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Selection of a Machine by Studying their Features among Various Types

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Abstract
Life is so fast that a lot of changes are coming in daily routine. Every person wants that his profit should maximum and his cost should be minimum. In the fast growing economy new inventions are coming. In mechanical sector there are lots of machines in the market. If we are able to find that machine which is more suitable then we can get more benefit. In this paper, we use the Sanchez's approach to identify the type of suitable machine. This method is based on the relation between the features (can also say factors) and types of machines by intuitionistic fuzzy sets. For this purpose, we develop a hypothetical case study with assigned degree of membership, degree of non membership and hesitation index containing some information about machines and their features.

Keywords: Fuzzy Sets, Intuitionistic Fuzzy Sets (IFS), Fuzzy Relations, Machine Information, Hypothetical Case Study.

1. Introduction

In modern days the industry is changing very rapidly. New inventions are coming very fastly especially in engineering sector. Mechanical sector is an evergreen sector and there are so many machines which are used for doing work in this sector. The selection of the correct machine which can be more profitable for an engineer or a customer is not an easy task. There are so many methods and techniques which may prove helpful in choosing a suitable machine. A person does work with interest and more energy if he gets success in selection of exact machine. By studying the features and factors of a machine a customer can know that whether he wants to purchase the machine or not. To overcome this difficulty, here we use the concept of maximum-minimum-maximum composition in intuitionistic fuzzy set theory.

In this paper, we describe an attempt to provide a formal model of the process to find that type of machine which is more suitable as compare to others by using intuitionistic fuzzy set theory and intuitionistic fuzzy relation theory. Losch[] suggested the process of diagnosis of glaucoma by using fuzzy sets. Tania has defined factors influencing teachers'laptoppurchases.Khan and Rohi have investigated factors that affect the choice of youth for purchasing mobile phones. Kumar, Biswas and Roy Ahn has done the applications of IFS theory in diagnosis of various types of diseases. Adlassing has applied fuzzy set theory in medical diagnosis.Szmidt proposed different measures for Intuitionist Fuzzy Sets.Sata [] has told about factors those affect consumer's buying behavior

2. Methodology

I order to find the solution we put some efforts to know about the market and influencing factors and features. Firstly, we establish IF relation between customers and features or factors, influencing a machine with assigned degree of membership and degree of non-membership as explained in table (1.1). Secondly, we establish IF relation between the types and features of machine explained in table (1.2). Finally, we apply Sanchez's approach and get results of table (1.3), then calculate hesitation index and find out the results of table (1.4) as weight elements. If there is a tie in weight elements then customer may purchase both kind of machines with their features and factors.

3. Brief introduction to IFS and IFR

Intuitionist fuzzy sets are sets whose elements have degrees of membership and degrees of non-membership.Intuitionistic fuzzy sets have been introduced by KrassimirAtanassovin 1983 as an extension of LoftiAskarZadeh'snotion of fuzzy sets, which itself extends the classical notion of a set. The theory of IFS allows the assessment of the elements by two functions say u for membership and v for non-membership. The sum of both the functions varies between the range 0 and 1. Like IFSs the IFRs are also the extension of crisp relations. In IFSs the degree of association can be represented by membership grade. We use the relations or operations like inclusion, equality, conjunction, disjunction etc. on intuitionistic fuzzy sets.

Zadeh [], for a fixed set X, an IFS of A is defined as: $A = \{ < x, u_A(x), v_A(x) > | x \in X \}$,where $u_A(x)$: X $\rightarrow$ [0, 1] and $v_A(x)$: X $\rightarrow$ [0, 1] define the degree of membership and degree of non-membership of the element x $\in$ X to the set A.

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For every x ∈ X, $0 \leq u_A(x) + V_A(x) \leq 1$ and the amount $\pi_A(x) = 1 - u_A(x) - v_A(x)$ is called the intuitionistic index or hesitation index, which may require to membership value, non-membership value or both.

Again, Let A be an IFS of the set X and let R be an IF relation from X→Y, then max-min-max composition of IFS X with the IF relation R (X → Y) is defined as B = R o A with membership and non-membership function defined as:

$$u_B(y) = \max_{x \in X} \{\min[u_A(x), u_R(x, y)]\}$$ And

$$v_B(y) = \min_{x \in X} \{\max[v_A(x), v_R(x, y)]\}$$

Let F = {f_1, f_2 .....f_m}; M = {m_1, m_2 .....m_n};

C = {c_1, c_2 .....c_q}; be the finite set of features, machines and customers respectively.

