Reducing the Conflict Factors Strategies in Question Answering System

W Suwarningsih¹,²*, A Purwarianti¹, I Supriana¹

¹School of Electronic Engineering and Informatics, Institute Technology Bandung, Indonesia. Jl. Ganesa No. 10 Bandung, Indonesia

²Research Center for Informatics, Indonesian Institute of Science. Jl. Cisitu No 21 Sangkuriang Bandung, Indonesia

*wiwin.suwarningsih@students.itb.ac.id

Abstract. A rule-based system is prone to conflict as new knowledge every time will emerge and indirectly must sign in to the knowledge base that is used by the system. A conflict occurred between the rules in the knowledge base can lead to the errors of reasoning or reasoning circulation. Therefore, when added, the new rules will lead to conflict with other rules, and the only rules that really can be added to the knowledge base. From these conditions, this paper aims to propose a conflict resolution strategy for a medical debriefing system by analyzing scenarios based upon the runtime to improve the efficiency and reliability of systems.

1. Introduction

A system based on rules (such as expert systems, question and answer system, decision support systems and information systems) is particularly vulnerable to conflicts both in the use and in the setting rules. Such conflict can occur in that every time new knowledge will emerge and indirectly must sign in to the knowledge base used by the system. Many strategies have been developed to cope with the conflict. For example, for expert systems [1] have made a presentation form for the conflict rules to detect the conflicts of arithmetic in diagnosing faults in the aircraft systems. Konar and Mandal [2] proposed a new strategy based on a functional approach heuristic for next-generation expert systems. The proposed technique is superior to existing techniques for improving the stability in the line of reasoning of the system by using existing rule base. While on decision support systems, Ahn and Choi [3], used the decision analysis techniques that explicitly included an assessment of the user's preference rules. Jose et al. [4] provided the taxonomy of semantic conflict and analyzed each of the main features of each and provided modeling OWL / SWRL to ascertain realistic scenarios related to information systems.

The biggest motivation in dealing with the conflict rules-based system is a system capable of processing information optimally using the existing knowledge base. A conflict occurred between the rules in the knowledge base can lead to the errors of reasoning or reasoning circulation [1]. Therefore, when added, the new rules will lead to conflict with other rules, and the only rules that really can be added to the knowledge base. Under such conditions, this paper aims to propose a conflict resolution
strategy for medical debriefing system by analyzing scenarios based on runtime to improve the efficiency and reliability of systems.

The rest of the paper is organized as follows: Section 2 describes several related work on conflict management, followed by Section 3 presenting the details of the proposed method. Furthermore, Section 4 describes the experiment. Finally, the conclusion and future directions are presented in Section 5.

2. Related Work
At the beginning of making the knowledge base, it is still relatively few numbers of rules in which the conflict between the rules unfrequently occurred. However, when the intervals of new knowledge are added to the knowledge base, the knowledge base becomes larger. One way to resolve the conflict in the knowledge base is by determining a strategy for dealing with conflict. A research conducted by Ahn and Choi [5] used meta-rules in conflict resolution as adapted by domain experts as a reference to build a knowledge-based system. In this study, they presented a new method to resolve the conflict rules in the knowledge-based system using the decision analysis techniques that explicitly included the assessment of the user's preference rules. Similarly, Li and Xiong [6] proposed a strategy of conflict resolution-based optimization. The proposed strategy was in the form of concurrent design based on network constraints by determining the parameters in the interval that benefitted from the experience and preference. Therefore, the potential conflicts could be resolved to avoid a significant redesign.

Other research was focused on the conflict resolution using the database. For example, Magill and Blum [7] built models to investigate the network rules and conflict resolution rules to control the behavior of devices on a network of sensors used for psychiatric applications Ambulatory Assessment. They used a rule where each of the nodes in the network used a rules engine to process the rule distribution across the network. Rules dictated the behavior of each node in response to sensor data value and controlled the overall behavior of the sensor network. Neither study conducted by Samuel nor Ahmad [8] proposed a new strategy for handling conflict resolution in using the data in SQL server. The system was built to focus on synchronization and conflict resolution for railway safety systems, which used the database as a support system applied the incorporation replication for mobile applications and servers to predict the likelihood of a data conflict during the distribution rules.

