

# Application of fuzzy mathematics to study brain jam\*

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**Abstract:** In this paper, for 200 persons suffering from brain jam, it is statistised that such fourteen biochemistry indexes, as CH etc. Using pattern recognition, it is analysed that relation, between these indexes and brain jam, and then main index is pointed out causing the brain jam initial practice have showed, the conclusion obtained in this paper has important significance for preventing and diaghosing the brain jam.

**Key words:** Brain jam, Biochemistry indexes, Fuzzy set pattern recognition

Brain jam is the one of main disease harming human body, and the incidence of this disease is higher. It has undoubtedly important significance for preventing and diagnosing the disease that to make clear the mechanism of the disease and, especially the relation between it and some biochemistry indexes. In general, deviation of

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Biochemistry indexes such as CH(cholesterol),TG(triacylglycerol),SUG(blood glucose), C-HDL( High density lipo protem), C-LDI( low density lipo protein ), C-VLDL(very low density lipo protein), hematocrit, whole blood reduction viscosity, erythrocyte electrophoresis time, erythrocyte sedimentation rate, Whole blood specific viscosity, plasma specific viscosity, fibrinogen and K value of ESR equation etc is the factors causing brain jam. But the reality of which deviation of indexes are main factors is seldom discussed at present. In fact ,people realize that brain jam is caused by the deviation of these indexes,But notody knows what quantitative relationship.exist among the deviations of these indexes and which indexes are the key factors.Since we have much fuzzy information from these data,it is very difficult to make the facts very clear.However,if we regard the factor of brain jam and medical diagnose system as one fuzzy system,we then are in position to make medical decision for the brain jam.Based on above acknowledgement, in this paper data from diagnose of brain jam will be analysed through fuzzy pattern recognition.

## **1.Anylisis of quantity original data**

The normal figure of each biochemistry index is defferent , then the original data of patient can't not be calculated to deviation so we have to quarantive these data mathematically given formula  $y=f(x)$  to correspondence indexes,from original data X of each index,through  $y=f(x)$  the Y we get is the deviation of the index.

The following is each index's normal value and vary formula.

	Name	Normal value	Vary formula
1	CH	[3.1,5.7]	$Y = \begin{cases} \frac{1}{5.7}(x-5.7) & x > 5.7 \\ 0 & x \leq 5.7 \end{cases}$
2	TG	[0.56,1.7]	$Y = \begin{cases} \frac{1}{1.7}(x-1.7) & x > 1.7 \\ 0 & x \leq 1.7 \end{cases}$
3	SUG	[3.9,5.6]	$Y = \begin{cases} \frac{1}{5.6}(x-5.6) & x > 5.6 \\ 0 & x \leq 5.6 \end{cases}$
4	C-HDL	[0.78,1.53]	$Y = \begin{cases} \frac{1}{0.78}(0.78-x) & x < 0.78 \\ 0 & x \geq 0.78 \end{cases}$
5	C-LDI	[1.59,3.8]	$Y = \begin{cases} \frac{1}{3.87}(x-3.87) & x > 3.87 \\ 0 & x \leq 3.87 \end{cases}$
6	C-VLDL	[0.11,0.3]	$Y = \begin{cases} \frac{1}{0.33}(x-0.33) & x > 0.33 \\ 0 & x \leq 0.33 \end{cases}$
7	The accumulation of red cell praessure	[45,48.5]	$Y = \begin{cases} \frac{1}{48.5}(x-48.5) & x > 48.5 \\ 0 & x \leq 48.5 \end{cases}$
8	Viscosity of whole blood return to the Original condition or shape	[6,8]	$Y = \begin{cases} \frac{1}{8}(x-8) & x > 8 \\ 0 & x \leq 8 \end{cases}$
9	The time of red cell electrophoresis	[16,17]	$Y = \begin{cases} \frac{1}{17}(x-17) & x > 17 \\ 0 & x \leq 17 \end{cases}$
10	Erythrocyte sed	[10,20]	$Y = \begin{cases} \frac{1}{20}(x-20) & x > 20 \\ 0 & x \leq 20 \end{cases}$
11	The viscosity of proportion of all blood	[4,4.5]	$Y = \begin{cases} \frac{1}{4.5}(x-4.5) & x > 4.5 \\ 0 & x \leq 4.5 \end{cases}$

12	The viscosity of proportion of plasma	[1.45,1.7]	$Y = \begin{cases} \frac{1}{1.7}(x-1.7) & x > 1.7 \\ 0 & x \leq 1.7 \end{cases}$
13	Fibre egg white-original	[2,4]	$Y = \begin{cases} \frac{1}{4}(x-4) & x > 4 \\ 0 & x \leq 4 \end{cases}$
14	K value of ESR equation	[30,70]	$Y = \begin{cases} \frac{1}{70}(x-70) & x > 70 \\ 0 & x \geq 70 \end{cases}$

For this paper ,all above mentioned indexes of 200 patients suffering acute brain jam were statisticised. (the diagnosis has been made of their diseases,and the bloods of each patient is taken in 48 hours.)

Through the formula we get each patient's deviation , then divide the patients into 6 groups according to the Range of their ages .Finally we calculate the average deviation of each patient in every group as following table.

