



Application of Calcium Level Expansion Systems In Broccoli Using The Certainty Factor Method

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Article Info

Article history:

Received, Sep 4, 2019

Revised, Okt 15, 2019

Accepted, Nov 21, 2019

Keywords:

Application,
Expert System,
Diagnose,
Broccoli,
Calcium Content,
Certainty Factor.

ABSTRACT

Expert System is a part of Artificial Intelligence that contains the knowledge and experience put by many experts into a certain area of knowledge so that everyone can use it to solve specific problems. The implementation of expert systems is widely used in the health sector, for example by making diagnoses such as diagnosing nutritional levels. For example, diagnosing calcium levels in broccoli. Diagnosis is the process of examining something using certain methods and techniques. Diagnosis is done to explain whether the object experiences / suffer certain things. Diagnosing the levels is done to explain whether broccoli vegetables have calcium. It is hoped that with this system, ordinary people can solve certain problems both slightly complicated even without the help of experts in the field. As for experts, this system can be used as an experienced assistant. This developed application aims to make it easier to analyze the data. By using the Certainty Factor method, it will be easier to find out the diagnosis of calcium levels in broccoli. This method is the right method used in expert systems.

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1. INTRODUCTION

An expert system is a part of artificial intelligence that contains knowledge and experience that is entered by many experts into a certain area of knowledge so that everyone can use it to solve specific problems. Implementation of expert systems is widely used in the health field such as brittle bones or brittle bones (Osteoporosis). Expert systems are seen as a way of storing expert knowledge in certain fields in a computer program so that decisions can be given in making intelligent reasoning. In its application, the expert system has several methods, one of which is the certainty factor method. One implementation that can be applied by using an expert system in the health sector is the expert system for determining calcium levels in broccoli (Brassica Oleracea).

One of the problems in the world of health is a mistake in choosing calcium for health. Calcium is a mineral that is needed for the growth of bones and teeth. The need for calcium by the body for adults is around 500-800 mg per day. Lack of calcium can cause bones to become brittle and break easily, this is called Osteoporosis. Very low levels of calcium in the blood can cause seizures. In making the determination some steps must be carried out so that we can find out whether the broccoli contains calcium needed by the human body[1].

To meet the nutritional needs of the community can consume food. Food is a very basic need for the body, Food is a very basic human need for the body, daily food must contain balanced nutritional elements, namely: carbohydrates, protein, fat, vitamins, and calcium. Broccoli is a vegetable that contains lots of vitamins and calcium including water, protein, fat, carbohydrates, fiber, calcium, iron, vitamin A, vitamin C, vitamin E, and thiamine. Broccoli is widely sold in traditional and modern markets.

2. RESEARCH METHOD

In carrying out this research, it is necessary to have clear and structured steps, so that it is easy to do the work in the form of diagram design like the diagram below:

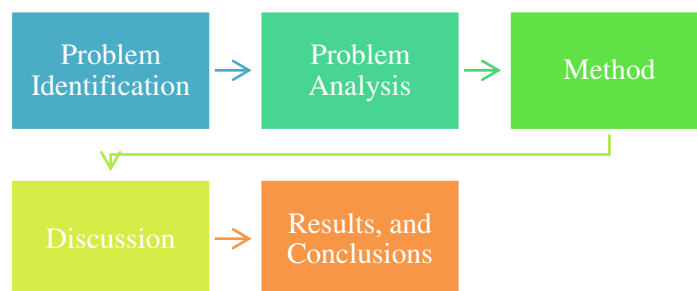


Figure 1. Diagram of Methods and Research Stages

- A. Identification of Problems Explains in detail what is very important to understand in this study. The identification of problems in the study as follows:
 1. Calcium levels
 2. Criteria
- B. Problem Analysis From the results of problem identification, the problem analysis process is carried out, in this case, the input, process, and output of the research are carried out.
- C. Method After knowing the problems in the research, we need the right method to solve the problem, whether it is an algorithm or methods that are suitable in the problem of calcium levels in broccoli.
- D. Discussion This stage is solving the problem with the method that has been determined by making a case example or discussing the manual.
- E. Results and Conclusions This stage is displaying the results of the manual into the application designed and drawing conclusions from problems that have been solved by the method used.

