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A Comparative Study On Decision Making Through Fuzzy Logic In Application Of Anaesthesia

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ABSTRACT:

This paper identifies how concept of fuzzy logic helps anaesthists to treat patients for painless surgery according to their characteristics and signs. This review gives a clear cut view of how the experts manage the consciousness and unconsciousness, pain and its relief moment of muscles and relaxation during prescribed time range using fuzzy logic system. It also compares human decision making and fuzzy logic decision making and drives to the fact which decision approach enhances the treatment of patients.

KEWORDS: *Anaesthesia, , fuzzy control system, bariatric surgery ,matlab, depth of anaesthesia*

INTRODUCTION

Fuzzy concepts deals with the things that are not certain and sure. The term fuzzy logic was presented with the proposition of fuzzy set theory by Lotfi Zadeh in 1965. Fuzzy logic is the extension of Boolean logic in contrast. Fuzzy logic is a many-esteemed logic which incorporates truth esteems that can be any genuine number somewhere in the range of 0 and 1 both comprehensive. All things considered, we face numerous circumstances where the outcome is questionable and obscure. In such circumstances we utilize fuzzy logic to predit the scope of the outcome. Fuzzy logic incorporates halfway truth and incomplete false additionally reality worth can be totally valid and totally false

Fuzzy logic assumes a significant job in medical decision making. Medicinal information need certainity now and again. Utilization of fuzzy logic in the spot of uncertainity brings about taking care of such issues. Fuzzy logic is like human reasoning and understanding and offers significance to patients side effects that are depicted utilizing terms like never, once in a while, some of the time, regularly, a large portion of the occasions, consistently, and so on.

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DEFINITION

Figure 1. Fuzzy control system

Linguistic variables: It is a variable whose values are in words or in natural language Example: never, rare, at some occasions, regularly

Fuzzification: Input values are translated to linguistic values and represented by fuzzy sets.

Fuzzy Inference: Fuzzy inference is a computer paradigm based on fuzzy set theory, fuzzy if-then-rules and fuzzy reasoning

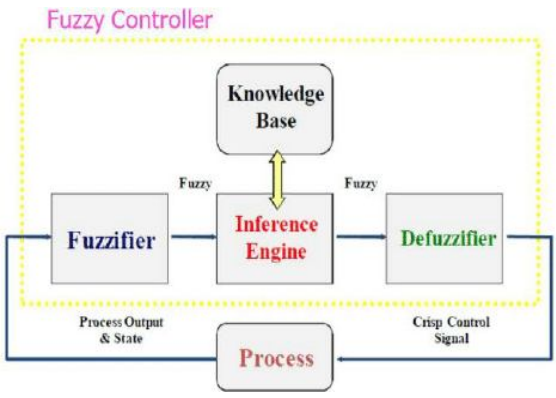
Defuzzification: A fuzzy system will have a number of rules that transforms a number of variabkes into a fuzzy result, that is the result described in terms of membership in fuzzy sets.

Mamdani Fuzzy Inference: It was first acquainted as a technique to make a control framework by synthesizing a set of linguistic control guidelines acquired from experienced human administrators. In a Mamdani framework, the yield of each standard is a fuzzy set.

Bariatric surgery:
Obesity is a major medical issue related with numerous complications. Bariatric surgery has been proposed as the best elective treatment for extraordinary obese patients.

Application of Anesthesia Anesthesia enables the painless performance of medical procedure. Three general classes of anesthesia exist:

- General anesthesia
- Sedation
- Local anesthesia



General anesthesia smothers central sensory system action and results in unconciousness and absolute absence of sensation. A patient getting general anesthesia can lose consciousness with either intravenous specialists or inhalation.

