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An Expert System for Diagnosing Facial-Swelling Using CLIPS

Mohammed A. Alkahlout[1], Azmi H. Alsaqqa[2], Tanseem N. Abu-Jamie[3], Samy S. Abu-Naser[4]

Department of Information Technology,
Faculty of Engineering and Infromation Technology,
Al-Azhar University, Gaza, Palestine
Email: a.saqqa@up.edu.ps[1], m.kahlout@up.edu.ps[2]

Abstract: Background: Face swelling is the enlargement or distention of the face due to fluid buildup or inflammation in the facial tissues. Swelling can occur anywhere on the face, but it is most noticeable on the lips, cheeks and eyelids. Swelling can also extend to the neck region. Facial swelling may also be referred to as facial edema[1]. ***Objectives:*** The main goal of this expert system is to get the appropriate diagnosis of disease and the correct treatment by presenting suggestions on Facial-Swelling disease to the user by asking about symptoms.. ***Methods:*** In this paper, we proposed an expert system that was designed and implemented to help doctor and user to diagnose some Facial-Swelling diseases. An overview of Facial-Swelling diseases is presented; the cause of diseases is determined and treats of the disease whenever possible. CLIPS and Delphi languages were used as the main tools for designing our expert system.

Keywords: Artificial Intelligence, Expert Systems - CLIPS, Facial-Swelling

1- INTRODUCTION

Face swelling is the enlargement or distention of the face due to fluid buildup or inflammation in the facial tissues. Swelling can occur anywhere on the face, but it is most noticeable on the lips, cheeks and eyelids. Swelling can also extend to the neck region. Facial swelling may also be referred to as facial edema. A variety of mild to serious disorders, diseases and conditions can lead to face swelling. Swelling can result from infections, inflammation, trauma and malignancy (cancer).Depending on the cause, facial swelling can last for a short time, such as when you develop swollen eyelids during an allergic reaction to animal dander. Facial swelling that develops over time and occurs along with additional symptoms may be a sign of an infection, such aserysipelas orsinusitis. Because facial swelling and swelling in general may be a sign of a serious condition, you should talk with your medical professional about your symptoms. If you experience facial swelling accompanied by difficulty breathing, hives, intense distress, fever, redness, or warmth. Face swelling may occur with other symptoms depending on the underlying disease, disorder or condition. For example, swelling over the cheeks and eyes can be a sign of sinusitis that is often accompanied by pain and congestion [1].

Face swelling may occur with other symptoms including:

- Eye pain or redness
- Facial pain
- Fatigue
- Fever
- Headache
- Skin sores or pus-filled bumps
- Watery, itchy eyes
- Pain while chewing or swallowing
- Painful swelling near one or both ears

For all the aforementioned reasons and complex common sign and symptoms, we have developed this expert system to help Doctor in diagnosing Facial-Swelling diseases, in order to prescribe the appropriate treatment.

2. LITERATURE REVIEW

There is a lot of Expert System that were designed to diagnose human and Plant Diseases [07-58] such as Problems of Teeth and Gums, Skin Diseases, Rickets and other types of Illness.. But there is no specialized expert system for diagnosis of Face-Swelling diseases available free and Use a language CLIPS Linked with Delphi. This expert system was characterized to be easy to use by specialists and user concerned. This is due to the coordinated application interface. we have built up this expert system to help specialists doctor in diagnosing Face-Swelling so as to prescribe the suitable treatment. Symptoms of a Face-Swelling disease can vary depending on the cause.
Expert system is a computer application of Artificial Intelligence (AI) [6]; which contains knowledge base inference engine, and User Interface as in Figure 3.

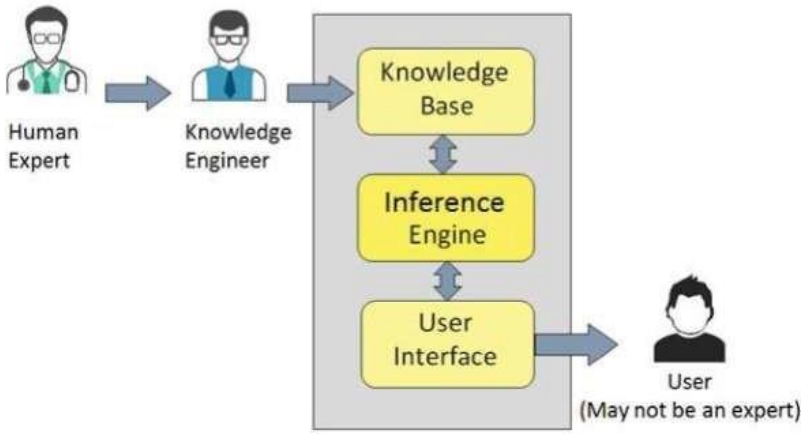

Figure 3 show the Main Components of an Expert System [6]

