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DEBARRED OBJECTS RECOGNITION BY PFL OPERATOR

Manish Kumar Srivastava[1] ,Madan Kushwah[2] , Abhishek kumar [3]

[1] Assistant Professor, Department of CSE, Lal Bahadur Shastri Group of Institutions Lucknow , Uttar Pradesh, India
[2,3] Assistant Professor, Department of CSE, Bansal Institute of Engineering & Technology, Uttar Pradesh, India

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Abstract - International security especially airport security pose serious concern and have to be talked on priority bases, Security has become one of the foremost issues of apprehension that needs to be methodically talked by every nation, in particular the developed nations, which are playing an dynamic role in counter terrorism. The planned system uses suitable preprocessed X-ray images of passenger's luggage and design to detect the banned objects like Pistol, Knife, Explosive resources , scissors, and handguns of different size and orientation etc The X-ray imaging is an important technology in many fields, from non-intrusive assessment of elusive objects, to weapons recognition at security checkpoints. In this work we will detect the object by partial fuzzy logic method(PFL) PFL operator delivers a parameterized family of combination operators, include well-known operators such as maximum, minimum, arithmetic mean, k-order statistics and median. Sometimes, exact "and-ness" is essential for multi-criteria decision making, which offers minimum value and sometimes exact "or-ness" which provides maximum value. The PFL aggregation operator lies between the two extremes of and-ness and or-ness. Two extremes are limited to mutually exclusive probabilities for multiplication (like AND gate) and summation (like OR gate). PFL operator is used to estimate the degree of likeness of knives, scissor and handguns.

Key Words: **Partial Fuzzy Logic, Security, and Prohibited Items like Pistol, Knife, and Handguns.**

1. INTRODUCTION PROBABILITY STUDY

Better security in the aftermath of the 9/11 attack in the United States of America has lead to added congestion in airport terminals, interruptions, hassle, more boundaries on carry-on luggage, a sense of anxiety, and sometimes a breach of retreat between the public. All these simply add cost to air-travel and thus have an effect on socio financial factors. It has almost become an standard norm that hundreds of flights have been recalled to terminals after being air-born, plentiful events of relocation, passengers rechecked, or even asked to take your clothes off.
The X-ray imaging is an important technology in many areas, from non-intrusive inspection of delicate objects, to weapons detection at security checkpoints.

1.1 REQUISITE FOR FUZZY LOGIC IN OBJECT RECOGNITION SYSTEM

With the above scenario, the entire world must be looking forward for a fuzzy object recognition system, which responds to awareness based query in natural language in an effective style. However, some of the vital task that needs to be followed prior to object recognition is as follows:

i. Assessment of fuzzy validity of hand drawn fuzzy shapes.
ii. Assessment of fuzzy similarity among such family of fuzzy shapes.

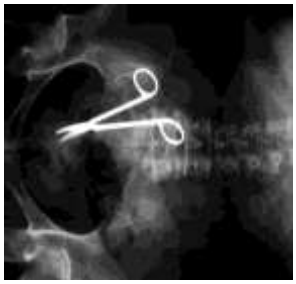
1.2 OBJECT RECOGNITION TECHNIQUES

In the recent past, the world faces the most hazardous crimes in general. Mainly, the terrorism has panicked people since a decade. The detection of threat objects using X-ray luggage scan images has become an important means of security. Most Computer Aided Screening (CAS) is still base on the manual recognition of potential threat objects by human expert's where probabilities of human error is relatively high as thousands of bags need to be scanned every day.

1.3 IMAGE SEGMENTATION

Image segmentation or division goes to separate an image into its object classes. Clustering methods, edge based methods, histogram-based methods, and region growing methods offer different benefits and drawbacks. The use of a Gaussian mixture expectation maximization (EM) method has been investigated to realize segmentation specifically for x-ray luggage scans.

Figure 1. Shows an input x-ray image and examples of objects found by segmentation.



Original image

Segmentation Image

Original image

2. Fuzzy Logic

In this section, the conditions and the desperate requirement of Fuzzy Logic, where objects for computation are perception based verbal information, instead of crisp measurements defined in terms of numbers. Mostly, the problems of resolving such perceptions in linguistics are carried forward by Zadeh for a long time. In the beginning the attitude of implementing linguistics is initiated in his serial papers.[1]

The fuzzy rule-based classification system creates too many rules for high dimension problems. It is often assumed that the numeral of fuzzy if-then rules exponentially increases as the number of structures increases. [2]For this purpose, only a small number of features are selected for constructing a fuzzy classifier, which decreases its accuracy. To solve this problem, we present a multi-level fuzzy classifier consists of several small fuzzy classifiers with a small number of structures, which not only improve the performance of fuzzy classifier but also solve the problem of high dimension.

