AUTOMATIC ANALYSIS OF THE PARAMENTERS, FUZZY EVALUATION AND SPECIAL DIAGNOSTIC SYSTEM ABOUT LUNG FUNCTION

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ABSTRACT

The main idea of this artical is to introduce the theoretical basis, working process and analytical result which is automatic analysis the paramenters of Lung function & fuzzy evaluation & special diagnostic system. This system can translate, compress, storge and analyse datas. It also includes Fuzzy estimation, special diagnosis, and management of cases. Micocompute (286, 386 or 486) is related with different kinds of lung function instrument in order to diagnose and analyse the parameters of lung function automaticly, sciencely and mordenly.

Keywords: lung Function, Fuzzy Evaluation, Special Diagnosis

1. preface

Measurement datas of lung function is a kind of new science to qualitative or quantitative estimation for human's respirtory function. Up to day, the instruement of lung function have not had the function of clinical analyzing, management and diagosis . It only have had the function of measurement. Now different kinds of instrument is related with micocomputer(286, 386 or 486) in order to translat, compress, storage or analyse the pictures and data. We combind historical document, accumulative data with special experience to establish a pattern of fuzzy mathematics. It can give proper diagnosis and suggestion through analyzing the data of lung function, comprehensive evaluation, historical document and special experence. It can also print the parameters and diagnosis. There is new measuremental item else. It's case management system can offer investigation and comparison. we have taken out 500 cases from 3000 cases to compare with the result of special doctor by method of random. The ratio of conformation is 98%.

2. Translation and analysis of data

There are lots of lung function instruments recently. They have different export forms and export contacts themselves. You can get data from the contact connector or print contact. Different instrument has different method of calculation and analysis. We can get the firsthand data on the basis of Flow Volume curve. So it becomes convenient to unify analysis result, to add new items and methods.

There are many curves of lung function. But the most important is Flow Volume curve. It can given us the number of V-T, the relation of V-T

and some other data so as to decrase the storage room. According to the historical document this system can caculate the data of inspiration function. Firty two data of inspritation and expiration function can be caculated and analyzed. The result will be stored in data bank and be displayed or printed.

3.model of fuzzy math

Form a scientific estimate for symptom of patient, first we carry on division of diverse clinical sympttom into five classes base on standard. It is respectvely normol, slight, medial, heavy degree and failure. There isn't boundary obviously between every class each other. Therefor it is fuzzy we must be make use of the classification of the fuzzy method. we establish membership function which is every factor relative to each class. In order to make them simple, they full adopted trapezoidal and triangle distributive function base on refereceE 1], [3] and theory of fuzzy math [4], [5] as well as physiological state of chinese people. let $Fi=(f_{i1},f_{i2},f_{i3},f_{i4},f_{i5})$ and $0<=f_{ij}<=1$. If $f_{ij}=1$ then the membership degree $f_{i1},f_{i2},f_{i31},f_{i4}$ and f_{i5} belong respectively to normol breath, slight, medial, heavy reduction and failure of breath. Now we line up the membership degrees of relative every class. e.g. vital capacity (VC).

$$f_{i5} = \begin{cases} 1 & (0 <= Vc < 15) \\ 1-(Vc-15)/10 & (15 <= Vc < 25) \\ 0 & (25 <= Vc\ ) \end{cases}$$

$$f_{i4} = \begin{cases} 0 & (0 <= Vc < 15) \\ (Vc-15)/10 & (15 <= Vc < 25) \\ 1 & (25 <= Vc < 45) \\ 1-(Vc-45)/10 & (45 <= Vc < 55) \\ 0 & (55 <= Vc\ ) \end{cases}$$

$$f_{i3} = \begin{cases} 0 & (0 <= Vc < 45) \\ (Vc-45)/10 & (45 <= Vc < 55) \\ 1 & (55 <= Vc < 65) \\ 1-(Vc-65)/10 & (65 <= Vc < 75) \\ 0 & (75 <= Vc\ ) \end{cases}$$

$$f_{i2} = \begin{cases} 0 & (0 <= Vc < 65) \\ (Vc-65)/10 & (65 <= Vc < 75) \\ 1-(Vc-75)/10 & (75 <= Vc < 85) \\ 0 & (85 <= Vc\ ) \end{cases}$$

$$f_{i1} = \begin{cases} 0 & (0 <= Vc < 75) \\ 1-(Vc-75)/10 & (75 <= Vc < 85) \\ 1 & (85 <= Vc\ ) \end{cases}$$

Based on the numbers of parameter n we establish the relative matrix F which is single factor of n x 5. Let the every parameter i relatives

to fuzzy value Fi.

