Dilated CNN trained to generate a depth map from an RGB image, the serving robot generates a depth map from RGB images captured by a single camera, and recognizes surrounding objects based on the generated depth map and the RGB image, thereby achieving high object-recognition accuracy without additional sensors.

In addition, by simplifying weights and performing quantization based on layer-wise weight importance, the Dilated CNN is lightweighted to improve compression efficiency while maintaining an acceptable level of accuracy, thereby enabling application of an appropriate Dilated CNN model to a serving robot having limited computing resources.

Furthermore, by deploying Dilated CNN models with different degrees of lightweighting depending on the operating environment of the serving robot, the invention enables adaptive responses to changes in operating conditions such as illuminance and the number of customers, and achieves effects such as reduced battery power consumption through environment-adaptive performance adjustment.

DRAWING



COMMON GENERAL KNOWLEDGE AT THE FILING DATE

To a person skilled in the art, deploying a trained model by quantizing weights of the trained model to generate a lightweight model constitutes a generally known method for deploying trained models.

However, it is assumed that the specific lightweighting technique recited in claim 2 does not form part of the common general knowledge at the filing date.

CITED INVENTION

An object recognition system for an autonomous driving robot, comprising:

a model receiving unit configured to receive a Dilated CNN for generating a depth map using feature maps of an image;

a depth map generating unit configured to receive an RGB image from a camera, generate feature maps of the image, and generate a depth map using the feature maps based on the received Dilated CNN; and

an object recognition unit configured to recognize objects using the generated depth map and the RGB image.

ASSESSMENT

1. The invention according to claim 1 may be considered to lack inventive step in view of the cited invention.

2. The invention according to claim 2 may be considered to involve an inventive step over the cited invention.

3. The invention according to claim 3 may be considered to involve an inventive step over the cited invention.

REASONS FOR ASSESSMENT (CLAIM 1)

(*Common Features*)

The invention according to claim 1 and the cited invention share the same technical purpose, namely, understanding a three-dimensional space and improving object-recognition accuracy using only a low-cost single RGB camera by means of a Dilated CNN.

Both inventions include a common configuration in which a Dilated CNN is

received, an RGB image captured by a camera is input into the Dilated CNN to generate a depth map, and objects are recognized based on the generated depth map and the RGB image.

(*Distinguishing Feature*)

The invention according to claim 1 differs from the cited invention in that:
when the serving robot requests a Dilated CNN model, the server generates a lightweight Dilated CNN model by quantizing weights of the trained Dilated CNN model and transmits the lightweight Dilated CNN model to the serving robot.

(*Assessment of the Distinguishing Feature*)

Although the invention according to claim 1 adopts a configuration in which the server generates a lightweight Dilated CNN model by quantizing weights of a trained Dilated CNN model and the serving robot receives the lightweight Dilated CNN model, the cited invention merely discloses receiving a Dilated CNN model.
However, quantizing weights of a trained model to deploy a lightweight model is a deployment method generally known in the field of artificial intelligence.
Accordingly, adopting a configuration in which the server generates a lightweight model and the robot receives the lightweight model merely amounts to adding a generally known technique related to AI model deployment to the cited invention.
Further, there is no evidence that the effects achieved by claim 1 differ from or exceed effects expected from the cited invention.
Therefore, the invention according to claim 1 could be readily derived by a person skilled in the art from the cited invention and does not involve an inventive step.

REASONS FOR ASSESSMENT (CLAIM 2)

(*Common Features*)

The common features are the same as those discussed in the assessment of claim 1.

(*Distinguishing Feature*)

The invention according to claim 2 differs from the cited invention in that, in generating the lightweight Dilated CNN model, it includes the specific configuration of:

extracting threshold values for determining weight importance from weight matrices of each layer of the Dilated CNN model;

generating binary masks indicating retention or removal of individual weights based on the threshold values;

generating sparse weight matrices by applying the binary masks;

performing quantization on the sparse weight matrices; and

updating model parameters using the quantized sparse weight matrices.

(*Assessment of the Distinguishing Feature*)

The cited invention does not disclose or suggest the specific configuration for generating a lightweight Dilated CNN model as recited in claim 2.

Further, through the concrete difference in the lightweighting configuration, the invention according to claim 2 improves model compression efficiency, thereby deriving a lightweight Dilated CNN model suitable for application in a serving robot having limited computing resources.

