



COMPARISON OF *CERTAINTY FACTOR* AND *DEMPSTER SHAFER* METHODS IN EXPERT SYSTEMS FOR IDENTIFYING FACIAL SKIN TYPES

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ABSTRACT

Knowledge about health skin face is one of the matter important Because skin face is part outermost from body that often exposed to light sun and dust pollution . One of the factor most important For guard health skin face is with know moreover formerly type skin the face that is owned . Generally face has 5 types skin , namely normal, oily , dry , combination , and sensitive . However , there are still many people have not Can know type skin face alone , so that not seldom they difficult in take action what fits For nurse skin his face . So from That objective he did study This is For make A system expert in identify type skin face with method certainty and uncertainty . The results of system expert This expected can help Lots individual For know and understand type skin her face , so that can give more solutions appropriate .

ARTICLE INFORMATION

Keywords:

System expert , Identification type skin face , health skin face

1. Introduction

Development technology information has push transformation significant in various fields , including sector health and care skin . Skin face as part outermost body own role protective to exposure ultraviolet rays , pollution , and factor environment other . Conditions skin an unseen face well maintained can cause various problems , such as irritation , acne , skin dry , or excess sebum production . Therefore that , understanding about type skin face become step essential beginning in determine appropriate and effective treatment strategies .

In a way general , type skin face can classified into five categories , namely normal, oily , dry , combination and sensitive skin . Each type own characteristics specifically reviewed from level humidity , size pores , tendency irritation , to response to product maintenance certain . Differences characteristics This demand approach different treatments . However so , no all individual capable identify type the skin in a way accurate . Error in recognize condition skin often impacts the selection less product appropriate , so that potential make things worse condition skin face .

Identification type skin in a way clinical generally done through consultation direct with power expert dermatology . Although method the assessed objective and comprehensive , limitations access , time , and cost become constraint for part society . On the other hand , the increasing need will solution practical and fast open opportunity utilization technology based intelligence artificial , especially system expert , as alternative identification process support .

System expert is system based computer designed For represent knowledge and patterns reasoning a expert to in form rules logical . Through mechanism inference certain systems This capable give recommendation or decision based on inputted symptoms user . In the context of identification type skin face , system expert functioning For analyze relatedness between symptoms experienced users with characteristics of each type skin based on the knowledge base obtained from expert .

Various study previously has develop system expert in the health domain with approach method different inferences . Research results show that method reasoning based uncertainty own contribution significant in increase level accuracy system . Two methods that are widely used used For handle uncertainty are Certainty Factor and Dempster-Shafer. The Certainty Factor method emphasizes the level of belief expert to something hypothesis based on symptom certain , whereas The Dempster-Shafer method accommodates merger a number of proof For get degrees more trust comprehensive .

Although second method the You're welcome designed For handle uncertainty , characteristics calculations and approaches mathematics used own difference fundamental . Difference This potential produce variation level accuracy in the identification process . Therefore that , is necessary study comparative For analyze effectiveness second method in system expert identification type skin face .

Based on problem said , research This focused on development system expert web -based for identify type skin face with compare Certainty Factor and Dempster-Shafer methods . Research This No only aim produce capable system give recommendation type skin and solutions appropriate care , but also evaluate which method shows level accuracy more optimal based on data and knowledge expert . With Thus , the results study expected can give contribution

academic in development system expert as well as give benefit practical for public in understand condition skin face in a way more precise and measurable .

2. Method

2.1. Method of collecting data

Data used in study This obtained through a number of techniques , namely :

1. Interview (Interview) Primary data collection done through interview direct with experts , namely doctor who has competence in field maintenance skin face . Interview aim For get information related classification type skin , characteristics symptoms , weight belief expert for each symptom , as well recommendation appropriate care For every type skin .
2. Literature Study Literature study done with examine books , journals scientific , and other relevant references about system experts , Certainty Factor method , Dempster-Shafer method , and theory about classification type skin face . This study aim strengthen runway conceptual and methodological study .
3. Expert Data Analysis Result Data interview arranged in form table containing a list of types skin , accompanying symptoms , value weight belief experts , as well as rules (rule base) that become the basis of the inference process in system .

2.2. Application of the Certainty Factor Method

The Certainty Factor (CF) method is used For count level belief to something hypothesis based on combination selected symptoms user .

Stages the calculation includes :

1. Determine mark belief expert (CF expert) against every symptom .
2. Input mark belief users based on level selected certainty .
3. Count CF value for each symptom use equality :

$$CF(H, E) = CF_{pakar} \times CF_{user}$$

4. Merge CF value of a number of symptom in One hypothesis use formula combination :

$$CF_{combine} = CF_{old} + CF_{new} \times (1 - CF_{old})$$

5. Converting results end to in form percentage For determine level belief to type skin certain .

This method emphasis on representation level trust experts and users to something hypothesis in a way gradually through a combination process .

