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CONSTRUCT AND DESIGN PREDICTION SYSTEM OF LEVEL CHILDREN RETARDATION IN CERTAINTY FACTOR MODEL

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Abstract

Children with special needs tend to have the ability with a unique personality background and different from other children. Teacher faces difficulties in predicting the level of children retardation. The limited human inference becomes the main obstacle in this issue. Related to this, this study has directed to overcome the limitation by developing a software for inferring the prior knowledge and providing the information to predict the level of retardation. The purpose of this research is to help teachers in predicting and obtaining the level of retardation with the assertion of prior knowledge that build a knowledge model in forward chaining inference. We used forward chaining method inference to match the level of retardation with certainty factor. The benefit of certainty factor is the process of deployment on numeric calculation with the formula that composes certainty value and rules from prior knowledge. Combining IF-THEN rule and certainty factor calculation have given a close to precise value ranging from 0 to 1. This study formulated for every prior knowledge with the expert prediction value. We built 35 rules from prior knowledge and construct IF-THEN rule. The result of the research is a prediction software that can measure the level of retardation for children. The impact of this research is that teachers can obtain the precise level of retardation and determine the treatments to be given.

Keywords: Certainty factor, Children retardation, Forward chaining, Human inference, Inferencing, Treatments.

1. Introduction

The expert system is a system that helps a decision maker to solve a problem. The expert system composes a knowledge and data tracking to solve problems that normally require experts [1]. We collected information justification from teachers at SLB BC Yatira Cimahi in making rules. The teacher has an ability to review various aspects for students. This study also integrates between categories of children who are mentally mentored or have basic intelligence and behaviour constraints.

All information retrieved was designed into knowledge as information acquisition. Meanwhile, the knowledge construction was built by forward chaining and certainty factor [2, 3].

A person's ability to solve problems, learn, understand things, and ultimately make decisions is an intelligence possessed by every human being. First expert systems were dendral, mycin, and prospector which construct in forward chaining method [4]. Providing an understanding of expert systems, namely a system of computer software with knowledge based on a specific domain using inference reasoning. It has assembled by an expert to solve a problem. The knowledge is obtained from formal and non-formal knowledge, most of them were obtained from the experience of problem-solving [5].

The previous research conducted by Nursikuwagus and Rengga [6] have designed the software that has an ability to predict consumer buying level in buying electronic equipment. Applying forward chaining into the problem can help matching consumer needs and electronic equipment. Inferring process with prior knowledge that constructs into the tree can handle a limitation of human perception in electronic equipment [6]. Aji et al. [7] conducted a research about measurement of Weschler Intelligence Scale for Children (WISC) can precisely predict the value of children talent using forward chaining method. The expert system that composes of prior and database knowledge has been made. The process used conversion technique from pure verbal value and performance into Intelligence Quotient (IQ). Complexity and numeric process is built the software on the method. The result can be applied into talent. Then, a score was given as a suggestion for recommendation about children growth [7].

Susanto [8] had a contribution in software engineering by building the system that can diagnose patient with mental illness. The software which has built by certainty factor and forward chaining method can handle certainty degree of a patient that have a mental illness.

Lestari and Handayani [9] have successfully built the software that can predict children ability based on mental Behavioral with forward chaining method. Mistake in education for children can give more burden to the children. The system can predict how precise the strengthen of children burden using prior knowledge from children factual behaviour. The research problem is to overcome the limitation of teachers and parents in predicting the level of retardation in their children. A wrong prediction can lead to wrong handle of children activities [10].

Based on previous studies, we proposed an expert system to handle a prediction of children retardation that infers by forward chaining and certainty factor method. By applying both concepts, we used the system for assessment children retardation and suggest a treatment for the children. This study is to help teachers and parents

to assess and measure children ability and growth, especially those who have intellectual disorders or behavioural. The software can overcome the limitation of teachers and parents in measuring the level of retardation using forward chaining and certainty factor method. To perform the system, we designed and implemented the system by UML modeling and PHP language. Every rule that has construct on forward chaining and certainty factor method, we asserted to the system as a prior knowledge. As a result, the teacher can determine and learn from the value gives by the system. Thus, they can help the children according to the level of retardation.

2. Research Method

There are several theories learned in this Artificial Intelligence. However, this research focuses on the theory of certainty factors and advanced tracking, namely forward chaining. Shortliffe and Buchanan [11] proposed certainty factor to overcome the measurement of uncertainty determinants extent about decision making and accommodation of an expert thoughts on a rule.

Meanwhile, forward chaining is a technique to search a known fact and then match it with the IF part of the IF-THEN rule [12]. Children who are slow or impaired (retarded) are interpreted as children with special needs. Children with special needs have a lesser variety of general and special categories of cognitive and social functions such as mentally retarded children. Based on the IGD-10 Classification of Mental and Behaviour Disorders, mental retardation was divided into four groups namely, Light Mental Retardation (Mild retardation: IQ 50- 69), Medium Mental Retardation (Moderate retardation: IQ 35-49), Severe Mental Retardation (Severe retardation: IQ 20-34), and Heavy Mental Retardation (Profound retardation: IQ <20) [13].

