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Fuzzy Set & Fuzzy logic in soft computing

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Abstract: fuzzy logic is more accessible to fuzzy logic researchers to promote their research, designs, and use. for this purpose, this paper explains in simple - what is fuzzy logic(FL), & why to study fuzzy representations. what are the basic concepts used in FL such as Fuzzy sets, fuzzy operators, fuzzy relations and how each of they are different than classical representations. also it explains how to represent fuzzy basics conceptually & mathematically , Application domains of fuzzy logic.

Keywords: fuzzy sets Vs crisp sets,fuzzy logic,fuzzy operators,fuzzy relations Vs Crisp relations ,Applications domains of FL

I. INTRODUCTION

1)***Basics***-The modelling is done by 3 most popular techniques in soft computing that are used for knowledge representation which are,
1)fuzzy logic & fuzzy set theory(having vast use in various areas such as operation, planning, and control)
2) AI(A similar process is used in Fuzzy logic that is essential to develope human-like capabilities for artificial intelligence. And neural network (ANN) artificial NN is artificial brain developed that does same work as biological brain or Biological Neural Network (BNN).
3)A Genetic Algorithm (GA) is evolutionary algorithm that uses techniques under evolutionary theory such as inheritance, mutation, selection, and crossover (which is also known as recombination) for producing off springs from existing parents for survival.

2)what is fuzzy logic
the concept *fuzzy logic* was invented by Dr. Lotfi Zadeh at research laboratory at University of California, Berkeley, in the 1960s. Fuzzy logic is a multi-valued logic approach to compute "degrees of truthness" rather than the boolean /traditional logic that contains values "true or false" (1 or 0) that states either full or non –membership. the basic concept in FL, which plays a central role in its applications, is fuzzy if-then rules or simply, fuzzy rules to find truthness . Fuzzy logic is a convenient way to map an input space to an output space.

Fuzzy logic works as our brains works/thinks by intitution which contains input of kind uncertainty, vague, imprecision and partially truthness i.e. values between interval [0,1].
It also used for approximate human reasoning capabilities.

3)Why to use Fuzzy logic?
fuzzy logic is used in order to solve many real-world problems.
Fuzzy logic is flexible.

Fuzzy reasoning or intitution yields better understanding the process.

Fuzzy logic uses natural language so real life issues can be represented easily by FL also Fuzzy logic simplifies implementation of conventional computations.

fuzzy logic is easy to use as it is built on qualitative description used in everyday's human language, as we use words 'not sure', 'maybe' ,'that depends' and so on. i.e. qualitative statements that neither true nor false ,no certain situation.

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1) When Not to Use Fuzzy Logic:
2) if input space can not be mapped to output space don't use FL.

4)Fuzzy sets Vs Crisp sets:-

Fuzzy set is the basic concept of fuzzy logic theory. fuzzy logic (FL) is theory of fuzzy set with unsharp or movable i.e. not fixed or variable boundaries in which membership is a matter of degree.

The membership of each element in classical or crisp set theory is binary i.e. 1 means an element x in universe X *must* belong to a set *S* and 0 means an element x in universe X is not belongs to a set *S* For example,
A={1,2,3,4}
A fuzzy set A in membership X is denoted as μA (x) is pronounced as the degree of membership of element x in fuzzy set A for each x ϵ X. All membership values lies between only [0,1] interval.

Where X = {x1, ……, xn} is a finite universal set.

$$\tilde{A} = \left\{ \frac{1}{10} + \frac{0.9}{20} + \frac{0}{30} \right\}$$

Where ,X=(10,20,30) be Universal Set.
={1,0.9,0} be fuzzy set on Universe X.