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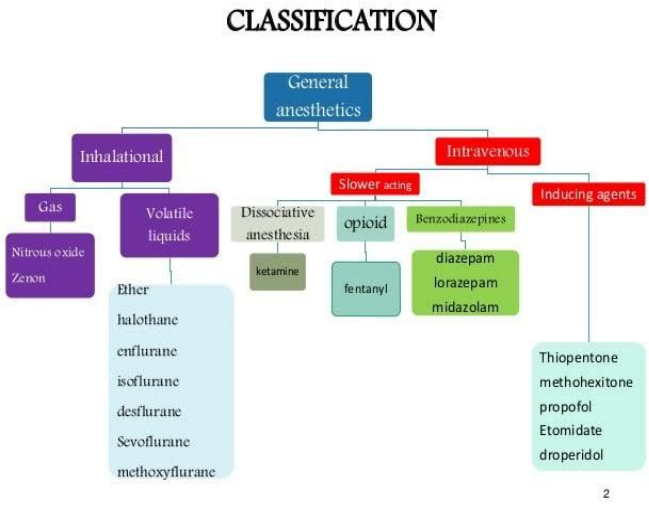

Figure2. General anesthetics classification

In bariatric surgery maintenance of anesthesia using desflurane has been proposed on account of its low blood:gas parcel coefficient which results in a progressively fast and reliable recovery profile. Effectively titratable medications, for example, remifentanil and propofol have likewise been effectively utilized in bariatric surgery.

Local anesthesia suppresses the transmission of nerve impulses from a particular part of the body.

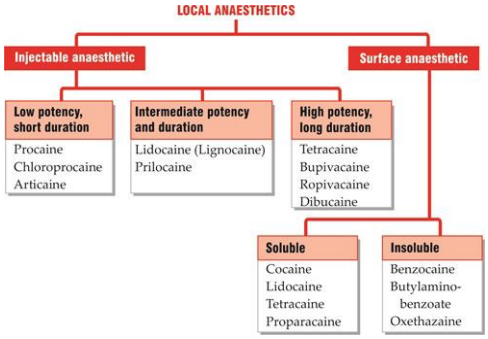

Figure 3. local anesthetics classification

Application on MATLAB

The application is actualized in MatLab which is an development environment, utilizing the Fuzzy Toolbox. Figure 4 demonstrates the fundamental methodology of the issue, the fuzzy controller takes the input sources (ASA physical status, BMI, AGE, WEIGHT,GENDER), forms the data and yields the depth of anesthesia (DOA).

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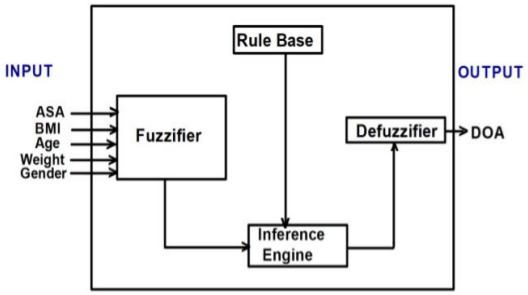

Figure 4. The Fuzzy Controller.

By utilizing Mamdani fuzzy inference method, Defuzzification with center point of gravity, the accumulation by the maximum, the subsets of the information and yield factors are in trapezes structure.

Application of fuzzy rules:

Before the details of the fuzzy control are handled, the scope of potential qualities for the Input and ouput factors are resolved. These are the enrollment capacities used to outline estimations of the genuine qualities to fuzzy values,so that tasks can be concerned them. Figure 5 demonstrates the input and output factors and their related enrollment capacities. The values of the input factors ASA physical status measured in grade points from I to IV BMI standardized and included in the range of [40-120] (unit of measure is kg/m2: kilogram/meter square). The input AGE is included in the range of [0-100] (unit of measure is year).Input WEIGHT is incorporated in the range [0-200] (unit of measure is Kilogram). The evaluation of the output variable DOA are standardized and in the range [0.7-5] (unit of measurement is mg/Kg)

