THE METHOD OF FUZZY MULTIFACTORIAL EVALUATION OF LUNG FUNCTION

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ABSTRACT

In this paper, we make use of the method of multifactor evaluation of multiple stage to carry on evaluation for the lung function.The parrotry rate of clinical diagnose of breath function is 98.7% basde on the result of clinical analysis of lung function in case reports of 856 of patients.
Key Word: Lung function Fuzzy mulitifactoral evaluation

1. Preface

The measurement of lung function is a subject assessed person respiratory function, basde on respiratory physiology of the human body. Now the clinic workers more and more pay great attention to the measurement of lung function. We assess the ditermination of charater and ration which is the patients with illness of lung and breath. We assess objectively nature or extent of lung function or degree restored and condition of labour force as well as risk of operation. The measurement of lung function aid in clinic diagnose and distinguish diagnosis of sickness, basde on results of measurement of the lung function, therefore it is applied extensive increasingly.

Now it is more important how to evaluate multifactorially the lung function of the patients. As we know: there are many factor targets reflecting the patients breath functions to be better or worse. It is a more complex problem that multifactorially evaluate the condition of lung function of a patient. We analysing and assessing the results of lung function, it is difficult for us to manage and solve the problem by using this common method of breath function because it is difference reflected condition of every factor targets of various illness. In this paper, we make use of the method of multifactor evaluation of multiple stage to carry on evaluation for the breath function of patients. The Fuzzy Math Model and applying method-mulitifactorial evaluation of breath funcion ara intraduced as follow.

2. Math Model is Formed

We make use of the method of multifactorial evaluation for the lung function. First of all, we take the method of trapezoidel distributive function as a bridge. Basde on it we establish membership function of every grade (that is normal, light, medium and heavy degree) about every target according to each target valuee of measurement of lung function. Seconde, the number of weight of every target basde on clinical data and experience. Finally, we get the result basde on the principle of maximal membership degree of multifactorial evaluation. The above problems have been solved by this way is better.

The method expourded with the targets of the F-V curve as follow. We select the four targets of flow curve(that is Vmax75 Vmax50 Vmax25). We form the factor set which is shown in vector U={u1, u2, u3, u4}. Distribution of number of weight in the whole for all the factors, such as Ui is respectively a1=0.18, a2=0.3, a3=0.22, a4=0.3. This is shown in vector A = { a1, a2, a3, a4 }. It is fuzzy set on U. Then evaluation set is formed. We divide the grade of evaluation of the lung function in to four classes and establish standard of grade basde on clinical data of lung function. Let V1 = normal V2 = light degree V3 = medial degree V4 = heavy degree. The normal show the lung function is normal. the light or medirm and heavy degree show relatively the lung function to reduce lightly, medially, heavyly. Therefor the evaluation set V = { V1, V2, V3, V4 }.

Now we make-up relation matrix R basde on membership function between factor setand evaluation set.

$$R = \{ (Ui,\ Vj,\ U\ rij) \ /\ i=1,\dots,4;\quad j=1,\dots 4. \}$$

If R have got we cary on operation basde on formula B = A o R . The operator 'o' is calculated by adding and multiplying.

$$B = A \circ R \qquad (1)$$

$$= (a1, a2, a3, a4) \begin{bmatrix} r11 & r12 & r13 & r14 \\ r21 & r22 & r23 & r24 \\ r31 & r32 & r33 & r34 \\ r41 & r42 & r43 & r44 \end{bmatrix}$$

$$= (b1, b2, b3, b4)$$

Among them $$Bj = \sum_{k=1}^{n} ak\ rkj \qquad (\ j = 1, \ldots, 4\ ) \qquad (2)$$

If $Bjo = \underset{1 \leq j \leq 4}{MAX}\ bj$ then the appraisal object is evaluated to get a comment Vjo. Thisis the final result of multifactorial evaluation.

3. Applying of the Methed

Now taking the obstructive ventilation for example. We establish normal standard of evry target (that is Vmax25/75, Vmax75, Vmax50, Vmax25). The normal range is 80%-120% which is the actual value as compared with presumption value. In turn the light degree is 60%-80%; the medial degree is 60%-40%; the heavy degree is under 40% . Therefor the range of each grade is shown V1 [120, 80], V2 [80, 60], V3 [60, 40], V4 [40, 0].

We establish membership function between every factor and each class. In order to make them simple, they fall adopted trapezoided distributive function. If fij (x) (i = 1, ... , 4; j = 1, ... , 4) show respectively membership function which is factor Ui relative to the grade Vj.

We line up tthe fij (x) in part as follows but others fij (x) are omited.

$$fij(x) = \begin{cases} 1 & ,\ (80 <= X <= 120) \\ X/80 & ,\ (80 > X > 0) \end{cases} \qquad fij(x) = \begin{cases} 1/40\,(120-X) & ,\ (80 <= X <= 120) \\ 1 & ,\ (80 <= X <= 60) \\ 1/60\,(x) & ,\ (60 > X > 0) \end{cases}$$

$$fij(x) = \begin{cases} (120-X)/60 & ,\ (60 <= X <= 120) \\ 1 & ,\ (60 > X => 40) \\ X/40 & ,\ (40 > X > 0) \end{cases} \qquad fij(x) = \begin{cases} (120-X)/80 & ,\ (40 <= X <= 120) \\ 1 & ,\ (40 > X > 0) \end{cases}$$

... ... , ... , ...

For the above membership we can reckon respectively value of membership function of each target which is above the measurement of patient and it is show in matrix R for example. The four measurement results of a patient Vmax is 54% , 80% , 65% and 30% respectively. We from the relationship matrix R1.

Let the Vmax75, Vmax50, Vmax25 and Vmax25/75 are subordinated to x respectively. Then we get every value of fij (Vmax25/75) as followss.

$f11(Vmax25/75) = 0.675$, $f12(Vmax25/75) = 0.9$, $f13(Vmax25/75) = 1$, $f14(Vmax25/75) = 0.825$ ... then is got

$$R1 = \begin{bmatrix} 0.675 & 0.900 & 1.000 & 0.825 \\ 1.000 & 1.000 & 0.667 & 0.500 \\ 0.813 & 1.000 & 0.917 & 0.688 \\ 0.375 & 0.500 & 0.750 & 1.000 \end{bmatrix}$$

According to formula (1) and (2), we get

$$B = (0.7089,\ 0.8500,\ 0.8620,\ 0.7640)$$

Therefor the V3 get comment(diagnose) of the patient. It is medial reduction of ventilation function of small trachea obstruction.

We can alse get comment of other targets reflected breath function all the same. Finally, we make use of the method of fuzzy analyses of multiple-stage to get the result of diagnose for lung function of the patients basde on centre principle of fuzzy gravity.

4. Conclusion

In this paper, the method of multifactorial evaluation is applied to evaluation of lung function. The linchpin upon which problom depends is to find a bridge in Meth Method. Here we establish membership function between each evaluation target and evaluation object. They full adopted trapezoidal distribution function. We make use of method of multifactorial evaluaton to carry on management for diagnose of lung function. The parrotry rate of clinical diagnose of lung function is 98.7% basde on the results of clinical analysis of lung function in case reports of 856 patients. The method is of actual value of clinical medicine. It may be applied to practise of clinical medicine.

5. Reference

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