Accordingly, the effects achieved by claim 2 exceed effects that would be expected from the cited invention combined with common general knowledge (i.e., simple application of quantization to trained neural network models).

Therefore, the invention according to claim 2 cannot be readily derived by a person skilled in the art from the cited invention and involves an inventive step.

REASONS FOR ASSESSMENT (CLAIM 3)

(*Common Features*)

The common features are the same as those discussed in the assessment of claim 1.

(*Distinguishing Feature*)

The invention according to claim 3 differs from the cited invention in that:

the serving robot collects operating environment data including illuminance and

number of customers;
selects one of a plurality of modes based on the operating environment data; and
generates a lightweight Dilated CNN model by adjusting the degree of quantization according to the selected mode.

(*Assessment of the Distinguishing Feature*)
The cited invention does not disclose or suggest collecting operating environment data, selecting an operating mode, or adjusting the degree of quantization according to the selected mode.
Further, by generating and deploying lightweight Dilated CNN models adaptively according to changes in the operating environment, the invention according to claim 3 enables environment-adaptive application of Dilated CNN models and achieves effects such as reduced battery power consumption through adaptive performance control.
Accordingly, the invention according to claim 3 achieves effects different from those expected from the cited invention.
Therefore, the invention according to claim 3 cannot be readily derived by a person skilled in the art from the cited invention and involves an inventive step.

4.13 Case 13

TITLE OF THE INVENTION

Artificial-Intelligence-Based Logo Image Generation and Distribution Method

GUIDELINE

1. Where a claimed invention merely uses a generative AI model as such, without any particular features in the training model or training data, and where, in comparison with a cited invention having the same technical field and purpose, the differences attributable to the use of generative AI amount only to a routine design modification that would be readily adopted by a person skilled in the art, inventive step may be denied.

2. Where the claimed invention differs from the prior art in a post-processing configuration applied to output data of a generative AI model (logo images) for deployment to digital signage, and where such differences result in technical effects exceeding those expected from the prior art, inventive step may be acknowledged.

CLAIMS

[Claim 1]

An artificial-intelligence-based logo image generation and image distribution method using a generative AI model, comprising, by a computer system:

receiving, from a user, a business name, a business category, a product name, and a description of the product;

receiving, from the user, a selection of a logo style;

converting the business name, business category, product name, product description, and selected logo style into a text sentence requesting generation of a logo image, and generating a prompt;

transmitting the prompt to a generative AI model;

receiving a logo image from the generative AI model; and

distributing the logo image for use as content of a digital signage device.

[Claim 2]

The method according to claim 1, further comprising, after step (5) and before step (6):

5-1. accessing a digital signage content management system;
5-2. receiving, from the user, selection of one or more digital signage devices on which the logo image is to be distributed;
5-3. collecting, from a database of the digital signage content management system, location information, resolution, size, and ambient lighting information of the selected digital signage devices;
5-4. modifying the logo image on the computer system based on the collected information, wherein modifying the logo image comprises:
(5-4-1) acquiring weather information corresponding to the location information from a weather information server; estimating product classification information by inputting the business category, product name, and product description into a trained product classification model; acquiring background image information corresponding to the weather information and the product classification information from a background image database; and generating a composite image by compositing the logo image with the background image; and
(5-4-2) adjusting a size of the composite image based on the resolution and size, and adjusting clarity of the composite image based on the ambient lighting information; and
5-5. determining the composite image as a final logo image.

PROBLEM TO BE SOLVED

An object of the present invention is to provide a method by which a user can easily generate a logo image using a generative AI model, and to distribute the generated logo image in a manner optimized for specifications of digital signage devices.

MEANS FOR SOLVING THE PROBLEM

The computer system receives, from a user, a business name, a business category, a product name, and a product description, and receives selection of a logo style from the user.
For example, the logo style may be selected from a calligraphy style, an animation style, or a symbol/graphic style.
As an example, the user may input “Banana Store, apparel business, Banana

Popcorn T-shirt, a T-shirt with an image of bananas popped like popcorn," and select a "calligraphy style."

The computer system converts the received inputs into a text sentence requesting logo image generation, generates a prompt, transmits the prompt to a commercial generative AI model, and receives a logo image generated by the generative AI model.

