

Survey On Image Classification Methods In Image Processing

Chaitali Dhaware^[1], Mrs. K. H. Wanjale^[2]

Department of Computer Engineering,
Vishwakarma Institute of Information Technology
Pune-India

ABSTRACT

Classification is the vital and challenging task in computer science. Classification is based on the description, texture or similarity of items or things. Image classification considers two approaches- supervised classification and unsupervised classification. Pixels are the unit represented in an image. Image classification groups the pixels in different classes. The image classification includes- image acquisition, image pre-processing, image segmentation. Some image classification methods are- Support Vector Machine (SVM), Artificial Neural Network (ANN) and Decision Tree (DT).

Keywords: - Image Processing, Support Vector Machine (SVM), Artificial Neural Network (ANN) and Decision Tree (DT).

I. INTRODUCTION

Classification of the objects is an easy task, but it's challenging to the machine. The image classification includes image pre-processing, image sensors, object detection, object segmentation, feature extraction and object classification. The Image Classification system consists of a database that contains predefined patterns that compare with an object to classify to appropriate category. Image Classification is an important task in various fields such as remote sensing, biometry, biomedical images, and robot navigation.

A typical classification system consists of a camera fixed high on the interested zone, where images are captured and consequently processed.

In Supervised classification, the some pixels are known grouped and gives the label to classes. This process is known as training. After that classifier uses trained pixels for classify other images

In Unsupervised classification, pixels are grouped with the help of their properties. This process known as clustering and groups are known a cluster. In this user decide how many clusters he wants. The unsupervised classification used when no trained pixels are available.

In Image classification different methods are used: Decision Tree, Artificial Neural Network (ANN) and Support Vector Machine (SVM)

II. RELATED WORK

The paper by Jianxin Wu et al. [1], the challenge of image classification from a large dataset is the subject of the recent research work. The support vector machine (SVM) classifier shows to be very effective in image classification.

The paper by Fuliang Wang And Feng Wang et al. [2] explains, Artificial Neural Network is efficiently handling the noisy data and this method capable of representing AND, OR and NOT.

Similarly, Monica Bianchini et al. [3] also discuss the artificial neural network classification technique.

The paper by Serafeim Moustakidis et al. [5] explains the novel fuzzy decision tree where the node discriminations are implementing via binary SVMs.

Lizhen Lu et al. [6], Decision Tree classifier calculate the class membership by partitioning the input into categories.

Cheng-Hsuan Li et al. [7] discuss, A Spatial-Contextual Support Vector Machine for Remotely Sensed Image Classification.

Different image classification methods have their advantages and some disadvantages. Some methods are the combination of another classifier in image classification.

A classifier is considering more efficient if they can predict correctly. Image Classification is important to extract the pattern or feature from the available input datasets.

III. IMAGE CLASSIFICATION STEPS

Image Classification includes following steps:

- a. Image Acquisition: acquire the images from for image processing.
- b. Image Pre-Processing: In preprocessing image transformation, noise removal, atmospherically correction techniques are used.

- c. Feature Extraction: Extracting the important characteristics of the image.

Classification: The images are classified based on the extracted features into predefined categories by using suitable methods that compare the image pattern with images which inside the database.

IV. IMAGE CLASSIFICATION METHODS

The Image Classification methods are:

- 1) **Support Vector Machine**: This method constructs a set of hyperplanes in a high dimensional space, which is use for classification or regression. The good separation achieved by the hyperplane. SVM uses non-parametric with binary classifier approach and handles more input data efficiently. Accuracy depends on hyperplane selection.
The Structure of the SVM algorithm is more complicated than other methods. This gives the low result transparency.
- 2) **Artificial Neural Network (ANN)**: Artificial neural network is a type of artificial intelligence that emits some functions of the human mind. An ANN is having a sequence of layers. Each layer of neural network system consists of a set of neurons. Neurons of all layers are linked by weighted connections to all neurons of the preceding and succeeding layers. The accuracy depends on the number of input and structure of the network. ANN is non-parametric approach.
In this method, the classification of the input is very fast, but the training process is slow. Choosing correct architecture is tough.
- 3) **Decision Tree**: Decision tree is a tree-like graph of decisions. Each branch represents the decisions to be made graphically. It is a non-parametric supervised approach. It partition input into uniform classes. This method permits the acceptance and rejection of class label at each intermediate stage. This method gives the set of rules after classification that should be understood.

