Fuzzy Expert System for Migraine Analysis and Diagnosis

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Abstract: *Fuzzy Logic is use to solve those type of problems in which the solution cannot be defined in rigid boundary either yes or no. Most of human disease can be determine with the help particular test or test value which guide people have the particular disease is yes or no. Migraine is not well known disease. Till today there is not permanent cure for migraine. There is no particular test which can determine migraine. That means only physical and psychological symptoms by which can determine migraine. Also symptoms vary from person to person. There is no rigid determination of migraine. There is no any kind of test available in the medical science which can determine migraine. Symptoms are vague property we cannot determine pain but we can determine its degree. There is no measurement for pain but with help of fuzzy logic we can measure the degree of symptoms or we can say there membership function in terms of fuzzy logic. That there is no crisp value can find in test of migraine. Symptoms give the idea of severity and condition of migraine. This expert system tries to determine and diagnose migraine using symptoms which are vague properties. Vague means things or properties that cannot measure in terms of crisp logic in other words there is no sharp boundary between yes or no. Migraine has many symptoms only symptoms on the basis of these symptoms we can determine the condition of migraine weather migraine is mild moderate and severe. I used Matlab for solution of problem.*

Keywords: Fuzzy Expert system, migraine, fuzzy, fuzzy logic, migraine diagnosis, symptoms of migraine.

1. Introduction

Now these days various discipline of artificial intelligence are the part of our social, personal life. Fuzzy logic is also the part of artificial intelligence. In every field of science or even not science stream there is a tremendous use of artificial intelligence. Disease diagnosis, medicine selection blood count or in any types of medical testing equipment use some sort of artificial intelligence. Fuzzy logic is one of most popular part of artificial intelligence. Fuzzy deals with the problem which cannot be determine using our yes or no true or false. It lies between 0 and 1. Membership function is used to represent solution. Example you have a headache. There is no device or test available to evaluate or calculate headache. But in fuzzy logic we can determine with the help of membership function. We can find degree of headache. We can divide headache in three categories **mild moderate severe.** A common fuzzy expert system.
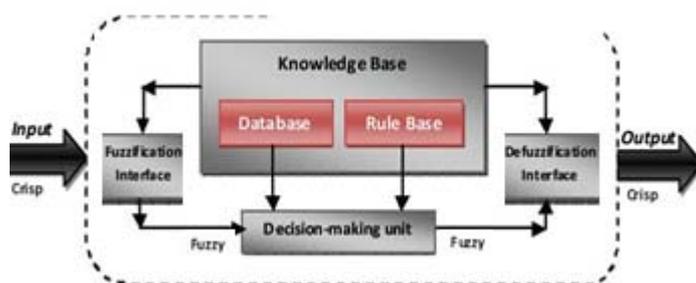
Figure 1: Fuzzy Interference System

It gets fuzzy input interact with knowledge base after it, it defuzzyfy the data after it give crisp value.

There are various method to determine migraine but I prefer fuzzy theory because it is more flexible and more reliable and very simple. Anything that can be made with traditional crisp system can also be determined by fuzzy theory but fuzzy cannot be converted into crisp with any techniques.

There is mainly two types of inference rule mamdani and sugeno. Mamdani takes fuzzy out whereas sugeno gives crisp output.

2. Migraine

One of the most unknown headaches is **migraine**. Still today there is knowledge of why and how migraine works that's why still there is no permanent remedy of migraine. Only symptoms decides whether someone has migraine or not. In migraine there is severe headache which persist for long time sometimes up to 72 hours. Pain is occur only one part of the or one side of the head. Some other symptoms are frequent urination; one of the most important symptom is sensitivity with light and sound. Another common symptom is nausea and vomiting, if you have severe headache but do not have symptom of nausea and vomiting that means you have not migraine. Another important symptom is aura, blurry image or vision, throbbing pain, pulsating pain, lack of sleep**.** One of the important facts is migraine dominates more than 60% of women while only 30% of men suffer from migraine. Only analgesic like asprin, paracetamol are use with high dose but they only reduce but not cure the migraine. Every year almost 70 lac hours waste due to migraine because due to migraine people can work due to severity of pain. Something which trigger the migraine are dry fruits, chocolate, ice cream etc. There are many symptoms which occur in migraine but have chosen headache intensity, headache duration, light and sound sensitivity, nausea and vomiting because they plays most important symptoms in migraine. Migraine is neurologic disorder.

