DESIGN PATTERN IDENTIFICATION MODELS

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ABSTRACT

This work provides some minimal guidelines (and requirements) for writing a research paper. Issues related to the contents, originality, contributions, organization, bibliographic information, and writing style are briefly covered. Evaluation criteria and due dates for the research paper are also provided.

Keywords: Originality, Contributions, Organization, Bibliographic.

1. INTRODUCTION

In the Pattern matching, we usually work with one-dimensional, two-dimensional data, or fingerprints, signature, faces, barcode, characters, handwriting, sometimes it involves the one-dimensional string matching concept also. Patterns are either tree structures or sequences. In different programming languages and machines we work with different way for matching the patterns. [i] [ii] [iii]

In the case of machines, the major classifications include deterministic finite state automata, deterministic pushdown automata, nondeterministic pushdown automata and Turing machines.

Regular programming languages make use of regular expressions for pattern matching. Tree patterns are also used in certain programming languages like Haskell as a tool to process data based on the structure. In comparison of regular expressions, the tree patterns lack simplicity and efficiency.

In our daily life there are many areas where the applications for pattern matching are utilized. With the help of pattern matching, the skills of abstraction and generalization are essential to find our way in the world, we are able to deal with much more complex patterns that may not directly be based on sensorial observations. The ability of pattern matching is also in other biological systems like in the Animal navigation.

There is the ability of many animals, insects & birds to find their way accurately without maps or instruments. Birds such as the Arctic tern, insects such as the monarch butterfly and fish such as the salmon regularly migrate thousands of miles to and from their breeding grounds, and many other species navigate effectively over shorter distances. [iv]

In the 20th century, Karl von Frisch showed that honey bees can navigate by the sun, by the polarization pattern of the blue sky, and by the earth's magnetic field; of these, they rely on the sun when possible.

William Tinsley Keeton showed that homing pigeons could similarly make use of a range of navigational cues, including the sun, earth's magnetic field, olfaction and vision.

Ronald Lockley demonstrated that a species of small seabird, the Manx shearwater, could orient themselves and fly home at full speed, when released far from home, provided either the sun or the stars were visible. [v]

Many other insects and birds are able to combine learned landmarks with sensed direction (from the earth's magnetic field or from the sky) to identify where they are and so to navigate.

Internal 'maps' are often formed using vision, but other senses including olfaction and echolocation may also be used.

The ability of wild animals to navigate may be adversely affected by products of human activity. For example, there is evidence that pesticides may interfere with bee navigation, and that lights may harm turtle navigation.

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Unsupervised Learning – It gives the scientist an automatic system to indicate the presence of yet unspecified patters in the observations.

Supervised Learning – It is an automatic system that verifies (confirms) the patterns described by the scientist based on a representation defined by him.[xi]In the pattern recognition system, there are three main stages:Representation, Generalization andEvaluation.There are four approaches used in Pattern Matching :

1) Introspection by a Platonic viewpoint : object modeling (it is also called Syntactic and Structural approaches to pattern recognition, thereby belong to the area, as well as the case-based reasoning)

2) Introspection by an Aristotelian viewpoint : generalization (it is Physiological process and is internally inaccessible. The researcher who wonders how he himself generalizes from low level observations given by numbers may rely on statistics.)

3) Extrospection by an Aristotelian viewpoint : system modeling (these models are based on the physical and physiological knowledge of cells and the proteins and minerals that constitute them.)

4) Extrospection by a Platonic viewpoint: concept modeling (the networks and probabilistic networks belong to this area as far as they are defined by experts and not learned from observations.)

Fingerprint based biometric system is essentially a pattern recognition system that recognizes a person by determining the authenticity of his/her fingerprint. It consists of two parts –

☐ Verification system – It helps in authenticating any person's identity by comparing the captured fingerprint with his/her own biometric template pre-stored in the system. It works with one-to-one (1:1) comparison to determine whether the identity claimed by the individual is true.

☐ Identification system – It helps in recognizing any individual by searching the entire template database for a match. It works with one-to-many (1:M) comparisons to establish the identity of the individual.

Working of pattern matching system in reference of biometric fingerprint system

Main building blocks of any fingerprint-based verification and identification system are – 1) Sensing, 2) Feature extraction, and 3) Matching. For identifying any individual under pattern matching, we have to go through some steps

o User Enrollment – It is responsible for registering individuals in the biometric system database. The fingerprint of an individual is acquired by a fingerprint scanner to produce a raw digital representation. The raw digital representation is usually further processed by a feature extractor to

generate a compact but expressive representation, called a template.

o Biometric reader captures the fingerprint of the individual to be recognized and converts it to a digital format, which is further processed by the feature extractor to produce a compact digital representation.

o Output is either the identity of an enrolled user or an alter message such as "User Not Identified".

2. PATTERN

The pattern matching is the act of checking a given sequence of tokens for the presence of the constituents of some pattern. In pattern recognition, the match usually has to be exact. The patterns generally have the form of either sequences or tree structures. xii

Fingerprint

There are several patterns of fingerprint, the analysis of fingerprints is for matching that requires the comparison of several features of the print pattern.

These include patterns, which are aggregate characteristics of ridges, and minutia points, which are unique features found within the patterns.

It is also necessary to know the structure and properties of human skin in order to successfully employ some of the imaging technologies.

The three basic patterns of fingerprint ridges are the arch, loop, and whorl:

Arch: The ridges enter from one side of the finger, rise in the center forming an arc, and then exit the other side of the finger.

Loop: The ridges enter from one side of a finger, form a curve, and then exit on that same side.

Whorl: Ridges form circularly around a central point on the finger.

Hand geometry

It is used to identify the users by the shape of their hands. Hand geometry readers measure a user's hand along many dimensions and compare those measurements to measurements stored in a file.

