Journal of Artificial Intelligence
ISSN: 2229-3965 & E-ISSN: 2229-3973, Volume 3, Issue 2, 2012, pp.-90-93.
Available online at http://www.bioinfo.in/contents.php?id=71

INTRODUCTION TO ARTIFICIAL INTELLIGENCE SYSTEM

PURANIK N.N.

Amolakchand Mahavidyalaya, Yavatmal, India.
*Corresponding Author: Email- nilunarayan@yahoo.co.in

Received: February 21, 2012; Accepted: March 15, 2012

Abstract- Artificial intelligence is the area of computer science concerned with designing intelligent computers system. It includes neural network fuzzy logic and probabilistic reasoning expert system cellular automata. Out of these technologies neural network fuzzy logic and probabilistic reasoning are predominantly known as soft computing.
Just as crisp set theory has influenced symbolic logic fuzzy set theory has given rise to fuzzy logic. It is multi-value logic. Fuzzy logic has found extensive patronage in consumer products especially promoted by the Japanese Companies and has found wise use in Control System pattern recognition application and decision making. Fuzzy set theory is an excellent mathematical tool to handle the uncertainty arising due to vagueness.
In this research paper I have presented real life problem which can be considered as a fuzzy set.

Citation: Puranik N.N. (2012) Introduction to Artificial Intelligence System. Journal of Artificial Intelligence, ISSN: 2229-3965 & E-ISSN: 2229-3973, Volume 3, Issue 2, pp.-90-93.

Introduction

The primary purpose of the paper is to facilitate education in increasing important areas of fuzzy set and fuzzy logic - No previous knowledge of fuzzy set theory or fuzzy logic is required for an understanding of the material in this paper. Although we assume that the reader is familiar with the basic notion of classical (nonfuzzy) set theory and classical (two valued) logic.

Fuzzy sets

Consider the following statements, which some of us make often in many common situations:

- "A set of smart people
- The boy is tall, hence this shirt will be short for him
- Do not give less kerosene to me
- This month we might require extra sugar.
- Air-travel is expensive
- Chinese girls have small eyes
- Today is very hot
- He is slow."

In the above statements, there are many instances such as hot temperature, slow person, and extra sugar which are not sharply defined. Hence we may call them fuzzy statements. Statements which convert sharply defined meanings could be called crisp statements. However as a human we do make sense out of this kind of information or corresponding sets, and use them effectively in decision-making.
Many of these statements cannot be considered to be true or false. For example, the statement 'He is slow' cannot be attributed an absolute meaning. There could be some one slower than him and then we are in a fix.
A logic based on two truth-values T and F is, as has been argued above, many times inadequate when describing the human reasoning. Fuzzy logic uses the whole of the interval between 0 and 1 to describe human reasoning. As a result, fuzzy logic finds many real applications. It is being applied in rule based automatic controllers. Even a commonly used washing machine has automatic selectors, which are fuzzy.
Consider U to be the universal set, which is the starting point of defining a Set in Set algebra. A definable grade of membership of

an element for all its members describes a fuzzy set (Zadeh, … ref). Zadeh, the founder the theory of fuzzy logic and sets, does not give a formal basis for how to determine the grade of membership.
The grade of membership is a precise but subjective measure that depends on the context. For example, can I classify the people sitting in this hall, and who are listening to my lecture, as Young, Middle aged and old?
Now the universal set U = {all the people in the Hall}.
Fuzzy sets which I am trying to define are
Set 1 = Young , Set 2 = Middle aged, Set 3 = Old

Now let me define Youth (fullness):
1 if age is less than or equal to 25
¾ if age is less than or equal to 28 but greater than 25
0 if age is greater than 28

Further, let me define Middle (fullness):
0 if age is less than or equal to 25
2/3 if age is less than or equal to 28 but greater than 25
1 if age is less than or equal to 40 but greater than 28
1/3 if age is less than or equal to 50 but greater than 40
0 if age is greater than 50

further let me define Old(age) as :
0 if age is less than or equal to 40
1/4 if age is less than or equal to 45 but greater than 40
¾ if age is less than or equal to 50 but greater than 45
1 if age is greater than 50

