

PATTERN RECOGNITION

Dr. K.Vijayarekha

Associate Dean

School of Electrical and Electronics Engineering

SASTRA University, Thanjavur-613 401

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1.PATTERN RECOGNITION

1.1 Introduction

The Term pattern is taken from the French word patron which means a similarity of events or some basic things which occur regularly.

The basic thing can be a dot or a line or a circle or a square or whatever and this basic thing is called a **primitive**

Dot primitive

Line primitive -----

Circle primitive ooooo

Square primitive □□□□□

Animation 1

If these basic primitives are repeated we get a pattern. Patterns with dot primitive and line primitives are shown below.

..... -----
..... -----
..... -----

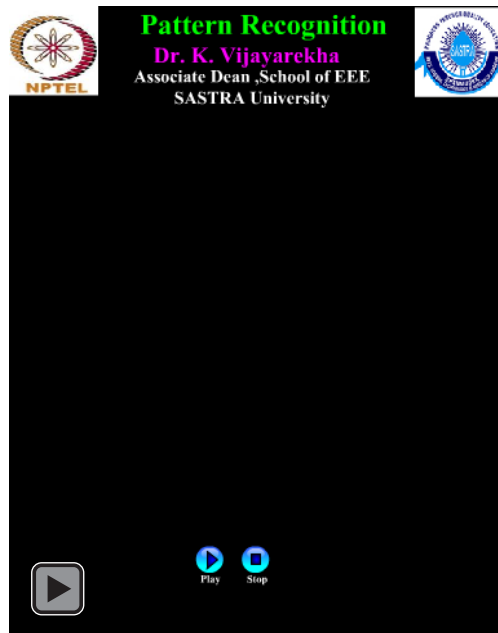
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Dr. K. Vijayarekha
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SASTRA University

Primitives

Play Stop

The basic primitive being a circle or a square will result in a pattern shown below

00000	□□□□□
00000	□□□□□
00000	□□□□□





The **basic patterns** are based on how often something gets repeated or in other words it is based on the periodicity of something which repeats itself without any change or modification. Few patterns are based on the symmetry. In other words, it depends on finite repetition.

In our day to day life we do come across many patterns. We try to **learn** them for the first time we see them and try to **recognize** them at a later time. These two operations combine together to form the basic concept of **pattern recognition**

Understanding and learning a pattern type is pattern learning and grouping the patterns based on pattern learning is called pattern classification. **Pattern learning along with pattern classification is called pattern recognition.**


Basically pattern recognition is a study which provides or attempts to provide an answer to the basic question “What is it?”


Animation 3




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SASTRA University





Play Stop



If objects are to be identified based on shape the pattern recognition problem tries to answer the basic question “What object is this based on some factor like shape?” If pixels in an image are to be identified based on the local properties of the image, it tries to provide an answer for the basic question “What pixel is it based on the local properties of the image?”

In general the subject pattern recognition encircles both understanding a pattern and classification done based on the understanding.

Patterns are to be well recognized for many applications. We humans differentiate one person from the other by certain factors.

We can also have three or more type of things among which one type may have to be identified.

Let us consider few examples.

Example 1:

Let us consider that a mobile is ringing.

When a person picks up the mobile and says “Hello” the person on the other end is able to identify the person who has made the call with this single word.

Do you know how this is possible? Simple..

When the second person hears the word Hello, he tries to compare the way the word is spelt, the voice, the modulation with which it is pronounced and other such nuances which helps in arriving at finding the name of the person who has called.

The pattern of speech of one person is different from that of the other. A human being is capable of segregating people based on this difference.

So the brain does all these jobs, especially within a shorter duration of time. Here human brain acts like a computer and derives at a solution.

So there is basically a pattern when a person speaks.

Example 2:

Imagine that you are walking on a road. When you meet a person who is known to you but you are meeting him after 10 years or so.

Still you will be able to recognize him and say a hello

You know how did you find that the new person you met now is already known to you?

It is based on the recollection of memory or the comparison of the similar things between the features of the newly seen person to that of the person whom we already know.

It may be the nose or the forehead or the eyes or even the ears which might have made us identify.

Now just consider a case wherein you travel in a train after attending an international conference. Assume that people from different countries are returning to the city by the same train.

Assume that there are two persons one from America and the other from China are sitting near the window in opposite seats. Your seat happens to be next to that of the person from China. Imagine that you get down from the train to say Bye to your friend who had come all the way to drop you in the railway station and the train has started to move.

What will you do?

You will jump into the compartment and try finding out your seat.

While you start to move from one seat to the other you will stop the moment you see the person from China and occupy your seat. You would not have chosen to sit near the person from America because you very well know that your seat is next to that of the Chinese.

How did you recognize the person whom you had seen only for a moment?

You were able to recognize the person because you distinguished him from the other man by his nose. That was the prominent feature among all features which are visible.

Suppose the above example had a person from America and the other from Africa

If we want to find the difference between an American and an African we can do so by looking at the skin color.

Example 3:

Imagine a situation where you enter a classroom of a school where the children are too small. You need to find the teacher of the class. The moment you enter the class you will look at the person who is much taller than the rest. Here the differentiating factor is the height. If we want to group a set of thin people from a group of people where we have both thin and stout people, the weight of each person will be of use to us.

Example 4:

Imagine an old man who is a fruit vendor comes to your house daily to sell fruits.

Assume that he has a big basket full of all kinds of fruits like oranges, mangoes, pomegranate, papaya and green apples.

If you plan to buy only green apples what do you think you should do?

Probably you should start picking up the green coloured fruits which will essentially be green apples. Hence color plays an important role in differentiating green apples from the rest of the fruits. Hence if we want to sort out green apples from a mixed fruit collection which include oranges, pomegranates and papaya we can do so by identifying the color of the fruit (green).

Example 5:

If a Wedding is to take place in your house you would prefer buying silk sarees for close relatives. When you visit a textile store the sales person will show you different varieties of clothes.

If you prefer choosing silk cloth, you can do so by checking the texture of the fabric.

Example 6:

Imagine a situation wherein you are at home preparing seriously for your forthcoming exams. All other family members have gone out.

You feel sleepy and would like to have a cup of tea to get rid of sleepy feeling.

You go to the kitchen.

You find two containers with two white colored powders one powdered salt and the other powdered sugar.

How will you find which one to use for preparing tea?

You will take a pinch from each container and whichever is sweet will be used for the preparation of tea.

Here the input from our taste buds in the tongue helps in proper identification.

An A4 bond sheet is differentiated from an ordinary A4 size sheet by the color, texture and the thickness of each of the type of paper.

A portion of a map is identified to be a part of a sea if it is represented by blue color and we arrive at a conclusion that it may be a part of a mountain if it is represented by brown color.

So in all these examples we understood that for pattern learning and pattern classification we need to have some thing which will help us to differentiate between the two things.

The thing which helps us to differentiate or distinguish between different patterns is called feature.