2.1 CORRELATION FUNCTIONS

The person brain interprets the incomplete and partial information delivered by the sensory organs. The fuzzy logic delivers a systematic way for valuing this perception or natural language based information. The fuzzy logic used some arithmetical calculation on the basis of linguistic qualifier used in the partial information. The fuzzy inference system (if – then rules) or membership functions are used convert the inaccurate in order into a specific facts.

A fuzzy if-then rule assumes the form

If x is A then y is B,

Where A and B are linguistic values defined by fuzzy sets on universes of discourse X and Y, respectively. "x is A" is called antecedent and "y is B" is known as conclusion. For example

If pressure is high, then volume is small. In fuzzy logic membership function is used to map imprecise vague information into a precise or crisp value. The membership is the degree of belongingness of a particular value to certain characteristics. For example if the temperature of water is 20^{o} then its membership value is closer to the degree of coldness than the degree of hotness of water.

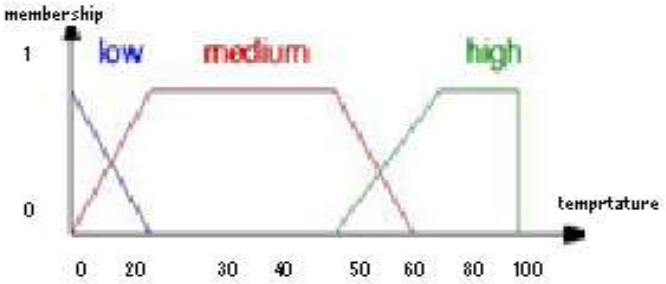


Fig 2. Membership function for valuing of degree of belongingness of water with temperature.

3. PARTIAL FUZZY LOGIC METHODS (PFL)

Partial Fuzzy Logic (PFL) is the crucial concept of information aggregation, was originally presented by Yager.[3] PFL helps the means of aggregation in solving problems that arises in multi criterion decision making. Furthermore, PFL operator offers a parameterized family of aggregation operators, with well-known operators such as *maximum, minimum, arithmetic mean, k-order statistics* and *median*. Sometimes, exact "*and-ness*" is essential for multi-criteria decision making, which deals minimum value and sometimes exact "*or-ness*" which offers maximum value. The PFL aggregation operator lies between the two extremes of *and-ness* and *or-ness*. Two extremes are limited to equally exclusive probabilities for multiplication (like AND gate) and summation (like OR gate). Subsequent part discloses a brief account of PFL operators, a detailed discussion about the behavior of operators. The PFL operation involves three following steps - 1) Reordering of inputs, 2) Weight determination related with PFL operators, and 3) Aggregation process.

3.1 EXPLANATION OF PFL

Mapping the PFL operator R from $R^m \rightarrow R$, (where R = [0, 1]), with dimension *m*, has weighting vector $w= (w_1, w_2, w_3,... w_m)^T$, where $w_j \in [0, 1]$ and $\sum w_j = 1$, the summation of individual weights will always found to be one. Thus, for the multi-criteria of size *m,* the input parameter ($x_1, x_2, x_3……x_m$), the PFL determines the f-validity in f-geometric figures as follows:

$$\text{PFL}\ (x_1, x_2, x_3 \ldots\ldots x_m) = \sum_{j=1}^{m} w_j y_j$$

where y_j is the j^{th} largest number in the vector($x_1, x_2, x_3,...x_n$), and $y_1 \geq y_2 \geq y_3 \geq ...\geq y_m$. However, the weights w_j of the operator R are not related with any exact value of x_j , instead they are related with the ordinal position of y_j.

The *minimum* and *maximum* range of values can be decided based upon the concept of *or-ness* (β).

$$\beta = \frac{1}{m-1} \sum_{j=1}^{m} w_j (m-1)$$

3.2 MANIPULATIVE PFL WEIGHTS

One of the vital tasks is to compute the weights. We use the linguistic quantifier denoted as *Q(r),* to generate the weights w_j. *Q(r)* satisfies two properties: i) $Q(0) = 0$, ii) $\forall r \in [0, 1]$, such that $Q(r) = 1$. Furthermore, $Q(r)$ is non-decreasing if possesses the following property:

$$\forall a, b \in [0,1],$$

when a > b then $Q(a) \geq Q(b)$.

