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Hesitant Fuzzy Linguistic Term Set Based Laws of Algebra of Sets

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Abstract—This Paper Presents Hesitant Fuzzy Information About Data Sets. Hesitant Fuzzy Linguistic Term Set (HFLTS) is based on the fuzzy linguistic Approach that will serve as basis to Increase the flexibility of elicitation of linguistic Information. For experimental Classification accuracy results analysis evaluated using the Analytical SAS 9.0 Software is used. The Experimental Laws of Algebra Results show the proposed approach Best performs.

Keywords— Hesitant Fuzzy Set, Laws of Algebra, Data sets, Linguistic Term Set.

I. Introduction

Hesitant Fuzzy Information collection based on Fuzzy logic, Fuzzy sets theory, Intuitionistic fuzzy sets, Fuzzy multi sets, fuzzy linguistic approach, uncertainty and model the information etc. In this Paper Hesitant Fuzzy Linguistic Term Set (HFLTS) is used to calculating Document Classification Results.

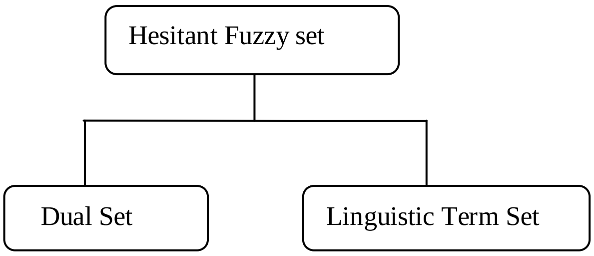

Fig 1: Hesitant Fuzzy Information collection

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The paper is organized as follows. Section-I described the introduction and review of literatures. In Section-II, the Hesitant Fuzzy Information is described. In Section-III, Methodology of document Classification accuracy results is described. In Section-IV, Experimental results are described. In Section-V, Evaluation measurement is described. Finally, we concluded and proposed some future directions in Conclusion Section.

II. HESITANT FUZZY LINGUISTIC TERM SET

Hesitant Fuzzy Linguistic Term Set: Uncertainty is a problem that occurs when calculating document classification results then the best and optimum solution in present time is given by Hesitant Fuzzy Set. Hesitant Fuzzy Set gives new computational solution with numerical capability. Hesitant Fuzzy used Linguistic Term Set then it knows Hesitant Fuzzy Linguistic Term Set (HFLTS). Linguistic Term Set just like Context Free Grammar (CFG).

A. Theorem 1: (Idempotent laws)

For any Hesitant Fuzzy Linguistic Term Set H_s *, we have* $(i) H_s \cup H_s = H_s$ $(ii) H_s \cap H_s = H_s$

(i) *proof* $H_s \cup H_s = \{x : x \in H_s or x \in H_s\} = \{x : x \in H_s\} = H_s$

(ii) *proof* $H_s \cap H_s = \{x : x \in H_s and x \in H_s\} = \{x : x \in H_s\} = H_s$

B. Theorem 2: (Identity laws)

For any Hesitant Fuzzy Linguistic Term Set H_s, we have $(i) H_s \cup \phi = H_s$ $(ii) H_s \cap \mu = H_s$ ø, μ are identity elements for union and intersection respectively.

(i) *proof* $H_s \cup \phi = \{x : x \in H_s or x \in \phi\} = \{x : x \in H_s\} = H_s$

(ii) *proof* $H_s \cap \mu = \{x : x \in H_s and x \in \mu\} = \{x : x \in H_s\} = H_s$

C. Theorem 3: (Commutative laws)

For any two Hesitant Fuzzy Linguistic Term Set H_s and H_s^1 ,we have $(i) H_s \cup H_s^1 = H_s^1 \cup H_s$

$(ii) H_s \cap H_s^1 = H_s^1 \cap H_s$ Union and intersection are commutative.