3. Proposed Method
The need for a strategy to reduce a conflict factor in the Indonesian medical question and answer system (ImeQAS) are in consideration to: (i) Accuracy of the answers of the questions users as a top priority in the question and answer system that needs a way to optimize the provision of answers to be achieved [10]. (ii) Conflict resolution in a rule-based system incorporates several user preferences in a particular problem domain so as to increase the ability of the system [11]. (iii) The handlers factor of conflict in a rule-based system demonstrated the existence and reliability of the rule itself to be used in improving the reliability of knowledge in the system and effectively DAPT prevented or minimized the errors in making decisions [12] [13].

The strategies used in this paper were applied to the modules debriefing system that consisted of a processing module of questions, pattern matching module, and the module search for answers. The taxonomy of conflict resolution in each of these modules would be described in the form of how to detect conflicts, conflict management when conflict has occurred and anticipate how the conflicts do not occur.

3.1. Conflict Detection
There are several approaches in computer science to detect conflicts. In [13] stated that the methods and techniques of conflict detection approaches can be categorized into (1) conditions-based approach (state-based approaches) that stores a model of the condition and takes the difference by comparing those two conditions and (2) change-based approaches to record some changes in the system during the process and save it. Changes based approach has been already applied in IMeQAS namely the
question of recording module (query logs). The query log records all data input in addition to trend recording and input from the user in the form of grammar and the question pattern.

The detection of conflicts in the software environment refers to the reliability of the system that is capable of performing the introduction of the conflict process during the system running or the potential for inconsistency condition of the system or system notifications through logic devices. Condition-based approach is applied in this part by installing a conflict detection algorithm on the system frequently asked questions such as research conducted by Huang and Lin [14].

Input: ASM, CSM
// (Antecedent Similarity Matrix, ASM) and (consequent Similarity Matrix, CSM)
Output: RF
// RF = reliability factor of the conflict rules
Step 1: Select a set of knowledge of the rules that conflict in accordance with ASM and CSM.
Step 2: calculation of the value of the reliability factor (RF) for each rule that conflict.
Step 3: Output RF for any rules that conflict.
Step 4: END

3.2. Handling Conflict

Strategies for dealing with conflict in IMeQAS using a method created by Luo et al. [15] include (i) the rules given priority number if a choice must be made to select the rule with the highest priority number and (ii) if a choice must be made to select rule that position beginning in the rule base. Reasoning-based rule has the concept as follows:

- Statement or a collection of statements after the word IF represents some patterns that can be observed.
- Statement or a collection of statements after the word THEN represents the conclusions that can be drawn, or some action to be taken.

3.3. Anticipation to Avoid Conflict

Most of conflicts arise because of the opposition actions on objects in the environment in which the system operates. In this paper, we focused on two types of anticipation of conflict; those are (1) changes to the contrary that is if there are two or more rules that will be processed by the system simultaneously to change the same case in a question and answer system to different conditions. This occurs because of the semantic ambiguity when defining the role of each sentence that becomes the data input; and (2) the process of executing exclusive i.e. two or more rules requiring the exclusive ownership because both have a high priority value. As a result, this condition would be a conflict.

When some of the rules apply and qualify under certain circumstances, the option to apply the transition to the next configuration is the role of election strategy. The combination of strategies used in this paper includes: (i) Priority on rule instance where a rule r = (o, g, a) is equipped with a numeric expression in the variable \( \pi_r \) rules. The sequence is based on the value of the expression for each instance in its current state (current state); (ii) Strict ordering of the rules, the order in which strict is explicitly defined in the rules, the example set priority rules in a permutation of \( \{1, ..., n\} \); (iii) Recency, this sequence is based on a constant value associated with each object in working memory called novelty object to the idea that the object has been inserted into the working memory. With the idea, the object has been put in order working memory. Recency instance rules are given by the maximum novelty objects in instances rules.

Anticipation is to handle the uncertainty that can be sourced from individual rules, conflict resolution and rules incompatibility. Conflict resolution is a part of the source of the uncertainty caused by an interaction between the rules. The interaction between the rules depends on the rules of conflict resolution and compatibility (compatibility of rules). Uncertainty in conflict resolution is associated with the activation priority.

Based on the analysis on handling the uncertainty, we have identified the source of the conflict in question and answer system IMeQAS. As for the source of the conflict there were two processes,
namely: (i) retrieve process, i.e. the process in selecting a similar case when the system of case-making database, (ii) Retain process, i.e. when the system must perform an additional new knowledge. Handling Conflict IMeQAS system to retrieve process is semantic role labeling for similar cases PPPICCOOQTD element-based pattern matching, and the priority for pattern matching. As for the process is Pattern Matching PPPICCOOQTD retain and specifications knowledge.