2.3. Application of the Dempster-Shafer Method

The Dempster-Shafer method is applied For accommodate uncertainty with combine a number of evidence in form function mass (mass function).

Steps taken includes :

1. Determine mark mass beginning based on weight belief expert For every symptom .
2. Count function belief and plausibility of each hypothesis .

- Combine two or more evidence using rule Dempster combination :

$$m_3(Z) = \frac{\sum m_1(X) \cdot m_2(Y)}{1 - K}$$

where K is mark conflict between the evidence that is not own slices .

- Determine mark trust the greatest ending as results identification type skin .

This method allows integration a number of proof at a time as well as differentiate between uncertainty and ignorance .

3. Results and Discussion

3.1. Dataset Description

Dataset used in study This sourced from results acquisition knowledge expert through the interview process structured . Data consists of over five categories type skin face , namely normal (JK01), oily (JK02), dry (JK03), combination (JK04), and sensitive (JK05). Each category represented by a number of symptom clinical that becomes indicator in the identification process .

In a way overall There are 22 symptoms (G001–G022) used as evidence variables in system . Each symptom given weight expert belief in range 0–1 which represents level trust to connection symptom with type skin certain . In addition , the system also accommodates weight belief from users with scale six level (no to be very sure).

Table 1. Summary of Research Dataset

Component	Amount	Information
Skin Type	5	JK01–JK05
Symptoms (Evidence)	22	G001–G022
Rules (Rule Base)	5 rules main	IF–THEN
User Confidence Scale	6 levels	0–1
Data source	1 Dermatologist	Interview direct

The data structure shows that each skin type has at least six primary symptoms that are interconnected through inference rules. This relationship pattern forms the knowledge base that is central to the calculation process of both methods.

3.2. System Design

3.2.1. The System Flow that will be designed

Following is a flowchart of the system that will designed This own channel where the user accesses the diagnostic menu and performs diagnosis with answer questions in the form of symptoms presented by the system . After the User has finished answer question said , then system do analysis For identify type skin experienced by Users with use Certainty Factor method . After it is a diagnostic process disease Where the system make a final decision with determine type skin face based on symptoms inputted by the user . Then the system do analysis said , then

system storing and processing results diagnosis Then display results diagnosis with show type skin experienced face .

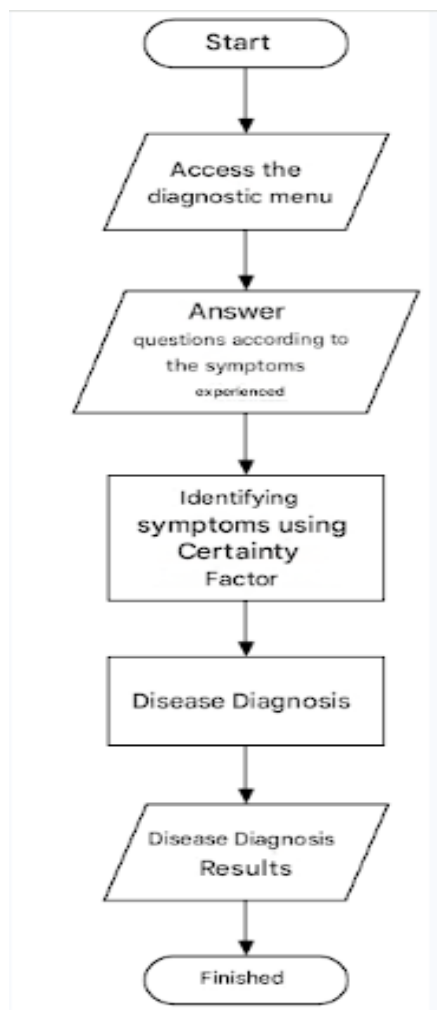


Figure 1. System flow that will be designed

3.2.2.Context Diagram System

Following is a context diagram in the Expert System for Identification Facial Skin . For system expert This has two types users namely Admin and User.