(i) Proof: Let x be an arbitrary element of $H_s \cup H_s^1$ Then,

$x \in H_s \cup H_s^1 \Rightarrow x \in H_s or\ x \in H_s^1 \Rightarrow x \in H_s^1 or x \in H_s \Rightarrow x \in H_s^1 \cup H_s$

$H_s \cup H_s^1 \subseteq H_s^1 \cup H_s$ 1

Let x be an arbitrary element of $H_s^1 \cup H_s$ Then,

$x \in H_s^1 \cup H_s \Rightarrow x \in H_s^1 or\ x \in H_s \Rightarrow x \in H_s\ or\ x \in H_s^1 \Rightarrow x \in H_s \cup H_s^1$

$H_s^1 \cup H_s \subseteq H_s \cup H_s^1$....2

Hence, from 1 and 2

$H_s \cup H_s^1 = H_s^1 \cup H_s$

(ii) Proof: Let x be an arbitrary element of $H_s \cap H_s^1$ Then,

$x \in H_s \cap H_s^1 \Rightarrow x \in H_s and\ x \in H_s^1 \Rightarrow x \in H_s^1 and x \in H_s \Rightarrow x \in H_s^1 \cap H_s$

$H_s \cap H_s^1 \subseteq H_s^1 \cap H_s$ ...3

Let x be an arbitrary element of $H_s^1 \cap H_s$ Then,

$x \in H_s^1 \cap H_s \Rightarrow x \in H_s^1 and\ x \in H_s \Rightarrow x \in H_s\ and\ x \in H_s^1 \Rightarrow x \in H_s \cap H_s^1$

$H_s^1 \cap H_s \subseteq H_s \cap H_s^1$...4

Hence, from 3 and 4

$H_s \cap H_s^1 = H_s^1 \cap H_s$

D. Theorem 4: (Associative laws)

If any H_s , H_s^1 and H_s^2, are three Hesitant Fuzzy Linguistic Term Set then

$(i)\ (H_s \cup H_s^1) \cup H_s^2 = H_s \cup (H_s^1 \cup H_s^2)$ $\quad (ii)\ H_s \cap (H_s^1 \cap H_s^2) = (H_s \cap H_s^1) \cap H_s^2$

Union and intersection are associative.

(i) Proof : Let x be an arbitrary element of $(H_s \cup H_s^1) \cup H_s^2$ Then

$x \in (H_s \cup H_s^1) \cup H_s^2 \Rightarrow x \in (H_s \cup H_s^1) or x \in H_s^2 \Rightarrow (x \in H_s or\ x \in H_s^1) or x \in H_s^2 \Rightarrow x \in H_s or\ (x \in H_s^1 or x \in H_s^2)$

$\Rightarrow x \in H_s or\ x \in (H_s^1 \cup H_s^2) \Rightarrow x \in H_s \cup\ (H_s^1 \cup H_s^2)$

$(H_s \cup H_s^1) \cup H_s^2 \subseteq H_s \cup (H_s^1 \cup H_s^2)$..5

Let x be an arbitrary element of $H_s \cup\ (H_s^1 \cup H_s^2)$ Then

$x \in H_s \cup\ (H_s^1 \cup H_s^2) \Rightarrow x \in H_s \text{or } x \in\ (H_s^1 \cup H_s^2) \Rightarrow x \in H_s \text{or }\ (x \in H_s^1 or x \in H_s^2) \Rightarrow (x \in H_s \text{or }\ x \in H_s^1) or x \in H_s^2$

$\Rightarrow x \in (H_s \cup H_s^1) or x \in H_s^2 \Rightarrow x \in (H_s \cup H_s^1) \cup H_s^2$

$H_s \cup (H_s^1 \cup H_s^2) \subseteq (H_s \cup H_s^1) \cup H_s^2$..6

Hence, from 5 and 6

$(H_s \cup H_s^1) \cup H_s^2 = H_s \cup (H_s^1 \cup H_s^2)$

(ii) Proof: Let x be an arbitrary element of $H_s \cap (H_s^1 \cap H_s^2)$ Then

$x \in H_s \cap (H_s^1 \cap H_s^2) \Rightarrow x \in H_s \text{and } x \in\ (H_s^1 \cap H_s^2) \Rightarrow x \in H_s \text{and}(x \in\ H_s^1 and x \in H_s^2) \Rightarrow (x \in H_s \text{and } x \in\ H_s^1) and x \in H_s^2$