V. COMPARISON OF METHODS

The table shows the advantages and disadvantages of the image classification methods.

Table 1: Advantages and Disadvantages of image classification methods

Method	Advantages	Disadvantages
1.Support Vector Machine	<ul style="list-style-type: none"> • Deliver unique solution. • Very efficient than other methods. • Avoid over-fitting 	<ul style="list-style-type: none"> • High algorithm complexity • Run slowly
2. Artificial Neural Network	<ul style="list-style-type: none"> • Robust to noisy training dataset • Very efficient for large dataset 	<ul style="list-style-type: none"> • High computational cost • Lazy learner
3. Decision Tree	<ul style="list-style-type: none"> • Require little efforts from users • Easy to interpret and explain 	<ul style="list-style-type: none"> • Splits are very sensitive to training data set • High classification error rate

VI. CONCLUSIONS

This paper gives the brief knowledge on some supervised classification methods used in Image Classification. The most common approach for image classification is non-parametric. This survey provides the some different classification method with their some limitations.

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] Alessandro Bergamo and Lorenzo Torresani, “Classes and Other Classifier-Based Features for Efficient Object Categorization”, *IEEE Transactions On Pattern Analysis And Machine Intelligence*, Vol. 36, No. 10, October 2014.
- [5] 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
- [6] 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.
- [7] 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 Geoscience And Remote Sensing*, Vol. 50, No. 3, March 2012.
- [8] Chiming Chang, Paul-Armand Verhaegen, and Joost R. Dufloy, “A Comparison of Classifiers for Intelligent Machine Usage Prediction”, *IEEE Transaction Machine Learning*, 2014.
- [9] Sri-Kaushik Pavani, Federico M. Sukno, David Delgado-Gomez, Constantine Butakoff, Xavier Planes, and Alejandro F. Frangi, “An Experimental Evaluation of Three Classifiers for Use in Self-Updating Face Recognition Systems”, *IEEE Transactions On Information Forensics And Security*, Vol. 7, No. 3, June 2012.
- [10] Donglian Sun, Yunyue Yu, and Mitchell D. Goldberg, “Deriving Water Fraction and Flood Maps From MODIS Images Using a Decision Tree Approach”, *IEEE Transaction On Applied Earth Observations And Remote Sensing*, Vol. 4, No. 4, December 2011.
- [11] Fuliang Wang And Feng Wang, “Void Detection in TSVs With X-Ray Image Multithreshold Segmentation and Artificial Neural Networks”, *IEEE TRANSACTIONS ON COMPONENTS, PACKAGING AND MANUFACTURING TECHNOLOGY*, VOL. 4, NO. 7, JULY 2014.
- [12] Chenggang Yan, Yongdong Zhang, Jizheng Xu, Feng Dai, Liang Li, Qionghai Dai and Feng Wu, “A Highly Parallel Framework for HEVC Coding Unit Partitioning Tree Decision on Many-core Processors”, *IEEE SIGNAL PROCESSING LETTERS*, VOL. 21, NO. 5, MAY 2014.
- [13] Xiaolin Huang, Lei Shi, and Johan A.K. Suykens, “Support Vector Machine Classifier with Pinball Loss”, *IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE*, VOL. 36, NO. 5, MAY 2014.
- [14] Luis Diago, Tetsuko Kitaoka, Ichiro Hagiwara, and Toshiki Kambayashi, “Neuro-Fuzzy Quantification of Personal Perceptions of Facial Images Based on a Limited Data Set”, *IEEE TRANSACTIONS ON NEURAL NETWORKS*, VOL. 22, NO. 12, DECEMBER 2011.
- [15] Dorin Bibicu and Luminita Moraru, “Cardiac Cycle Phase Estimation in 2-D Echocardiographic Images Using an Artificial Neural Network”, *IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING*, VOL. 60, NO. 5, MAY 2013.