Linguistic variable for migraine {no migraine, mild, moderate, severe}

Criteria used in expert system and their respective linguistic variable headache intensity {mild, moderate, severe} headache duration {no migraine, mild, moderate, severe}

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light and sound sensitivity {no effect, some effect, huge effect} nausea and vomiting {mild, moderate, severe}

3. Headache Intensity

It has three linguistic variable mild, moderate and severe. Headache intensity is most important symptoms of migraine. In migraine generally there is a moderate to severe headache intensity occurs. Study shows 90% of patient suffer severe headache. I used 0 for no pain and 1 for severe pain. Since there is no test which can measure headache, for the solution of that problem we give weight to the headache between [0, 1].
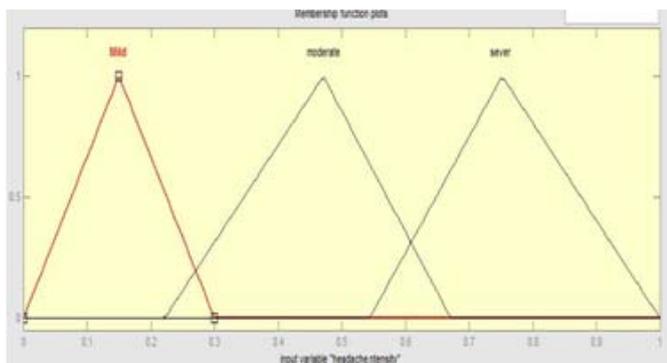
Figure 2: Headache intensity

Mild (0, .3)
moderate (.2, .65)
Severe (.55, 1)

4. Headache Duration

In migraine time duration of headache is most important. If headache persist for few hours then it may be common headache, if is go on for 6 to 9 hours then may be mild if it goes for up to 24 hours then it is moderate migraine if it persists for 72 hours the it is severe case of migraine
no migraine {0, 3}
mild {2, 8}
moderate{6,24}
 severe{36,72}
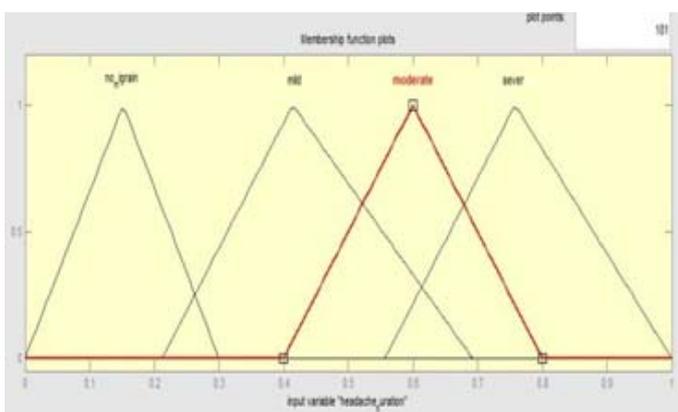
Figure 3: Headache duration

5. Light and Sound sensitivity

In more than 90% cases there are symptoms of sensitiveness with light and sound. People observe blurry light unknown sound problem with light and sound etc. Obviously there is

no measurement of these properties that's why I have given weight to them.
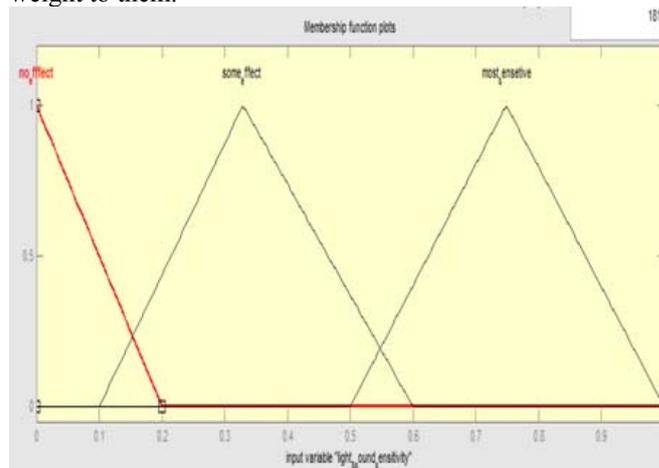
Figure 4: Light and sound sensitivity