$\Rightarrow x \in (H_s \cap\ H_s^1) and x \in H_s^2 \Rightarrow x \in (H_s \cap\ H_s^1) \cap H_s^2$

$H_s \cap (H_s^1 \cap H_s^2) \subseteq (H_s \cap H_s^1) \cap H_s^2$)..7

Let x be an arbitrary element of $(H_s \cap\ H_s^1) \cap H_s^2$ Then

$x \in (H_s \cap H_s^1) \cap H_s^2) \Rightarrow x \in (H_s \cap H_s^1) and x \in H_s^2) \Rightarrow (x \in H_s and x \in H_s^1) and x \in H_s^2 \Rightarrow x \in H_s and (x \in H_s^1 and x \in H_s^2)$

$\Rightarrow x \in H_s and x \in (H_s^1 \cap H_s^2) \Rightarrow x \in H_s \cap (H_s^1 \cap H_s^2)$

$(H_s \cap H_s^1) \cap H_s^2) \subseteq H_s \cap (H_s^1 \cap H_s^2)$..8

Hence, from 7 and 8

$H_s \cap (H_s^1 \cap H_s^2) = (H_s \cap H_s^1) \cap H_s^2$

E. Theorem 5: (Distributive laws)

If any H_s, H_s^1 and H_s^2 are three Hesitant Fuzzy Linguistic Term Set

$(i) H_s \cup (H_s^1 \cap H_s^2) = (H_s \cup H_s^1) \cap (H_s \cup H_s^2)$ $(ii) H_s \cap (H_s^1 \cup H_s^2) = (H_s \cap H_s^1) \cup (H_s \cap H_s^2)$

Union and intersection are distributive over intersection and union respectively.

(i) Proof: Let x be an arbitrary element of $H_s \cup (H_s^1 \cap H_s^2)$ Then

$x \in H_s \cup (H_s^1 \cap H_s^2) \Rightarrow x \in H_s or x \in (H_s^1 \cap H_s^2) \Rightarrow x \in H_s or (x \in H_s^1 and x \in H_s^2) \Rightarrow (x \in H_s or x \in H_s^1) and (x \in H_s or x \in H_s^2)$

['or' is distributive over 'and']

$\Rightarrow x \in (H_s \cup H_s^1) and x \in (H_s \cup H_s^2) \Rightarrow x \in (H_s \cup H_s^1) \cap (H_s \cup H_s^2)$

$H_s \cup (H_s^1 \cap H_s^2) \subseteq (H_s \cup H_s^1) \cap (H_s \cup H_s^2)$..9

Let x be an arbitrary element of $(H_s \cup H_s^1) \cap (H_s \cup H_s^2)$ Then

$x \in (H_s \cup H_s^1) \cap (H_s \cup H_s^2) \Rightarrow x \in (H_s \cup H_s^1) and x \in (H_s \cup H_s^2) \Rightarrow (x \in H_s or x \in H_s^1) and (x \in H_s or x \in H_s^2)$

$\Rightarrow x \in H_s or (x \in H_s^1 and x \in H_s^2) \Rightarrow x \in H_s \cup (H_s^1 \cap H_s^2)$

$(H_s \cup H_s^1) \cap (H_s \cup H_s^2) \subseteq H_s \cup (H_s^1 \cap H_s^2)$..10

Hence, from 9 and10

$H_s \cup (H_s^1 \cap H_s^2) = (H_s \cup H_s^1) \cap (H_s \cap H_s^2)$

(ii) Proof: Let x be an arbitrary element of $H_s \cap (H_s^1 \cup H_s^2)$ Then

$x \in H_s \cap (H_s^1 \cup H_s^2) \Rightarrow x \in H_s and x \in (H_s^1 \cup H_s^2) \Rightarrow x \in H_s and (x \in H_s^1 or x \in H_s^2) \Rightarrow (x \in H_s and x \in H_s^1) or (x \in H_s and x \in H_s^2)$