5)Fuzzy Relations Vs Crisp Relations:-

1)Crisp relation-

A = { 1, 2, 3 }

B = { a, b, c, d }

=mapping of each element from set A to each element from Set B

A X B = { (1, a), (1, b), (1, c), (1, d) ,(2, a), (2, b), (2, c), (2, d) (3, a), (3, b) (3, c), (3, d)}

2)Fuzzy relation-

$$\tilde{A} = \left\{ \frac{1}{10} + \frac{0.9}{20} + \frac{0}{30} \right\}$$

$$\tilde{B} = \left\{ \frac{0.5}{10} + \frac{0.2}{20} + \frac{0.4}{30} \right\}$$

Relation can be denoted with Let AϵX, BϵY be universal sets then,
$R = \mu_R (X , Y) \}$

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=min (row1=(1,0.5),(1,0.2)(1,0.4)), row2=(0.9,0.5),(0.9,0.2)(0.9,0.4), row3=(0,0.5),(0,0.2),(0,0.4))

$$= \begin{pmatrix} 0.5 & 0.2 & 0.4 \\ 0.5 & 0.2 & 0.4 \\ 0 & 0 & 0 \end{pmatrix}$$

6) operators used in Fuzzy logic

Fuzzy logic works as Boolean logic but with 3 membership valued logic.

full -membership or 1 or true

partial - membership or [0-1] or may be

non- membership or 0 or false

It uses basic operators for fuzzy sets& relations AND, OR, NOT. These are called *Zadeh operators*:

AND ∧ min(x,y)

$$\tilde{A} = \left\{ \frac{1}{10} + \frac{0.9}{20} + \frac{0}{30} \right\}$$

$$\tilde{B} = \left\{ \frac{0.5}{10} + \frac{0.2}{20} + \frac{0.4}{30} \right\}$$

OR ∨ max(x,y)

NOT - 1-x

Also FL contains operators on Fuzzy relations like,

1) Composition

2) Cartesian product

There are also special fuzzy operators called linguistic hedges used for adverbs such as *very* ,*extremely* ,*indeed*, or *somewhat*, which modify the meaning of fuzzy set.

Concentration ,dialation ,intensification

6) Applications of fuzzy logic

The wide range of applications of FL ranging from consumer perspectives to industrializations.

1) neural networks, expert systems , artificial intelligence ,robotics, facial pattern recognition ,image processing, air-conditioning,
2) medical purpose- medical diagnostics
3)education- economy, management, sociology, , psychology,

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4)decision-support systems

5)customer products-cameras, Photo copies, camcorders
6)home products- washing machines, Refrigerators, Toasters, Television ,microwave ovens ,food processors
7)Target tracking ,Transport planning, flight aid for helicopters,

8)Temperature control ,weather forecasting
9) to improve driving comfortability improved fuel consumption for automobiles,

II. CONCLUSION

We have learned in brief the basics of fuzzy logic and set theory in soft computing, and have surveyed a vast areas of applications of fuzzy logic ranging from the purely theoretical to the real life problems.

REFERENCES

[1] Almeida, J. P., Oliveira, J. F., & Pinto, A. A. (2015). Operational Research: IO 2013 - XVI Congress of APDIO, Bragança, Portugal, June 3-5, 2013. Springer
[2] https://www.researchgate.net/publication/312212400_Fuzzy_Genetic_Algorithms_Fuzzy_Logic_Controllers_and_Genetics_Algorithms [accessed Feb 02 2018].
[3] Inma P. Cabrera, Pablo Cordero, and Manuel Ojeda-AciegoDept. Matematica Aplicada, Univ. de Malaga. Spainf ipcabrera,pcordero,aciegog@uma.es
[4] Hermawanto, D. (2013). G. algorithm for solving simple mathematical equality problem. arXiv preprint arXiv:1308. 4675. (2013). Genetic algorithm for solving simple mathematical equality problem. arXiv Preprint arXiv:1308.4675.
[5]. Herrera, F., & Lozano, M. (1996). Adaptation of genetic algorithm parameters based on fuzzy logic controllers. Genetic Algorithms and Soft Computing, 8, 95–125.
[6] H.J.Zimmermann “Fuzzy set theory and its application”, 4th edition, Kluwer Academic Publishers, Boston, 2001.
[7] A.Rosenfeld and Fuzzy graphs. “In Fuzzy sets and their application to cognitive and decision processes” L.A.Zadeh, K.S.Fu, K. Tanaka and M.Shimura, Academic Press New York, 1975.