



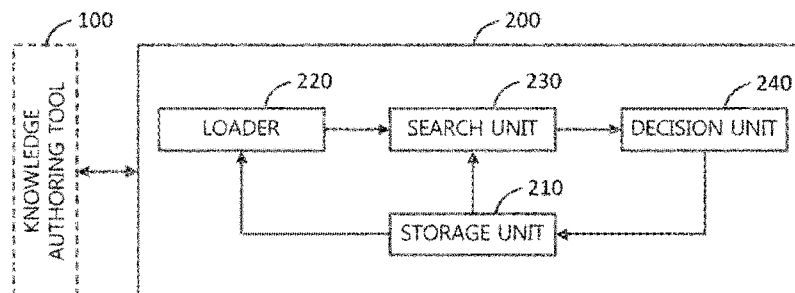
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(54) **Title:** CLINICAL KNOWLEDGE VALIDATION SYSTEM AND METHOD BASED ON CASE BASE REASONING



(57) **Abstract:** Provided is a clinical knowledge validation system based on case base reasoning, the clinical knowledge validation system including: a storage unit which stores a knowledge base based on clinical rules and a case base based on clinical cases; a loader which loads clinical candidate rules from a knowledge authoring tool (KAT); a search unit which searches for, in the case base, candidate cases included in at least one of duplication and contradiction of the clinical candidate rules; and a decision unit which decides at least one of reuse and retention of the candidate cases based on whether the candidate cases exist.



Description

Title of Invention: CLINICAL KNOWLEDGE VALIDATION SYSTEM AND METHOD BASED ON CASE BASE REASONING

Technical Field

- [1] One or more embodiments of the present invention relate to a clinical knowledge validation system and method based on case base reasoning, and more particularly, to a clinical knowledge validation system based on case base reasoning, which validates new clinical rules from a case base without participation of domain experts, and a clinical knowledge validation method.

Background Art

- [2] A clinical decision support system (CDSS) provides base knowledge necessary for a doctor to decide and determine diagnosis and treatments when examining a patient, helps the doctor, properly infer, and supports decision making of the doctor.
- [3] Furthermore, when a doctor examines a patient, the CDSS implements predefined medical guidelines, other than subjective determinations of a doctor in charge, by using a computer and provides a piece of clinical knowledge corresponding to a state of the patient, thereby providing an environment in which misdiagnoses of a doctor are prevented and the doctor may objectively examines patients.
- [4] Also, the CDSS may logically parse clinical information and generate rules (or clinical rule information) in order to provide the clinical knowledge to the doctor. The rule information is stored in a knowledge base and may be used to support decision making of the doctor.
- [5] Furthermore, the CDSS may convert the clinical knowledge into query-based rule information using a logical engine tool in order to allow at least one of a doctor, a domain expert providing clinical knowledge, and a system administrator to generate, revise, renew, delete or search for the rule information.
- [6] The clinical knowledge used in the CDSS may include empirical knowledge information of a doctor, which includes symptoms of patients, treatments for diseases, causes of diseases, etc., and opinion information of domain experts.
- [7] In addition, the CDSS may generate new candidate rules according to inputs of the domain experts and may validate the candidate rules through validation of the domain experts and comparative validation (for example, knowledge-based internal validation) with existing candidate rules.
- [8] However, when new candidate rules candidate rules are validated, the conventional CDSS only performs the knowledge-based internal validation, and thus, new candidate rules candidate rules including contradicted rules may be provided.

- [9] Korean Laid-open Patent 101261177 discloses Clinical Decision Support System and Method, and Korean Patent Publication 1020140135133 discloses clinical decision support system devices and method thereof.

Disclosure of Invention

Technical Problem

- [10] One or more embodiments of the present invention include a clinical knowledge validation system and method based on case base reasoning. The clinical knowledge validation system validating clinical candidate rules by validating a case base without limitation on knowledge-based internal validation and participation of experts.
- [11] One or more embodiments of the present invention include a clinical knowledge validation system and method based on case base reasoning, the clinical knowledge validation system loading and validating clinical candidate rules by using an integrated API adaptor and processing a large amount of data in real time.
- [12] One or more embodiments of the present invention include a clinical knowledge validation system and method based on case base reasoning, the clinical knowledge validation system storing clinical candidate rules and case-based acquisition knowledge and iteratively conducting searches.

Solution to Problem

- [13] A clinical knowledge validation system based on case base reasoning includes: a storage unit which stores a knowledge base based on clinical rules and a case base based on clinical cases; a loader which loads clinical candidate rules from a knowledge authoring tool (KAT); a search unit which searches for, in the case base, candidate cases included in at least one of duplication and contradiction of the clinical candidate rules; and a decision unit which decides at least one of reuse and retention of the candidate cases along with associated clinical candidate rules based on whether the candidate cases exist.
- [14] The loader may standardize the clinical candidate rules with an Arden syntax MLM format and may load the standardized clinical candidate rules. Also, the loader may load a plurality of clinical candidate rules by using an integrated API adaptor.
- [15] The decision unit may share information with regard to existence of the candidate cases with the KAT and may decide at least one of the reuse and retention of the candidate cases based on validation response information of the KAT.
- [16] The decision unit may include: a reuse decision unit which decides whether to reuse the candidate cases when the candidate cases exist; and a retention decision unit which decides whether to retain the clinical candidate rules when the candidate cases do not exist.
- [17] If the candidate cases are duplicated, the reuse decision unit may reuse the duplicated

candidate cases, and if the candidate cases are contradicted, the reuse decision unit may renew contradicted candidate cases which are revised or replaced with clinical candidate rules.