$\Rightarrow x \in (H_s \cap H_s^1) or x \in (H_s \cap H_s^2) \Rightarrow x \in (H_s \cap H_s^1) \cup (H_s \cap H_s^2)$

$H_s \cap (H_s^1 \cup H_s^2) \subseteq (H_s \cap H_s^1) \cup (H_s \cap H_s^2)$..11

Let x be an arbitrary element of $(H_s \cap H_s^1) \cup (H_s \cap H_s^2)$ Then

$\Rightarrow x \in (H_s \cap H_s^1) \cup (H_s \cap H_s^2) \Rightarrow x \in (H_s \cap H_s^1) or x \in (H_s \cap H_s^2) \Rightarrow (x \in H_s and x \in H_s^1) or (x \in H_s and x \in H_s^2)$

$\Rightarrow x \in H_s and (x \in H_s^1 or x \in H_s^2) \Rightarrow x \in H_s \cap (H_s^1 \cup H_s^2)$

$(H_s \cap H_s^1) \cup (H_s \cap H_s^2) \subseteq H_s \cap (H_s^1 \cup H_s^2)$..12

Hence, from 11 and 12

$H_s \cap (H_s^1 \cup H_s^2) = (H_s \cap H_s^1) \cup (H_s \cap H_s^2)$

Theorem 6: (De-Morgan's laws)

If any H_s, H_s^1 are two Hesitant Fuzzy Linguistic Term Set then

$(i)(H_s \cup H_s^1)' = H'_s \cap H_s^{1'}$ $(ii)(H_s \cap H_s^1)' = H'_s \cup H_s^{1'}$

(i) Proof: Let x be an arbitrary element of $(H_s \cup H_s^1)'$ Then

$x \in (H_s \cup H_s^1)' \Rightarrow x \notin (H_s \cup H_s^1) \Rightarrow x \notin H_s and x \notin H_s^1$

$\Rightarrow x \in H_s' and x \in H_s^{1'} \Rightarrow x \in H_s' \cap H_s^{1'}$

$(H_s \cup H_s^1)' \subseteq H'_s \cap H_s^{1'}$..13

Let y be an arbitrary element of $H_s' \cap H_s^{1'}$ then

$\Rightarrow y \in H_s' \cap H_s^{1'} \Rightarrow y \in H_s' and y \in H_s^{1'} \Rightarrow y \notin H_s and y \notin H_s^1$

$$\Rightarrow y \notin H_s \cup H_s^1 \Rightarrow y \in (H_s \cup H_s^1)'$$

$$H'_s \cap H_s^{1'} \subseteq (H_s \cup H_s^1)' ..14$$

Hence, from 13 and 14

$$(H_s \cup H_s^1)' = H'_s \cap H_s^{1'}$$

(ii) Proof : Let x be an arbitrary element of $(H_s \cap H_s^1)'$ Then

$$x \in (H_s \cap H_s^1)' \Rightarrow x \notin (H_s \cap H_s^1) \Rightarrow x \notin H_s or x \notin H_s^1$$

$$\Rightarrow x \in H_s' or x \in H_s^{1'} \Rightarrow x \in H_s' \cup H_s^{1'}$$

$$(H_s \cap H_s^1)' \subseteq H'_s \cup H_s^{1'} ..15$$

Let y be an arbitrary element of $H_s' \cup H_s^{1'}$ then

$$y \in (H_s' \cup H_s^{1'}) \Rightarrow y \in H_s' or y \in H_s^{1'} \Rightarrow y \notin H_s or y \in H_s^1 \Rightarrow y \notin (H_s \cap H_s^1)$$

$$\Rightarrow y \in (H_s \cap H_s^1)' \; H'_s \cup H_s^{1'} \subseteq (H_s \cup H_s^1)' ..16$$

Hence,from 15 and 16

$$(H_s \cap H_s^1)' = H'_s \cup H_s^{1'}$$

III. METHODOLOGY

In the Classification of document different the steps are used. The steps are as follows:

A. *Data Collection:* In this phase collect relevant documents like e-mail, news, web pages etc. from various heterogeneous sources. These text documents are stored in a variety of formats depending on the nature of the data. The datasets are downloaded from UCI KDD Archive. This is an online repository of large datasets and has wide variety of data types.

