

Classifiers in Image processing

¹Rama Gaur

²Dr. V.S. Chouhan

¹Ph.D. Scholar (ECE)

Jodhpur National University, Jodhpur, Rajasthan, India

²Professor and Head ECE department

MBM Engineering college, Jodhpur, Rajasthan, India

Abstract: - Image classification is a necessary step in pattern recognition, the efficiency and accuracy mainly depends on the classification. To do the successful classification pre-processing, segmentation, at last feature extraction have to do. Recognition rate depends on all the steps but classification has its own importance in pattern recognition. Some important classifier such as support vector machine (SVM), artificial neural network (ANN), decision tree, KNN etc. All has their importance in one or the other way. In this paper there is a discussion about many classifiers.

Keywords: - Artificial neural network, Support vector machine, Decision tree, KNN, Classification.

I. Introduction

The image classification follows the steps as pre-processing, segmentation, feature extraction and classification. In the Classification system database is very important that contains predefined sample patterns of object under consideration that compare with the test object to classify it appropriate class. Image Classification is an important task in various fields such as biometry, remote sensing, and biomedical images.

In a typical classification system image is captured by a camera and consequently processed. In Supervised classification, first of all training took place through known group of pixels. The trained classifier used to classify other images. The Unsupervised classification uses the properties of the pixels to group them and these groups are known as cluster and process is called clustering. The numbers of clusters are decided by users. When trained pixels are not available the unsupervised classification is used. The example for classification methods are: Decision Tree, Artificial Neural Network (ANN) and Support Vector Machine (SVM).

II. Literature

The paper by Fuliang Wang and Feng Wang et al. [2] explains, Artificial Neural Network also has its position in the field of image classification, and has capability to handle distorted data. The paper by Jianxin Wu et al. [1], details about the challenge in image classification using a lengthy dataset is the field for researchers. The support vector machine (SVM) classifier is a very effective method for image classification. The ANN is also discussed in Monica Bianchini et al. [3]. Lizhen Lu et al. [5], the class membership is calculated in decision tree method of classification and the input partitioned into categories. Paper by Serafeim Moustakidis et al. [4] on implementation of

node discrimination through binary SVM using a novel fuzzy decision tree. Cheng-Hsuan Li et al. [6] discuss, Remotely Sensed Classification through SVM. Every classification method has its own benefits and losses the use varies from application to application. To get the good results some time hybrid classifiers are used. The performance of a classification system depends on recognition rate.

III. Artificial Neural Network

A neural network model is similar to human nervous system. As the human learn things by experience and practice or by repetition, to develop the human like behaviour in machine we use artificial intelligence and neural network model uses the concept of artificial intelligence that's why it called as artificial neural network. The artificial neural network is taught through a dataset. This dataset may be known to us then ANN is trained in a supervised manner, and it learns precisely and quickly about the pattern buried in dataset. And Trained ANN is used to identify the patterns for which it is trained. But if the dataset is not known to us in advance then the unsupervised training is used. The neural network is consist of neurons that are correlated together to convert inputs into useful output.

The ANN has its application in many fields some are mentioned here:

