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RESEARCH ARTICLE

A Study on Object Classification Approaches

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Abstract- The main significance of image processing is to identify the object present in the captured image. The recognition of real time object and its classification is always a challenge. Medical Image processing, Biometrics, Agricultural image processing etc are the areas that involves object recognition as core approach. In this paper, we study is presented to different classification algorithms. These algorithms include supervised as well as unsupervised learning approaches. The paper also includes the exploration of standard classification model adapted by real time object recognition.

Keyword- Object Recognition, Classification, Learning Approaches, Real Time

1. INTRODUCTION

Image Processing is having its significance in almost all the application area because of its visual involvement. It can be used as the real time online information processing as well as can be work on offline captured image set. In each application area, the significance of image processing is in various applications. Such as in case of medical image processing it can be used for organ classification, disease identification etc. It means, each application area as well as application data having its own constraints specification and restriction under which the information processing is performed. One of the common image processing area is object classification. Object is one of the broader term and specific to the application area.

An object can be represented as an individual identity described under the shape and size features with some quantitative measures. The object can be an organ in medical image processing, an apple or flower in agricultural image processing or some real time object can found around. The identification of these objects and divided them in various classes is having different challenges. Some of the objects forms that can be identified in real time processing are described here in table 1.1:

Objects and Relative Class

Objects	Class
Bike, Scooter, Car, Cycle	Vehicles
Hand, Mouth, Finger, Foot	Biometric
Apple, Banana, Orange	Fruits
Table, Chair, Dinning	Furniture
Skull, Brain, Lung	Medical Imageset

As seen in table 1, there are number of classes as well as sub classes belong to each application area. There is the requirement of effective classification approach to perform the categorization of these objects. More the number of classes, more typical the classification process will be. This classification process also suffers from various type of challenges. These challenges begin with acquisition of images. To capture the images there is the requirement of specific devices such as cameras or the scanner. The challenge is not only limited to the device itself but also the device quality and the expertise to handle the device. If the acquisition is not proper, it can results number of impurities in the capturing. Some of these impurities are shown in figure 1.

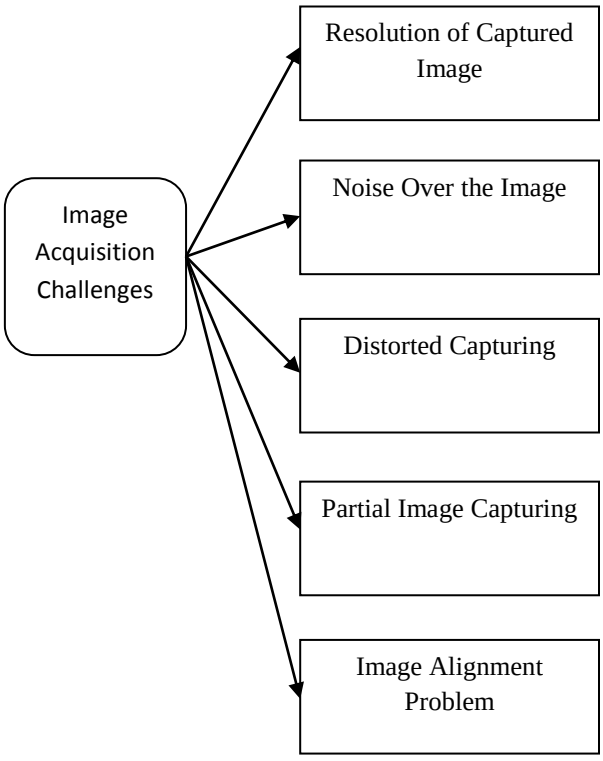

Figure 1 : Image Acquisition Problems

These problems can occur because of device problem, expertise problem or the environmental problems. To perform the effective image operations, it is required to either get a perfect image without any impurity or remove these impurities before performing the actual operation. The stage of removing these impurities over the image is called preprocessing the image. The preprocessing stage is defined before the actual process to remove the noise, blur, adjustment of brightness-contrast, angular alignment, shape normalization etc. Once the filtered image is obtained, the next work is to apply the actual algorithmic process for object segmentation or classification.

1.1 CLASSIFICATION

Image classification is one of the most requirement approach used in most of the application area to identify the object and the object category. This is also used to identify the outlier over the object image. There are different context respective to which the object categorization and pattern recognition can be performed. This object categorization includes the object search based on the visual characteristics. The basic model of object information extraction and classification is shown in figure 2.

