Expert System in Detecting Children's Intelligence using Certainty Factor

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Abstract:
Children are the most valuable asset for parents. Every child has a different intelligence. Some children have the ability to catch more; there are also those who have low intelligence. Children's intelligence can be known early to get a quick solution and help. Expert systems can be used to determine how smart a child is. Assessment using questions to the child with some predetermined criteria is one technique to determine the intelligence. Each criterion is a symptom that will be tested on a child. Certainty Factor Method is an excellent method in conducting tests on the intelligence of children. Some parameters are tested in determining intelligence. Applying the Certainty Factor method can help a psychologist determine how smart a child is.

Key Words: expert system, symptom, Certainty Factor

INTRODUCTION

Intelligence is a matter of intelligence, the perfection of human reason [1]. Nowadays, many parents find it challenging to analyze the intelligence experienced by their children, even though learning is a significant activity in every type and level of education [2][3][4]. It means that the success or failure of achieving educational goals is highly dependent on the learning process experienced, both when he is in school or the environment of his own home or family, not even children with low ability, but also experienced by highly capable children. Besides, children of average ability also experience learning disabilities while intelligence is a condition of the learning process that is marked by certain obstacles to achieving success. To make it easier for parents to analyze academic intelligence that occurs in children needed a system that can be used as a substitute for experts to consult. The method applied is the Certainty Factor method [5]–[7].

Based on previous research perfomed by Annisa, the title is the Expert System Certainty Factor Method to Diagnose Schizophrenia Type [8]. It results in making schizophrenia a type of mental disorder expert system. It is to diagnose the schizophrenic type of mental disorder has been able to provide information to schizophrenic type mental disorders. Users about the type of schizophrenia they suffer based on the symptoms given (initial diagnosis). Then the user of the Certainty Factor (CF) method can find out the degree of trust in the illness. Future research is expected to use another algorithm so that it can be compared with certainty factor methods to find the right method in determining the type of schizophrenia. According to Stephanie Halim, 2015 entitled "The Implementation of Certainty Factor Methods in Expert Systems for Osteoporosis and Osteoarthritis Risk Detection", concluded that the implementation of the certainty factor method for expert system applications to detect the risk of osteoporosis and osteoarthritis was successfully implemented [9]. With an 80% accuracy presentation it becomes clear evidence that the diagnosis of each expert's symptoms influences the accuracy of the system so that to avoid this if more than one expert is involved, the experts must discuss the symptoms that are right for these experts

so that the accuracy of the system has a higher percentage well. In this study, for a list of symptoms involving only one expert, while one other expert only as an additional tester of the application validation process.

THEORIES

2.1 Expert System

An expert system is a system that mimics what is done by an expert when dealing with complex problems, based on the knowledge he has. Expert system knowledge is formed from the rules or experiences of the behavior of elements from a particular field of knowledge [5]. Knowledge in expert systems is obtained from people who have knowledge in a particular field, books, scientific journals, and other printed documentation. The knowledge is presented in a specific format and collected in a knowledge base. This knowledge base is then used by an expert system to determine the reasoning for the problems it faces. The expert system tries to find a satisfactory solution, which is a solution that is good enough so that a job can run even though it is not an optimal solution [10].

2.2 Certainty Factor

The definition, according to David McAllister, the Certainty Factor, is a method for determining whether a statement is true or not accurate. Certainty Factor is the concept of certainty and uncertainty. This method is in the form of metrics that are usually used in expert systems. This method is suitable for expert systems that diagnose something that is not necessarily true [11].

METHODOLOGY

The Certainty Factor method is used when facing a problem for which the answer is uncertain. This method was introduced in the 1970s and was used when diagnosing and treating infectious diseases and blood infections. The following equations are the steps for calculating an expert system using the Certainty Factor method.

Certainty Factor with one premise.

$$CF[P,E] = MB[P,E] - MD[P,E]$$

Certainty Factor with more than one premise.

$$CF[A \text{ and } B] = Minimum[CF(A), CF(B)]$$

Certainty Factor with similar conclusions.

$$CF[A \text{ or } B] = Maximum[CF(A), CF(B)]$$

$$CF [CF1, CF2] = CF1 + CF2 * (1 - CF1)$$

The step of knowledge representation made for this expert system knowledge base is the collection of data obtained from the survey results at the Hospital. The success of expert-based systems lies in knowing how to process this knowledge so that conclusions can be drawn — knowledge . which includes types of intelligence, intelligence characteristics, decision data, and sample data. The following table lists the symptoms used in the Certainty Factor calculation

Table 1. Symptoms

No.	Code	Symptom Name	MB
1.	G1	Words Memorize Words	0,40
2.	G2	Active Moving	0,40
3.	G3	Asking Many Questions	0,30
4.	G4	Tell a Story	0,30
5.	G5	Easy to count	0,35
6.	G6	Able to write	0,35
7.	G7	Respond to Behavior	0,35
8.	G8	Active Answering	0,35
9.	G9	Draw	0,40
10.	G10	Actively Composing a Game	0,40