- Character Recognition
- Fault detection
- Speech detection
- Product detection

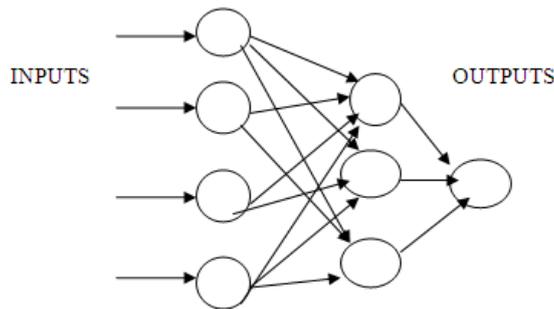
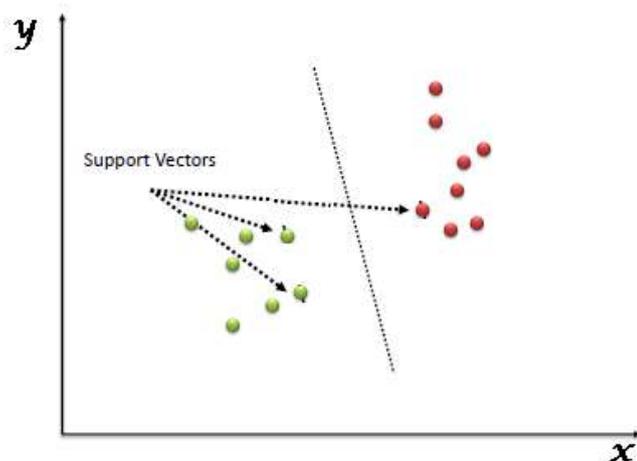


Fig1. Artificial Neural Network

IV. Support Vector Machine

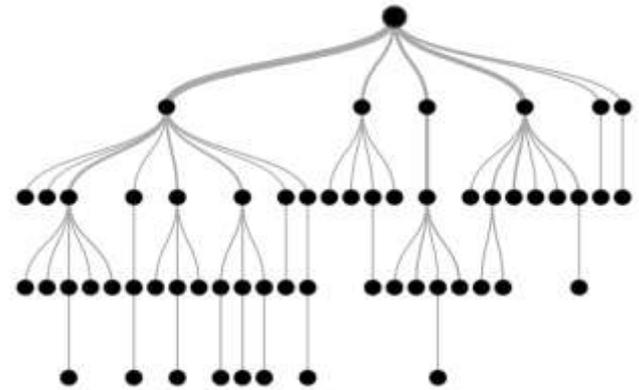
The Support vector machine comes in the category of supervised learning. The SVM used for regression and classification. But it is popularly known for classification. It is a very efficient classifier. In this every object or item is represented by a point in the n- dimensional space. The value of each feature is represented by the particular coordinate. Then the items divided into classes by finding hyper-plane as shown in the figure.



The diagram shows support Vectors that represent the coordinates of each item. The SVM algorithm is a good choice to segregate the two classes

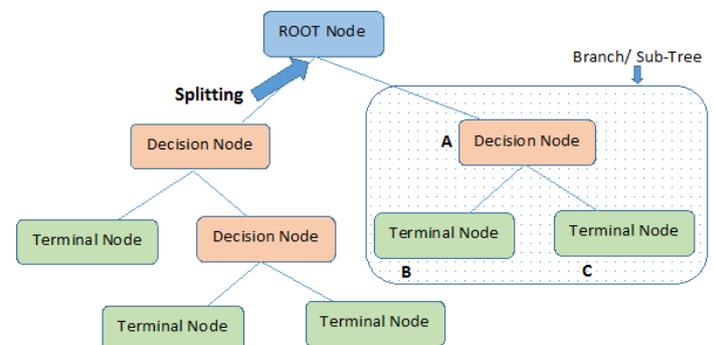
V. Decision Tree

Decision tree also uses supervised learning algorithm and is used for classification. Decision tree is applicable in both cases that are continuous and categorical output and input variables. In the DT algorithm the significant differentiator in input variables is used to split the samples of dataset into homogeneous sets.



Decision tree are classified according to their target variable. They are as follows:

1. Continuous Variable Decision Tree
2. Categorical Variable Decision Tree



Note:- A is parent node of B and C.

Advantages

1. Minimum requirement of data cleaning
2. Method is Non Parametric
3. Can be used in Data exploration
4. Constraint of Data type not present
5. Can be easily Understandable

Disadvantages

1. Over fitting
2. Not fit for continuous variables

VI. K-NN

The K-NN is also the classifier of the category of supervised learning algorithm. In supervised learning the targets are known to us but the pathway to target is not known. To comprehend machine learning nearest neighbour's forms is the perfect example.

