

An Analysis of Classification Techniques In Pattern Recognition

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Abstract: Pattern recognition involves study from image processing and from various other fields that includes machine learning. Classifications involved in pattern recognition are supervised and unsupervised. The supervised classification of input data in the pattern recognition method and the unsupervised classification method works by finding hidden structures in unlabeled data..This paper discusses about the various methods of pattern recognition and classifications.

Keywords: Pattern recognition, classification, Feature Extraction.

I. Introduction

Image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images or a video, such as a photograph or video frame, the output of image processing may be either an image or a set of characteristics or parameters related to the image. There are many Applications of image processing are Image sharpening and restoration, Medical field, Remote sensing, Transmission and encoding, Machine/Robot vision, Color processing, Video processing, Microscopic Imaging.

II. Pattern Recognition

Pattern recognition is the science of making inferences from perceptual data, using tools from statistics, probability, computational geometry, machine learning, signal processing, and algorithm design. The central importance to artificial intelligence and computer vision, and has far-reaching applications in engineering, science, medicine, and business. It is natural that should seek to design and build machines that can recognize patterns. From automated speech recognition, fingerprint identification, optical character recognition, DNA sequence identification, and much more, it is clear that reliable, accurate pattern recognition by machine would be immensely useful.

A



Fig 2.1 Pattern Recognition

Moreover, in solving the indefinite number of problems required to build such systems, gain deeper understanding and appreciation for pattern recognition systems. For some problems, such as speech and visual recognition, design efforts may in fact be influenced by knowledge of how these are solved in nature

A. Supervised Classification

The supervised classification of input data in the pattern recognition method uses supervised learning algorithms that create classifiers based on training data from different object classes. The classifier then accepts input data and assigns the appropriate object or class label. In computer vision, supervised pattern recognition techniques are used for optical character recognition (OCR), face detection, face recognition, object detection, and object classification.

B. Unsupervised Classification

The unsupervised classification method works by finding hidden structures in unlabeled data using segmentation or clustering techniques. Common unsupervised classification methods include:

- K-means clustering
- Gaussian mixture models
- Hidden Markov models



Fig 2.2 Object Detection

From Fig 2.2, moving objects are detected by classifying image pixels into foreground (white pixels) and background (black pixels) using Gaussian mixture models.

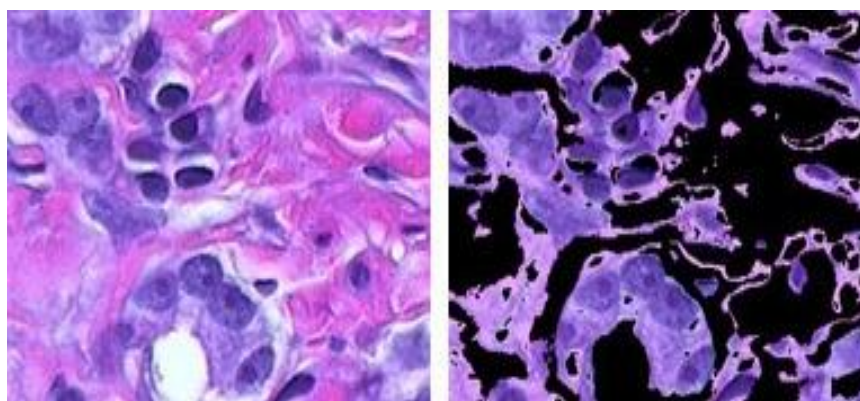


Fig2.3. Color-based image segmentation using k-means clustering.

In image processing and computer vision, unsupervised pattern recognition techniques are used for object detection and image segmentation, which is shown in Fig 2.3.

III. Components Of Pattern Recognition

1. Preprocessing

The role of preprocessing is to segment the interesting pattern from the background. Generally, noise filtering, smoothing and normalizations should be done in this step. The preprocessing also defines a compact representation of the pattern.

2. Feature Selection and extraction

Features should be easily computed, robust, insensitive to various distortions and variations in the images, and rotationally invariant. Two kinds of features are used in pattern recognition problems. One kind of

features has clear physical meaning, such as geometric or structural and statistical features. Another kind of features has no physical meaning. The advantage of physical features is that they need not deal with irrelevant features. The advantage of the mapping features is that they make classification easier because clear boundaries will be obtained between classes but increasing the computational complexity. Feature selection is to select the best subset from the input space. Its ultimate goal is to select the optimal features subset that can achieve the highest accuracy results. While feature extraction is applied in the situation when no physical features can be obtained. Most of feature selection algorithms involve a combinatorial search through the whole space. Usually, heuristic methods, such as hill climbing, have to be adopted, because the size of input space is exponential in the number of features.

IV. Classifiers design

Classifier can be designed using various approaches. There are three different approaches. The first approach is the simplest and the most intuitive approach which is based on the concept of similarity. Template matching is an example. The second one is a probabilistic approach. It includes methods based on Bayes decision rule, the maximum likelihood or density estimator. Three well-known methods are K-nearest neighbour (KNN). The third approach is to construct decision boundaries directly by optimizing certain error criterion. Examples are fisher's linear discriminant, multilayer perceptrons, decision tree and support vector machine

V. Conclusion

In feature extraction, most methods are supervised. These approaches need some prior knowledge and labeled training samples. The supervised method like Linear feature extraction contains various techniques include Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), projection pursuit, and Independent Component Analysis (ICA). Nonlinear feature extraction methods include kernel PCA, PCA network, nonlinear PCA, nonlinear auto-associative network, Multi-Dimensional Scaling (MDS) and Self-Organizing Map (SOM). Extract the patterns from the Image using Linear or Non-Linear feature methods. From this study the supervised classification methods outperformed unsupervised algorithms.

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