The data source that will be used in this study consists of secondary data. Secondary data is data obtained through library research that is reviewing literature, articles, coverage, papers, and information about criteria or symptoms regarding calcium levels from broccoli vegetables.

2.1 Basic theory

A. Artificial intelligence

Artificial intelligence (Artificial Intelligence) is a part of computer science that is specifically aimed at the design of intelligent behavior automation in computer intelligence systems. The system shows the characteristics that are associated with intelligence in behavior or actions that can fully mimic some functions of the human brain, such as understanding language, knowledge, thinking, problem solving and so forth[2].

Artificial intelligence are ideas for making computer software that has intelligence so that computer software can do a job done by humans. The work is in the form of consultations that can provide information in the form of suggestions that will be very useful. Artificial intelligence allows this computer to think by simplifying programs. In this way, artificial intelligence can mimic human learning processes so that new information can be absorbed and used as a reference in the future[3].

Intelligence or intelligence is obtained from knowledge and experience, for that so that the software developed can have intelligence, the software must be given a knowledge and ability to

reason from the knowledge that has been obtained in finding solutions or conclusions like an expert in a particular field that is specific . Artificial intelligence offers media and intelligence theory tests. This theory can be stated in the language of computer programs and proven through its execution on real computers. One branch of science of artificial intelligence is an expert system (expert system)[4].

So that computers can act like and as good as humans, then computers must also be equipped with knowledge and have the ability to reason. For that AI will try to provide several methods to equip computers with both components so that computers can become smart machines.

B. Certainty Factor

The certainty factor (Certainty Factor) was introduced by Shortcliffe Buchanan in making MYCIN (Wesley, 1984). Certainty Factor (CF) is the value of the MYCIN parameter to indicate the magnitude of trust. Certainty factors express confidence in an event (facts or hypotheses) based on evidence or expert judgment[5].

Certainty Factor uses a value to assume the degree of confidence of an expert in data. Certainty Factor introduces the concepts of beliefs and uncertainties which are then formulated in the basic formulation as follows[5]:

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

The following is a description of some Certainty Factor combinations for various conditions:

1. Certainty Factor for rules with a single premise (single premise rules):

$$\begin{aligned} CF (H, E) &= CF (E) * CF (\text{rule}) \\ &= CF (\text{user}) * CF (\text{expert}) \end{aligned}$$

2. Certainty Factor for rules with multiple premises:

$$CF (A \text{ AND } B) = \text{Minimum } (CF (a), CF (b)) * CF (\text{rule})$$

$$CF (A \text{ OR } B) = \text{Maximum } (CF (a), CF (b)) * CF (\text{rule})$$

3. Certainty Factor for rules with similar conclusions (similarly concluded rules):

$$CF_{\text{COMBINE}} (CF_1, CF_2) = CF_1 + CF_2 * (1 - CF_1)$$

C. Broccoli history

Broccoli (*Brassica Oleracea*) is a vegetable plant that belongs to the cabbage tribe or Brassicaceae. Broccoli originates from the Mediterranean region Which has been cultivated since ancient Greece. This vegetable entered Indonesia recently (around the 1970s) and is now quite popular as food. The part of broccoli that is eaten is a green flower head arranged tightly like a tree branch with thick stems. Most of the flower buds are surrounded by leaves. Broccoli is most similar to cauliflower, but broccoli is green while cauliflower is white[6].

These plants include vegetables that are not resistant to hot air, but they are also not strong in continuous rain. For this reason, broccoli will grow well when planted in high altitude humid areas with low temperatures, which is above 700 meters above sea level. The soil texture for broccoli is sandy clay and contains a lot of organic matter. If broccoli is planted without regard to the conditions of growth, then this plant can change color to yellowish, even black spots and rot[1].