Let us consider that there are many clusters of labelled samples. The nature of items of the same identified clusters or groups are of homogeneous nature. Now if an unlabelled item needs to be labelled under one of the labelled groups. Now to classify it K-nearest neighbours is easy and best

algorithm that have record of all available classes can perfectly put the new item into the class on the basis of largest number of vote for k neighbours. In this way KNN is one of the alternate to classify an unlabelled item into identified class.

Selecting the no. of nearest neighbours or in another words calculating k value plays important role in determining the efficiency of designed model. The accuracy and efficiency of k-NN algorithm basically evaluated by the K value determined. A larger number for k value has advantage in reducing the variance because of noisy data.

Advantage: The KNN is an unbiased algorithm and have not any assumption of the data under consideration. It is very popular because of its simplicity and ease of implementation plus effectiveness.

Disadvantage: The k-NN not create model so abstraction process not included. It takes high time to predicate the item. It requires high time to prepare data to design a robust system.

VII. Conclusion

The paper provides a brief idea of classifier to the beginners of this field. It helps the researchers in selecting the appropriate classifier for their problem. This paper explains about ANN, SVM, DT, and KNN which are very popular classifier in field of image processing. The classifier mainly classified as supervised or unsupervised classifiers. So in short this paper provides the theoretical knowledge of concept of above mentioned classifiers.

References

- [1] Jianxin Wu, "Efficient Hik SVM Learning For Image Classification", *IEEE Transactions On Image Processing*, Vol. 21, No. 10, October 2012.
- [2] Fuliang Wang and Feng Wang, "Rapidly Void Detection In TSVS With 2-D X-Ray Imaging and Artificial Neural Networks" *IEEE Transactions On Semiconductor Manufacturing*, Vol. 27, No. 2, May 2014.
- [3] Monica Bianchini and Franco Scarselli, "On the Complexity of Neural Network Classifiers: A Comparison Between Shallow and Deep Architectures", *IEEE Transactions On Neural Networks And Learning Systems*, Vol. 25, No. 8, August 2014.
- [4] Serafeim Moustakidis, Giorgos Mallinis, Nikos Koutsias, John B. Theocharis and Vasilios Petridis, "SVM-Based Fuzzy Decision Trees for Classification of High Spatial Resolution Remote Sensing Images", *IEEE Transactions On Geoscience And Remote Sensing*, Vol. 50, No. 1, January 2012.
- [5] Lizhen Lu, Liping Di, Senior and Yanmei Ye, "A Decision-Tree Classifier for Extracting Transparent Plastic-Mulched Landcover from Landsat-5 TM Images", *IEEE Journal Of Selected Topics In Applied Earth Observations And Remote Sensing*, Vol. 7, No. 11, November 2014.
- [6] Cheng-Hsuan Li, Bor-Chen Kuo, Chin-Teng Lin and Chih-Sheng Huang, "A Spatial-Contextual Support Vector Machine for Remotely Sensed Image Classification", *IEEE Transactions On Geosciences And Remote Sensing*, Vol. 50, No. 3, March 2012.
- [7] R. Muralidharan, Dr. C. Chandrasekar, "Object Recognition Using SVM-KNN Based on Geometric Moment Invariant", *International Journal of Computer Trends and Technology*- July to Aug 2011.
- [8] Jianxin Wu, "Efficient Hik SVM Learning For Image Classification", *IEEE Transactions On Image Processing*, Volume 21, No. 10, October 2012.
- [9] Guoqiang Peter Zhang "Neural Network for Classification- A Survey 2000" *IEEE Transactions on systems, man and cybernetics- part c: applications and reviews*, Vol 30, Issue.4, 2000.
- [10] Chiming Chang, Paul-Armand Verhaegen, and Joost R. Duflou, "A Comparison of Classifiers for Intelligent Machine Usage Prediction", *IEEE Transaction Machine Learning*, 2014.