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THE MORE DIFFICULT CHALLENGE FOR GOOD CLASSIFICATION IS IMAGE ANALYSIS AND THE USE OF SEVERAL APPROACHES

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ABSTRACT

The rapid evolution of computer applications from straightforward data processing to machine learning is driven by the accessibility and availability of vast amounts of data gathered from sensors and the internet. This study demonstrates that machines may learn about themselves and develop after receiving the proper instruction. For manual categorization of pictures to be effective, image analysis and the use of various approaches are more difficult tasks. Because of this complexity, we now need to automate in order to get high accuracy. The suggested research seeks to conduct a comparative analysis of the effectiveness and precision of several machine learning algorithms for image categorization. Logistic regression model, Naive Bayes classifier model, Support Vector model, and Random Forest classifier algorithms used to test with UC Merced dataset, initiates with preprocessing and training followed by testing of data set. From this point investigation prompts towards best pick algorithm by observing the calculated accuracies among tested algorithms.

Keywords—Image Processing; Machine Learning, Logistic regression model; Naïve Bayes classifier model; Support Vector model; Random Forest classifier model

INTRODUCTION

Many pictures are constantly being produced, necessitating categorization in order to organize and analyze them more quickly. Despite the difficulty of image analysis and classification, it is crucial to demonstrate resolutions in many applications that rely on pictures. Because manual categorization takes too long and requires too much precision, it fails. Researchers concluded that the image's complexity Analysis of a picture becomes more complex when more things are present. With the help of highly accurate results, a variety of classifiers are being used to automate processes that minimize the amount of human effort.

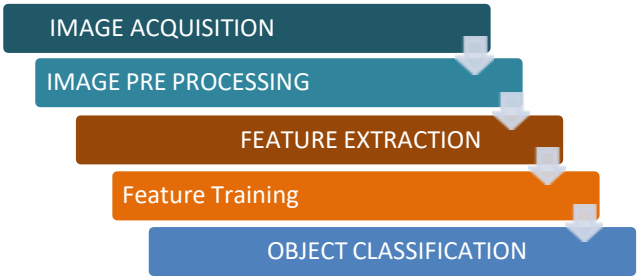


Fig 1.1: Image Classification Flow.

The Machine Learning research came forward to adopt the capabilities of human to computers to learn by sensing and understand so that to take action based on previous and current positive and negative outcomes [1].Machine learning provides number of well formed algorithms for prediction and analysis that fall under three different categories (a) Supervised Classification that considers image as a labeled data points and a known group of pixels which requires more training Unsupervised classification which uses no labeled data that can be considered when training needed on random data and when trained pixels not available. (c) Semi-supervised classification which takes advantage from both supervised and Unsupervised

Techniques.[2]. These Machine learning techniques turns as a free service by real-time companies like Amazon, Microsoft and Google which runs on clouds as a "machine learning as a service" and "cloud machine learning" [3].

The Systematic study of the classification considers captured image data set which should process all together. Image classification involves segregation of images into different categories depends upon feature similarities and dissimilarities. This segregation may generate false results due to noisy, blurry and images with bad quality and clutter. The test object should compare with pre defined sample patterns available in data set to classify them into appropriate class[10,11,12,13,14].

To attain the desired results with accuracy in classification of image, various tasks to be performed in a structured manner step by step depicted in Figure 1.

Image Pre Processing: Task to be carried out for the benefit of models from the improved data which is attained by removing unwanted distortions. This step may include reading the image, resizing the image and augmentation includes gray scaling, reflection, histogram, Gaussian blurring, equalization rotation and translation. In this paper doubuchies wavelet transform is applied to devide the image into high level and low level frequencies. The high level frequencies are represents the approximation (smoothing components), Horizontal, vertical and Diagonal detail components are exracted.

Feature Extraction: This step make use of statistical methods to identify most interesting features and patterns that may confine to a particular class to differentiate the model from other classes or other models. This step refers to as model building or model training.

Feature Training: The extracted features are trained using various machine learning algorithms such as perceptron, svm, random forest, decision tree so on. The trained feature model is used to test the testing set of features for prediction of objects.

Classification of Object: This step refers to catalog detected objects into pre defined classes by using appropriate classification algorithm. Here comparison takes place between target patterns and mined patterns.

The Goal of this comparative study is to examining applications of machine learning analytically in the field of image processing. The proposed study organized in seven sections section 2 corresponds to related research done, section 3 Implementation, section 4 demonstrates data set description, and section 6 presents results and discussions. The last section concludes with future enhancement.

LITERATURE REVIEW

Random Forest Algorithm (RFA) is a supervised learning algorithm which consists of many decision trees. The algorithm creates decision trees on data samples and gets the prediction from each of them and finally selects the best solution by means of voting. The authors [4] developed an effective classification approach based on the Random Forest algorithm. Three fruits – apple, strawberry, and orange were analyzed and different features were extracted based on the fruit shape, color characteristics, and scale-invariant feature transform. A pre-processing stage using image processing was implemented to prepare the dataset to reduce their color index. Then, the fruit image features were extracted. Finally, the classification process is adopted using a random forest algorithm [4]

Two different experiments were performed by Hua Zhang;, Wenzhong Shi, Kimfung Liu to evaluate the performance of the FTSVM (Fuzzy- Topology- Integrated support vector machine) method, in comparison with standard SVM, maximum likelihood classifier (MLC), and fuzzy- topology-integrated MLC. Experimental results indicate that the FTSVM method performs better than the standard SVM and other methods to improve the classification accuracy, hence providing an effective classification method for

remotely sensed images. [5]