[18] The storage unit adaptively may store acquisition knowledge with regard to the clinical candidate rules and the candidate cases in at least one of the knowledge base and the case base.

[19] The search unit may iteratively search for additional candidate cases corresponding to the clinical candidate rules in the case base in which the acquisition knowledge is stored.

[20] A clinical knowledge validation method includes: storing a knowledge base based on clinical rules and a case base based on clinical cases; loading clinical candidate rules from a KAT; searching for candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base; and deciding at least one of reuse and retention of the candidate cases along with associated clinical candidate rules based on whether the candidate cases exist.

[21] The loading may include loading a plurality of clinical candidate rules by standardizing the plurality of clinical candidate rules with an Arden syntax MLM format and loading a plurality of clinical candidate rules by using an integrated API adaptor.

[22] The deciding may include: sharing information with regard to the existence of the candidate cases with the KAT; and deciding at least one of the reuse and retention of the candidate cases based on validation response information of the KAT.

[23] The storing may include adaptively storing acquisition knowledge with regard to the clinical candidate rules and the candidate cases.

Advantageous Effects of Invention

[24] According to one or more embodiments of the present invention, clinical candidate rules may be validated by validating a case base without limitation on knowledge-based internal validation and participation of experts.

[25] The clinical candidate rules are loaded and validated by using an integrated API adaptor, and thus, a large amount of data may be processed in real time.

[26] The clinical candidate rules and acquisition knowledge with regard to a case-based search result are stored, and searches may be iteratively conducted based on the stored acquisition knowledge.

Brief Description of Drawings

[27] FIG. 1 illustrates a mechanism for validating clinical candidate rules according to an embodiment of the present invention.

[28] FIG. 2 is a block diagram of a clinical knowledge validation system based on case base reasoning, according to a first embodiment of the present invention.

[29] FIG. 3 is a block diagram of a decision unit of a clinical knowledge validation system based on case base reasoning, according to an embodiment of the present invention.

[30] FIG. 4 is a block diagram of a clinical knowledge validation system based on case base reasoning, according to a second embodiment of the present invention.

[31] FIG. 5 is a flowchart of a clinical knowledge validation method according to an embodiment of the present invention.

Mode for the Invention

[32] The present invention will now be described more fully with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. However, the present invention should not be construed as being limited to the embodiments set forth herein.

[33] In the description of the present invention, certain detailed explanations of the related art are omitted when it is deemed that they may unnecessarily obscure the essence of the invention. Unless otherwise defined, all terms are used to properly describe embodiments of the present invention and may vary according to users' intentions or practice. Hence, the terms must be interpreted based on the contents of the entire specification.

[34] FIG. 1 illustrates a mechanism for validating clinical candidate rules according to an embodiment of the present invention.

[35] Referring to FIG. 1, the mechanism for validating the clinical candidate rules may be configured to validate clinical candidate rules having modified clinical rules or clinical candidate rules for generating new clinical rules from the KAT 100.

[36] The clinical rules may be information generated as a rule type by referring to empirical knowledge information of doctors, which includes symptoms of patients, treatments for diseases, causes of diseases, etc., and opinion information of domain experts and may be information used to make decisions.

[37] According to an embodiment, the mechanism for validating the clinical candidate rules sequentially perform a search process, a reusing (revising) process, and a retaining process, and the clinical candidate rules may be validated. The clinical candidate rules may be validated by a clinical knowledge validation system. Hereinafter, the clinical knowledge validation system will be described in detail with reference to FIG. 2.

[38] FIG. 2 is a block diagram of a clinical knowledge validation system 200 based on case base reasoning, according to a first embodiment of the present invention.

[39] Referring to FIG. 2, the clinical knowledge validation system 200 includes a storage unit 210, a loader 220, a search unit 230, and a decision unit 240.

[40] The storage unit 210 stores a knowledge base based on clinical rules and a case base

based on clinical cases.

- [41] The clinical rules may be information generated as a rule type by referring to empirical knowledge information of doctors, which includes symptoms of patients, treatments for diseases, causes of diseases, etc., and opinion information of domain experts, and the clinical cases may be information with regard to precedent clinical cases.
- [42] Also, the clinical rules may be information used to make decisions, and the clinical cases may be information used to validate the candidate rules.
- [43] According to an embodiment, the storage unit 210 may collect the clinical rules in the knowledge base and may collect the precedent clinical cases in the case base.
- [44] The loader 220 loads the clinical candidate rules from a knowledge authoring tool (KAT) 100. In detail, the loader 220 may load clinical candidate rules having modified clinical rules or clinical candidate rules for generating new clinical rules from the KAT 100.
- [45] The KAT 100 may be used to support clinical decision making and may provide domain experts with an environment for generating, modifying, and deleting clinical knowledge such as clinical candidate rules.
- [46] In detail, the KAT 100 may generate, modify and delete the clinical candidate rules according to selective inputs of the domain experts and clinical rules included in the knowledge base.
- [47] In addition, the KAT 100 may standardize the clinical candidate rules and the clinical rules with an Arden syntax medical logic module (MLM) standardization data model, may generate clinical candidate rules and clinical rules, and may share the clinical candidate rules and the clinical rules with the clinical knowledge validation system 200.
- [48] According to an aspect of the present invention, the loader 220 may standardize the clinical candidate rules with the Arden syntax MLM standardization data model and may load the clinical candidate rules by using an integrated API adaptor.
- [49] The integrated API adaptor may load the clinical candidate rules from the KAT 100 and may provide the KAT 100 with a shared interface so that the KAT 100 may access the knowledge base.
- [50] The search unit 230 searches for candidate cases which are included in at least one of duplication and contradiction of the clinical candidate rules in the case base. In detail, the search unit 230 uses a similarity function and may search for the candidate cases which are included in at least one of duplication and contradiction of the clinical candidate rules in the case base.
- [51] For example, the search unit 230 uses a similarity function, which extracts distribution of similar keywords existing between the clinical candidate rules and the