No effect {0, .1}
some effect {.2, .6}
huge effect {.5, 1}

6. Nausea and vomiting

In any cases of migraine there is a symptom of nausea or vomiting. If someone has no such symptom then he/she not suffering from migraine.
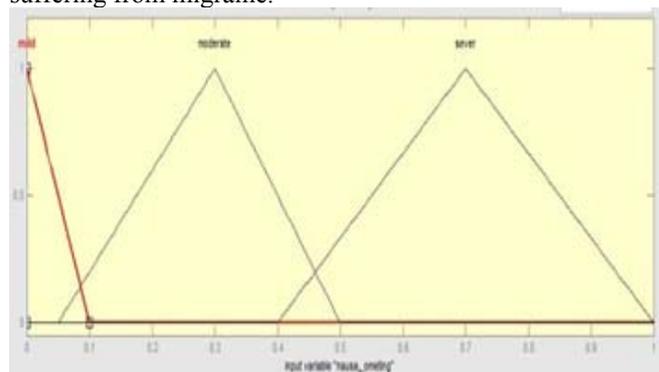

Figure 5: Nausea and vomiting

Mild {0, 2}
moderate {1, 5}
severe {3,10}

7. Rules

I used mamdani style for inference and if then rule are as follows.

8. Conclusion

This expert system not only for patient but also for doctors who are treating migraine. This expert system uses most important factors or symptoms of migraine. Matlab code used for making expert system. I used fuzzy logic toolbox for this purpose.

9. Future scope

This research used limited number and most important factor you can say symptoms of migraine symptoms varies from person to person. It might be possible that there may be huge amount of symptoms can be added it is a simplest expert system for migraine analysis and diagnosis.

10. Surface Curve
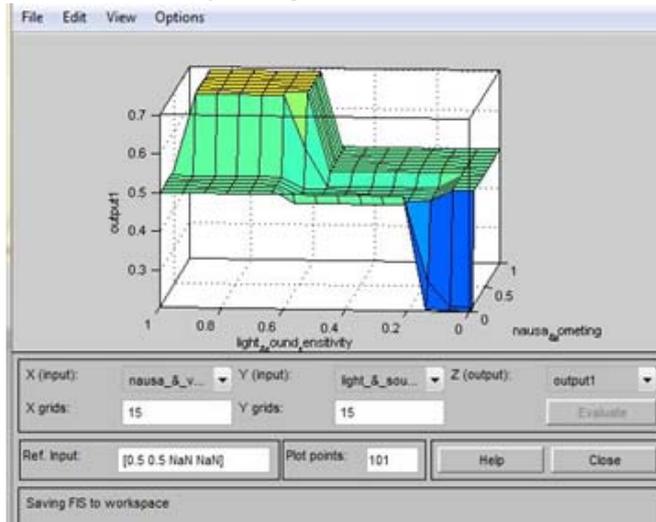
Figure 7: Rules

**Figure 6:** Surface graph

11. Output Graph
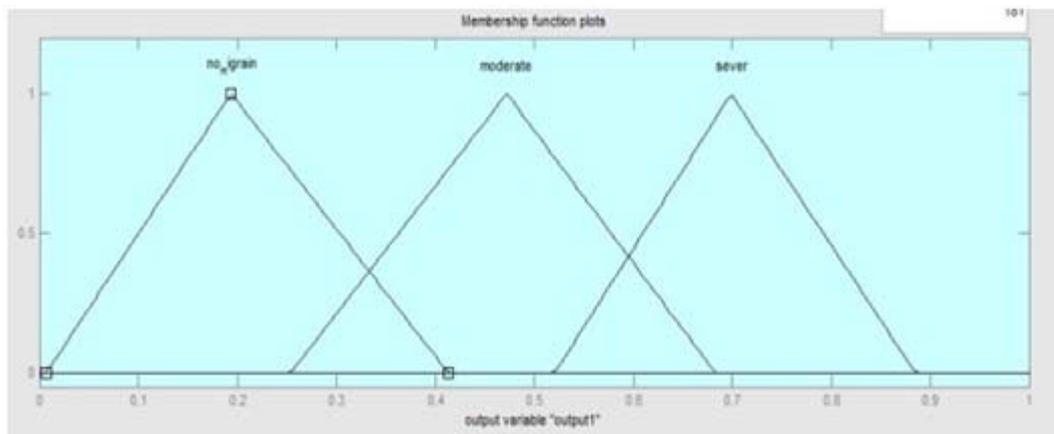
Figure 8: Output graph

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Author Profile

Vishal Chandra did B.Tech (CSE) and he is pursuing M. Tech in Artificial Intelligence.