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Active Object Detection Model with Deep Neural Network for Object Recognition

R. Kapila[1*], H. Wadhwa[2]

[1]Dept. Of Information Technology, Chandigarh engineering college,Punjab technical University,Mohali, India
. [2]Dept. Of Information Technology, Chandigarh engineering college,Punjab technical University,Mohali, India

[*]*Corresponding Author: kapila.ranjanaa17@gmail.com, Tel.: +91- 7347427238*

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Abstract- The number of the computations and feature transformations along with the normalization and automatic categorization is required by the object classification algorithms. In this paper, the robust feature descriptor used with the active object detection method (AODM) along with the probabilistic equation enabled deep neural networks (DNN). The multi-category DNN (mDNN) has been described with the repetitious phases so that it is simple to do job with the multi-category dataset. In every iterative phase mDNN shows the training data of main class as primary class and remaining all other training data are divided as the secondary class for the supervised classification. In the object image dataset, designed model is proficient of working with the variations which are observed in the configuration of the color, texture, light, image orientation, and occlusion and color illuminations. Certain analysis has been organized over the designed model for the performance calculation of the object identification system in the designed model. The results which we collected are in the shape of the various performance parameters of statistical errors, precision, recall, F1-measure and overall accuracy. In the terms of the overall accuracy the designed model has clearly outperformed the existing models. The designed model growth has been recorded higher than ten percent for all of the evaluated parameters against the existing models based upon SURF, FREAK, etc.

Keywords— Deep neural network, active object model, object recognition, SIFT, SURF.

I. INTRODUCTION

The object oriented classification is a new classification method which is based on image segmentation. This is opposed to per pixel image segmentation method. In this kind of image segmentation objects are the basic units for classification which are composed of a group of pixels representing real world objects (that the user intends to identify) rather than per pixel as the basic unit of classification. These objects are created by image segmentation process mainly the region based segmentation process. Most approaches to shape or texture matching; find a transformation that gives a factor of dissimilarity between two shapes. Verifying the digital image is a sincere affair now-a-days and so far the authors and researchers has determined so many techniques, which can be categorized into 1) Active(Intrusive)and 2) Blind or passive(Non-Intrusive). Further the active methods can be categorized into two classes i.e. Embedding a watermark and 2) Incorporating Digital signatures in a picture. In each of these methods, a chunk of data is combined into digital pictures as help for verifying digital data and security rights as well. Once, the unauthorized change is made on the digital contents of a picture the integrated data is also gets altered. The legitimacy of a picture is certified by assuring that the inserted information is invariable [1]. Although these techniques are robust in nature with restricted domain of application because all digital techniques are not embedded with the function with digital signature [2].These shortcomings of active techniques enhanced the research to develop non-intrusive techniques for verifying the digital pictures. This class of techniques didn't have any embedded knowledge like signatures or watermarks to legalize the originality of digital image. Instead these techniques give their results about the authenticity of digital data of picture with the usage of its structural alterations, which occurs due to tempering in the image [5]. The growth of computer industrialization has enhanced the digital picture forgery very simple and easy and it leaves no visible indication of being altered. This leads to the degradation of the trust of picture evidences. In the investigation of digital images there are Passive and Active ways to verify the goodness of digital pictures [9]. In Active image authentication methods, the digital signatures and digital watermarks are being widely used. However, digital signatures and digital flood marks are not always feasible to an image. These bounds the use of active methods is dependent on the evaluation of different pictures attributes to investigate the inconsistencies that can be caused by the forgery. Different elements of image can be referred for

forgery investigation, lossy compression artefacts, pixel statistics of natural image, and the essence of interaction between light and camera and physical object and soon. In an adventure to build a design and manufacture the replicates of robotics of human, it haven't come a long way, yet there is a set of methods, models used algorithms which handles as a good initial point [2]. The twist is how human brain works and has evaded researchers over the century. The goal of this research is used to enhance the mechanical creations to think and to resolve the situations in similar ways. However, the most investigate thing is to model a human brain by realizing it physically. Artificial Intelligence combines work in fields like computer science, neuroscience, mathematics, psychology, philosophy, cognitive sciences etc. The proposed work based upon the object recognition in the aurora dataset has been proposed in this paper. The proposed work has been based upon the appearance based object recognition and classification over the given dataset. The knowledge discovery based object recognition and localization method has been utilized for the object recognition in the proposed work for the word detection or classification. The Deep Neural Network (DNN) classification model has been utilized for the object classification from the aurora dataset collected from the online source across the internet. The image data has been detected and classified in the proposed work by using the pattern matching based upon the DNN under this technique. The proposed work has been evaluated for its performance under the chain of experiments using this technique. The object recognition incorporates the knowledge-driven approach, which utilizes the slider window function based pattern discovery within the image matrix to localize the region (or object).

II. RELATED WORK

B.Sathya Bama et al. (2011) gives an efficient Plant Image Retrieval method which is using Shape, Color and Texture features based on plant leaf images intended mainly for industries like medical, botanical gardening and cosmetics. Here, the HSV colour space is used to extract the various features of leaves. To input image for texture feature extraction Log-Gabor wavelet is applied. However in harvesting process they often damage fruits. To presevere the fruits quality progress of useful fruit removal methods is required.

Parisa Pouladzadeh et al. (2012) presented a new recognition algo for emerging food classification

Meenu Dadwal et. al (2012))representing different methods to find the of ripeness of vegetables and fruits. This paper gives methods like histogram matching, clustering algorithms based image segmentation. Each technique uses colored images of vegetables and fruits as input data. In these techniques we set some threshold levels

Alireza Missourian et al. (2013) said that image coordination and segmentation are the two main necessary parts in the 3D vision system of a harvesting robot. First part, using the robot's camera the vision system service in the real time identification of affected areas of the farm based on the damage identified.