candidate cases, and may search for the candidate cases included in the duplication and contradiction of the clinical candidate rules in the case base.

- [52] The similarity function may include search operators in order to extract the distribution of the similar keywords. The search operators may include an AND operator, which satisfies two or more keywords or syntaxes, an OR operator which satisfies one of two or more keywords or of syntaxes, and a proximity operator which satisfies a relative distance between two keywords and locations of the keywords.
- [53] Also, the search unit 230 may search for candidate cases by interconverting the clinical candidate rules into standardized case structures based on an Arden syntax MLM format.
- [54] The decision unit 240 decides at least one of reuse and retention of candidate cases based on whether the candidate cases exist. Hereinafter, a detailed structure of the decision unit 240 will be described in detail with reference to FIG. 3.
- [55] FIG. 3 is a block diagram of a decision unit of a clinical knowledge validation system based on case base reasoning, according to an embodiment of the present invention.
- [56] Referring to FIG. 3, the decision unit 240 may include a reuse decision unit 241 and a retention decision unit 242.
- [57] The reuse decision unit 241 may decide whether to reuse candidate cases when the candidate cases exist.
- [58] For example, when the candidate cases are duplicated, the reuse decision unit 241 reuses the candidate cases, and when the candidate cases are contradicted, the contradicted candidate cases are revised or replaced with clinical candidate rules, thereby renewing the candidate cases.
- [59] The retention decision unit 242 may decide whether to retain the clinical candidate rules when the candidate cases do not exist.
- [60] According to an aspect of the present invention, the decision unit 240 shares information with regard to the existence of the candidate cases with the KAT and may decide at least one of the reuse or the retention of the candidate cases based on validation response information of the KAT.
- [61] The storage unit 210 may adaptively store acquisition knowledge with regard to the clinical candidate rules and the candidate cases in at least one of the knowledge base and the case base. The search unit 230 may iteratively search for additional candidate cases corresponding to the clinical candidate rules in the case base in which the acquisition knowledge is stored.
- [62] Therefore, the clinical knowledge validation system 200 may improve validity of decision making by iteratively performing the validation of the clinical candidate rules.
- [63] FIG. 4 is a block diagram of a clinical knowledge validation system 400 based on case base reasoning, according to a second embodiment of the present invention.

- [64] Referring to FIG. 4, the clinical knowledge validation system 400 may include a knowledge manager 400-1 and an CBR based MLM reasoner 400-2.
- [65] The knowledge manager 400-1 may load, from a KAT 300, clinical candidate rules having modified clinical rules or clinical candidate rules for generating new clinical rules and may transmit the loaded clinical candidate rules to the MLM reasoner 400-2.
- [66] The MLM reasoner 400-2 searches for candidate cases which are included in at least one of duplication and contradiction of the clinical candidate rules and may transmit a search result with regard to the candidate cases to the knowledge manager 400-1.
- [67] The knowledge manager 400-1 shares information with regard to existence of the candidate cases with the KAT 300 and may decide at least one of reuse and retention of the candidate cases based on validation response information of the KAT 300.
- [68] A detailed structure of the knowledge manager 400-1 and that of the MLM reasoner 400-2 may be interlocked.
- [69] Therefore, the detailed structures of the knowledge manager 400-1 and the MLM reasoner 400-2 will be defined first and then described.
- [70] The knowledge manager 400-1 may include a KAT adaptor 410, an MLM manipulator 420, a VMR manipulator 430, and a case manipulator 440.
- [71] Also, the MLM reasoner 400-2 may include a case processor 450, an MLM interface 460, and a Knowledgebase 470.
- [72] The KAT adaptor 410 may load the clinical candidate rules from the KAT 300 and may provide the KAT 300 with a shared interface so that the KAT 300 may access a knowledge base included in the standard knowledgebases 470.
- [73] In detail, the KAT adaptor 410 may load clinical candidate rules having modified clinical rules or clinical candidate rules for generating new clinical rules from the KAT 300.
- [74] The KAT 300 may be used to support clinical decision making and may provide domain experts with an environment for generating, modifying, and deleting clinical knowledge such as the clinical candidate rules and the clinical rules.
- [75] For example, the KAT 300 may generate, modify and delete the clinical candidate rules according to selective inputs of the domain experts.
- [76] Also, the KAT 300 may standardize the clinical candidate rules and the clinical rules with an HL7 Arden syntax MLM standardization data model, may generate clinical candidate rules and clinical rules, and may share the clinical candidate rules and the clinical rules with the clinical knowledge validation system 200.
- [77] The KAT adaptor 410 may standardize query-based clinical candidate rules with an Arden syntax MLM standardization data model so called VMR. Also, the KAT adaptor 410 may transmit the clinical candidate rules to the MLM manipulator 420, the VMR manipulator 430, and the case manipulator 440 and then may share the clinical

candidate rules with the MLM manipulator 420, the VMR manipulator 430, and the case manipulator 440.