3. MATERIALS AND METHODS

The proposed expert system performs diagnosis for six Face-Swelling diseases by presenting all symptoms. The proposed expert system will ask the user to choose the type of problem symptoms. At the end of the dialogue session, the proposed expert system provides diagnosis and recommendations for the user. Figure 2 shows the main interface of the system and the usersystem. Figure 3 shows symptoms disease, Figure 4 Obtain diagnosis and recommendation.

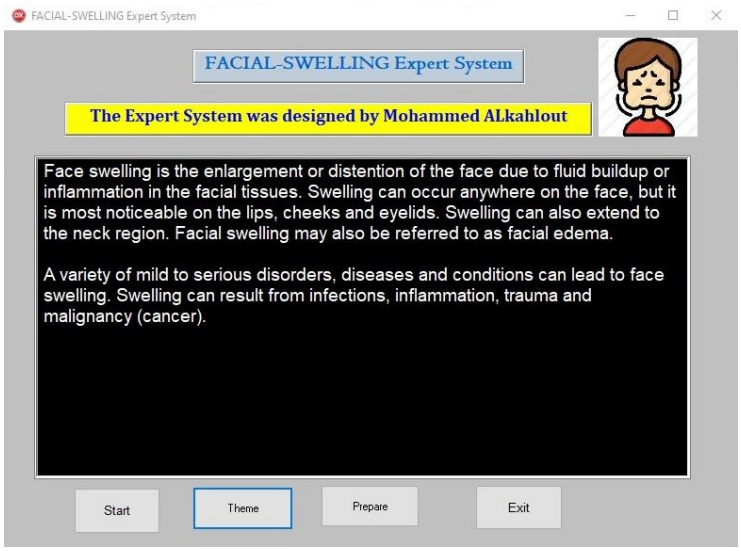

Figure 2 shows the main interface of the system

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Figure 3 shows a sample dialogue between the expert system and the user.

