Research Paper Education

Job Oriented Decision using Intuitionistic Fuzzy Sets

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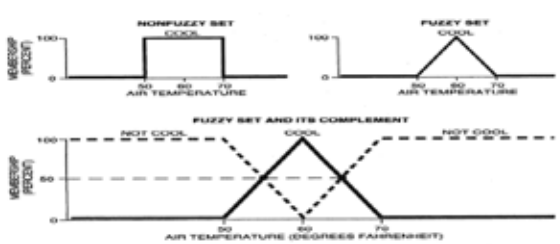
ABSTRACT

The theory of fuzzy sets proposed by Zadeh has achieved a great success in various fields. Out of several higher order fuzzy sets, the concept of an intuitionistic fuzzy set (IFS) introduced by Atanassov has been found to be highly useful to deal with vagueness/imprecision. One the promising role of IFS has been emerged in Decision making Problems. In this paper, we reviewed the concept of IFS and proposed its application in career determination using normalized Euclidean distance method to measure the distance between each student and each career respectively. Solution is obtained by looking for the smallest distance between each student and each career.

KEYWORDS : Euclidean distance, fuzzy set,, Intuitionistic fuzzy set, hesitation margin, membership degree, IT domain.

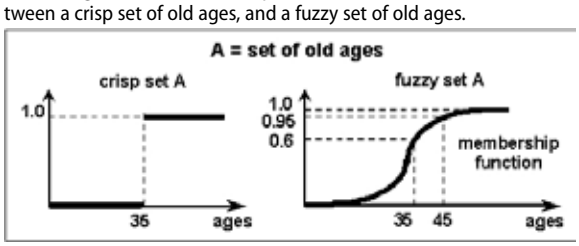
Introduction

Intuitionistic fuzzy sets are **sets** whose elements have degrees of membership and non-membership. **Intuitionistic fuzzy sets** have been introduced by Krassimir Atanassov (1983) as an extension of Lotfi Zadeh's notion of **fuzzy set**, which itself extends the classical notion of a **set**. **Intuitionistic fuzzy sets** are sets whose elements have degrees of membership and non-membership. Intuitionistic fuzzy sets have been introduced by Krassimir Atanassov (1983) as an extension of Lotfi Zadeh's notion of fuzzy set, which itself extends the classical notion of a set.



Fuzzy set theory provides a major newer paradigm in modeling and reasoning with uncertainty. Though there were several forerunners in science and philosophy, in particular in the areas of multivalve logic and vague concepts. Zadeh, a professor at Berkeley was the first to propose a theory of fuzzy sets and an associated logic, namely fuzzy logic. Essentially, a fuzzy set is a set whose members of the set may have degrees of membership between 0 and 1, as opposed to classical sets where each element must have either 0 or 1 as the membership degree—if 0, the element is completely outside the set; if 1, the element is completely in the set. As classical logic is based on classical set theory, fuzzy logic is based on fuzzy set theory.

In fuzzy sets, the transition from membership to non-membership in sets is gradual and not abrupt. Shown below is the difference between a crisp set of old ages, and a fuzzy set of old ages.



In the illustration of fuzzy set A, ages 35 years or below are still members of fuzzy set A of old ages but their degrees of membership are lower. Degrees of membership in fuzzy sets are in the range of 0.0 (non-membership) to 1.0 (full-membership) in contrast to only either 0.0 (member) or 1.0 (non-member) in crisp sets. Generally, membership degrees in the fuzzy set of old ages decrease as ages decrease. If we have another fuzzy set B of young ages, we expect the membership degree to increase with age.

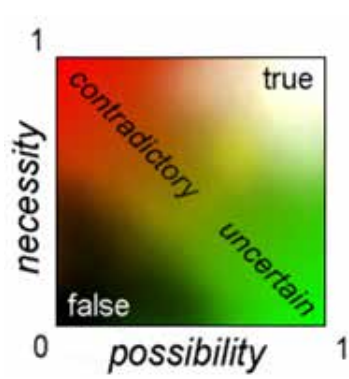
From the above firgure, an age of 45 may be perceived in fuzzy logic as *old* at a degree of around 0.95 and as *young* at a degree of around 0.5. Thus, we move from exact, crisp measurements to inexact, fuzzy perceptions which are normally associated to words or linguistic terms.

Fuzzy logic is applied in expert systems to handle linguistic uncertainties which experts use when they verbalize their knowledge about a particular domain. Degrees of uncertainty are used not only in representing expert knowledge, but also in processing expert tasks.