Now consider the following cases.
Case I: Now if Mr. Hitesh in the audience is aged 23
His membership to Youth is 1, i.e he is certainly young,
His membership to Middle is 0 , and membership to Old is zero.
Case II : If Mrs. Janaki is aged 45 then
Her membership to Youth is 0
Her membership to Middle is 1/3
And Her membership to Old is also 1/4.
In other words Mrs. Janaki is not young, but is somewhat middle aged, and may be somewhat old as well. She has 0 grade membership to fuzzy set Young, and has 0.33 grade membership to set Middle and 0.25 grade membership to fuzzy set old.
So every member of the audience will have some grade of membership to Young, Middle and Old simultaneously.
This is not possible with crisp sets where every member will be either Young, if not he could be in Middle age group, if not even that then he would certainly be old. That is he will have an exclusive membership of any one set.
An application of the universe is to suppress faulty measurements data. We can be dealing with non-numerical scales as well. The elements taken from psychological continuum form an example of such universe.
Membership function: Mathematically a Fuzzy set is the collection of ordered pairs A = (x, m(x)), where Item x belongs to the universe and m(x) is its grade membership in A. A single pair (x, m (x)) is called fuzzy singleton. Thus the whole set can be viewed as the union of its constituent singletons. It is often convenient to think of set A just as a vector{ (m(x1), (m(x2),-----)it is understood then that each position i,=12,3,4,5,6,7,8,9-------n) corresponds to a point in the universe
Example: A fuzzy set of real numbers “much greater than 5” is a function
A: R → [0 ,1] defined as
A(x) = 0 if x is less than equal to 5
=(x - 5)/x otherwise
Note that: if the number is 1/3 then its membership to “much greater than 5 is zero.
If the number is 6 it is (6 -5)/6 = 1/6 = 0.166667
If the number is 30 it is (30 –5/30) = 25/30 = 0833333
So we see that the strength of membership of 30 to “Much greater than 5” is strong compared to membership of number 6. This is obvious. And numbers less than 5 have zero grade membership as expected.
A complement of about fuzzy set “Much greater than 5 “could be” not much grater than 5”. The obvious choice for the complement fuzzy set could be
~A : R → [0 ,1] defined as
~A(x) = 1 if x is less than equal to 5
= 1 - (x - 5)/x = 5/x otherwise
Note that AÈ~A = U. i.e. grade of a membership of a number to A and its complement put together is always 1.Which says in words everything that is in A, and everything that is not in A, put together is everything. This statement is known as the law of excluded middle. Here is another example:
We define V={a ,e, i o, u}.
C = ~V the set of a consonant or a vowel. However we know that in English the letter y is sometimes vowel and sometime consonant for example in “my” y is vowel, but in the words “yours” it is not. Does y belong in set of V or in set of C the set of consonant? The answer is unclear because y does not fit neatly into either in V or in C but rather in both. This means that rule separating vowels and consonants does not lead mutually exclusive classification of letters suggested by the dichotomy between Vowels and consonants. The letter y violates the law of excluded middle that is assumed when we define C= ~V Thus law of exclusive middle and law of contradiction are violated in fuzzy set theory under the standard fuzzy sets operation.

Level Set
Concept of level sets play crucial role in fuzzy role in fuzzy arithmetic and fuzzy logic
Definition ----Let Abe fuzzy set in U and a[0,1].The set \A(X) a}is called a level set or simply a-cut of A and the set \A(X)> a}is called strong a level set or simply a-cut of A.
Example
Consider the fuzzy set
A= .5/1+0.2/2+0.8/3+0.6/4+0.2/5+0.9/6+o.4/7+0.3/8+1.0/9+0.3/10
Then

- $^{0.5}A=\{1,3,4,6,9\}$
- $^{0.5+}A=\{3,4,6,9\}$
- $^{0.7}A=\{3,6,9\}$

- $^{1.0}A = \{9\}$

Properties

- $^{\alpha+}A \subseteq {}^{\alpha}A$
- $\alpha \leq \beta \Rightarrow {}^{\beta}A \subseteq {}^{\alpha}A$
- $^{\beta+}A \subseteq {}^{\alpha+}A$

Operation on fuzzy sets

- A is said to be contained in B, i.e. A $\subseteq$ B if A(x) $\leq$ B(x) $\forall$ x $\in$ U
- The fuzzy set A $\cap$ B in U is called in intersection of A and B if

A $\cap$ B(x) = min{A(x), B(x)}, $\forall$ x $\in$ U

- The fuzzy set A $\cup$ B in U is called union of A and B if

A $\cup$ B(x) = max {A(x), B(x)}, $\forall$ x $\in$ U

- the fuzzy set ~A in U is called complement of A if ~A(x) =(1-A (x))

The well known properties of sets are found true even in the case of fuzzy sets.

- A $\cap$ B = B $\cap$ A and A $\cup$ B=B $\cup$ A
- (A $\cap$ B) $\cap$ C=A $\cap$ (B $\cap$ C)and (A $\cup$ B) $\cup$ C=A $\cup$ (B $\cup$ C)
- A $\cap$ A=Aand A $\cup$ A=A
- (A $\cap$ B) $\cup$ C=(A $\cup$ C) $\cap$ (B $\cup$ C) and (A $\cup$ B) $\cap$ C=(A $\cap$ C) $\cup$ (B $\cap$ C)
- (A $\cap$ B) $\cup$ B=B and (A $\cup$ B) $\cap$ B=B
- ~((A $\cap$ B) = ~A $\cup$ ~ B