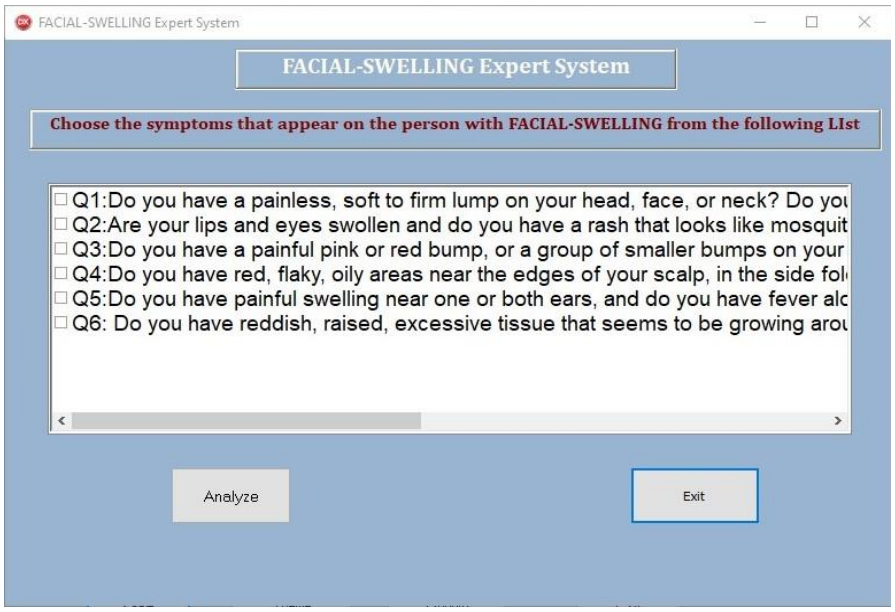

Figure 3 Dialogue between the expert system and the user

Figure 4 shows how the users get the diagnosis and recommendation

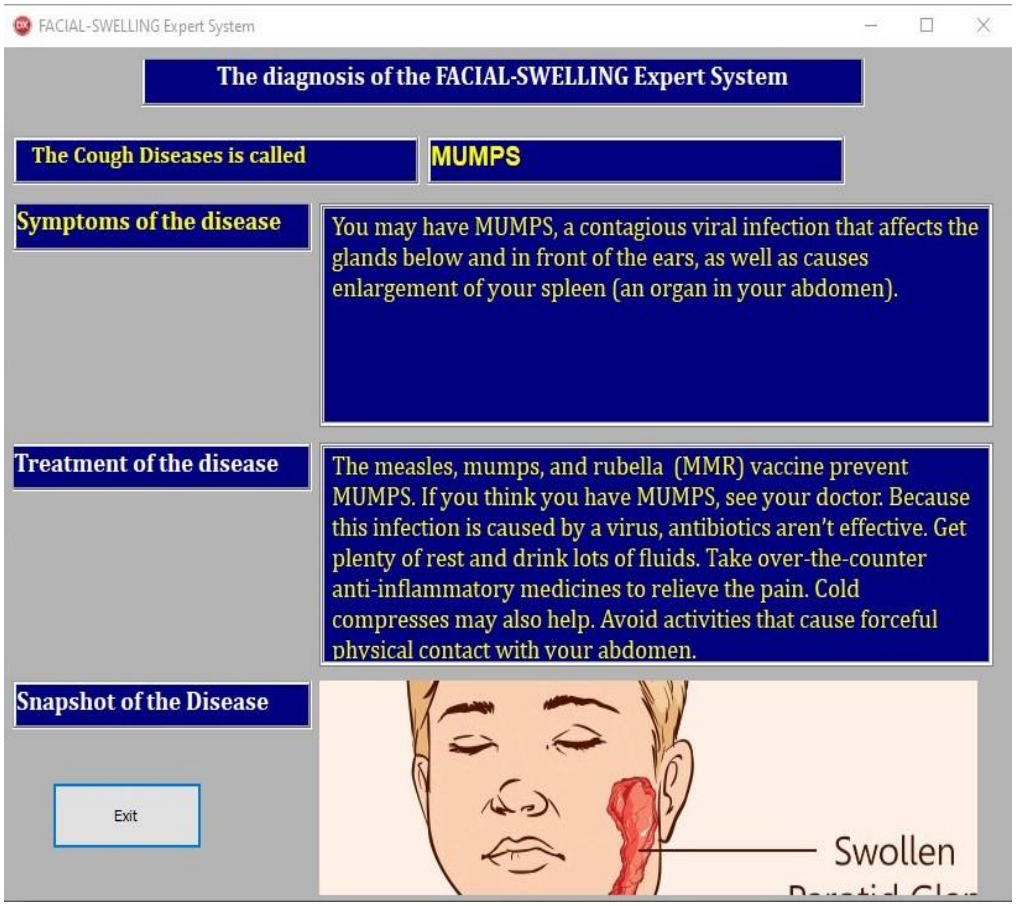

Figure 4: Diagnosis and recommendation

4. NOWLEDGE REPRESENTATION

Knowledge is collected by a set of rules is created where each rule contains in IF part that has the symptoms and in THEN part

that has the disease that should be realized. The inference engine (forward reasoning) is a mechanism through which rules are selected to be fired. It is based on a pattern matching algorithm whose main purpose is to associate the facts (input data) with applicable rules from the rule base. Finally, the Facial-Swelling are produced by the inference engine. This expert system defined the symptoms for problems of the Facial-Swelling. The scope of our expert system is the following Facial-Swelling: SEBACEOUS CYST, ALLERGIC REACTION, CARBUNCLES, or ACNE, skin irritation caused by ACNE, ROSACEA, or SEBORRHEA, MUMPS, KELOID .

Here some overview about above DIAGNOSIS :

sebaceous cysts: also known as, Skin cysts are slightly hardened, fluid-filled bumps within the skin. They can occur anywhere on the skin and often affect the face, neck, and torso [2].

Allergic reactions: that affect the face can lead to raised welts, swollen lips, and watering eyes. Beauty products or hay fever often cause these reactions [2].

A carbuncle : is collection of boils that develop under the skin. When bacteria infect hair follicles, the follicles can swell and turn into boils and carbuncles [2].

Acne : is a chronic, inflammatory skin condition that causes spots and pimples, especially on the face, shoulders, back, neck, chest, and upper arms.Whiteheads, blackheads, pimples, cysts, and nodules are all types of acne [2].