Rajendran, Periyasamy proposed hybrid approach of association rule mining and decision treealgorithm classifies the brain tumors cells in an efficient way. The anticipated algorithm has been found to be performing well compared with the existing classifiers. The accuracy of 95% andsensitivity of 97% were found in classification of brain tumors. The developed brain tumor classification system is expected to provide valuable diagnosis techniques for the physicians [6] Craig Rodarmel and Jie Shan says that PCA approach is a useful preprocessing technique for hyper spectral image classification. They have used HYDICE and AVIRIS data sets for theirclassification research. The correct classification rate increases slowly in linearly when more PCAbands are involved in the classification process. The use of the most significant 5 (~10 percent)and 10 (~20 percent) bands can led to exact classification rates of about 70 percent and 80 percentor higher. Misclassifications caused by PCA-induced information loss mainly occur at featureclass boarders in the image. They revealed CPU performance for PCA transformation will dominate the entire processing time if the most significant PCA bands are used. [7]

PROBLEM STATEMENT

Image classification gains lots of interest by researchers in many applications such as surveillance analysis, social media analytics, remote sensing and medical domain. To identify the scene or object existing in the image automatically in real time is very tedious task due to complexity of understanding the content of the digital image. Digital image is a 2 dimensional function which consists of small elements called pixels. Content Based Image Retrieval (CBIR) techniques included many feature extraction techniques to extract the visual content of the techniques using color, shape and texture based statistical features. But extracting most suitable features for large image datasets is challenging.

EXISTING SYSTEM

In Existing system statistical features from high resolution images are extracted and classified using traditional distance measures such as Euclidean and Manhattan etc., The distance is computed between the feature vector and based on the Thresholding approach the feature vectors will be grouped. But the thresholding approach has failed for many non linear datasets due to their incapability of defining exact threshold.

PROPOSED SYSTEM

The proposed system adopted feature extraction process using multi resolution Daubuchies wavelet, texture features and PCA for dimensionality reduction. The extracted feature vectors will be classified using various machine learning approaches. The decision tree classification method chosen as proposed method as it exhibits the highest precision and recall over the other methods

DATASET REVIEW

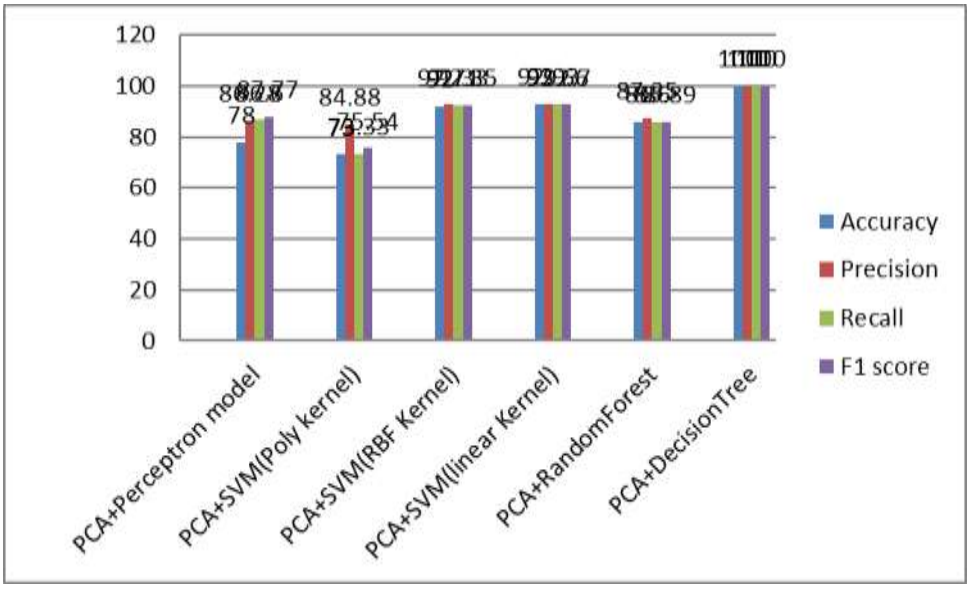
Remote sensing benchmark multispectral dataset UC Merced is considered for the experiment in the proposed work. The dataset is consisting of 21 classes of land use data for research purpose [14]. The images are sub sampled from USGS National Map urban area image collection.. Each image consists of 256 x 256 pixels. The resolution of each pixel is 1 foot. The input image bands will be separated to apply the 2D Fast Discrete Curvelet Transform in Unequally Spaced Fast Fourier Transform (USFFT). Curvelet transform will decompose the image into three coefficients which are coarse, detail, and fine scale coefficients

RESULT

Classifier	Accuracy	Precision	Recall	F1 score

PCA+Perceptron model	78.0	86.28	86.60	87.77
PCA+SVM(Poly kernel)	73.0	84.88	73.33	75.54
PCA+SVM(RBF Kernel)	92.0	92.71	92.33	92.35
PCA+SVM(linear Kernel)	93.0	92.93	92.66	92.70
PCA+RandomForest	86.0	87.35	86.0	85.89
PCA+DecisionTree	100	100	100	100

Table 1: Comparison of Various Machine Learning Models for Image Classification



FUTURE WORK

The future work can be concentrated on defining the deep learning model for the automatic feature extraction process. The domain specific features extracted by the user will not be suitable for all the datasets and may not give good precision and recall rate for all classification algorithms. So that machine can learn the features by its won will be a great advancement in classification domain. But the challenging task to adopt deep learning models is availability of labeled dataset.

CONCLUSION

So far we compared significant number techniques on UC Merced dataset, PCA with perceptron, PCA with poly kernel, PCA with RBF Kernel, PCA with Linear Kernel, PCA with RF, PCA with Decision Tree . Among them Decision tree noted highest accuracy and remaining techniques noted more than 85% of Accuracy with respect to classification of images. So weconcluded that features considered are good enough for classification andDecision tree classifies the images with 100% accuracy.

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