4. Experiment

4.1. Scenario and Testing Purposes
The main scenario testing to IMeQAS still uses homemade question. On the question of this test the deployment scenario created a variety of questions by making four questions to the sentence structure that is different on Expected Answer Type. This test was done to see to what extent the IMeQAS system is able to detect conflicts and handle the conflict. Testing continued to include a number of questions that had been prepared previously and were then answered by the system. Answers were returned by the system and assessed the validity of the correct answer summed. The sum was divided by the number of correct answers to questions so that the percentage of system accuracy could be obtained.

Tests performed on IMeQAS were to determine the level of accuracy in the truth of the answers to the application. The returned answers containing information can be used when the analysis. Returning the correct answer in accordance to the context of the question has the information that the system is running well.

| # | Example of Sentences | Tagging | Output Parser | Result |
|---|----------------------|---------|---------------|--------|
| 1 | Apa gejala flu? (What is flu symptoms?) | Apat/WP Gejala/NNS flu/VBZ | nsubj(flu-2, Apa-1) root(ROOT-0, flu-2) dobj(flu-2, gejala-3) | Search and open database for the word “gejala” and “flu” |
| 2 | Bagaimana cara mencegah asma? (How to prevent asthma?) | bagaimana/WRB cara/NN mencegah/VB asma/NN | advmod(mencegah-3, bagaimana-1) mark(mencegah-3, cara-2) root(ROOT-0, mencegah-3) dobj(mencegah-3, asma-4) | Search and open database for the word “mencegah” and “asma” |
| 3 | Kapan radang amandel dapat menyerang kita? (When tonsillitis can attack us?) | Kapan/WRB Radang amandel/NNS dapat/MD menyerang/VB kita/PRP/? | nsubj(menyering-5, kapan-1) amod(radang-2, amandel-3) nsubj(menyering-5, radang-2) aux(menyering-5, dapat-4) root(ROOT-0, menyerang-5) dobj(menyering-5, kita-5) | Search and open database for the word “menyerang” and “radang amandel” |
Table 1. Cont.

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
| 4 | **Tandanya bagaimana sakti rhinitis itu?** | **Tandanya/NN bagaimana/WRB sakit/JJ rhinitis/VBZ itu/PRP** | **nsubj(rhinitis-4, tandanya-1)** | **advmod(sakit-3, bagaimana-2)** | **nmod(tandanya-1, sakit-3)** | **root(ROOT-0, rhinitis-4)** | **dobj(rhinitis-4, itu-5)** |
|   | (How sick rhinitis sign it?) |   |   |   |   | Search and open database for the word “tanda”, ”sakit”, and “rhinitis” |

| 5 | **Mengapa hemoglobin saya tinggi?** | **mengapa/WRB hemoglobin/NN saya/PRP tinggi/JJ** | **dep(hemoglobin-2, mengapa-1)** | **amod(hemoglobin-2, tinggi-4)** | **compound(hemoglobin-2, saya-3)** | **root(ROOT-0, hemoglobin-2)** |
|   | (Why my hemoglobin high?) |   |   |   |   | Search and open database for the word “hemoglobin” and “tinggi” |

| 6 | **Asam lambung, bagaimana mencegahnya?** | **asam/JJ lambung/NN**, | **amod(lambung-2, asam-1)** | **root(ROOT-0, asam-2)** | **advmod(mencegahnya-5, bagaimana-4)** | **dep(asam-2, mencegahnya-5)** |
|   | (How to prevent stomach acid?) | **bagaimana/WRB mencegahnya/VR** |   |   |   | Search and open database for the word “asam”, “lambung” and “mencegah” |

### 4.2. Experimental Results

Table 1 shows the results obtained from the various types of queries. Here it can be seen how the system analysis and process have different queries based classification techniques to questions, easy to handle the different sentences in question. To Query No. 1, the system identified the phenomenon as the subject, checked whether the flu was a word contained in the database, and then checked the phrase “gejala flu” (in English: flu symptoms) in the second database words that have certain words without a meaning of their own. The key phrase to be searched formed by this module is “gejala flu”.

The same process applies to the processing of the query 2 and 3.

At present, the system fails to identify the type of demand for some complex queries. The examples of such questions are: “efek stamina menurun terhadap serangan cacar air” (in English: the effect of decreased stamina against chicken pox). In this case, the system cannot categorize the query as the type of question word “bagaimana” (How). Similarly, for a request such as “1 hari 1 kali minum dengan dosis 250 mg” (in English: 1 day 1 drink with a dose of 250 mg), the system cannot identify the type of query like this because it cannot categorize the query as the type of question word “Berapa” (How many). Handling the case of ambiguous questions query done by giving ratings from a couple of questions and answers were found. Thus, the answer given is at the highest rank.