A facial rash : is an inflammatory reaction of the skin of the face. Facial rashes can be caused by a wide variety of mild to serious diseases, disorders and conditions. In some situations the presence of facial rash is a warning for other problems elsewhere in the body, such as systemic lupus. Facial rashes can affect a small to large area of the face and can occur in all age groups and populations [3] .

Rosacea : is a chronic inflammatory skin condition that usually affects the face. People may mistake rosacea for acne, eczema, or an allergic skin reaction [2].

Mumps : is an extremely contagious viral infection of the salivary glands that most commonly affects children. The most obvious symptom is swelling of the salivary glands, giving the patient a “hamster-like” face [2].

KELOID：When skin is injured, fibrous tissue called scar tissue forms over the wound to repair and protect the injury. In some cases, extra scar tissue grows, forming smooth, hard growths called keloids. Keloids can be much larger than the original wound. They’re most commonly found on the chest, shoulders, earlobes, and cheeks. However, keloids can affect any part of the body. Although keloids aren’t harmful to your health, they may create cosmetic concerns[4].

The proposed expert system will diagnose the six Facial-Swelling problems by employing the knowledge obtained from a specialized site [5] to the user in the form of a question and will be asked to answer, and through it the proposed expert system will provide the diagnosis and recommendations to the user.

The diagnosis is based on the Decision Tree in figure 5.