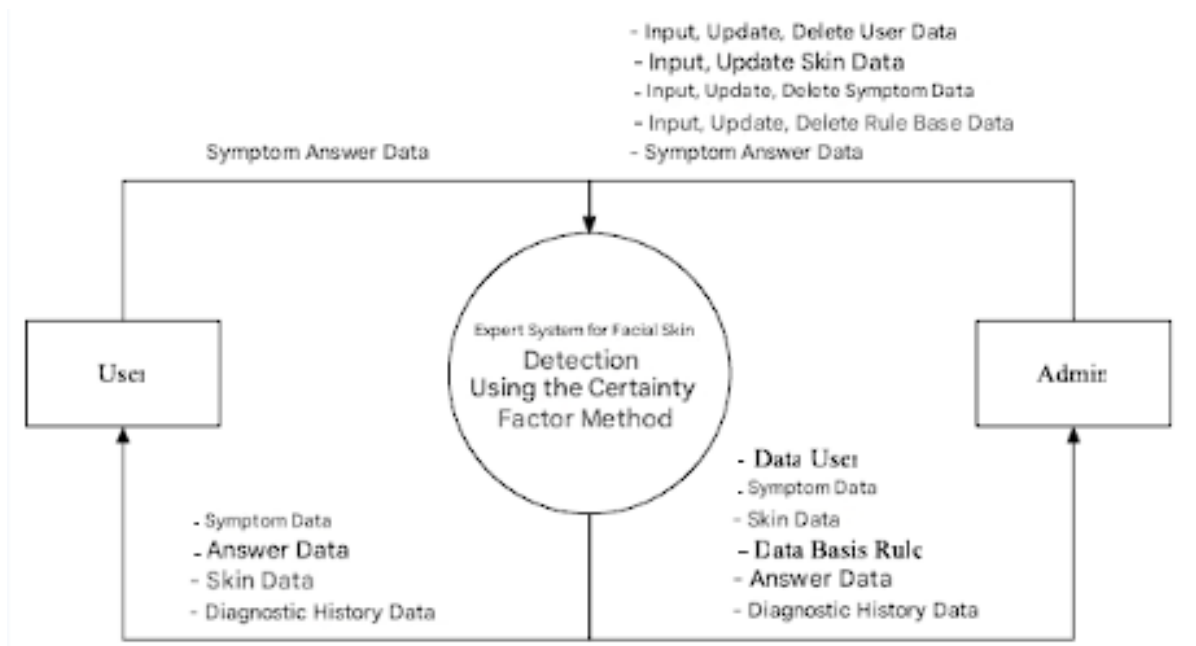


Figure 2. Context Diagram Identification Expert System Facial Skin

Explanation :

- a. Admin has right access For manage all over systems , including activity like enter , change , and delete user data , symptoms , types skin , rules basics , answers , and history diagnosis . In addition , the Admin can also do diagnosis and viewing results diagnosis , similar with right access owned by the user .
- b. System provide a platform for interaction between users and admins with all the information contained therein . This is facilitate communication , data exchange , and management information in a way effective in system .
- c. Users own access to system with method give answer on question or provide input regarding symptoms experienced . As response , system provide output in the form of result data diagnosis or identification type skin based on symptoms inputted by the user .

3.2.3. Design Entity Relationship Diagram (ERD)

Following is design *Entity Relationship Diagram* (ERD) from system expert For identification type skin face .