Iris based identification

an automated method of biometric identification that uses mathematical pattern-recognition techniques on video images of one or both of the irises of an individual's eyes, whose complex patterns are unique, stable, and can be seen from some distance.

Retinal pattern recognition

Ocular-based biometric technology that uses the unique patterns on a person's retina blood vessels and is often confused with iris recognition

Facial recognition

An automated system with the ability to identify individuals by their facial characteristics

Signature recognition

Signature recognition is a behavioral biometric. It can be operated in two different ways:

1. Static: Here the users write their signature on paper, digitize it through an optical scanner or a camera, and the biometric system recognizes the signature analyzing its shape, it is also known as "off-line".

2. **Dynamic:** Here the users write their signature in a digitizing tablet, which acquires the signature in real time. Another possibility is the acquisition by means of stylus-operated PDAs. Some systems also operate on smart-phones or tablets with a capacitive screen, where users can sign using a finger or an appropriate pen, it is also known as "on-line". Dynamic information usually consists of the following information:

o spatial coordinate $x(t)$

o spatial coordinate $y(t)$

o pressure $p(t)$

o azimuth $az(t)$

o inclination $in(t)$

o pen up/down

Speaker verification

Identification of a person from characteristics of voices (voice biometrics).

Multi-biometrics

An authentication technology using different biometric technologies such as fingerprints, facial features, and vein patterns in the identification and verification process.

Fingerprint analysis

A fingerprint is an impression left by the friction ridges of a human finger. The recovery of fingerprints from a crime scene is an important method of forensic science. Fingerprints are easily deposited on suitable surfaces (such as glass or metal or polished stone) by the natural secretions of sweat from the eccrine glands that are present in epidermal ridges. Used by investigating team to identify the criminals

Identification

Biometrics authentication (or realistic authentication) is used in computer science as a form of identification and access control.

Analysis

Biometrics is the measurement and statistical analysis of people's physical and behavioral characteristics. The technology is mainly used for identification and access control, or for identifying individuals that are under surveillance.

Pattern types

Pattern based algorithms compare the basic fingerprint patterns (arch, whorl, and loop) between a previously stored template and a candidate fingerprint. This requires that the images can be aligned in the same orientation. To do this, the algorithm finds a central point in the fingerprint image and centers on that. In a pattern-based algorithm, the template contains the type, size, and orientation of patterns within the aligned fingerprint image. The candidate fingerprint image is graphically compared with the template to determine the degree to which they match. [xiii]

3. PATTERN RECOGNITION & ITS SYSTEM

It's the study how the machine can observe the environment, learn to distinguish various patterns of interest from its background and make reasonable decisions about the categories of the patterns. During recognition, the given objects are assigned to a prescribed category.

The designed model of a pattern recognition system essentially involves the following three steps:-

Data Acquisition and preprocessing : data from the surrounding environment is taken as the input and given to the pattern recognition system. The raw data is then preprocessed by either removing noise from the data or extraction pattern of interest from the background so as to make the input readable by the system.

Feature extraction: the relevant features from the processed data are extracted. These are collectively form entity of object to be recognized or classified.

Decision making: the desired operation of classification or recognition is done upon the descriptor of extracted features.

4. PATTERN RECOGNITION MODELS

There are four basic models followed in pattern recognition, these are as under –

1) Statistical Model: These systems are based on statistics and probabilities. Each pattern is described in terms of feature sets. These Feature Sets are chosen in such a way that different patterns occupy non-overlapping feature space. Effectiveness of the feature set is determined by how well patterns from different classes can be separated. i.e, there is a proper interclass.

2) Syntactic Model: Based on relation between features, the patterns are represented by structures which can take into account more complex relations between features unlike the numerical feature sets used in statistical pattern recognition models. The patterns sued in the model forms a hierarchical structure composed of sub-patterns.

3) Template Matching Model: To determine the similarity between two samples, pixels or curves to localize and identify shapes in an image, a template or a prototype of the pattern to be recognized is available. Each pixel of the template is matched against the stored input image while talking into account all possible position in the input image, each possible rotation and scale changes.

Neural Network Model: It is consisting of an extremely large number of simple processors withmany interconnections between them. A neural network or to be more specific, an artificial neural network (ANN) is a self-adaptive trainable process that is able to learn and resolve complex problems based on available knowledge. ANN Based system behaves in the same manner as how the biological brain works. It is composed of interconnected processing elements that simulate neurons. Using this interconnection, each neuron can pass information to another.xiv

5. PATTERN MATCHING ALGORITHMS

The design pattern of all these algorithms consists of three basic elements, i.e, data perception, feature extraction and classification. There are various different technique to implement these three basic elements. So which technique is chosen for each element in design cycle defines the algorithm characteristics of the pattern recognition algorithm.

Supervised learning: A process of allotting a function to some desired category as learnt form supervised training data. The training data consist of a set of training examples where each set consist of a pair consisting of an input object and a desired output value.

Unsupervised learning: The problem of trying to find out the hidden structure in an unlabelled data set. Here no labeled training sets are provided and the system applies a specified clustering or grouping to ht unlabeled dataset based on some similarity criteria. An unsupervised learning method is used for clustering.

6. CONCLUSION

It is always difficult to decide which algorithm is best to classify patterns with least computation efforts, least time and maximum and best results. Pattern recognition field has a wide range of application in the field of classification, clustering, regression, sequence, labeling and parsing among which the best suitable algorithm to be used for the pattern recognition, i.e., classification and clustering. The classification approach to pattern recognition uses labeled training set with which it classifies the test unlabeled data to the desired category. In clustering algorithms don't have a labeled set. They use some other metric like Euclidean distance to put the test set into correct cluster.

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