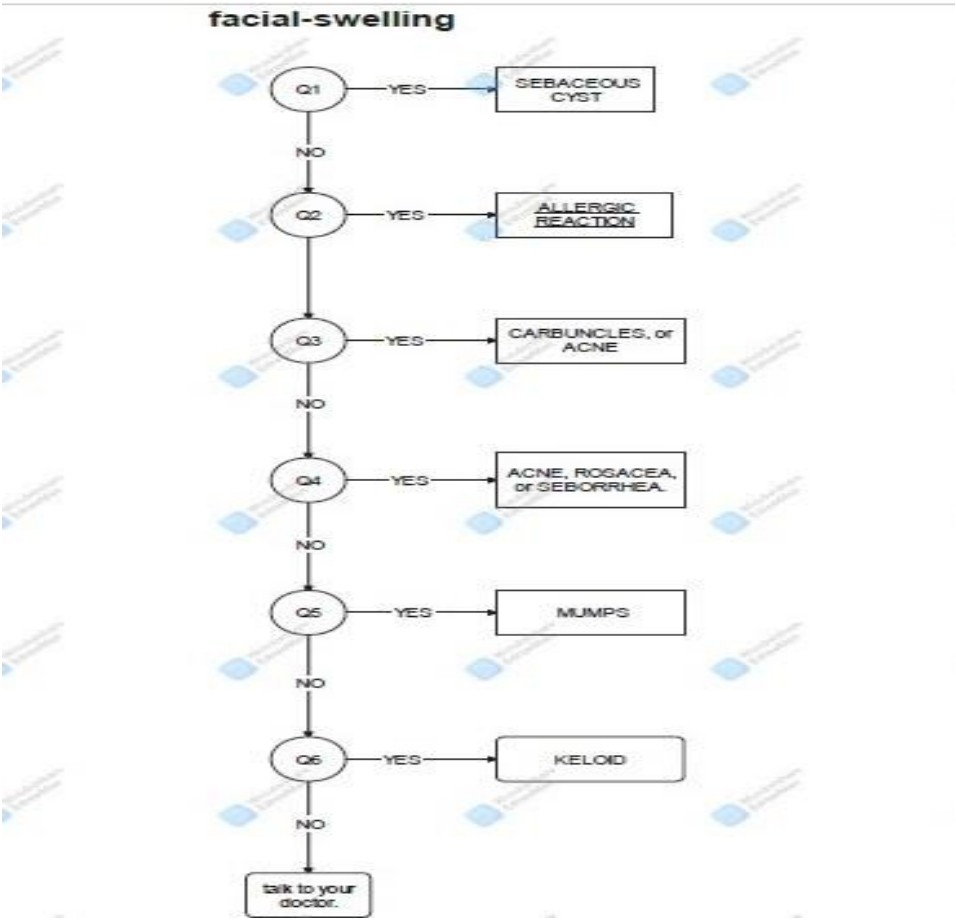

Figure 5: Decision Tree for Facial-Swelling Diagnosis

List of questions for Decision Tree listed in Table 1

Table 1: List of Questions for Decision Tree

Q1:Do you have a painless, soft to firm lump on your head, face, or neck? Do you see a pore or small hole at the top of the bump?
Q2:Are your lips and eyes swollen and do you have a rash that looks like mosquito bites?
Q3:Do you have a painful pink or red bump, or a group of smaller bumps on your forehead or face?
Q4:Do you have red, flaky, oily areas near the edges of your scalp, in the side folds of your nose, or on your cheeks?
Q5:Do you have painful swelling near one or both ears, and do you have fever along with pain when chewing or swallowing?
Q6: Do you have reddish, raised, excessive tissue that seems to be growing around the area of a scar or piercing?

The captured knowledge has been converted into CLIPS Knowledge base syntax (Facts and Rules).

5. FUNCTION OF THE SYSTEM

The proposed system performs many functions. It will conclude the Facial-Swelling problems diagnosis based on answers of the user to specific question that the system asks the user. The questions provide the system for explanation for the symptoms of the patient that helps the expert system for diagnosis the disease by inference engine. It stores the facts and the conclusion of the

inference of the system, and the user, for each case, in data base. It processes the data base in order to extract rules, which complete the knowledge base.

6. LIMITATIONS

The current proposed expert system is specialized in the diagnosis only the following six Facial-Swelling: SEBACEOUS CYST, ALLERGIC REACTION, CARBUNCLES, or ACNE, skin irritation caused by ACNE, ROSACEA, or SEBORRHEA, MUMPS, KELOID .

7. CONCLUSION

In this paper, a proposed expert system is presented to help doctor and people with Facial-Swelling problems to diagnose the problem with six different possible symptoms of Facial-Swelling problems. This system enables the user to obtain a diagnosis quickly and more accurately than a traditional diagnosis. It is also easy to use and does not require any training before use.
It was developed using clips Expert System language and Delphi. An initial evaluation of the expert system was carried out and a positive feedback was received from the users. As future work we will constitute the expert system to cover all Facial-Swelling problems.

8. EXPERT SYSTEM SOURCE CODE

```
(defrule disease1
(Q1:Do you have a painless, soft to firm lump on your head, face, or neck? Do you see a pore or small hole at the top of the bump?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "1"  crlf )
)


(defrule disease2
(Q2:Are your lips and eyes swollen and do you have a rash that looks like mosquito bites?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "2"  crlf )
)

(defrule disease3
(Q3:Do you have a painful pink or red bump, or a group of smaller bumps on your forehead or face?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "3"  crlf )
)

(defrule disease4
(Q4:Do you have red, flaky, oily areas near the edges of your scalp, in the side folds of your nose, or on your cheeks?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "4"  crlf )
)


(defrule disease5
(Q5:Do you have painful swelling near one or both ears, and do you have fever along with pain when chewing or swallowing?)
(not (disease identified))
=>
```

```
(assert (disease identified))
(printout fdatao "5"  crlf )
)


(defrule disease6
(Q6: Do you have reddish, raised, excessive tissue that seems to be growing around the area of a scar or piercing?)
(not (disease identified))
=>
(assert (disease identified))
(printout fdatao "6"  crlf )
)

(defrule endline
(disease identified)
=>
  (close fdatao)
)


(defrule readdata
  (declare (salience 1000))
  (initial-fact)
  ?fx <- (initial-fact)
=>
  (retract ?fx)
  (open "data.txt" fdata "r")
  (open "result.txt" fdatao "w")

  (bind ?symptom1 (readline fdata))
  (bind ?symptom2 (readline fdata))
  (bind ?symptom3 (readline fdata))
  (bind ?symptom4 (readline fdata))
  (bind ?symptom5 (readline fdata))
  (bind ?symptom6 (readline fdata))
  (bind ?symptom7 (readline fdata))

  (assert-string (str-cat "(" ?symptom1 ")"))
  (assert-string (str-cat "(" ?symptom2 ")"))
  (assert-string (str-cat "(" ?symptom3 ")"))
  (assert-string (str-cat "(" ?symptom4 ")"))
  (assert-string (str-cat "(" ?symptom5 ")"))
  (assert-string (str-cat "(" ?symptom6 ")"))
  (assert-string (str-cat "(" ?symptom7 ")"))

   (close fdata)
)
```

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