MEMBERSHIP GRAPHS

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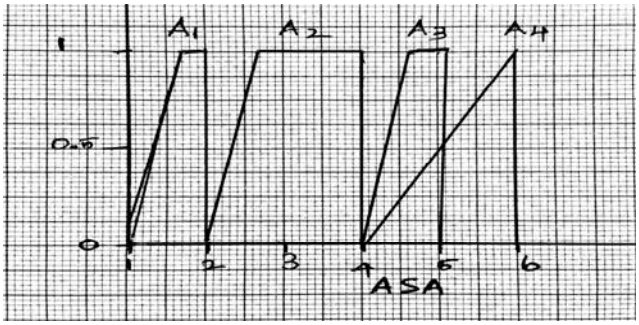

Figure 5. (a) Membership function of the ASA input.

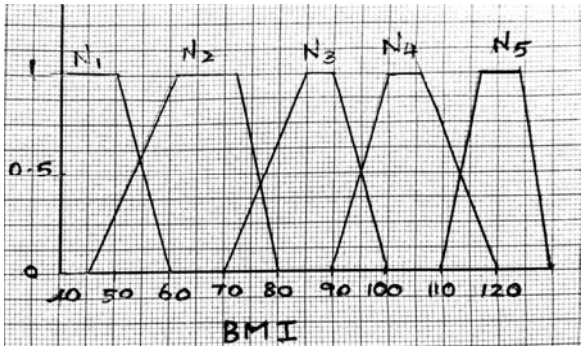

Figure 5. (b) Membership function of the BMI input.

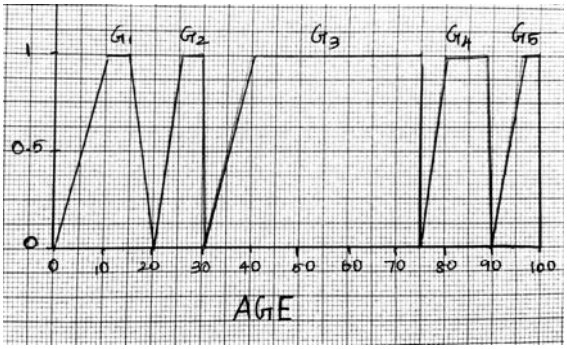

Figure 5. (c) Membership function of the AGE input.

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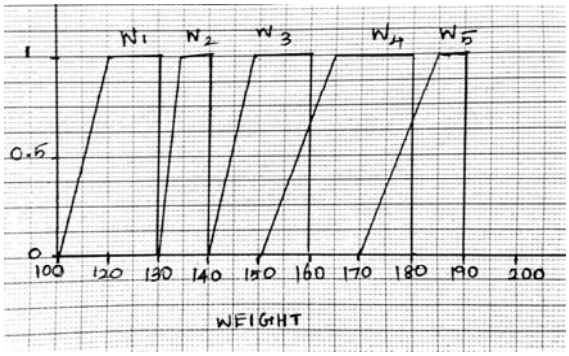

Figure 5. (d) Membership function of the WEIGHT input.

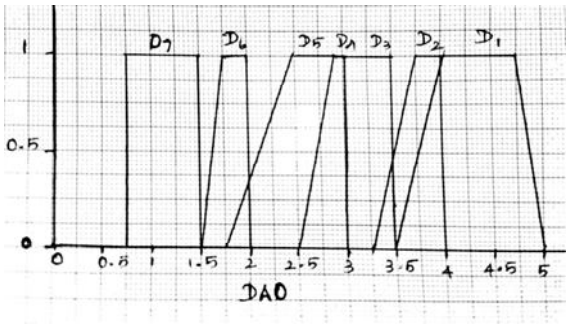

Figure 5. (e) Membership function of the DOA output.

The decision that the fuzzy controller makes is driven from the guidelines database. The principles utilized in our work depend on sound judgment, information from experimentation in a controlled domain. The standard sets utilized here to get the output are listed in Table 1.