	1- 50 years	51-55 years	56-60 years	61-65 years	66-70 years	70years over
1	0. 0196	0. 0266	0.0789	0.0851	0.0123	0.0000
2	0.0664	0.0681	0.1406	0.1179	0.0254	0.4786
3	0	0	0.0453	0.0179	0.2976	0.0383
4	0.0117	0.1044	0.0390	0.0604	0.0470	0.0201
5	0.0323	0.0517	0.1198	0.1181	0.0413	0.0203
6	0.0728	0.0433	0.3478	0.1297	0.0403	0.4977
7	0	0.0310	0.0033	0	0.0320	0
8	0.2866	0.2027	0.6656	0.0903	0.2236	0.0627
9	0.0024	0.0060	0.0037	0.0017	0.0110	0
10	0.6700	0.5071	0.3577	0.3429	0.2944	0.3643
11	0.6661	0.1773	0.1588	0.0954	0.2759	0.0800
12	0.0834	0.1281	0.0818	0.0746	0.0803	0.1991
13	0.3150	0.0650	0.3135	0.0036	0.0904	0.2957
14	0.9960	0.7553	0.9693	0.5136	0.3694	0.6601

In order to make clear the relationship between each index and brain jam and to find the main biochemistry indexes causing brain jam the above data will be discussed

using method of fuzzy pattern recognition.

## 2. Fuzzy pattern recognition

Put  $X = \{1-50\text{years}, 51-55\text{years}, 56-60\text{years}, 61-65\text{years}, 66-70\text{years}, 70\text{years}\}$  over  $\{x_1, x_2, x_3, x_4, x_5, x_6\}$  and regard 1-14 line above list respective as fuzzy set on universe of discourse which are denoted as  $A^{(1)}, A^{(2)}, \dots, A^{(14)}$ . To regard the maximum of each arrange in the list fuzzy set universe of discourse X.

Let  $A = \{0.996, 0.7553, 0.9693, 0.5136, 0.3691, 0.6601\}$ . According Haiming

distance formula  $d(A^{(i)}, A) = \sum_{k=1}^6 |A^{(i)}(x_k) - A(x_k)|$  we have

$$\begin{array}{lll}
 d(A^{(1)}, A) = 0.6735, & d(A^{(2)}, A) = 0.5611, & d(A^{(3)}, A) = 0.6441, \\
 d(A^{(4)}, A) = 0.6635, & d(A^{(5)}, A) = 0.6467, & d(A^{(6)}, A) = 0.5219, \\
 d(A^{(7)}, A) = 0.6996, & d(A^{(8)}, A) = 0.555, & d(A^{(9)}, A) = 0.7066, \\
 d(A^{(10)}, A) = 0.2879, & d(A^{(11)}, A) = 0.5517, & d(A^{(12)}, A) = 0.6027, \\
 d(A^{(13)}, A) = 0.5300, & d(A^{(14)}, A) = 0. & 
 \end{array}$$

According formula we get approachability of  $A^{(i)}$  and A:

$$\begin{array}{llll}
 (A^{(1)}, A) = 0.3265, & (A^{(2)}, A) = 0.4389 & (A^{(3)}, A) = 0.3559, & (A^{(4)}, A) = 0.3365 \\
 (A^{(5)}, A) = 0.3533, & (A^{(6)}, A) = 0.4781, & (A^{(7)}, A) = 0.3005, & (A^{(8)}, A) = 0.4446, \\
 (A^{(9)}, A) = 0.2934, & (A^{(10)}, A) = 0.7122, & (A^{(11)}, A) = 0.4483, & (A^{(12)}, A) = 0.3973, \\
 (A^{(13)}, A) = 0.4700, & (A^{(14)}, A) = 1. & & 
 \end{array}$$

According big or small of approachability it is arranged to order as follows:

$(A^{(14)}, A) = 1 > (A^{(10)}, A) = 0.7122 > (A^{(6)}, A) = 0.4781 > (A^{(13)}, A) = 0.4700 > (A^{(11)}, A) = 0.4483$   
 $> (A^{(8)}, A) = 0.4446 > (A^{(2)}, A) = 0.4389 > (A^{(12)}, A) = 0.3973 > (A^{(3)}, A) = 0.3559 > (A^{(5)}, A) = 0.353$   
 $3 > (A^{(4)}, A) = 0.3365 > (A^{(1)}, A) = 0.3265 > (A^{(7)}, A) = 0.3005 > (A^{(9)}, A) = 0.2934.$

### 3. Discussion

Through above result, the above 14 biochemistry indexes' position. According to causing brain jam are k value of ESR equation, erythrocyte sedimentation rate, C-VLDL, fibrinogen, whole blood specific viscosity, whole blood reduction viscosity, triacylglycerid, plasma specific viscosity, SUG, CLDI, CHDL, cholesterol, hematocrit, erythrocyte electrophoresis time. As we see from the sequence and the value size, k value is not only top one, but also obviously most important than other indexes. Therefore, k value should be regarded as key indexes during preventing and diagnosing brain jam. In addition, erythrocyte sedimentation rate is in the second position, and the value gap is big to the consequent indexes. C-VLDL, fibrinogen whole blood specific viscosity, plasma specific viscosity, whole blood reduction viscosity, SUG, C-LDI, C-HDL and CH'S value's difference is small. erythrocyte are the last 2 positions, their clinical significance are small relatively.

The sequence for bloodfat and carrierfat egg white is C-VLDL, TG, C-LDI, C-HDL, CH, which is reasonable C-VLDL going up causes atherosclerosis, which is a dangerous factor causing brain jam. Highfat egg white blood disease of brain jam go up a higher as straight model, thus TG often go up. In designing computer instrument

forecasting apoplexy C-VLDL must be considered . we know that CH, C-HDL, specially C-HDL go up a high and rate of suffering from coronary heart disease and serious degrees appear negative relativity. C-HDL is the protective element. But the analysed results show that the related degree is small relatively of them and brain jam preventing.

### References

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