The membership function of a relative quantifier can be characterized as:

$$Q(r) = \begin{cases} 0 & if \quad r < a \\ \dfrac{r-a}{b-a} & if \quad b \leq r \leq a \\ 1 & if \quad r > b \end{cases}$$

where a,b,r ∈ [0,1].

In Yager calculates the weights wj of the PFL aggregation from the function Q describing the quantifier, with m number of criteria.

$$w_j = Q\left(\frac{j}{m}\right) - Q\left(\frac{j-1}{m}\right)$$

The following figures are *atmost,atleast half* and *as many as possible.*

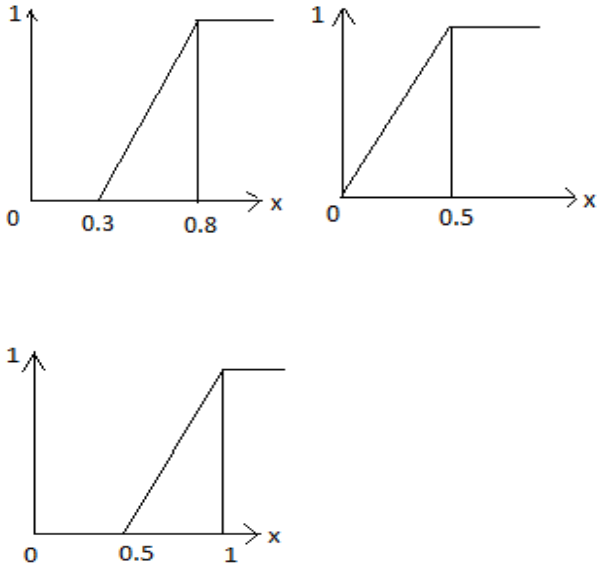


Figure 3. Atmost , Atleast half and as many as possible.

4. Experiments and outcomes

The experiment are made on some sample images after preprocessing. Some images of knives, scissors and handguns have been presented in figure respectively. Each image is of 96x96 pixel per inches and height and width of image scale for 1x1 inch. Moreover Tables comprises of mutual membership values of all the sample images of knives, scissors and hand guns respectively.

Figure 4. Sample Images Of Knives Taking As Inputs

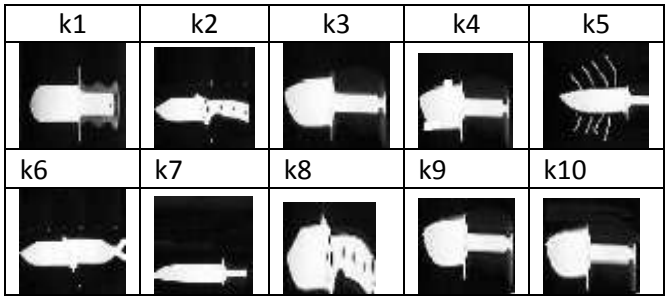


Table 1. Membership values of Knives

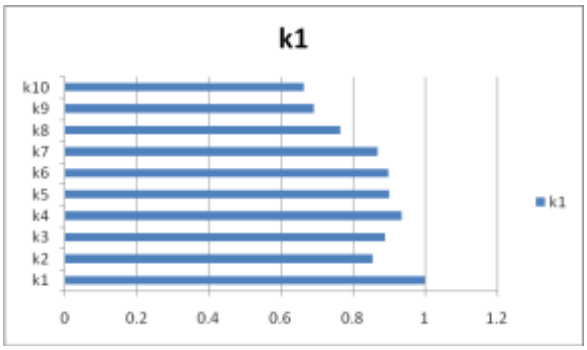
	k1	k2	k3	k4	k5	k6	k7	k8	k9	k10
k1	1	0.574	0.5117	0.5098	0.3838	0.5846	0.455	0.8446	0.5374	0.5916
k2	0.9395	1	0.5909	0.5908	0.4238	0.8031	0.8135	0.5145	0.6608	0.6608
k3	0.9741	0.4286	1	0.9613	0.359	0.4962	0.4746	0.8201	0.4845	0.6212
k4	0.975	0.4286	0.9274	1	0.3599	0.4895	0.4595	0.8019	0.476	0.606
k5	0.8963	0.5845	0.6083	0.6074	1	0.6406	0.5479	0.8301	0.612	0.6212
k6	0.9415	0.6535	0.5196	0.524	0.3484	1	0.4709	0.7558	0.4852	0.6088
k7	0.8232	0.519	0.5296	0.5421	0.4493	0.5498	1	0.7525	0.5569	0.6069
k8	0.9949	0.1947	0.196	0.207	0.1568	0.2528	0.2408	1	0.2916	0.2772
k9	0.9038	0.4945	0.5557	0.561	0.3655	0.5316	0.4421	0.7195	1	0.62
k10	0.9671	0.3469	0.4431	0.4562	0.2871	0.3974	0.3829	0.7201	0.4417	1