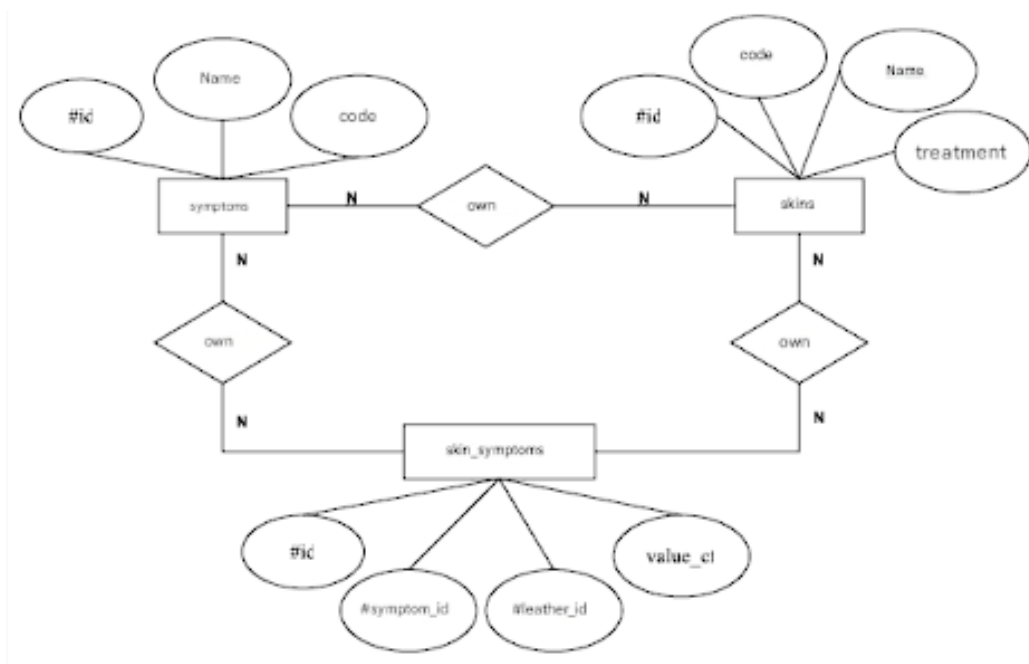


Figure 3. ERD Design of the Identification Expert System Facial Skin

3.3. System Implementation

Program implementation refers to the execution application a system that allows two types right login access , namely Admin and User. User can use system For do diagnosis type skin face and look results diagnosis based on selected symptoms , according to with existing symptom data in system . Admin, on the other hand , is responsible answer For manage all data in application system expert this , and have ability For do diagnosis like case in point users . The following is shared program interface with steps in use system expert identification type skin face with Certainty Factor method .

3.4. Model Performance Comparison

The evaluation was conducted using expert-validated test data. Each case was tested using both methods, and the results were then compared based on their level of agreement with the expert's diagnosis.

Table 2. Comparison of Calculation Results of Methods

Test Cases	CF Result (%)	DS Result (%)	Expert Diagnosis	Compliance
Case 1	82% (JK02)	76% (JK02)	JK02	In accordance
Case 2	78% (JK03)	71% (JK03)	JK03	In accordance
Case 3	85% (JK05)	80% (JK05)	JK05	In accordance
Case 4	74% (JK04)	69% (JK04)	JK04	In accordance
Case 5	88% (JK01)	83% (JK01)	JK01	In accordance

Based on testing , both method show consistency results to diagnosis expert . However Thus , the Certainty Factor method produces mark belief relative end more tall compared to Dempster-Shafer method in part big case .

In a way quantitative , level accuracy Certainty Factor method is more stable Because mechanism combination gradual manner that takes into account contribution every symptom

linearly. In contrast, the Dempster-Shafer method is more sensitive to conflict of evidence, so that mark end can experience decline if there is slices evidence that is not consistent.

3.5. Scientific Interpretation

Research result show that second method capable represent reasoning expert in condition uncertainty. The Certainty Factor method tends to give mark more confidence tall Because his approach focused on strengthening gradually to hypothesis without penalty significant conflict.

In contrast, the Dempster-Shafer method has superiority in differentiate uncertainty and ignorance, however calculation conflict (K) can influence mark end in a way more complex. In the context of identification type skin a face that has symptom each other overlapping overlap, the Certainty Factor approach is assessed more adaptive to relative data patterns homogeneous.

In a way conceptual, findings This indicates that method with structure combination simple more effective applied to the system expert based symptom clinical that is not own level conflict tall between evidence. Meanwhile that, the Dempster-Shafer method is more relevant used in cases with variation very heterogeneous evidence.

3.6. Synthesis of Discussion

In a way overall, system developed experts capable:

1. Identifying type skin face based on 22 indicators symptom.
2. Produce recommendation maintenance according to knowledge base expert.
3. Show that Certainty Factor method has performance more computing stable in context study This.

This result strengthen argument that election method inference in system expert must consider data characteristics and levels complexity connection between symptoms. In case identification type skin face, approach based on proven Certainty Factor more efficient and consistent compared to Dempster-Shafer method, although both of them You're welcome capable produce harmonious decisions with opinion expert.

4. Conclusion

This study successfully designed and implemented a web-based expert system to identify facial skin types using two inference approaches: the Certainty Factor and Dempster-Shafer methods. The system was developed based on a knowledge base obtained through a knowledge acquisition process from dermatology experts, which includes five skin type categories and twenty-two symptom indicators as evidence variables.

Test results show that both methods are capable of producing decisions consistent with expert diagnoses. However, the Certainty Factor method demonstrated relatively more stable performance in producing final confidence values. This is due to its calculation mechanism, which gradually combines confidence levels without being significantly influenced by conflicting evidence. In contrast, the Dempster-Shafer method is more sensitive to conflicting evidence, resulting in lower final confidence values in some cases.

In terms of system implementation, the developed application facilitates self-consultation through a web-based interface and presents identification results in the form of a confidence level percentage, along with treatment recommendations based on skin type

characteristics. Therefore, this system can be a supporting alternative to help people identify facial skin conditions in a more structured and measurable way.

Overall, this study demonstrates that the choice of inference method in an expert system needs to be tailored to the characteristics of the data and the complexity of the relationships between symptoms. In the context of identifying facial skin types with relatively structured symptom patterns, the Certainty Factor method was deemed more effective than the Dempster-Shafer method. These findings are expected to serve as a reference for the development of similar expert systems in the health sector and other domains with similar uncertainties.

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