3. RESULTS AND DISCUSSION

The analysis of the expert system that was built was a rule-based expert system that applied the certainty factor method, where this method was used to overcome the difficulty of certainty the types of calcium provisions in broccoli.

Certainty factor (CF) indicates a measure of certainty about a fact or rule. These rules will be used as rules for later calculations. In calculating certainty factomagnagnosis of calcium levels there are several samples obtained from an expert, as shown in the table below:

Table 1 Broccoli criteria

Sampel	Kriteria	Ketetapan		
		A	B	C

I(x)	X1	0.2		
	X2	0.15		
	X3	0.3		
II(y)	Y1		0.7	
	Y2		0.8	
	Y3		0.65	
	Y4		0,85	
III(z)	Z1			0.5
	Z2			0.6
	Z3			0.65

Information:

X1 = too much water content in broccoli buds

X2 = the stems on broccoli are not hard

X3 = black and yellowish spots indicate putrefaction

Y1 = broccoli stems when pressed are still very hard

Y2 = broccoli florets do not expand and are still solid

Y3 = dry broccoli

Y4 = broccoli also has a fresh and clean aroma

Z1 = has a hard stem

Z2 = green broccoli florets still buds

Z3 = looks still fresh and green

A = small amount of calcium

B = moderate calcium levels

C = high calcium levels

Based on this information, this case compiled 3 release production rules relating to broccoli samples, the following rules are:

Rule 1

IF X 100 gr sample weight AND Average volume of 1.83 ml in the sample AND X3 = black and yellowish spots indicate rot THEN CALCIUM LEVELS ARE NOT APPROACHING

Rule 3

IF Z sample weight 100 gr AND Average volume of 1.90 ml in the sample AND Y2 = broccoli florets do not expand and are still solid THEN CALSIUM LEVELS ALMOST APPROACHING

Rule 3

IF Y 100 gr sample weight AND Average volume of 1.93 ml in the sample AND Z2 = green broccoli florets still buds THENKADAR CALCIUM APPROACHES

As for the logic of the certainty factor method in the system consultation session, the consultation user is given a choice of answers each having the following weight:

1. Not close to 0
2. Slightly approaching 0.5
3. Quite close to 0.7
4. Approaching 0.8
5. Very Approaching 1

A value of 1.6 in the titer volume indicates that the nutritionist informs that the person is not approaching the stipulated calcium level of 78 mg / 100 gr, this may be due to the quality of the broccoli itself, as stated by the system. The more a nutritionist believes in these provisions, the higher the percentage of confidence results with solving rules that have multiple premises, becoming rules that have a single premise. Then each rule, then the CF value is combined.

The results of these criteria will be analyzed/processed using certainty factor methods. The way it works is as follows:

1. The first step, determine the weight value for each of the features that have been determined from the criteria table;
 - a. CFpakar (broccoli florets part is not fluffy and still solid) = 0.8