The decision rule is as follows, for instance: see (3) in table:
If A3 and N2 and G3 then we decide D4, as it is shown in the table 1
If we take the following values: ASA = 3 → A3, BMI= 40 → N2, AGE = 30 → G2 , WEIGHT = 130 → W1
So: we decide D4 =3.5

DECISION RULES

S.No	ASA physical ststus	BMI	AGE	WEIGHT	GENDER	DOA
1	A1	N3	G1	W3	F	D4
2	A2	N1	G2	W3	F	D6
3	A3	N2	G3	W1	M	D4

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4	A4	N2	G4	W2	M	D3
5	A4	N3	G4	W4	F	D5
6	A5	N4	G5	W5	M	D6
7	A3	N5	G6	W6	F	D2
8	A1	N5	G3	W2	M	D3
9	A2	N6	G3	W4	M	D4
10	A3	N5	G4	W5	F	D2

Table 1. Decision matrix

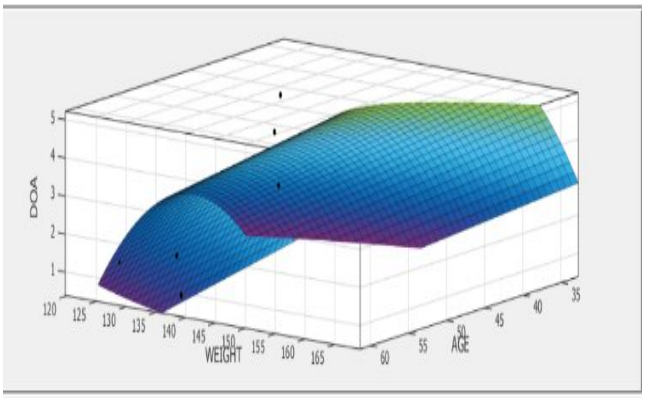

Figure 6. Surface of the DOA output according to the AGE AND WEIGHT inputs.

The results presented in Figure 6 show how will differ the administered dose that will be the answer in different conditions compared to two parameters: weight and age. We observed a curved structure in dosages of anaesthesia by fuzzy control system contrasted with the choice of anaesthetists.

CONCLUSION:

Fuzzy control system assumes a vital role in the application field of anesthesia. From the study we notice that utilizing the fuzzy logic control system the time can be decreased and the specialists can go to progressively large number of patients in short span of time range. Fuzzy controllers perform well than human decisions within restricted range of time. The fuzzy controller can imitate the decisions of the anaesthesists. Fuzzy logic gives great outcomes in connection to Boolean logic or different frameworks. Our study is to compare the decision making by fuzzy control system and anaesthists, In that point of view this paper shows the decision of fuzzy controller is better than human decision making. Hence Fuzzy controller proposed with appropriate fuzzy rules can be installed in hospitals to enhance the treatment of patients which reduces the need of anesthetists.

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REFERENCES:

[1] S.Rajasekaran and G.A Vijayalakshimi pai, Neural networks and fuzzy logic and genetic algorithms published by PHI.

[2]Senen Barro and Roque Marin, study of fuzziness and soft computing, published by Springer-Verlag Berlin and Heidelberg GmbH & Co. KG

[3] Chennakesava R. Alavala, Fuzzy logic and neural networks basic concepts and application, Published by New Age International Pvt Ltd

[4]Abraham kandel and Gideon Langlohz Fuzzy control systems, Published by CRC Press

[5]Jerry M. Mendel,Hain Hagra, Woei-Wan Tan,William W. Melek, Hao Ying introduction to type 2 fuzzy logic control- theory and applications Published by Wiley-IEEE Press

[6]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1079229/

[7]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4504868/

[8]https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1079229/

[9]https://journalofinequalitiesandapplications.springeropen.com/articles/10.1186/1029-242X-2013-82

[10]https://www.researchgate.net/publication/237265131_Intelligent_Alarms_for_Anaesthesia_Monitoring_Based_on_a_Fuzzy_Logic_Approach