

## Application of Task Driven teaching mode in the course teaching of Pattern Recognition

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### Abstract

Pattern Recognition is an important elective course in the high grade of automation specialty. This paper discusses the use of task driven teaching method in the teaching of Pattern Recognition, and tries to use to mobilize the enthusiasm of students learning, and cultivate students' ability to solve practical problems.

### Keywords

Task driven teaching mode; Automation major courses; Pattern Recognition.

### 1. Introduction

Task driven teaching mode is the latest outcome of developments of 20th century college education in the West since the 80's and it also is the latest developments. Pattern recognition is the scientific discipline whose goal is the classification of objects into a number of categories or classes. Pattern Recognition has a long history, but before the 1960s it was mostly the output of theoretical research in the area of statistics. And the advent of computers increased the demand for practical applications of pattern recognition, which in turn set new demands for further theoretical developments. The task-driven teaching approach embodies the practical characteristics of Pattern Recognition course, which is benefit to the training of high-quality personnel.

### 2. Examples of Task Driven Teaching Mode for Pattern Recognition Teaching

Fig.1 shows the basic methods of pattern recognition and the establishment of the corresponding tasks. In this thesis, we have chosen the statistical pattern recognition, fuzzy pattern recognition, and the pattern recognition based on neural network as examples. To establish the corresponding task scenarios for these methods.

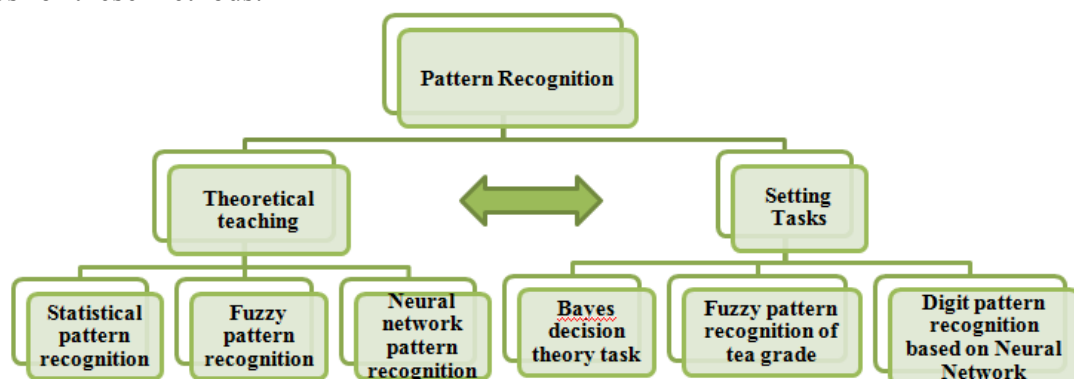


Fig.1 Implementation Plan of Task Driven Teaching Mode for Pattern Recognition

#### 2.1 Statistical Pattern Recognition

For statistical pattern recognition, we choose the core content of the Bayesian decision theory, and establish the task situation. Select examples close to the students living, such as the classification of

cell samples, classification situation according to the data of men and women and the height and weight data, etc. On the same task, such as the same cell sample, Let the students to classify, respectively base on the maximum a posteriori decision criterion and the minimum risk Bias decision criterion of Bias decision theory. Comparative conclusion, let the students feel the impact of different criteria for classification. Course teaching in accordance with the following steps:

A) First review the relevant basic concepts

(1)  $P(\omega_i)$  : Prior probability (of class  $\omega_i$ ).

(2)  $P(\omega_i|X)$  : Posterior Probability (of class  $\omega_i$  given the observation  $x$ ).

(3)  $P(X|\omega_i)$  : Likelihood (conditional prob. of  $x$  given class  $\omega_i$ ).

(4)  $P(x)$  A normalization constant that does not affect the decision.

(5)  $p(X|\omega_i)$  – class mass probability of  $x$  in  $\omega_i$  or class conditional probable mass/density function of  $\omega_i$ .

B) Account specific tasks:

Suppose in cell recognition, prior prob. of ill cell and prob.

$$P(\omega_1) = 0.05, P(\omega_2) = 0.95 \quad (1)$$

Now give a new cell  $X$  to be observed. and from their density function

$$p(X|\omega_1) = 0.5, p(X|\omega_2) = 0.2 \quad (2)$$

First use Bayesian Decision with the minimum probability of error; Then increase the conditions -Loss functions are :  $L_{11}=0, L_{21}=10, L_{22}=0, L_{12}=1$ . classify it according to Bayes risk . Let the students compare different results of different methods.

C) At the end, a batch of cell sample data is given, which requires the students to realize the whole task based on the theory of MATLAB.

The teaching task is suitable for the comprehensive practice in first chapter. Before the implementation of the task, the students have mastered some basic concepts and Bias decision theory, such as prior probability, posterior probability, total probability formula concepts and Bayesian decision theory. On the basis of theoretical calculation, students are required to use MATLAB software programming to achieve the whole task. Through the task of strengthening the students in front of the contents of the study, and through the task to achieve the purpose of cultivating students' ability to solve practical problems.