For example, the prompt may be generated as:

"Draw, in a calligraphy style, a logo for promotional material of a Banana Popcorn T-shirt, which is a T-shirt with an image of bananas popped like popcorn, from Banana Store in the apparel business."

The conversion of user inputs into a sentence may be performed using a predefined template such as

"Please draw a logo for promotional material of %s, which is a %s from %s in the %s business, in a %s style,"

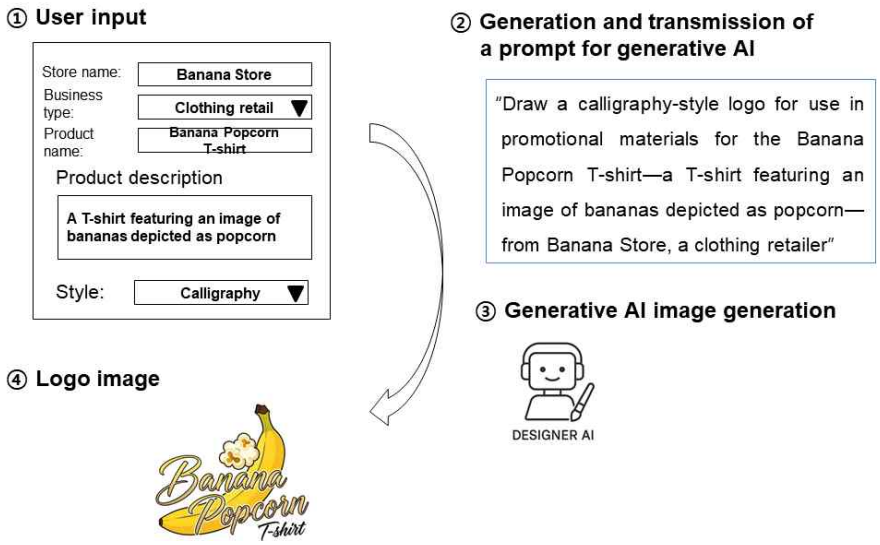
or by using natural language processing techniques, where "%s" corresponds to the respective input strings.

The computer system accesses a digital signage content management system, selects one or more digital signage devices for distribution of the logo image, and collects location information, resolution, size, and ambient lighting information of the selected devices.

Based on the collected information, the logo image is modified. The modification may include acquiring weather information corresponding to the location information, estimating product classification information using a trained product classification model, acquiring a background image corresponding to the weather information and the product classification information from a background image database, and generating a composite image by compositing the logo image with the background image.

Further, the size of the composite image may be adjusted based on resolution and size of the digital signage device, and clarity of the composite image may be adjusted based on ambient lighting information. The adjusted composite image is then determined as the final logo image and distributed as digital signage content.

DRAWING



CITED INVENTION

A logo request and production system, comprising:

a logo user computer for requesting logo production; and

a server connected to the logo user computer via a communication network and configured to complete logo design,

wherein the server includes a logo database storing designs previously created by professional designers according to business categories and types,

wherein the server receives, from the logo user computer, a business name, business category, product name, and product description necessary for logo production,

wherein the server receives, from the logo user computer, selection of a logo style,

wherein the server generates a logo design image, and

wherein the server transmits the generated logo design image to the logo user computer.

ASSESSMENT

1. The invention according to claim 1 may be considered to lack inventive step in view of the cited invention.

2. The invention according to claim 2 may be considered to involve an inventive step over the cited invention.

REASONS FOR ASSESSMENT (CLAIM 1)

(*Relevant Legal Standard- Article 29(2)*)

Where utilization of an output of an AI-related invention (result data) is specifically defined, and the technical configuration gives rise to effects exceeding those expected from the cited invention, such utilization does not fall within the ordinary creative ability of a person skilled in the art.

Here, “specific definition of utilization of output data” refers to concretely specifying configurations such as use of output generated by a trained model, products based on the output, or processing methods based on the output.

However, where the claim merely states use of output data in a general manner, such utilization amounts only to a routine design modification based on a specific application of technology, and thus may fall within the ordinary creative ability of a person skilled in the art.

(*Common Features*)

The invention according to claim 1 and the cited invention share the same objective in that both receive information for logo image production and generate a logo image.