[78] The MLM manipulator 420 transmits the clinical candidate rules to the MLM interface 400-2 and may receive, from the MLM interface 400-2, a search result with regard to candidate cases which are included in at least one of duplication and contradiction of the clinical candidate rules.

[79] The VMR manipulator 430 may be used to parse and manipulate the data model used in candidate rules.

[80] For example, VMR manipulator extracts the data information used in candidate rule and formulate for further manipulation by CBR Based MLM Reasoner 400-2.

[81] According to an aspect of the present invention, the VMR manipulator 430 shares information with regard to the existence of the candidate cases with the KAT 300 .

[82] The case manipulator 440 may mediate the MLM manipulator 420 and the VMR manipulator 430, may transmit the clinical candidate rules to the case processor 450, and may search for candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base included in the Knowledgebase 470.

[83] In detail, the case processor 450 may search for the candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base by using a similarity function.

[84] For example, the case processor 450 uses a similarity function which extracts distribution of similar keywords existing between the clinical candidate rules and the candidate cases and may search for the candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base.

[85] The similarity function may include search operators in order to extract the distribution of similar keywords. The search operators may include an AND operator which satisfies two or more keywords or syntaxes, an OR operator which satisfies one of two or more keywords or of syntaxes, and a proximity operator which satisfies a relative distance between two keywords and locations of the keywords.

[86] The MLM interface 460 may perform a data bridge between the MLM manipulator 420 and the Knowledgebase 470.

[87] For example, the MLM interface 460 receives the clinical candidate rules from the MLM manipulator 420 and may transmit the received clinical candidate rules to the clinical knowledgebase 470. Then, the MLM interface 460 receives acquisition knowledge with regard to the candidate cases from the Knowledgebase 470 and may transmit the received acquisition knowledge to the MLM manipulator 420.

[88] The Knowledgebase 470 may adaptively store acquisition knowledge with regard to the clinical candidate rules and the candidate cases in at least one of the knowledge base and the case base.

- [89] The case processor 450 may iteratively search for additional candidate cases corresponding to the clinical candidate rules in the case base in which the acquisition knowledge is stored.
- [90] FIG. 5 is a flowchart of a clinical knowledge validation method which is based on case base reasoning according to an embodiment of the present invention.
- [91] Referring to FIG. 5, a clinical knowledge validation system stores a knowledge base based on clinical rules and a case base based on clinical cases, in operation 510.
- [92] The clinical rules may be information generated as a rule by referring to empirical knowledge information of a doctor, which includes symptoms of patients, treatments for diseases, causes of diseases, etc., and opinion information of domain experts, and the clinical cases may be information with regard to precedent clinical cases.
- [93] Also, the clinical rules may be information used to make decision, and the clinical cases may be information used to validate the clinical rules and the clinical candidate rules.
- [94] In operation 510, the clinical knowledge validation system may collect the clinical rules in the knowledge base and may collect precedent clinical cases in the case base. In operation 510, the clinical knowledge validation system become precedence knowledge to validate further clinical candidate rules.
- [95] In operation 520, the clinical knowledge validation system loads the clinical candidate rules from a KAT. In detail, in operation 520, the clinical knowledge validation system may load clinical candidate rules having modified clinical rules or clinical candidate rules for generating new clinical rules from the KAT.
- [96] The KAT may be used to support clinical decision making and may provide the domain experts with an environment for generating, modifying and deleting clinical knowledge such as the clinical candidate rules and the clinical rules.
- [97] In detail, the KAT may generate, modify and delete the clinical candidate rules according to selective inputs of the domain experts and may generate, modify and delete the clinical rules included in the knowledge base.
- [98] Also, the KAT may standardize the clinical candidate rules and the clinical rules with an Arden syntax MLM standardization data model, may generate clinical candidate rules and clinical rules, and may share the clinical candidate rules and the clinical rules with the clinical knowledge validation system.
- [99] In operation 520, the clinical knowledge validation system may standardize the clinical candidate rules with the Arden syntax MLM standardization data model and may load the clinical candidate rules by using an integrated API adaptor.
- [100] The integrated API adaptor may load the clinical candidate rules from the KAT and may provide a shared interface to the KAT so that the KAT may access the knowledge base.

