Some Simple Measures of Fuzzy Information

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Abstract:

Some simple additive and non-additive measure of fuzzy entropy, fuzzy directed diverges fuzzy inaccuracies fuzzy information improvement have been obtained.

Key Words:

Measures of Fuzzy Entropy/ Fuzzy Directed Divergence / Fuzzy inaccuracy /Fuzzy information improvement.

1. Introduction:

Zadeh [3] developed his theory if fuzzy sets to enable him to measure the malignity of a fuzzy set. A fuzzy set A is characterized by a membership function $\mu_A(x)$, where to each x in the universe of discourse, there is associated a membership value in [0, 1].

If A is a fuzzy set with finite member of support points $x_1, \ldots x_n$, then its member of fuzzy entropy H(A) need to satisfy following properties.

F_1H(A) should be defines for all $\mu_A(x_1)$, $0 \leq \mu_A(x_1), \leq 1 = 1$

F_2H(A) should be continuous in this region, but need not be differentiable at every point of the region.

F_3H(A) =0 when $\mu_A(x_1)$= 0 or 1 for all i=1,2, ….n

F_4H(A) should not change when any $\mu_A(x_1)$ is changed to $1 - \mu_A(x_1)$

F_5H(A) should be increasing function of why $O \leq \mu_A(x_1) \leq ½$ and other variables are kept fixed and should be decreasing function of $\mu_A(x_1)$ when $½ \leq \mu_A(x_1) \leq 1$ and other variable are kept fixed.

F_6H(A) should be maximum when $\mu_A(x_1) = ½$ for all I = b and its maximum value should preferable be unity.

In the some way we define the measure fuzzy set B as a function D(A:B) satisfying following properties:

D1 A(A:B) $\geq$0

D2 D(A:B) = 0 if and only if A= B

D3 D (A:F) = max (H(A) – H (A) =H (F) – H(A),

Where F/ is the fuzziest set.

Deluca and termini [2] defined the measure of fuzzy entropy as

H(A) = - …………. [μA (x1) lnμA (xi) + (1-μA(xi)ln(1-μA(i)] Bhandari and Pal (I) defined the measure of fuzzy directed divergence as

$$D(A:B)=\sum_{i=1}^{n}\left[\mu_A(xi)\ln\frac{\mu_A(xi)}{\mu_B(xi)}+(1-\mu_A(xi)\ln\frac{1-\mu_A(xi)}{1-\mu_B(xi)}\right]$$

The objective of the present paper is to investigate measures of fuzzy entropy and fuzzy directed divergence in simple way

2. Simple Measures of Fuzzy Entropy:

Let A be a fuzzy set with n supports $x_1, \ldots x_n$. Then the measure of fuzzy entropy is

H(A) ……………..

For

(i) H(A) is defined for all $\mu A(xi)$, $1 \leq I \leq n$.

(ii) H(A) is continuous for all $\mu A(xi)$, $o \leq \mu A(xi) \leq 1$

(iii) H(A) = 0 when $\mu A(xi)$, = 0 or ,1 $1 \leq I \leq n$

(iv) H(A) does not change when $\mu A(xi)$, is changed to $1 - \mu A(xi)$.

(v) Let (x) $= - \ln x - \ln (1-x)$

$= - \ln x (1-x)$

$$= f^1 (x) = - \frac{1-2x}{x(1-x)}$$

Now $f^1(x) \geq 0$, if $0 \leq x \leq ½$

≤ 0, if $½ \leq x \leq 1$

Hence H(A) is increasing function of $\mu A(xi)$ when $0 \leq \mu A(xi) \leq ½$ and is decreasing function of $\mu A(xi)$ when $½ \leq \mu A(xi) \leq 1$

(vi) clearly H(A) is maximum when $\mu A(xi) = ½$

Similarly we define another measure of fuzzy entropy as

$$H_1(A) = 1 - \max_{1 \leq i \leq n} \mu A(xi) + 1 - \max_{1 \leq i \leq n} (1-\mu A(xi)$$

3. Simple measures of Fuzzy directed Divergence

If A and B are two fuzzy sets with same n supports x_1, x_2, ….x_n, then the measure of fuzzy directed divergence is

$$D(A:B) = \ln \frac{\max}{1 \leq i \leq n} \left(\frac{\mu_A(xi)}{\mu_B(xi)} \right) + \ln \max_{i \leq i \leq n} \left(\frac{1-\mu_A(xi)}{1-\mu_B(xi)} \right)$$

It can be easily verified that it satisfies all the properties of measures of fuzzy directed divergence.

Corresponding to the second measure of fuzzy entropy, the measure of fuzzy direct divergence is

$$D_1 (A:B) = \frac{\max}{1 \leq i \leq n} \frac{\mu_A(xi)}{\mu_B(xi)} + \max_{i \leq i \leq n} \left(\frac{1-\mu_A(xi)}{1-\mu_B(xi)} \right)$$

Remark:

These measures are simple in fact the measures we have given are the simplest we can think of. In fact thee depend implicitly on the values of all the membership or the values of the ratio of their membership. Similarly these depend explicitly on the maximum values of membership or maximum values of ratio of memberships.

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