B. *Classification Method:* Initial step is to complete review of literature in the field of data mining. Next step is a detailed survey of data mining and existing Algorithms for Classification. In this area some work done by various researchers. After studying their work, it would be attempted to find the Classification algorithm.

C. *Classification Process:* Algorithms develop for Classification Process. Classification Process means transform documents into a suitable determined in classes for the Classification task. In Classification Process we performed Different tasks. Optimized classification will also be studied. The real data may be great source for the Classification.

D. *Classification Results:* In this Experiment we calculate Hesitant Fuzzy Linguistic Term Set Based Document Classification. Hesitant Fuzzy Linguistic Term Set Based Document Classification is efficient and accurate compare to other Classification method.

IV. EXPERIMENTAL RESULTS

In this Experiment we calculate Hesitant Fuzzy Linguistic Term Set (HFLTS) based accuracy percentage for laws of Algebra of Sets.

TABLE I
ACCURACY PERCENTAGE OF LAWS OF ALGEBRA OF SETS

	Idempotent	Identity	Commutative	Associative	Distributive	De-Morgan
500	0.85	0.98	0.94	0.97	0.82	0.98
1000	0.83	0.95	0.91	0.85	0.78	0.95
2000	0.81	0.93	0.89	0.83	0.75	0.93
3500	0.68	0.92	0.88	0.78	0.74	0.92
5000	0.78	0.89	0.87	0.75	0.74	0.89
6500	0.76	0.87	0.85	0.74	0.73	0.87
8000	0.74	0.85	0.82	0.74	0.73	0.85
10000	0.72	0.83	0.81	0.73	0.73	0.83

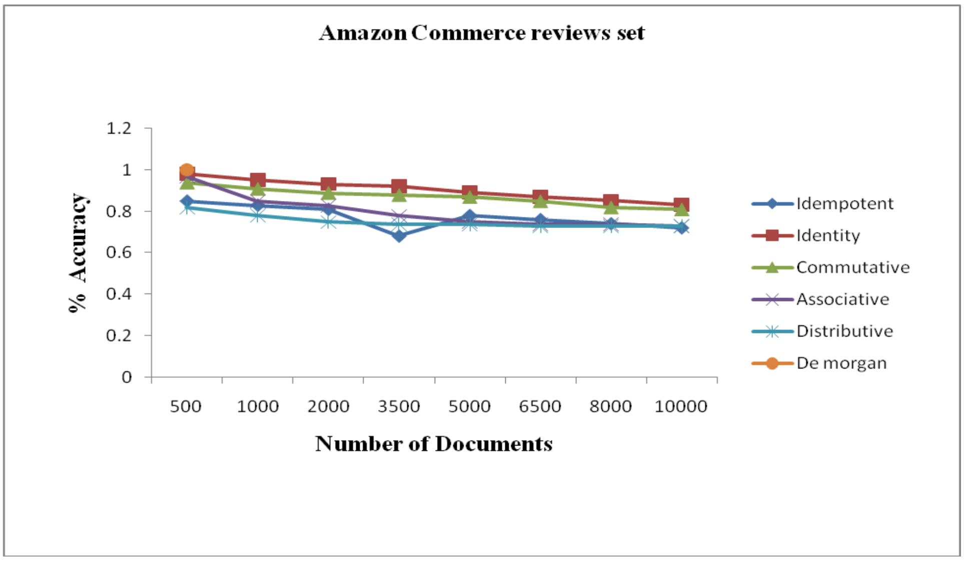

Fig. 2 Accuracy percentages of Laws of Algebra of Sets

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