This study used basic design and problem solving, with data collection using interviews and observations. The system approach and development method used the object-oriented approach method with development methods that used the prototype method. The tool used for modeling in system analysis and design is Unified Modeling Language (UML) [14]. The problem-solving method used forward chaining. It aims to find the facts that formed the knowledge base in this expert system and strengthened by the certainty factor that provides a certainty level of a premise on an issue.

Many models of the expert system were developed since the introductory of these concepts. We proposed the method that is aligned with our circumstance. The model composes many environments such as database as an inventory data, knowledge engineering, user interface, and output level of retardation. In Fig. 1., we proposed a model of our expert system which composed of user interface, knowledge base data, knowledge extraction, knowledge engineering, and output. Each environment system has a responsibility to respect an input. User interface acts as an input system and user interaction. Meanwhile, knowledge base acts as an inventory data for any new knowledge. Knowledge extraction acts as a process to divide knowledge according to its importance. Knowledge engineering has a task to build an expert decision and output as a value of retardation level from inferring the teacher input.

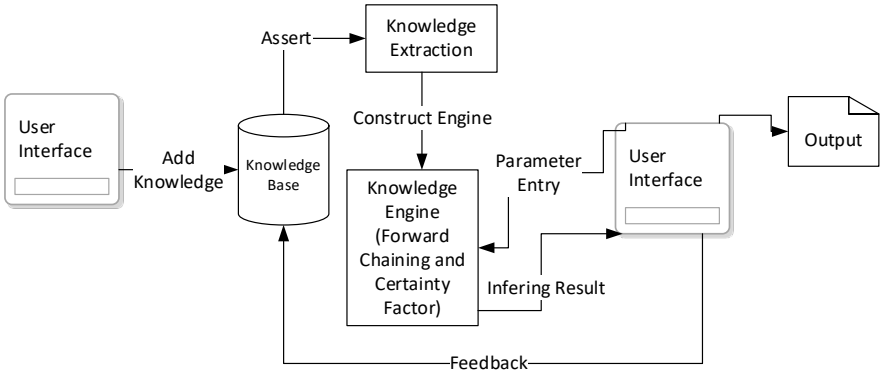

Fig. 1. Expert system model proposed.

3. Results and Discussion

From the interviews with experts and direct field observations, the data obtained for the knowledge base of the expert system recognizes mentally retarded children by containing the following statements. Table 1 shows children's level in retardation, which arranged in categorical value such as Light, Medium, Serious treatment, and very serious treatment based on WHO classification.

Meanwhile, Table 2 shows various assessment criteria to be fundamental to justify the level of retardation. There are 35 assessments in classifying the children's retardation. In order to get the fire rules, we collected the data from Tables 2 to 3. Table 3 shows the collected of match assessment among the children. The IF-THEN column that collecting the rules in ID information is shown in Table 3.

Table 1. Arrange of mental retardation groups.

Group Code	Group Name
G1	Light
G2	Medium
G3	Serious treatment
G4	Very serious treatment

Table 2. Criteria and expert weighted value [10].

ID	Criteria	Heavy	Severe	Medium	Light	Weight
P01	Children lack confidence			v	v	0.6
P02	Children are aloof, daydreaming and hallucinating		v	v		0.4
P03	Children find it difficult to communicate normally (verbal / non-verbal)	v	v	v		0.8
P04	Children talk alone and laugh alone without cause		v	v	v	0.4

The first row in Table 3 shows the ID of P1, P4, P5, P6, P7, P8, P9, P11, P12, P13, P14, P15, P21, P30, and P31 which are matched assessment for the case. The column goal shows the classification of children's levels similar with Table 1. It means the rules constructs as if P1, P4, P5, P6, P7, P8, P9, P11, P12, P13, P14, P15, P21, P30, and P31 categorized as Light. The results from IF-THEN rules show classification related to children's performance, we calculated with the formula (1).

Based on the example of the inference case that shown in Table 3, it can be concluded that the children level of retardation is classified as moderate mental retardation. It is because the previous expert has given a Certainty Factor (CF), which is known as aspects experienced by children with mental retardation. The summary of the children retardation assessment is the probability value such as with the assessment of ID P1 is 0.6. It means, the criteria with ID P1 states that the children lack self-confidence. The similar interpretation can be said with other value such as P4 which has the value of 0.4, it means children laugh and talk to themselves randomly. The list shows that the probability value for every criterion matches within the case. P5 is 0.4 means children speak an incomprehensible language. P6 is 1.0 means children are easily distracted. P7 is 0.6 means children can do hand skills. P8 is 0.4 means children can talk about activities at their school. P9 is 0.8 means children can communicate with cues through help. P11 is 0.2 means children often interfere with friends, relatives, or other family members. P12 is 0.2 means children will be lectured if they are naughty. P13 is 0.4 means children want to work with friends or family members. P14 is 0.2 means children are more spoiled by their parents. P15 is 0.6 means children can take care of themselves. P21 is 0.8 means the child is helped in cleaning their ears. P30 is 0.8 means children are helped to change their clothes. P31 is 0.8 means children are helped when they are using a dress.