Both inventions include a common configuration in which logo image generation information is received from a user and a logo image is generated using a logo image generation means such as a server.

(*Distinguishing Features*)

The invention according to claim 1 differs from the cited invention in that:

a generative AI model is used to generate the logo image; and

the generated image is distributed for use as content of a digital signage device.

(*Assessment of the Distinguishing Features*)

Replacing the server of the cited invention with a generative AI model merely

constitutes automating logo generation using a known AI technique, which would have been a routine design choice for a person skilled in the art in view of common general knowledge.
Further, using the generated image as content of a digital signage device merely constitutes simple utilization of output data of a trained AI model, and amounts only to a design modification based on a specific application.
Accordingly, the differences of claim 1 fall within the ordinary creative ability of a person skilled in the art, and the invention according to claim 1 does not involve an inventive step.

REASONS FOR ASSESSMENT (CLAIM 2)

(*Common Features*)

The common features are the same as those discussed in the assessment of claim 1.

(*Distinguishing Feature*)

The invention according to claim 2 differs from the cited invention in that the logo image is modified in accordance with conditions of selected digital signage devices, including location, resolution, size, and ambient lighting information, prior to distribution.

(*Assessment of the Distinguishing Feature*)

The cited invention relates to requesting and producing logo images and does not disclose or suggest modifying a generated logo image for distribution based on location information, resolution, size, or ambient lighting information of digital signage devices.
Further, the invention according to claim 2 automatically modifies and distributes logo images optimized for various digital signage devices, thereby avoiding manual editing and configuration of logo images for each individual device.
Accordingly, the invention according to claim 2 cannot be readily derived by a person skilled in the art from the cited invention, and therefore involves an inventive step.

4.14 Case 14

TITLE OF THE INVENTION

Method for Warning Entry into an Operating Area of Equipment

GUIDELINE

1. When comparing a claimed invention with a cited invention, if it can be determined that the learning models are substantially similar and that the only differences lie in the content of the recognition target data learned by the model due to a change in the applied industrial field, such differences may be regarded as merely a change in data content. In such a case, inventive step is not acknowledged.

2. Conversely, if a change in the applied industrial field results in differences in the specific data processing configuration that utilizes the output data of the trained model in accordance with the purpose of the invention, and if such differences lead to a distinct technical effect, inventive step may be acknowledged.

CLAIMS

[Claim 1]

A method for warning entry into an operating area of equipment, performed by a computing device, comprising:

receiving image data from an image sensor including a camera;

inputting the image data into a pre-trained artificial intelligence model configured to recognize equipment and moving objects;

when the artificial intelligence model identifies predefined equipment in the image, extracting position coordinates of the equipment and setting, based on the extracted position coordinates, a warning entry area spaced apart by a predetermined distance;

when the artificial intelligence model identifies a moving object in the image, extracting coordinates of the moving object;

determining whether the coordinates of the moving object are included within the warning entry area; and

when it is determined that the coordinates of the moving object are included

within the warning entry area, outputting a warning message.

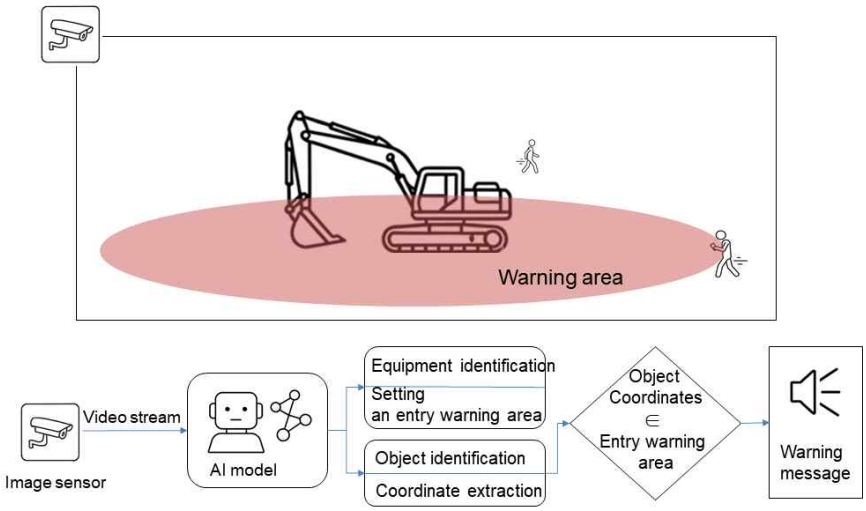
[Claim 2]
The method according to claim 1, further comprising:
receiving location information of each of a plurality of worker terminals; and
integrating boundary coordinate information of the equipment obtained from the image and the location information of the worker terminals into a common coordinate system,
wherein the step of outputting the warning message comprises:
transmitting, to all worker terminals determined to be located within a predefined distance range from the coordinates of the moving object determined to be included in the warning entry area, a warning message including location information of the equipment and the moving object and an alarm sound; and
simultaneously transmitting an emergency stop signal to the equipment.