- [101] In operation 520, the clinical knowledge validation system may standardize query-based clinical candidate rules with the Arden syntax MLM standardization data model.
- [102] In operation 530, the clinical knowledge validation system searches for candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base. In detail, in operation 530, the clinical knowledge validation system may search for the candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base by using a similarity function.
- [103] For example, in operation 530, the clinical knowledge validation system may search for the candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base by using a similarity function which extracts distribution of similar keywords existing between the clinical candidate rules and the candidate cases.
- [104] In operation 540, the clinical knowledge validation system may decide at least one of reuse and retention of the candidate cases based on whether the candidate cases exist.
- [105] For example, in operation 540, when the candidate cases exist, the clinical knowledge validation system may decide whether to reuse the candidate cases, and when the candidate cases do not exist, the clinical knowledge validation system may decide whether to retain the candidate cases.
- [106] Also, in operation 540, the clinical knowledge validation system shares information with regard to the existence of the candidate cases along with associate candidate rules with the KAT and may decide at least one of the reuse and retention of the candidate cases based on the validation response information of the KAT.
- [107] The method according to an embodiment of the present invention may be embodied as program instructions which may be executed by various computer media and stored on a computer-readable medium. The computer-readable medium may include at least one of program instructions, data files, data structures or any combination thereof. The program instructions stored on the computer-readable medium may be designed and configured for embodiments of the present invention or well known to one of ordinary skill in the art. Examples of the computer readable recording medium include read-only memory (ROM), random-access memory (RAM), CD-ROMs, magnetic tapes, hard disks, floppy disks, flash memory, optical data storage devices, and so on. Examples of the program instructions include machine codes written by a compiler and high-level language code which may be executed by a computer by using an interpreter, or the like. Hardware devices may operate as one or more software modules for executing operations of embodiments described herein, and vice versa.
- [108] While this invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that

various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

[109] For example, objectives of the present invention may be accomplished although a specific process order may be performed differently from the described order, and/or components such as a system, a structure, a device, and a circuit may be combined differently from the described components or replaced with other components or equivalents.

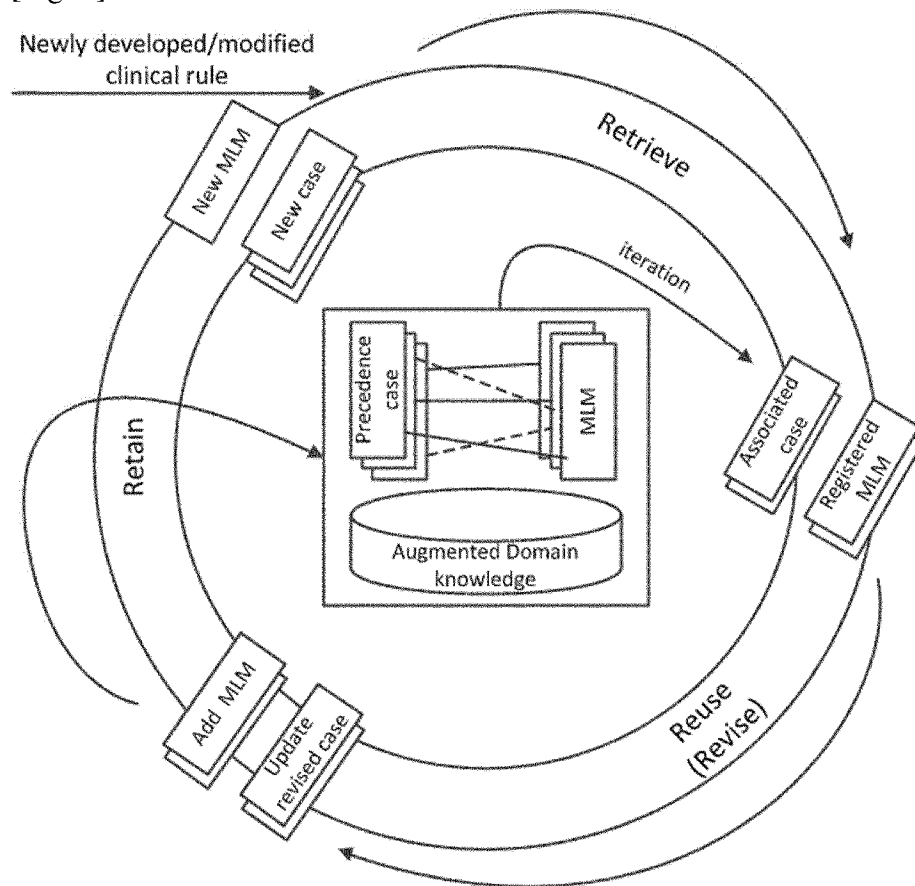
[110] Therefore, all changes, equivalents, and substitutes that do not depart from the spirit and technical scope of the present invention are encompassed in the present invention.