## 2.2 Fuzzy Pattern Recognition

Selecting tea classification as a task, According to the cable, color, clarity, color, aroma and taste of the soup of tea, divide the tea into "special", "excellent", "good", "bad" five types, they correspond to the fuzzy subsets of fuzzy theory, the fuzzy subsets of the tea models are given, and the grade of the tea leaves is identified. Guide students to complete the whole process, clear thinking, programming based on matlab Matlab software platform, Use different degree of similarity, such as Distance degree of similarity, Lattice Degree of Nearness to discriminate tea grade. Fig.2 is a student's programming work.

```

1  function[C]=fuzzy_mssb(model,A,B)           %fuzzy pattern recognition
2  C=[];
3  [m,n]=size(A);
4  s=length(B);
5  if(n~=s)
6      disp('wo vector of the dimension is not the same');
7  else
8      if(model==1)                           %Lattice Degree of Nearness
9          for(i=1:m)
10             x=max(min(A(i,:),B));
11             y=min(max(A(i,:),B));
12             C(1,i)=(x+(1-y))/2;
13         end
14     elseif(model==2)                       %minimum maximum Degree of Nearness
15         for(i=1:m)
16             x=sum(min(A(i,:),B));
17             y=sum(max(A(i,:),B));
18             C(1,i)=x/y;
19         end
20     elseif(model==3)                       % minimum average Degree of Nearness
21         for(i=1:m)
22             x=2*sum(min(A(i,:),B));
23             y=sum(A(i,:)+B);
24             C(1,i)=x/y;
25         end

```

Fig. 2 Student Programming Work

### 2.3 Digit Pattern Recognition based on Neural Network

In this section, the task is to design and train an accuracy Back Propagate Neural Network, in order to recognize the numbers from 0 to 9. Before pass the data to the BP Neural Network, let students use image processing to achieve the input for the Neural Network. Image preprocessing process is shown in Fig2. Then accomplish digits segmentation, resizing to set matrix for represent digit. For example, 5 will be represented by the 16\*16 matrix like Fig.3. Let students familiar with the neural network to achieve the process of digital recognition through the task. Choice network parameters, here can give the Reference resources of Digit Recognition NN structure is shown in Fig.4. Then let the students complete the neural network simulation program design and neural network test.

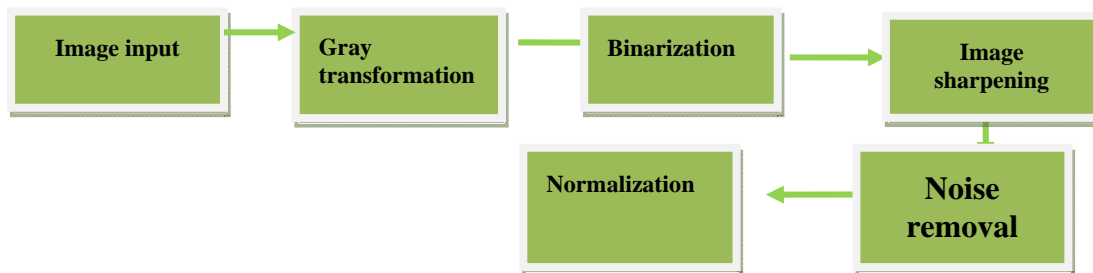


Fig. 2 Image preprocessing process

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1 1 1 1 1 1 0 0 0 0 0 0 0 1 1 1
1 1 1 1 1 0 0 0 0 0 0 0 0 1 1 1
1 1 1 1 1 0 0 0 0 0 0 0 0 1 1 1
1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1
1 1 1 1 0 0 0 0 1 1 1 1 1 1 1 1
1 1 1 1 0 0 0 0 0 0 1 1 1 1 1 1
1 1 1 0 0 0 0 0 0 0 0 0 1 1 1 1
1 1 1 0 0 0 0 0 0 0 0 0 1 1 1 1
1 1 1 1 1 1 1 1 0 0 0 0 0 1 1 1
1 1 1 1 1 1 1 1 1 0 0 0 0 1 1 1
1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1
1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1
1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1
1 1 1 0 0 0 0 1 1 1 1 0 1 1 1 1
1 1 1 0 0 0 0 1 1 1 1 0 1 1 1 1
1 1 1 1 0 0 0 0 0 1 1 1 1 1 1 1

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Fig.3: Matrix for represent digit

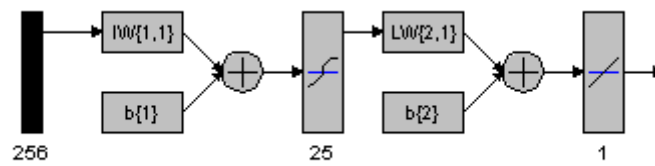


Fig. 4: Digit Recognition NN structure

### 3. Conclutions

Task-driven, need to complete a number of tasks associated with the discipline to learn and develop skills. Design is a prerequisite for the implementation of the task of teaching. Task based teaching method is beneficial to the students' knowledge system of pattern recognition. And through the task to achieve the purpose of cultivating students' ability to solve practical problems. Facts have proved that the task driven teaching method can get better teaching effect.

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