PROBLEM TO BE SOLVED

An object of the present invention is to prevent safety accidents by using an artificial intelligence model that recognizes objects in real-time captured images to identify equipment present in the image, to set a warning entry area around the identified equipment, to identify moving objects in the image, and to provide a warning when the identified moving object enters the warning entry area.
Another object of the present invention is to more proactively prevent safety accidents by receiving location information of a plurality of worker terminals, integrating boundary coordinate information of the equipment obtained from the image and the location information of the worker terminals into a common coordinate system, transmitting to worker terminals located near the identified moving object a warning message including location information of the equipment and the moving object as well as an alarm sound, and simultaneously transmitting an emergency stop signal to the equipment.
The artificial intelligence model pre-trained to recognize objects may be implemented using a deep learning model such as a convolutional neural network (CNN).
Further, the integration of coordinate information obtained from the image and

the location information of the worker terminals into a common coordinate system may be implemented by receiving position information of an image sensor including a depth camera (RGB-D), converting the position information of the image sensor and the location information of the worker terminals into a common coordinate system, and transforming image-plane coordinates of the equipment and objects recognized in the image into coordinates in the common coordinate system using corresponding depth information.

DRAWING



CITED INVENTION

An image-based access warning system comprising:

an image receiving unit configured to receive image data from a camera;

an access warning zone setting unit configured to input the image data into a pre-trained deep learning model in order to recognize a security object in the image, to acquire position coordinates of the security object calculated through the deep learning model, and to set an access warning zone within a predetermined distance from the position coordinates of the security object;

a security threat determination unit configured to detect, via the deep learning model, a second object different from the security object in the image, to track movement of the second object through the deep learning model, and to

determine whether position coordinates of the second object calculated through the deep learning model overlap with the access warning zone; and
a notification unit configured to notify an alarm signal when the security threat determination unit determines that the second object overlaps with the access warning zone.

ASSESSMENT

1. Claim 1 may be determined to lack inventive step in view of the cited invention.
2. Claim 2 may be determined to involve an inventive step over the cited invention.

REASONS FOR ASSESSMENT (CLAIM 1)

(*Common Features*)

Claim 1 and the cited invention share the same technical purpose in that both provide a warning or alarm by setting a specific area based on image-based object recognition and detecting an object intruding into the area.

Both Claim 1 and the cited invention comprise a common configuration in which image data is received from a camera, a trained model is used to recognize a specific object (equipment or a security object) in the image, a region is set based on the position (coordinates) of the recognized object, another moving object in the image is recognized, it is determined whether the moving object enters the set region, and a warning or alarm is issued accordingly.

(*Distinguishing Features*)

Claim 1 is directed to the industrial safety field and limits the specific object serving as the basis for area setting to equipment, whereas the cited invention is directed to the security field and limits the specific object serving as the basis for area setting to a security object.

(*Assessment of the Distinguishing Features*)

Although Claim 1 limits the specific object to equipment for the purpose of

industrial safety and the cited invention limits the specific object to a security object for security purposes, this difference merely reflects a change in the recognition target of the artificial intelligence model due to a difference in the applied industrial field.
In both inventions, the artificial intelligence model is used to identify a specific object and calculate its coordinates for the purpose of providing an access warning. Modifying the recognition target (content) according to the applied field is merely a change in data content that would be selected by a person skilled in the art within the scope of ordinary creativity.
Furthermore, there is no evidence that Claim 1 achieves a technical effect that is different from or superior to the predictable effects of the cited invention.
Accordingly, Claim 1 can be easily derived by a person skilled in the art from the cited invention and therefore lacks an inventive step.