Table 2. Intelligence

No.	Code	Intelligence Name	Symptom Code	MB
1	KC1	Verbal Communication	G1	0,4
			G2	0,4
2	KC 2	Comprehension	G3	0,3
			G4	0,3
3	KC 3	Creativity	G5	0,35
			G6	0,35
4	KC4	Imagination	G7	0,35
			G8	0,35
5	KC5	Accuracy	G9	0,4
			G10	0,4

Table 3. Rule

No.	Condition	Symptom Code		Intelligence Code
1	IF	G1 G2	THEN	KC1
2	IF	G3 G4	THEN	KC2
3	IF	G5 G6	THEN	KC3
4	IF	G7 G8	THEN	KC4
5	IF	G9 G10	THEN	KC5

RESULT AND DISCUSSION

This section contains the results of the calculation process of a child's intelligence expert system using the Certainty Factor method. The results of this calculation are the results of weights in children who are tested based on ten preset symptoms. The following illustration is a display of the calculation results of the child intelligence expert system using the Certainty Factor method. Manual testing must have the same value as what the application program produced. This shows that there were no mistakes made either by the application program or calculations done manually. The following are the results of calculations with several conditions.

Test 1:

G1 = Yes
G2 = Yes
G3 = Yes

Result:

CF[1] = CF[0] + MB[1] * (1 - CF[0])
CF[1] = 0,4 + 0,4 * (1 - 0,4)
CF[1] = 0, CF[2] = CF[1] + MB[2] * (1 - CF[1])
CF[2] = 0,64 + 0,3 * (1 - 0,64)
CF[2] = 0,748
CF[3] = CF[2] + MB[3] * (1 - CF[2])
CF[3] = 0,748 + 0 * (1 - 0,748)
CF[3] = 0,748
CF[4] = CF[3] + MB[4] * (1 - CF[3])
CF[4] = 0,748 + 0 * (1 - 0,748)
CF[4] = 0,748
CF[5] = CF[4] + MB[5] * (1 - CF[4])
CF[5] = 0,748 + 0 * (1 - 0,748)
CF[5] = 0,748
CF[6] = CF[5] + MB[6] * (1 - CF[5])
CF[6] = 0,748 + 0 * (1 - 0,748)
CF[6] = 0,748
CF[7] = CF[6] + MB[7] * (1 - CF[6])
CF[7] = 0,748 + 0 * (1 - 0,748)
CF[7] = 0,748
CF[8] = CF[7] + MB[8] * (1 - CF[7])
CF[8] = 0,748 + 0 * (1 - 0,748)
CF[8] = 0,748
CF[9] = CF[8] + MB[9] * (1 - CF[8])
CF[9] = 0,748 + 0 * (1 - 0,748)
CF[9] = 0,748
CF[10] = CF[9] + MB[10] * (1 - CF[9])
CF[10] = 0,748 + 0 * (1 - 0,748)
CF[10] = 0,748

The final value obtained is 0.748. CF calculations only end until the 2nd calculation because G4 to G10 are not selected or zero.

Test 2:

G1 = Yes
G2 = Yes
G3 = Yes
G4 = Yes
G5 = Yes
G6 = Yes
G7 = Yes
G8 = Yes

Result:

CF[1] = CF[0] + MB[1] * (1 - CF[0])
CF[1] = 0,4 + 0,4 * (1 - 0,4)
CF[1] = 0,64
CF[2] = CF[1] + MB[2] * (1 - CF[1])
CF[2] = 0,64 + 0,3 * (1 - 0,64)
CF[2] = 0,748
CF[3] = CF[2] + MB[3] * (1 - CF[2])
CF[3] = 0,748 + 0,3 * (1 - 0,748)
CF[3] = 0,8236
CF[4] = CF[3] + MB[4] * (1 - CF[3])
CF[4] = 0,8236 + 0,35 * (1 - 0,8236)
CF[4] = 0,88534
CF[5] = CF[4] + MB[5] * (1 - CF[4])
CF[5] = 0,88534 + 0,35 * (1 - 0,88534)
CF[5] = 0,925471
CF[6] = CF[5] + MB[6] * (1 - CF[5])
CF[6] = 0,925471 + 0,35 * (1 - 0,925471)
CF[6] = 0,95155615
CF[7] = CF[6] + MB[7] * (1 - CF[6])
CF[7] = 0,95155615 + 0,35 * (1 - 0,95155615)
CF[7] = 0,9685114975
CF[8] = CF[7] + MB[8] * (1 - CF[7])
CF[8] = 0,9685114975 + 0 * (1 - 0,9685114975)
CF[8] = 0,9685114975
CF[9] = CF[8] + MB[9] * (1 - CF[8])
CF[9] = 0,9685114975 + 0 * (1 - 0,9685114975)
CF[9] = 0,9685114975
CF[10] = CF[9] + MB[10] * (1 - CF[9])
CF[10] = 0,9685114975 + 0 * (1 - 0,9685114975)
CF[10] = 0,9685114975

The final value obtained is 0.9685114975. CF calculations only end until the 7th calculation because G9 through G10 are not selected or zero.

CONCLUSION

This expert system is excellent in determining the intelligence of children. The Certainty Factor method works based on previous data, which are interrelated between one symptom and another. Several conclusions can be explained in this study - Expert systems can be used to detect an event. In the case of child intelligence, an expert system can be used to test how much the child's ability to produce.

Certainty Factor method can identify based on existing symptoms.

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