4.Fuzzy Multifactorial Evaluation

After gotten all of the vector Fi which is all in all parameter we should consider the distribution of number of weighted in the whole for all the factors. Due to every parameter reflects different symptom thereby Their numbers of weighted are different but they relative and affect between them each other.base on special diagnostic result and experience we establish initially the coefficient of weighted,such as Xi (i=1,2,...,n) is respectively $a_1,a_2,\ldots,a_n$. By test and practical state we make use of the method of statistics regression to readjust repeatedly the numbers of weighted.Final we affirm relative weighting coefficients.Then we get the weighting vector set $A=(a_1, a_2,\ldots,a_n)$. Now taking the VC for example the weighting coefficients of VC is 0.35 initially but it is 0.29 affirmed finally.

Based on the formula $Y = A \circ F$ we carry on multifactorial evaluation by operation of the weighting vector A and fuzzy relative matrix F.

We can get the result of evaluation based on the principle of maximum membership degree. If the Yi is maximum then it is the class of i. When the Yi=Yi+1 let the Yi-1 compare with Yi+2. If the Yi-1>Yi+2 then it is the class of i .It is all the same conversely.When the Yi-1 or Yi+2 unexist or Yi-1=Yi+2 it is the class of i.

By the method of multifactorial evaluation we estimat some functions, such as the ventilation, diffussion, dangerous degree of operate, judgment pneumoconiosis, divided class of lung function decrease and compared with lung function of front and back of treatment. some are single class evaluation and others are multifactorial evaluation.

5. Special Diagnosis

Special Diagnosis is a system of which we regard special experience and diagnostic technique as a knowledge bank. It forms a judgement or deduction upon the data and the result whill is mentioned above. Then it can give us the proper diagnosis and remedial suggestion.

Diagnosis can also be obtained by comprehensive evaluation.But its accuracy is low for similar disease and complication. Sometimes multi-factorial evaluation will lose some useful news.In order to improve the accuracy,we adopt special diagnosis.

Knowledge bank is the basis of special diagnosis. Its material is acquired from books,summary of experience and special doctor. It can be changed into new pattern which the computer could understand. The knowledge is expressed as rule in knowledge bank. It means RULE: IF PRECONDITION THEN CONCLSION. In the light of patient's collaboratal

degree and the above-mentioned data of comprehensive evaluation,proper diagnosis and remedial suggestion can be given by deduction. Sometimes special data should be added.

6.Case management system

The case management system is builded to improve diagnostic technique at the same time to give patient and doctor with convience. It will give you a chance to inquire,select or compare the data of lung function so as to make case and diagnosis computerize, mordenize and scienceize.

7.Appling

This system has been used in lung function department of Tian Jin Medical University General Hospital about four years.Now it is used to analyse and diagnose everday.

This system is combined with Bodyscreen II and Transferscreen II lung function instrument in Tian Jin Medical University General Hospital.The results conformed with clinical reality basically. The effect is good in The First Centre Hospital and He Xi Hospital of Tian Jin.

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8.Referece

1. Mu kui-jing and Lin you-hua, *Measurement Principle and Clinical Applying of Lung Function.*(1992), P.33 - 216.
2. Wang Pei-zhuang, *Introduction to Fuzzy Mathematics, Mathematics Inprectice and theory,*(1980),P.55 - 110.
3. Zhu Bao-yu, *Fuzzy Pattern for Early Diagnosis of Cor Pulmonale, Fuzzy Systems and Knowledge Engineering,*1987, No, 7.
4. Guo cang and Zhu Bao-yu et al, *Observation on Clinical Results of Meptin in Asthma and Asmatic Bronchitis,*1990, No, 12.
5. Mu kui-jing and Lin you-hua, *Normal Standard of Lung Function of Chinese,* 1990.6.
6. Huang Chong-fu, *Analysis and Application of Fuzzy News,*1992.