Let A and B be fuzzy sets in U then

$$^{\alpha}(A \cap B) = {}^{\alpha}A \cap {}^{\alpha}B$$
$$^{\alpha}(A \cup B) = {}^{\alpha}A \cup {}^{\alpha}B$$
$$^{\alpha+}(A \cap B) = {}^{\alpha+}A \cap {}^{\alpha+}B$$
$$^{\alpha+}(A \cup B) = {}^{\alpha+}A \cup {}^{\alpha+}B$$
$$A \subseteq B \Rightarrow {}^{\alpha}A \subseteq {}^{\alpha+}B and\, {}^{\alpha+}A \subseteq {}^{\alpha+}B$$

$$({}^{\alpha}A)^{c} = ({}^{1+\alpha}A)^{c}$$

Definition Let A be fuzzy sets in U then we define the following two valued fuzzy sets 1 is the fuzzy set defined as follows

$$_{\alpha}A(x) = \alpha, if A(x) \geq \alpha$$

= 0 otherwise

2 $^{\alpha+}A; U \to [0,1]$ *is the fuzzy set defined as follows*

$_{\alpha+}A(x) = \alpha$ *, If A(x)>α*

= 0 otherwise

Here is an example for illustration.
A "Four person family wants to buy a house. An indication of how comfortable they want to be is the number of bedrooms in the house. But they also want a large house
Let U={1,2,3,4,5,6,7,8,9, 10}
Be the set of avaliable houses described by their number of bedrooms then the fuzzy set C
for "most comfortable house" may be give as
C [1,2,3,4,5,6,7,8,9,10] = [0.2,0.5,0.8,1,0.7,0.3,0,0,0,0].
Here C[6] = 0.3 means that membership of 6th house has a comfort grade of 0.3.
C[4] = 1 in the above function, means that 4th house is the most comfortable.
Let L be the fuzzy set L (large) defined as
L[1,2,3,4,5,6,7,8,9,10] = [0,0,.2,.4,.6,.8,1,1,1,1]

The intersection of comfortable and large then would be

C $\cap$ L = [0,0,.2,.4,.6,.3,0,0,0,0]

This shows fifth bedroom is optimal but only satisfactory to the grade 0.6.
The second best solution is fourth bedroom with membership value of 0.4.
The union of two fuzzy sets "comfortable and large" is given by membership
function
CL =[.2,.5,0.8,1,0.7,0.8,1,1,1,1]

Here fourth bedroom is fully satisfactory with membership 1.0. House numbers
7-10 are also fully satisfactory.
Complementary of L is [1,1,0.8,0.6,0.4,0.2,0,0,0,0]

Here is a test for your knowledge of secret of youthfulness.

State whether the following statements are right or wrong (R/W).
If your answers to the nine to ten questions are correct then you are one of
"The best person who knows secrets of YOUTH"
If your answers are correct to 5 to 8 then you will be considered as one of
"Better person how to maintain youth"

If your answers are correct to 1 to 3 statements then you are considered as
"Worst person who does not know secrets of YOUTH"

Questions

1) Very large friendship circle, engrossed in work, willingness to share responsibility these are special qualities of youth. R/ W
2) How far you like yourself is the basis of how for you will look? R/ W
3) You may be black or white in color you are young provided you maintain the shining and smoothes of your skin R/W
4) Tensions are advantages they give us sense of responsibility as a result of which we maintain our youth R/W
5) Exercise keeps us healthy but freshness of youth is something different. R/W
6) In spite of sufficient sleep old-age comes earlier. R/W
7) Youth is protected by balanced foursquare meal R/W
8) Old-age comes earlier due to smoking R/W
9) Drinking sufficient water is harmful to our skin R/W
10) Walking in air keeps our skin good R/W

Answers

1) Right - Enjoying Friends Company and enjoying happiness of our life is really an index of youth.
2) Right - one who loves oneself never get depressed His attitude towards life is +ve This means his youth is permanent whatever may be his age.
3) Wrong - Color of skin and youth are not related Skin automatically becomes shining provided you are healthy.
4) Wrong - Tension creates BP. And other diseases hence lesser the no of tensions in life greater is the happiness of youth.
5) Wrong - If we start exercise in proper age youth can be protected permanently freshness of youth and energy is protected for a long time.
6) Right - Insufficient sleep makes blood veins dry. Dark circle appear below the eyes
7) Right - Nutritious food gives sufficient calcium both become strong due to that youth also maintain permanently.
8) Right - Smoking is injurious to health alternately to our youth.
9) Wrong - Sufficient water keeps skin healthy and shining.
10) Wrong - Walking in unpolluted air keeps our skin good.

Result If your 7answers are correct then you should congratulate yourself because you know the secret of youth

Now we construct a set of corrected answers of group of ten people
Z={1,2,3,4,5,6,7,8,9,10}
Now we allot a degree
10 - 1
9 - 9{best}
8 - 6
6 - 6
7 - 7
5 - 5
4 - 4
3 - 3
2 - 1
1 - 0
The above simple exercise shows how to fuzzify real situations.

References

[1] George J. Klir & Yuan B., *Fuzzy sets and fuzzy logic*.
[2] Tanaka K., *An introduction to Fuzzy Logic for practical Applications*.
[3] Kumbhojkar, *Asserting Impression by Mathematics*.