### 5. Conclusion

This system has the repository that is sufficiently large to log a query that includes a variety of preventive measures and reverse for health domain such as the handling of the flu, asthma, chicken pox, cough, sore throat, tonsillitis, gastritis, and others. Checking formal word includes errors often typed and most often used nouns. The system is capable of analyzing the current conflict retrieve process and retain for being supported to analyze the semantic meaning of most of the questions based
on the classification and various conditions. It is able to identify a keyword or key phrase that will be searched.

Future work includes to improving the semantic analysis to be able to analyze more complex queries such as those mentioned above and includes more parameters in a semantic analysis. Filtering answers is based on a simple threshold as it can help to get rid of irrelevant content. Evidence scoring will collect evidence additional support to further evaluate the answer. Scores will be awarded to each of the possible answers based on evidence collected.

References
[1] Chen WenBin, Liu XiaoLing, He ChangJiu, Liu YiJun, 2009, Knowledge Base Design for Fault Diagnosis Expert System Based on Production Rule, Asia-Pacific Conference on Information Processing, pp:117-119.
[2] Konar, A.; Mandal, A.K, 1991, Conflict Resolution Strategy In Expert System With Ambiguous Knowledge Base”, TENCON ‘91. IEEE Region 10 International Conference on EC3-Energy, Computer, Communication and Control Systems , Volume: 3, pp: 278-283.
[3] Byeong Seok Ahn, Sang Hyun Choi, 2009, Conflict resolution in a knowledge-based system using multiple attribute decision-making, Expert Systems with Applications 36, pp: 11552–11558.
[4] Jose M. Alcaraz Calero, Juan M. Marin Pérez, Jorge Bernal Bernabé, Felix J. García Clemente, Gregorio Martínez Pérez, Antonio F. Gómez Skarmeta, 2010, Detection of semantic conflicts in ontology and rule-based information systems, Data & Knowledge Engineering 69, pp: 1117–1137.
[5] Byeong Seok Ahn, Sang Hyun Choi, 2009, Conflict resolution in a knowledge-based system using multiple attribute decision-making, Expert Systems with Applications; 36; pp:11552–11558.
[6] Tao Li and Guangleng Xiong, 2001, Conflict resolution strategy based on optimization, IEEE International Conference on Systems, Man, and Cybernetics, Volume: 3, pp: 1789–1794.
[7] E. Magill, J. Blum, 2016, Exploring conflicts in rule-based sensor networks, Journal of Pervasive and Mobile Computing, Volume 27, April 2016, Pp: 133–154.
[8] Ajila, S.A., 2011, Mobile databases - Synchronization & conflict resolution strategies using SQL server, IEEE International Conference on Information Reuse and Integration (IRI), pp: 487-489.
[9] Min Jin, Xiang Zhou, Jihui Zhou, Xianming Gao and Chunhong Gong, 2008, Strategy of Conflict Preprocessing and Reconciliation for Mobile Databases, 4th International Conference on Wireless Communications, Networking and Mobile Computing, (WiCOM '08), pp: 1-6.
[10] Saxena AK, Sambhu GV, Kaushik S, and Subramaniam LV, 2007, ltd-ibmirl system for question answering using pattern matching, semantic type and semantic category recognition. In Proceedings of the TREC, pp: 334-339.
[11] Byeong Seok Ahn a, Sang Hyun Choi, 2009, Conflict resolution in a knowledge-based system using multiple attribute decision-making, Expert Systems with Applications 36, pp: 11552–11558.
[12] Chin-Jung Huang & Ying-Hong Lin, 2007, A Conflict Treatment Model for Uncertainty Rule-based Knowledge, Second International Conference on Innovative Computing, Information and Control, IEEE Conference Publications, pp: 152 – 152.
[13] Paulo Carreira, Silvia Resendes, André C. Santos, 2014, Towards automatic conflict detection in home and building, Pervasive and Mobile Computing 12, pp: 37–57.
[14] X. Huang, J. Lin, D. Demner-Fushman., 2006, Evaluation of PICO as a knowledge representation for clinical questions. In Proceedings of the AMIA 2006 Symposium, AMIA,
2006, pp: 359–363.

[15] Hong Luo, Ruosi Wang, Xinming Li, 2013, A Rule Verification and Resolution Framework in Smart Building System, 19th IEEE International Conference on Parallel and Distributed Systems. Pp: 438-439.