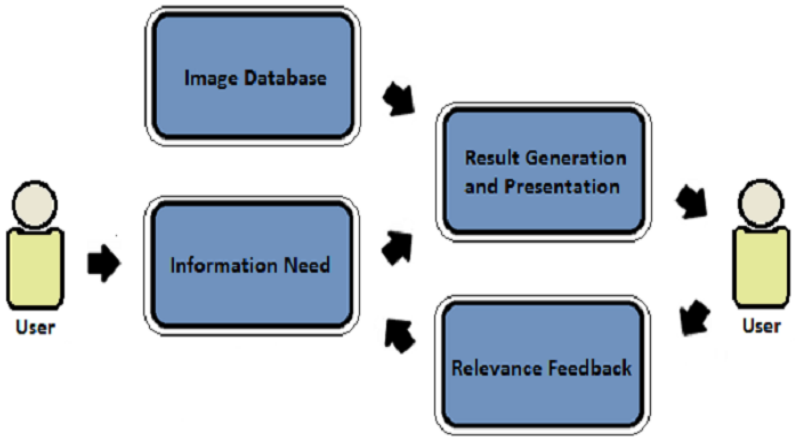

Figure 2 : Image Information Processing

As shown in the figure, the user perform the request on image dataset by specification of its need in terms of statistical features or the visual object input. The classification algorithm will use the object dataset as the training set and the input characteristics as the testing set and perform the classification. The classification model will match the appropriate image based on the similarity analysis and identify the most effective object from the dataset.

In this paper, an exploration to the classification model and the various algorithmic approaches adapted by different researchers are discussed. In this section, the requirement of image processing and classification approaches in different application areas is discussed. The section also discussed the challenges in the classification process. In section II, the work defined by earlier researchers is discussed. In section III, the study on the existing approaches is presented. In section IV, the conclusion obtained from the work is presented.

2. CLASSIFICATION MODEL

As discussed in earlier section, image processing in real time images is one of most required image processing activity with integrated challenges and significances. The basic model of the classification is shown in figure 3. This model is described in a generic form without the specification of any application area or application data. No specification of any integrated approach for any stage is also defined in this model.