Based on the experiment of calculations from CF, we employ and combine it with the formula (1).

$$CFtotal[CF1,CF2]=CF1+CF2*(1–CF1) \quad (1)$$

Table 3. Construct IF-THEN rules.

IF-THEN	Goal
P1, P4, P5, P6, P7, P8, P9, P11, P12, P13, P14, P15, P21, P30, P31	Light
P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P13, P14, P16, P19, P20, P21, P22, P24, P25, P26, P27, P29, P29, P30, P30 P31, P33, P34, P35	Medium
P2, P3, P4, P5, P6, P9, P10, P11, P16, P17, P18, P19, P20, P21, P22, P23, P24, P25, P26, P26, P27, P29, P30, P31, P33, P33 P34, P35	Heavy
P3, P6, P16, P17, P18, P19, P20, P21, P22, P23, P24, P25, P26, P27, P28, P29, P30, P31, P31, P32, P33, P34, P35	Very Heavy

From the case examples, the user must have a child with mild mental retardation with a value of CF = 1. It gives an accurate value of the mental retardation level through behavioural and independence aspects with the formula accuracy of final CF value times 100% = 1 x 100% = 100%. Therefore, it can be concluded that the children have light retardation mental.

In designing the system in Fig. 2., we used UML usecase diagram for depicting the process. There are five case diagrams to support the system, every case has a behavioural process that is responsible to add input and output. As a knowledge

engineering, we placed at rules management case and composed everything about inferring like forward chaining and certainty factor process.

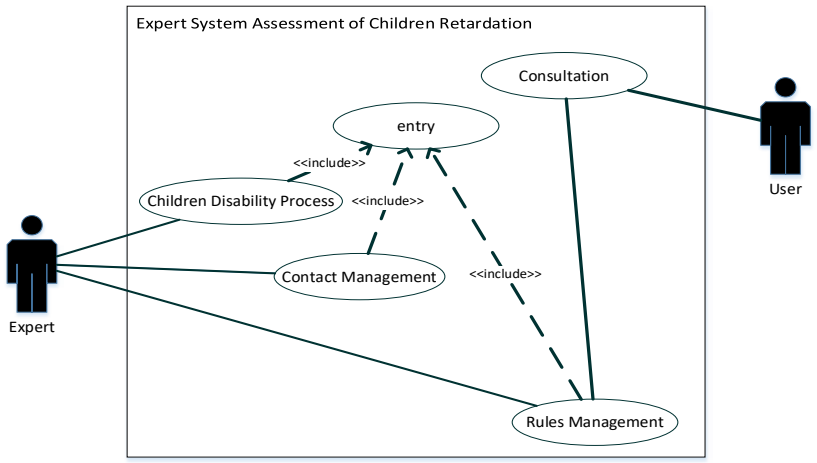

Fig. 2. Expert system usecase diagram [10].

The expert system is created by PHP language [15]. It was helped by the editor to write the code like Notepad++ and Sublime. We deployed the user interaction such as Graphical User Interface (GUI). The GUI is separated by two GUI namely front-end GUI and back-end GUI. Front-end GUI is used for user activities that want to assess their children. Meanwhile, back-end GUI for managing the system such as adding some knowledge or features to enhance the functionality of the system. In order to create recovery and data repository, we built the database that used Database Management System (DBMS) such as MySQL [16].

There are some GUI to help the user that aim to assess their children. We showed two examples of GUI for front-end GUI in Fig. 3. and back-end GUI in Fig. 4. We created the form of interaction in order to enter one or some criteria into the system, it is shown in Fig. 3. Every form has a responsibility to serve the user. We divided the user into two criteria namely general and expert user. A general user is a teacher who uses the system to measure the level of children retardation. Meanwhile, an expert user is responsible to add new knowledge and repair the system if the system crash.

Fig. 3. Expert system welcome screen.

Fig. 4. Expert system main menu.

4. Conclusion

In conclusion, we have designed a system for measuring level of retardation in children. Several user interfaces such as knowledge input and interaction form have been provided as a communication tool between user and system. Environment on an expert system was created to help teachers, parents, and the public to facilitate information about the level of retardation and understanding about children with special needs. The method used forward chaining and certainty factor that provides diagnoses based on facts in the form of criteria. Based on the interview results and observations from experts, it was converted into a percentage. The distance from generating the IF-THEN rules into fact helped to classify the level of retardation namely light, medium, serious, and very serious treatment.

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