According to Biswas [], two fuzzy relations (FR), Q and R are defined as:

Q = {<(c, f), u_Q(c, f), v_Q(c, f) > | (c, f) ∈ C × F}

R = {<(f, m), u_R(f, m), v_R(f, m) > | (f, m) ∈ F × M}

Where u_Q(c, f) indicate the degree that the machine is suitable for customer c due to the feature f and v_Q(c, f) indicate the degree that the machine is not suitable for customer c due to the feature f.

Similarly u_R(f, m) indicate the degree to which the feature f is present in the machine m and v_R(f, m) indicate the degree to which the feature f is not present in the machine m.

The composition T of IFR_s R and Q (T = R o Q) describe the interest of customer c_i in terms of choosing the suitable machine from C to M given by membership and non-membership as:

$$\mu_T(c_i, m) = \max_{f \in F} \{\min[\mu_Q(c_i, f), \mu_R(f, m)]\}$$ And

$$v_T(c_i, m) = \min_{f \in F} \{\max[v_Q(c_i, f), v_R(f, m)]\}, \forall c_i \in C$$ and $m \in M$

Now, we can find that type of machine which is more beneficial for a customer by using the information obtained from the chart of given case study. This information plays a significant role in analysis when many types of machines are presentin the market.

From Q and R, one may complete new measure of IFR T for which, in general the selection labels of customer c from the various machines m such that the following is to be satisfied:

(i) $S_T = u_T - V_T \bullet \pi_T$ is greatest and

(ii) The equality T = R_OQ is retained.

This measure of T will translate the higher degree of association of features as well as lower degrees of intuitionistic index to the analysis. If almost equal values for any analysis procedure in T are obtained, we consider the case for which intuitionistic index is least.

Case Study:-

Let P = {c_1, c_2, c_3, c_4} be the set of customers and F = {f_1,f_2, f_3, f_4,} be the set of features of the machines.

New let the IFR Q (P →F) is given by (hypothetically)

Table – I

Q	F 1		F 2		F 3		F 4	
Patients	u Q	v Q	u Q	v Q	u Q	v Q	u Q	v Q
P 1	0.6	0.1	0.4	0.4	0.3	0.6	0.0	0.6
P 2	0.5	0.2	0.7	0.1	0.5	0.5	0.3	0.5
P 3	0.0	0.9	0.2	0.5	0.2	0.4	0.9	0.1
P 4	0.4	0.3	0.3	0.6	0.1	0.8	0.2	0.7

Now M = {m_1, m_2, m_3, m_4} be the set of machines, which a person wants to buy.

Now suppose the IFR R (F→M) is given by (hypothetically)

Table – II

Q	M 1		M 2		M 3		M 4	
Patients	u Q	v Q	u Q	v Q	u Q	v Q	u Q	v Q
F 1	0.3	0.0	0.5	0.1	0.3	0.3	0.1	0.8
F 2	0.4	0.5	0.2	0.7	0.1	0.9	0.2	0.3
F 3	0.7	0.1	0.3	0.4	0.5	0.5	0.0	0.7
F 4	0.2	0.6	0.4	0.4	0.4	0.6	0.5	0.1

Now the composition T = RoQ is following as:

Table – III

Q	M 1		M 2		M 3		M 4	
Patients	u Q	v Q	u Q	v Q	u Q	v Q	u Q	v Q
C 1	0.4	0.1	0.5	0.1	0.3	0.3	0.2	0.4
C 2	0.5	0.2	0.5	0.2	0.5	0.3	0.3	0.3
C 3	0.2	0.4	0.4	0.4	0.4	0.5	0.5	0.1
C 4	0.3	0.3	0.4	0.3	0.3	0.3	0.2	0.6

Now we calculate $S_T = u_T - v_T * \pi_T$ is greatest where $\pi_T = 1 - u_T - v_T$ is called the intuitionistic index or hesitation index.

Table – IV

S T	M 1	M 2	M 3	M 4
C 1	0.35	0.46	0.18	0.04
C 2	0.44	0.44	0.44	0.18
C 3	0.04	0.32	0.35	0.46
C 4	0.18	0.31	0.18	0.08

Now from the above table we conclude that for customer C_1, and C_4machine M_2 is more profitable and for customer C_3 machine M_4 is suitable while for the customer $C_2$the machines M_1, M_2, M_3 are beneficial. After knowing the type of suitable machine a customer can get more profit in comparison of others.

Aluminium-sec-butoxide, vanadyl acetylacetonate,

4. Conclusions

In this paper, we have used the generalized concept of crisp and fuzzy set theory. A Study by applying Max-min. and Min-max composition has been made with IFS theory. There are some other compositions like maximum, minimum etc. that can be also applied. This method is an effective tool and can be used for various decision making problems.

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