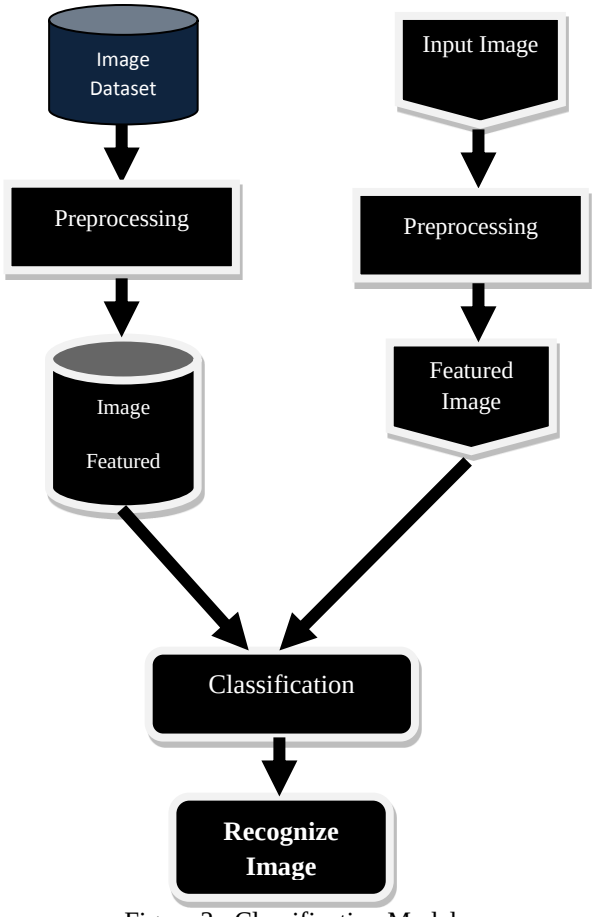

Figure 3 : Classification Model

As shown in the figure, to perform the recognition, the input set is defined in the form of imageset related to the domain and with acquired results in the form of class. This imageset can be a dataset of raw images or it can be featured component imageset. Each image of the dataset is described with the relative class. If the imageset is raw imageset, then to convert it to normalize images, it is required to perform the filteration over it. This filteration stage will reduce the image noise and convert it to normalize images adjusting the size and color contrast of images. Now this normalize imageset will be considered for the classification. Instead of performing the analysis on complete image, some of the image features are extracted. These features can be statistical features such as mean, standard deviation, entropy value etc. or it can be visual features of image. Later on these features will be defined as the dataset called featureset. Now this featureset will be consider as the training set for the classification algorithm. After generating the featured training set, the next work is to accept the input image and performed the classification process on it. To perform this classification, the input image will be converted to the normalize image. This normalize image is then processed under different measures to obtain the image features. This feature will work as the testing set for classification model. At the final stage of this model, the classification is been performed under specific algorithmic approach. There are number of available algorithmic approaches such as Bayesian network, neural network, SVM, decision tree, PCA, LDA etc. After this classification algorithm, the actual input object will be recognized under the specific class. The accuracy of the classification process will be identified based on multiple instances of test images. The accuracy of recognition process will be in terms of true positive and true negative rate of recognition.

3. CLASSIFICATION APPROCHES

There are number of available classification approaches that can be adapted to perform the classification and recognition of real time objects. These all approaches are based on different parameters that can be applied on the actual imageset as well as on featureset. The classification model is here defined as the mapping of the test images on the training set so that the actual class of object images will be identified. In this section some of the most reliable approaches for classification process are shown

3.1 Naïve Bayes Classifier

This classification is considered as the probabilistic classification model that uses the predictive probabilistic analysis for the recognition. Here the conditional estimation is performed between two or more attributes based on properties analysis. The conditional analysis is here performed between the input featured image and training set image on each feature individually and collectively. These features include the frequency analysis, mean value analysis. Naive Bayes classification is basically the estimation approach that includes the density based analysis. This approach basically work on the pattern analysis based on statistical information obtained respective to each class and the input object value is measured with this class statistics. This approach is defined different number of analytical attributes along with the specification of feature class and featured analysis. This featured class is here been estimated under the specification of probabilistic rules to map the feature vector to the relative feature class. The features based analysis respective to the class is given as

$P(Class_j)\ P(F_1,F_2..F_n|Class_j)$

$$P(Class_j|F_1,F_2..F_n) = P(F_1,F_2..F_n) \quad (1)$$

Here $Class_i$ and $Classs_j$ represents the object classes and F1,F2…Fn represents the features respective to which analysis is performed. The P(Class) represents the known probability of existing class and the P(F) represents the probability feature of input object. The conditional probability is here been performed to identify the actual relation of input object with object classes.

This algorithmic approach basically uses the decision constraint to define the actual condition for recognition of the input object class. This model is based on the probabilistic value based on which the actual recognition will be performed. This recognition will be defined based on relative mapping so that the actual object classification will be done.

3.2 KNN

Another simplest approach for dividing the objects in the appropriate class is based on the featured distance analysis. This distance value is divided in different class segments and each segment represents the class. The work is completely based on the statistical computation to obtain the analytical and accurate results from the system. This classification model is here been derived to generate the feature vector so that the distance level estimation and comparison will be performed. The distance analysis here performed under specification of training set and testing set under class specification. In this method the major vector is k that represents the number of classes. If the classes are known the system, the distance analysis on different features will be performed and with each stage and recognition method will be applied. The distance vector is differentiated to perform the recognition. In most cases, the intensity value analysis is been performed as the major criteria to perform the classification. This is the meteric based measure that uses distance analysis using different distance mechanisms.

3.3 Decision Tree

Another method to classify the object is defined using decision tree approach. This approach is considered as the tree based decision method approach. Each node is represented by a feature attribute and specify the decision criteria for the specification of the class. With each level, the exploration to the object class is done. This classification process is here defined under the formation of attribute level division and the value level decision making so that the element grouping and the class definition and separation will be obtained from the work. This method is specification of the random classification model with the derivation of the random variables and derive the decision based on the statistical decisions. These decisions can further explored to generate the object under true and false vectors. As the decision goes at the leaf with all true values, the correct and best match to the object will be identified. In same way different leaves over the dataset will represent different class.

4. CONCLUSION

In this paper, an effective and reliable object recognition model for real time objects is defined. The paper has explored the concept of object image classification along with generic model. This model is defined with independent to the application area and application data. The paper also discussed some of the common classification approach for object categorization.

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