- b. CFpakar (broccoli stems when pressed are still very hard) = 0.7
 c. CFpakar (dried broccoli) = 0.65
 d. CFpakar (broccoli also has a fresh and clean aroma) = 0.8
2. The second step, determine the value of the weight assessment of the feasibility of broccoli which has the quality or criteria mentioned:
- the broccoli florets are not fluffy and are still dense.
 - broccoli stems when pressed are still very hard = very close = 1
 - dry broccoli = close = 0.8
 - broccoli also has a fresh and clean aroma = close enough = 0.7
3. The third step, solving the initial rules that have a premise into rules with a single premise, so that it becomes:
- IF the broccoli florets are not fluffy and are still dense
 THEN High Level of Resolution
 IF broccoli stems when pressed are still very hard
 THEN High Level of Resolution
 IF broccoli is dry THEN High Level of Resolution
 IF broccoli also has a fresh and clean aroma
 THEN High Level of Resolution
4. The fourth step, calculate the CF value of the new rules (single premise) by multiplying CF_{User} by CF_{Pakar} becoming:
- CF 1.1 = $0,8 * 0,5 = 0,4$
 CF 1.2 = $0,7 * 1 = 0,7$
 CF 1.3 = $0,65 * 0,8 = 0,52$
 CF 1.4 = $0,85 * 0,7 = 0,595$
5. The final step is to combine the CF value of each rule:
- Combine CF 1.1 with CF 1.2:
- $$CF_{Combine} (CF_1, CF_2) = CF_1 + CF_2 * (1 - CF_1), \text{ thus becoming}$$
- $$CF_{Combine} (CF 1.1, CF 1.2) = CF 1.1 + CF 1.2 * (1 - CF 1.1)$$
- $$= 0,4 + 0,7 * (1 - 0,4)$$
- $$= 0,4 + 0,42$$
- $$= 0,82 \text{ } CF_{old}$$
- combination with CF_{old} with CF 1.3:
- $$CF_{Combine} (CF_{old}, CF 1.3) = CF_{old} * CF 1.3 (1 - CF_{old})$$
- $$= 0,82 + 0,52 * (1 - 0,82)$$
- $$= 0,82 + 0,0936$$
- $$= 0,9136 \text{ } CF_{old}$$
- combination with CF_{old} with CF 1.4:
- $$CF_{Combine} (CF_{old}, CF 1.4) = CF_{old} * CF 1.4 (1 - CF_{old})$$
- $$= 0,9136 + 0,595 * (1 - 0,9136)$$
- $$= 0,9136 + 0,051408$$
- $$= 0,965008 \text{ } CF_{old}$$
- percentage of statute = $CF_{Combine} * 100\%$
 = $0,965008 * 100\%$
 = 96,5008 %

Thus it can be said that the calculation of the certainty factor carried out for the sample is a type of high-level determination with a confidence level of 96.5008%.

Figure 2: Processing Form

Figure 3: Processing Result Form

Figures 2 and 3 are the results of the process of applying the certainty factor method in diagnosing calcium levels in broccoli based on the value of the criteria given by the user.

4. CONCLUSION

Based on the results and discussion, it can be concluded with the process of diagnosing calcium levels in broccoli. We can find out that the calcium content in broccoli is so much that our body needs and by applying the Certainty Factor Method, it is suitable to be used to diagnose calcium levels in broccoli because using this method designed system will be easier for users to understand.

REFERENCES

- [1] G. A. R. Saputri and A. P. Afrila, "PENETAPAN KADAR KALSIUM PADA BROKOLI (Brassica oleracea, L.) SEGAR, KUKUS, DAN REBUS SECARASPEKTROFOTOMETRI SERAPAN ATOM (SSA)," *J. Anal. Farm.*, vol. 4, no. 4, pp. 9–15, 2017, [Online]. Available: <http://ejurnalmalahayati.ac.id/index.php/analisfarmasi/article/view/2143/pdf>.
- [2] D. Nofriansyah and S. Defit, *Multi Criteria Decision Making (MCDM) pada Sistem Pendukung Keputusan*, 1st ed. Yogyakarta: Deepublish, 2017.
- [3] T. Sutojo, E. Mulyanto, and V. Suhartono, *Kecerdasan buatan*. Yogyakarta: Andi Offset, 2011.
- [4] Kusriani, *Konsep dan Aplikasi Sistem Penukung Keputusan*, 1st ed. Yogyakarta: Andi Offset, 2007.
- [5] M. Arifin, S. Slamin, and W. E. Y. Retnani, "Penerapan Metode Certainty Factor Untuk Sistem Pakar Diagnosis Hama Dan Penyakit Pada Tanaman Tembakau," *Berk. Sainstek*, vol. 5, no. 1, p. 21, 2017, doi: 10.19184/bst.v5i1.5370.
- [6] HALODOC, "5 Manfaat Brokoli untuk Kesehatan," 2019. <https://www.halodoc.com/artikel/5-manfaat-brokoli-untuk-kesehatan> (accessed Sep. 07, 2020).