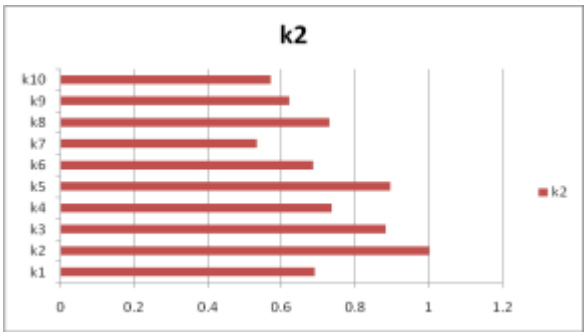
We have taken only one example from the above mentioned items.

4.1 RESULTS FOR KNIVES(VSM)

An image of object is a group of pixel values. This image can be measured as a 2-dimensional vector space (matrix) each subscripts of vector comprises of pixel value. Lets two matrixes A and B of unlike image are subtract for finding the parallel. [5]The resultant vector is a matrix C. The resultant matrix comprises of subscripts value zero due to the similar pixel values. These zero values are taken as count of similarity measure. The high number of the zero counts in each column leads to the higher similarity. The above said concept is basic of the VECTOR SPACE MODEL. Each object is characterized as vector. The size of the vector is number of column. Each element of vector has sum of matching count i.e. zeros of that specific column.

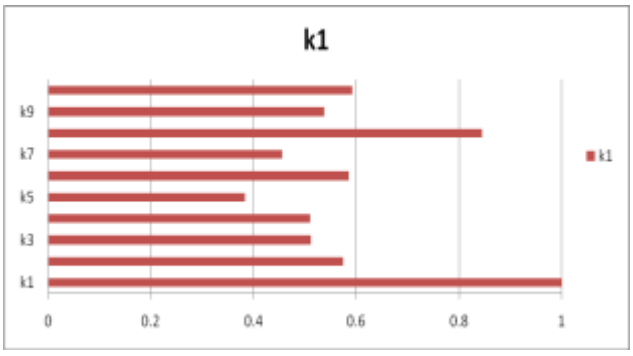
The 'Figure 4.1 to 4.2' compared the results for similarity for different images of knives taken by the PFL Method.





4.2 RESULTS FOR KNIVES(FSM)

In the environment where judgment making is very acute for time saving as well as security, for example air port or railway station there is a long line of passengers. And safety personnel have to mark decision on the basis of their perception at the moment very fast. Either they have to stop some body for security check or permit him or her to passes through. Both the thing detain the innocent person very painful as well as slipping of illegal object may be very dangerous. The exact explanation of objects inside the heavy and opaque baggage is very costly. In this case partial fuzzy logic can be used for estimating the shape of purpose. The ending decision can be occupied by using Partial Fuzzy Logic method. [4]



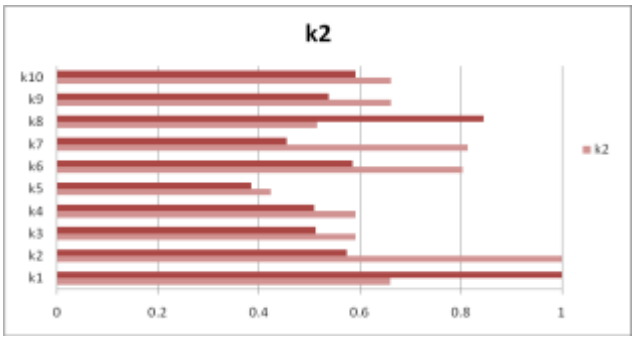


Figure 4.3 Comparison between PFL and FSM.

5. CONCLUSION

The most common technique for screening luggage at airports is with the use of X-ray technology. There are a number of reasons why it is commonly accepted including safety factors and the fact that the technology is well agreed and relatively inexpensive. As the digital X-ray technology suits more noticeable and based on the current state-of-the-art in image processing, feature extraction and classification technology. The role of computers in screening luggage will increase in order to enhance manual screening processes. A new method is suggested to determine the optimal number of clusters when segmenting X-ray images and to estimate the results acquired by different segmentation methods Compared with the statistical validity index method; our method deliberates both the spatial and statistical information of the image. [6]Preliminary experimental results indicate that our method yields results reliable with the human assessment. Another advantage of our method is that it is computationally well-organized. Our procedure only computes the Euclidian distance and Key Points.

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