Claims

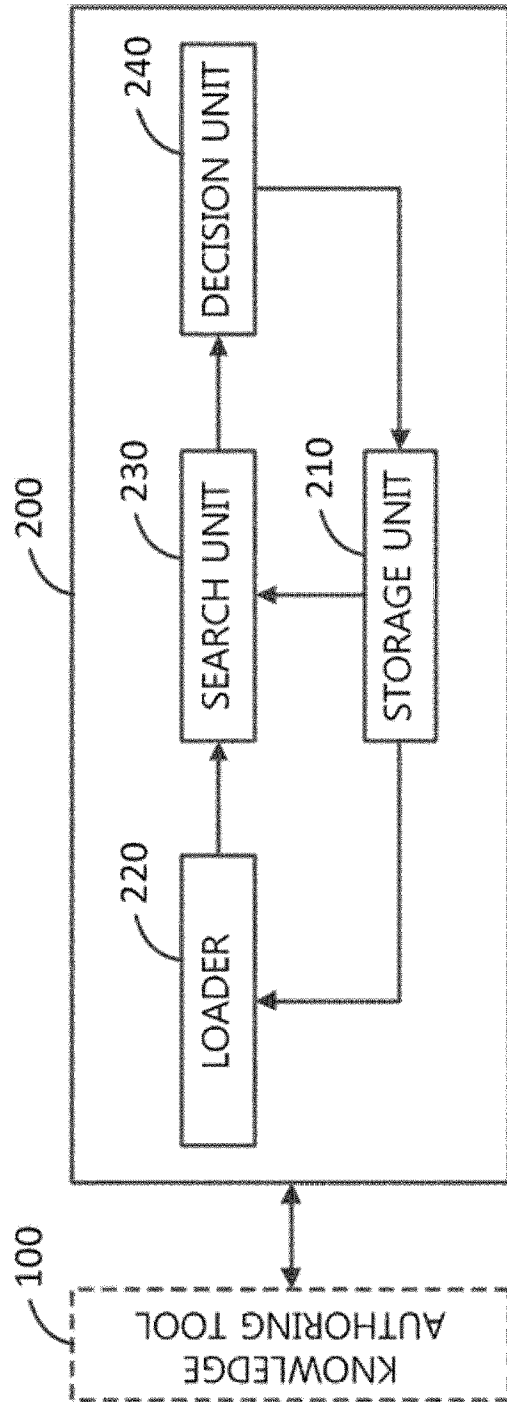
- [Claim 1] A clinical knowledge validation system based on case base reasoning, the clinical knowledge validation system comprising:
a storage unit which stores a knowledge base based on clinical rules and a case base based on clinical cases;
a loader which loads clinical candidate rules from a knowledge authoring tool (KAT);
a search unit which searches for, in the case base, candidate cases included in at least one of duplication and contradiction of the clinical candidate rules; and
a decision unit which decides at least one of reuse and retention of the candidate cases along with associated clinical candidate rules based on whether the candidate cases exist.
- [Claim 2] The clinical knowledge validation system of claim 1, wherein the loader standardizes the clinical candidate rules with an Arden syntax MLM format and loads the standardized clinical candidate rules.
- [Claim 3] The clinical knowledge validation system of claim 1, wherein the loader loads a plurality of clinical candidate rules by using an integrated API adaptor.
- [Claim 4] The clinical knowledge validation system of claim 1, wherein the decision unit shares information with regard to existence of the candidate cases with the KAT and decides at least one of the reuse and retention of the candidate cases based on validation response information of the KAT.
- [Claim 5] The clinical knowledge validation system of claim 1, wherein the decision unit comprises:
a reuse decision unit which decides whether to reuse the candidate cases when the candidate cases exist; and
a retention decision unit which decides whether to retain the clinical candidate rules when the candidate cases do not exist.
- [Claim 6] The clinical knowledge validation system of claim 5, wherein, if the candidate cases are duplicated, the reuse decision unit reuses the duplicated candidate cases, and
if the candidate cases are contradicted, the reuse decision unit may renew contradicted candidate cases which are revised or replaced with clinical candidate rules.
- [Claim 7] The clinical knowledge validation system of claim 1, wherein the

- storage unit adaptively stores acquisition knowledge with regard to the clinical candidate rules and the candidate cases in at least one of the knowledge base and the case base.
- [Claim 8] The clinical knowledge validation system of claim 7, wherein the search unit iteratively searches for additional candidate cases corresponding to the clinical candidate rules in the case base in which the acquisition knowledge is stored.
- [Claim 9] A clinical knowledge validation method comprising:
storing a knowledge base based on clinical rules and a case base based on clinical cases;
loading clinical candidate rules from a knowledge authoring tool (KAT);
searching for candidate cases included in at least one of duplication and contradiction of the clinical candidate rules in the case base; and
deciding at least one of reuse and retention of the candidate cases along with associated clinical candidate rules based on whether the candidate cases exist.
- [Claim 10] The clinical knowledge validation method of claim 9, wherein the loading comprises loading a plurality of clinical candidate rules by standardizing the plurality of clinical candidate rules with an Arden syntax MLM format.
- [Claim 11] The clinical knowledge validation method of claim 9, wherein the loading comprises loading a plurality of clinical candidate rules by using an integrated API adaptor.
- [Claim 12] The clinical knowledge validation method of claim 9, wherein the deciding comprises:
sharing information with regard to the existence of the candidate cases with the KAT; and
deciding at least one of the reuse and retention of the candidate cases based on validation response information of the KAT.
- [Claim 13] The clinical knowledge validation method of claim 9, wherein the storing comprises adaptively storing acquisition knowledge with regard to the clinical candidate rules and the candidate cases.
- [Claim 14] A non-transitory computer readable medium having embodied thereon a computer program, which when executed by a computer, performs the method of any one of claims 9 through 13.