REASONS FOR ASSESSMENT (CLAIM 2)

(*Common Features*)

The common features are the same as those discussed above with respect to Claim 1.

(*Distinguishing Features*)

Claim 2 differs from the cited invention in that Claim 2 further comprises:
receiving location information of a plurality of worker terminals;
integrating coordinate information obtained from the image and the location information of the worker terminals into a common coordinate system;
transmitting, to all worker terminals located within a predefined distance from the moving object determined to be within the warning entry area, a warning message including location information of the equipment and the moving object and an alarm sound; and
transmitting an emergency stop signal to the equipment.

(*Assessment of the Distinguishing Features*)

The cited invention does not disclose or suggest the above-described features, namely, integration of coordinate systems, transmission of warning messages to

worker terminals, and transmission of an emergency stop signal to equipment, which constitute a specific application of the object recognition results of the artificial intelligence model to industrial safety around operating equipment.

Claim 2 provides a concrete technical means for proactively preventing safety accidents by broadcasting location information of the hazard factor and an alarm sound to all worker terminals located near the hazardous situation and by transmitting an emergency stop signal to the equipment.

Accordingly, Claim 2 produces a technical effect that is different from and not predictable from the cited invention.

Therefore, Claim 2 cannot be easily derived by a person skilled in the art from the cited invention and is considered to involve an inventive step.

4.15 Case 15

TITLE OF THE INVENTION

A Real-Time Welding Quality Inspection Device

GUIDELINE

The claimed invention and the cited inventions are identical in the technology field and the learning model, but the claimed invention and the cited invention 1 are different in the learning data. However, in the cited invention 2, the corresponding feature is disclosed, and there are no difficulty in the combination and no difference in the working effect. In this case, it is determined that the claimed invention does not involve an inventive step.

CLAIM

A real-time welding quality inspection device comprising:

an image signal acquisition unit in which a laser is irradiated on the surface of a welded bead by a welder and the reflected light from the surface of said welded bead is acquired as an image signal;

a welding quality assessment unit where the weld bead geometry from said acquired image signal is measured, characteristic data are extracted from said weld bead geometry and welding defects are determined through a machine learning model;

wherein if it is determined that welding is normal without any defects, said welding quality assessment unit outputs a position movement control signal to the welder to get it to move to the next point for the subsequent welding process; or otherwise

if it is determined that welding is abnormal with defects, said welding quality assessment unit outputs a welding stop control signal to the welder;

said characteristic data contain at least one among the width between said welded bead's valley and hill, the valley angle of said welded bead and the valley’s curvature of said welded bead; and

said machine learning model is trained with said characteristic data and the welding defects assessment value corresponding to said characteristic data as training data.

PROBLEM TO BE SOLVED

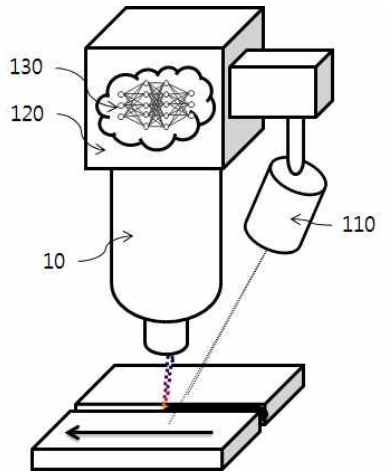
The purpose is to provide a real-time welding quality inspection device used for managing quality process of welding in such a way of uniformly conducting a welded bead quality inspection in real time and stopping welding process right away if any defects are detected.

MEANS FOR SOLVING THE PROBLEM

If a welder (10) implements welding, an image signal acquisition unit (110) irradiates a patterned laser on the surface of a welded bead and acquires the reflected light from the surface of said welded bead as an image signal and transmits the acquired image signal to a welding quality assessment unit (120). The welding quality assessment unit (120) measures the welded bead geometry from said acquired image signal for reading the bead quality and extracts characteristic data from the welded bead geometry, input the extracted characteristic data to a machine learning model within the welding quality assessment unit and carries out the quality assessment process through the machine learning model. If it is determined that welding is normal without any defects, the welding quality assessment unit (120) outputs a position movement control signal to the welder (10) to get the welder (10) to move to the next point for the subsequent welding process. In the meantime, if it is determined that welding is abnormal with defects, said welding quality assessment unit (120) outputs a welding stop control signal to the welder (10).