INTUITIONISTIC FUZZY SET:

This paper discusses the origin, motivation, current state of research and open problems of an extension of Zadeh's fuzzy sets [7]. Intuitionistic Fuzzy Sets (IFS) are extensions of the standard fuzzy sets. All results which hold of fuzzy sets can be transformed here, too. Also, any research based on fuzzy sets can be described in terms of IFS.

There are applications of IFSs in medical diagnosis and in decision making in medicine, developed by Anthony Shannon, Soon Ki-Kim and others. There are many applications of IFS in chemistry. There are also IF generalized nets models of the gravitational field, in astronomy, sociology, biology, musicology, controllers, and others.



We use Intuitionistic fuzzy sets as tool since it incorporate the membership degree (i.e. the marks of the questions answered by the student), the non-membership degree (i.e. the marks of the questions the student failed) and the hesitation degree (which is the mark allocated to the questions the student do not attempt).

Let S = {S_1, S_2, S_3, S_4, S_5} be the set of students, C = {System Analyst, Data Analyst, Software Developer, System and Database Admin} be the set of IT careers and Su = {CP, DS, OOPs, PPL, SPM, JP, DBMS, DWM, UML&DP, OS, UNIX} be the set of subjects in their UG related to their IT careers. We assume the above students sit for examinations (i.e. over 100 marks total) on the above mentioned subjects to determine their IT career placements and choices.

IT Career Positions:

SA	System Analyst
DA	Data Analyst
SD	Software Developer
SDBA	System and Database Admin

Subject Abbreviations:

CP – Computer Programming	PPL – Principles of Programming Languages	DBMS – Database Management Systems
DS – Data Structures	SPM – Software Project Management	DWM – Data Ware housing and Mining
OOPs – Object Oriented Programming through C++	JP – Java Programming	UML & DP – Unified Modeling Language & Design Patterns

The table below shows IT Career and related subjects requirements:

Table-1: IT Career Vs Subjects

	CP	DS	OOPs	JP	PPL	SPM	UML&DP	DBMS	DWM	OS	UNIX
SA	(0.6,0.3,0.1)	(0.5,0.3,0.2)	(0.7,0.2,0.1)	(0.6,0.3,0.1)	(0.7,0.2,0.1)	(0.8,0.2,0.0)	(0.9,0.1,0.0)	(0.5,0.3,0.2)	(0.3,0.5,0.2)	(0.4,0.4,0.2)	(0.3,0.6,0.1)
DA	(0.7,0.2,0.1)	(0.6,0.3,0.1)	(0.5,0.3,0.2)	(0.5,0.3,0.2)	(0.6,0.3,0.1)	(0.7,0.2,0.1)	(0.6,0.3,0.1)	(0.8,0.2,0.0)	(0.9,0.1,0.0)	(0.2,0.6,0.2)	(0.3,0.5,0.2)
SD	(0.9,0.1,0.0)	(0.7,0.2,0.1)	(0.8,0.2,0.0)	(0.7,0.2,0.1)	(0.9,0.1,0.0)	(0.6,0.3,0.1)	(0.7,0.2,0.1)	(0.6,0.3,0.1)	(0.5,0.3,0.2)	(0.4,0.4,0.2)	(0.3,0.6,0.1)
SDBA	(0.6,0.3,0.1)	(0.3,0.5,0.2)	(0.5,0.4,0.1)	(0.6,0.3,0.1)	(0.3,0.5,0.2)	(0.7,0.2,0.1)	(0.7,0.2,0.1)	(0.9,0.1,0.0)	(0.8,0.1,0.1)	(0.8,0.2,0.0)	(0.9,0.1,0.0)

The table below shows Students and related subjects performance:

Table-2: Students Vs Subjects

	CP	DS	OOPs	JP	PPL	SPM	UML&DP	DBMS	DWM	OS	UNIX
S_1	(0.8,0.1,0.1)	(0.9,0.1,0.0)	(0.7,0.2,0.1)	(0.8,0.1,0.1)	(0.8,0.2,0.0)	(0.7,0.2,0.1)	(0.6,0.2,0.2)	(0.7,0.1,0.2)	(0.8,0.1,0.1)	(0.7,0.2,0.1)	(0.8,0.1,0.1)
S_2	(0.9,0.1,0.0)	(0.6,0.1,0.3)	(0.8,0.1,0.1)	(0.6,0.2,0.2)	(0.8,0.1,0.1)	(0.6,0.2,0.2)	(0.7,0.2,0.1)	(0.9,0.0,0.1)	(0.9,0.1,0.0)	(0.8,0.1,0.1)	(0.5,0.2,0.3)
S_3	(0.5,0.2,0.3)	(0.6,0.3,0.1)	(0.9,0.1,0.0)	(0.7,0.2,0.1)	(0.7,0.2,0.1)	(0.5,0.3,0.2)	(0.9,0.0,0.1)	(0.7,0.2,0.1)	(0.7,0.1,0.2)	(0.5,0.2,0.3)	(0.9,0.1,0.0)
S_4	(0.6,0.3,0.1)	(0.7,0.1,0.2)	(0.6,0.2,0.2)	(0.9,0.1,0.0)	(0.9,0.0,0.1)	(0.8,0.2,0.0)	(0.7,0.3,0.0)	(0.8,0.1,0.1)	(0.9,0.0,0.1)	(0.7,0.1,0.2)	(0.8,0.1,0.1)
S_5	(0.7,0.1,0.2)	(0.8,0.1,0.1)	(0.7,0.1,0.2)	(0.8,0.2,0.0)	(0.8,0.0,0.2)	(0.7,0.2,0.1)	(0.5,0.2,0.3)	(0.8,0.2,0.0)	(0.8,0.1,0.1)	(0.6,0.2,0.2)	(0.7,0.2,0.1)

Each performance is described by three numbers i.e. membership μ, non-membership ϑ and hesitation margin π. After the various examinations, the students obtained the marks as shown in table-2 above.

S_1, S_2, S_3, S_4 and S_5 are Student-1, Student-2, Student-3, Student-4 and Student-5 respectively.

From Definition – Szmidt and Kacprzyk, 2014: The normalized Euclidean distance $d_{n\text{-}H}(A, B)$ between two IFS A and B is defined as

$$d_{n\text{-}H}(A, B) = \mu_A(x_i) - \mu_B(x_i))^2 + (\vartheta_A(x_i) - \vartheta_B(x_i))^2 + (\pi_A(x_i) - \pi_B(x_i))^2])^{1/2},$$

$X = \{x_1, x_2, \ldots, x_n\}$ for i = 1,2, …, n.

Table-3: Students Vs IT Careers

	SYSTEM ANALYST	DATA ANALYST	SOFTWARE DEVELOPER	SYSTEM AND DATABASE ADMIN
Student-1	0.9746	0.9110	0.7549	0.9
Student-2	1.0816	0.8544	0.80622	0.8944
Student-3	0.9013	0.9746	0.8485	0.8246
Student-4	1.0049	0.9219	0.8831	0.8602
Student-5	0.9874	0.8860	0.7211	0.8944

From the above table, the shortest distance gives the proper IT Job determination. Student-1 is fit to apply **Software Developer** based on the score he/she got.

$$d_{n\text{-}H}(A, B) = \mu_A(x_i) - \mu_B(x_i))^2 + (\vartheta_A(x_i) - \vartheta_B(x_i))^2 + (\pi_A(x_i) - \pi_B(x_i))^2])^{1/2},$$

$$d(SA, S1) = [(0.2+0.2+0)^2 + (0.4+0.2+0.2)^2 + (0)^2 + (0.2+0.2+0)^2 + (0.1+0+0.1)^2 + (0.1+0+0.1)^2 + (0.3+0.1+0.2)^2 + (0.2+0.2+0)^2 + (0.5+0.4+0.1)^2 + (0.3+0.2+0.1)^2 + (0.5+0.5+0)^2]^{1/2}$$

$$= [0.16+0.64+0.16+0.04+0.04+0.36+0.04+1+0.36+1]^{1/2}$$

$$= [3.8]^{1/2}$$

$$= [10949]$$

$$= 0.9746$$

Conclusion

This novel application of intuitionistic fuzzy sets in IT career determination is of great significance because it provides accurate and proper IT domain choice based on academic performance. IT career choice is a delicate decision making problem because if you take B.Tech/B.E. these students study more than 48 subjects during their under graduation out of which the students were confused on choosing their right IT career after their B.Tech/BE in CSE/IT. In the proposed application, we used normalized Euclidean distance to calculate the distance of each student from each career in respect to the subjects, to obtain results.

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