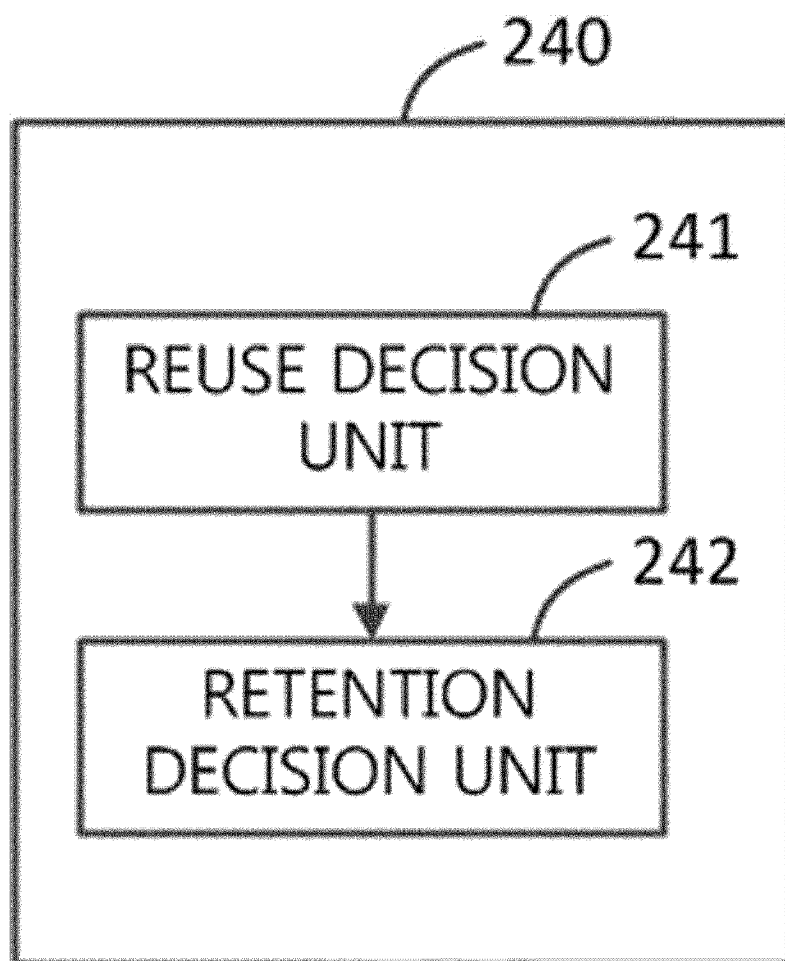
[Fig. 1]



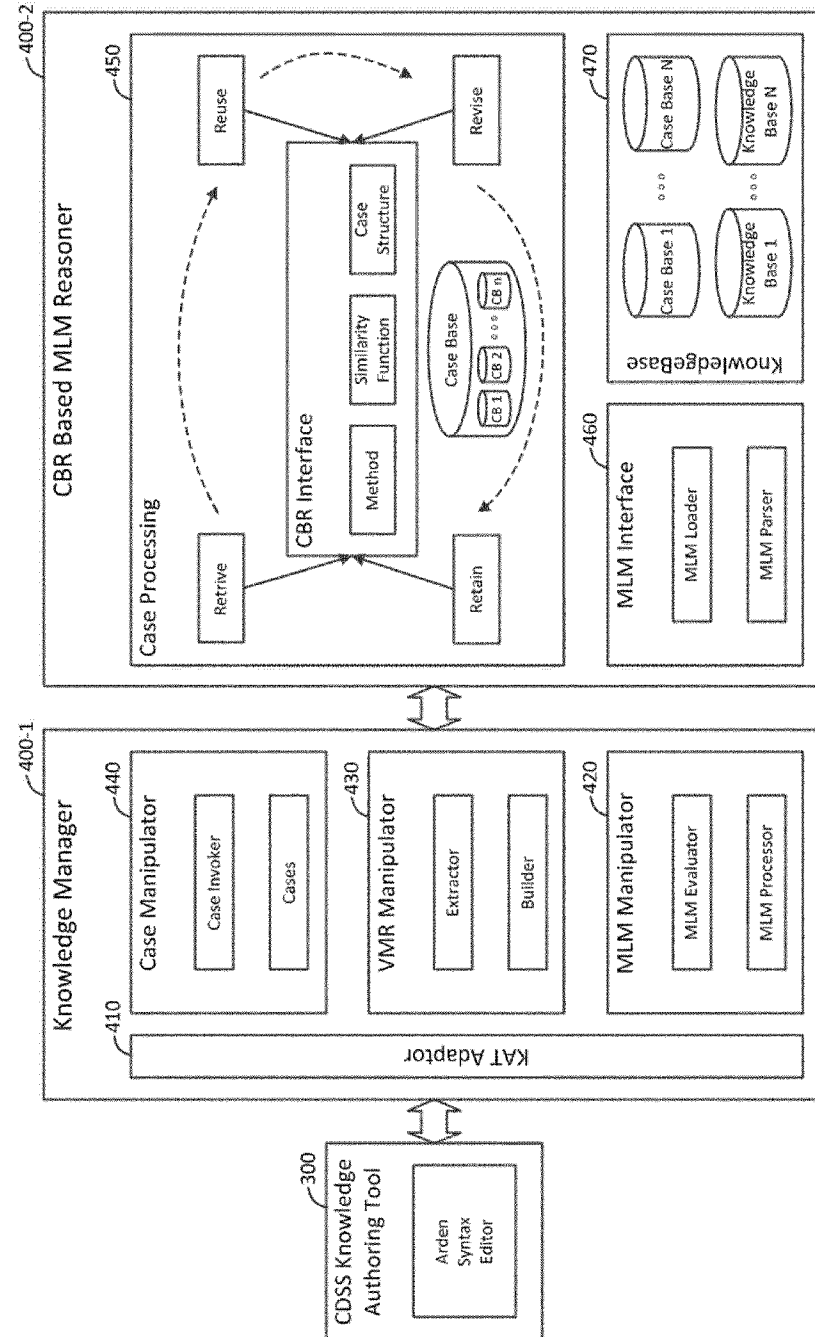
[Fig. 2]