Characteristic data input in the machine learning model (130) within the welding quality assessment unit contain at least one among the width between said welded bead's valley and hill, the valley angle of said welded bead and the valley’s curvature of said welded bead, and the machine learning model within the welding quality assessment unit is trained with said characteristic data and the welding defects assessment value corresponding to said characteristic data as training data. The machine learning model (130) can use an artificial neural network and can also be implemented in a knife-edge scanning or support vector machine.

DRAWING



CITED INVENTION 1

A measuring process of a welded bead using a welding carriage where a laser diode (LD) for irradiating laser beam, a laser vision system including a camera equipped on the surface of said laser diode (LD) and a welding torch unit are each mounted, comprising:

a welding initiation step where said welding torch unit starts welding processes;

a welded bead measuring step where said laser vision system irradiates laser beam of said laser diode (LD) on the welded bean on the surface of weld member and an weld bead image is acquired by capturing the laser beam reflected from said welded bead with said camera;

a welded bead abnormality assessment step where said laser vision system derives a characteristic value from said welded bead image, said derived characteristic value is input in the trained artificial neural network by using a characteristic value of a normally welded bead image and an abnormal one and said trained artificial neural network determines welding abnormality;

wherein a welding stopping step is contained for stopping the welding process of said welding torch unit, if said laser vision system detects weld defects in said welded bead defects assessment step; and

the characteristic value derived from said welded bead image is at least one among the shape and the color of a welded bead image.

CITED INVENTION 2

Cited invention 2 relates to a welding quality assessment method based on a welded part image in the welding process, suggesting a height difference between basic materials for welding, a valley depth of a welded bead, a hill height of a welded bead, the width between a welded bead's valley and hill, the valley angle of a welded bead, the valley's curvature of a welded bead, the width of a key hole, etc. as measurement data for concisely assessing the welding quality. A mock experiment for inspecting welding defects specifically suggests an experimental case comparing welding quality assessment values based on welding quality assessment data extracted from the welded bead image with really measured welding quality assessment values.

ASSESSMENT

It is determined that the invention of claim 1 does not involve an inventive step over the combination between cited inventions 1 and 2.

REASONS FOR ASSESSMENT

(*Common Features*)

The invention of claim 1 and cited invention 1 have the same purpose in that welding defects are determined in real time by using a machine learning model and welding process is stopped as defects are detected to improve quality of welding production process.

The invention of claim 1 and cited invention 2 are substantially identical in measuring data for determining welding defects.

Also, the invention of claim 1 and cited invention 1 are identical in that the welded bead feature is measured from a laser image signal reflected from the surface of the welded bead and the feature data are extracted and a machine learning model learns the feature data and welding defects assessment values corresponding to the feature data as learning data.

(*Distinguishing Feature*)

According to the invention of claim 1, learning data used in a machine learning model are data containing one or more amongst the width between a

welded bead's valley and hill, the valley angle of a welded bead and the valley's curvature of a welded bead. Meanwhile, cited invention 1 limits learning data to shape or color of a welded bead image. In this sense, the both inventions are different in learning data.

(*Assessment of the Distinguishing Feature*)

Cited invention 1 limits learning data to shape or color of a welded bead image. In the meantime, according to the invention of claim 1, learning data refer to feature data containing one or more amongst the width between a welded bead's valley and hill, the valley angle of a welded bead and the valley's curvature of a welded bead. In this sense, the both inventions are different from each other.

The invention of claim 1 and cited invention 2 in the same technological field, however, suggest a height difference between basic materials for welding, a valley depth of a welded bead, a hill height of a welded bead, the width between a welded bead's valley and hill, the valley angle of a welded bead, the valley's curvature of a welded bead, the width of a key hole, etc. as measurement data for concisely assessing welding quality in a mock experiment for inspecting welding defects.

Also, it is determined that a person skilled in the art may neither face any difficulty in combining a feature of cited invention 2 to citied invention 1 through an implication of cited invention 1 in view of the technological level as of the filing nor is a noticeable difference in the working effect.

Accordingly, the invention of claim 1 can be implemented by a person skilled in the art through the combination of cited inventions 1 and 2. It is, thus, determined that the invention of claim 1 does not involve an inventive step.