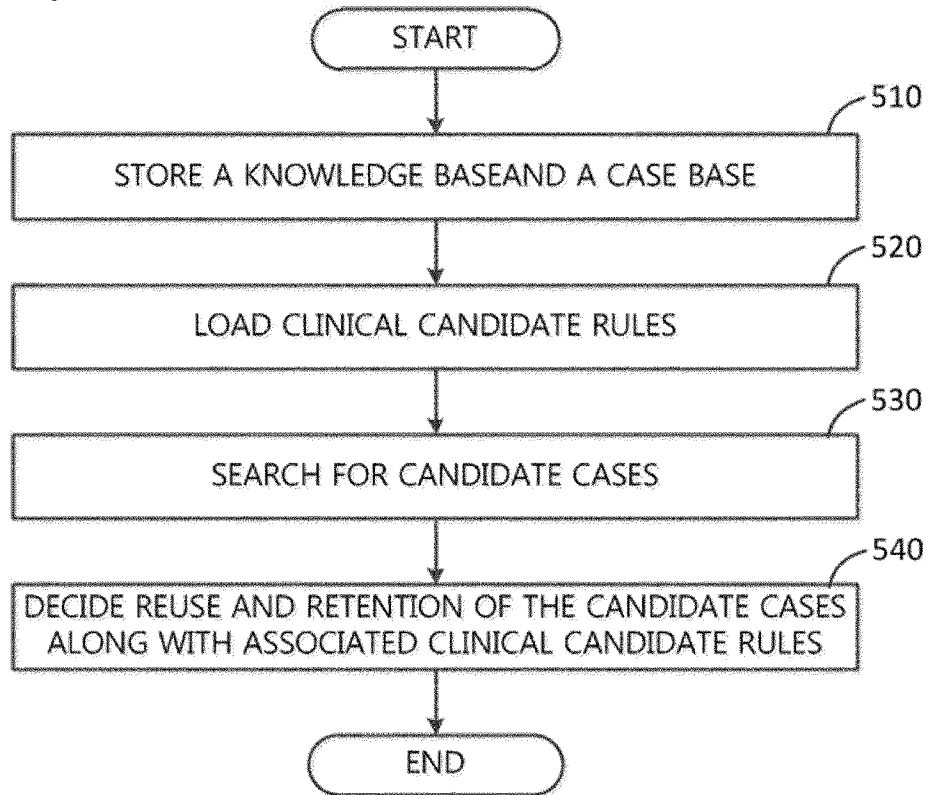
[Fig. 3]



[Fig. 4]



[Fig. 5]



A. CLASSIFICATION OF SUBJECT MATTER**G06F 19/00(2011.01)i, G06F 17/30(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F 17/00; G06F 17/30; G06F 19/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: clinical knowledge validation, clinical rules, case base, duplication, contradiction, reuse, retention, and similar terms.**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008-0275838 A1 (RANDAZZO, MICHAEL THOMAS et al.) 06 November 2008 See paragraphs [0015], [0028]-[0029], and [0036]; and figures 1-2 and 4.	1-14
Y	MARTIJN VAN DEN BRANDEN et al., "Integrating case-based reasoning with an electronic patient record system," Artificial Intelligence in Medicine, Vol. 51, No. 2, pp. 117-123, February 2011 (http://www.sciencedirect.com/science/article/pii/S0933365710001429) See abstract; pages 119-122; and figures 3-6.	1-14
A	DONG-XIAO GU et al., "Intelligent Technique for Knowledge Reuse of Dental Medical Records Based on Case-Based Reasoning," Journal of Medical Systems, Vol. 34, Issue 2, pp. 213-222, April 2010 (http://link.springer.com/article/10.1007/s10916-008-9232-y) See pages 213-214 and figure 1.	1-14
A	YOON-JOO PARK et al., "New knowledge extraction technique using probability for case-based reasoning: application to medical diagnosis," Expert Systems, Vol. 23, No. 1, pp. 2-20, February 2006 (http://onlinelibrary.wiley.com/doi/10.1111/j.1468-0394.2006.00321.x/abstrac) See abstract; pages 3-5; and figure 1.	1-14



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

09 June 2015 (09.06.2015)

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2014/012297

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	STEFANIA MONTANI et al., "Integrating model-based decision support in a multi-modal reasoning system for managing type 1 diabetic patients," Artificial Intelligence in Medicine, Vol. 29, Issue 1-2, pp. 131-151, September-October 2003 (http://www.sciencedirect.com/science/article/pii/S0933365703000459) See pages 133-135.	1-14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2014/012297Patent document
cited in search reportPublication
datePatent family
member(s)Publication
date

US 2008-0275838 A1

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US 8170972 B2

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