Fleites, Fausto et. al. (2015) has worked on the enhancement of the product exposure with multicue optimization for TV shopping applications. The designed model has been used to realize this use case and detect the products in the satisfied stream must be detected so that the TV system notifies consumers of possibly interesting ones. A practical solution must address the detection of complex products, i.e., those that do not has a fixed form and can appear in various poses, which poses a significant challenge. To finish this, a multicue product exposure framework is designed for TV shopping.

Girshick, Ross et. al. (2016) has worked on the region-based feature extraction for the convolutional networks to achieve the higher accuracy of classification. This research tells that author have proposed the algorithm that is easy and flexible detection which improves the previous result on VOC 2012—getting a mAP of 62.4%.

III. METHODOLOGY

The proposed scheme in this thesis is depend upon the object recognition model based upon the Deep Neural Networks (DNN) classification along with active object detection model (AODM) and other pattern or texture extraction methods based hybrid feature description. The deep learning based proposed work has been designed to achieve the higher order accuracy by recognizing the visual object features. The object recognition applications from image data is used to count the density of image samples, in order to acquire the data for preparing the object recognition model policies. Also such object recognition techniques can be enhanced for various applications such as classification or other applications. The major problem of the existing scheme lies in the lower accuracy, which has been measured in the mode of precision, recall, f1-measure and classification accuracy. The designed technique will use a merger of the AODM based object localization along with Deep Neural Networks for the features extraction for the prospect of recognition of the visual objects in the target image. The DNN based proposed work has been designed to decrease the object recognition rate, which eventually increases the overall recognition accuracy. The proposed work will be using the AODM model for the aim of object recognition with the DNN classification. The AODM model is utilized to detect the target objects in the given image data by analyzing the visual boundaries around the different shapes and textures in the image matrix.

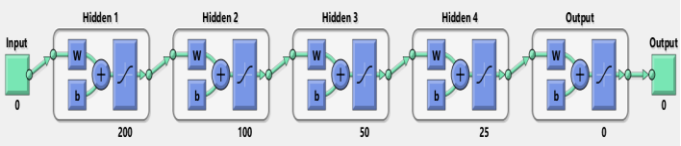

Figure 1: Showing the DNN model with 4-hidden layers and one output layer

The proposed solution using DNN will perform its operation on the reconstructed visual object features of higher quality after its processing with AODM, and will produce improved object recognition results than the existing algorithm, which is solely based upon DNN. Additionally the designed algorithm would be able of performing the classification of the detected items in the image data. Both of the techniques, existing and designed would be developed in this research. The comparison of the both of the techniques, existing DNN and proposed AODM-DNN for object recognition, would be performed at large using various performance parameters like word error rate, accuracy, etc.

The following algorithm illustrates the working of designed model:

Algorithm 1: Deep Neural Networks for Noise Robust Object recognition

Acquire the training image data from target location.

1. Extract the feature of each image using following procedure.

a) Acquire the image file (index I = 1 to N).
b) Apply the Gaussian filtering over the instruction image for matrix normalization .
c) Apply the variation of Gaussian algorithm to create the minima matrix.
d) Localize the possible objects in the target image matrix/
e) Evaluate each individual object
f) Filter the partially visible objects from the selection
g) Extract the category label of current image (Lr)
h) Return the selected objects to the program (Tr)

2. Acquire the testing image data from the target location

a) Acquire the image file (index I(t) = 1 to M)
b) Apply the Gaussian filtering over the instruction image for matrix normalization.
c) Apply the variation of Gaussian algorithm to create the minima matrix
d) Localize the possible objects in the target image matrix
e) Evaluate each individual object
f) Filter the partially visible objects from the selection
g) Extract the category label of randomly selected test image (Ls)
h) Return the selected objects to the program (Ts)

3. Train the deep neural networks with training image set (Tr) and labels (Lr)
4. Test the deep neural network with testing image set (Ts) and labels (Ls)
5. Deep neural classifier returns the predicted labels (Lp) for each testing image
6. Compare the predicted labels (Lp) against the original test labels (Ls)
7. Compute the performance indicators to evaluate the classifier.

IV. RESULTS AND DISCUSSION

Analysis with 50 test cases: The first experiment has been conducted over the 50 test samples, which has been randomly selected out of the given image set. From the given dataset the randomizer module generates the random index which consists of the ten image ids, which are collected. Such randomly selected samples are further processed and analyzed under the proposed model for the result evaluation.

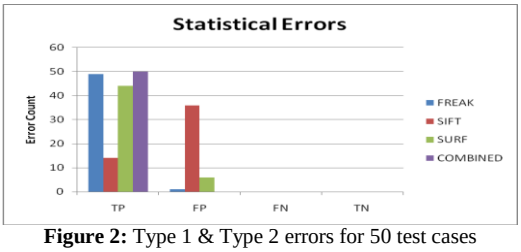

Figure 2: Type 1 & Type 2 errors for 50 test cases

The Type 1 & Type 2 errors has been evaluated from the testing of the input test samples. The graph obtained from the values of the statistical Type 1 & Type 2 errors has been presented in the figure 2.

The Table 1 shows the value obtained for figure 2.

Table 1: Type 1 &Type 2 errors for 50 test cases

Feature Descriptor	TP	FP	FN	TN
FREAK	49	1	0	0
SIFT	14	36	0	0
SURF	44	6	0	0
COMBINED	50	0	0	0

The above Table 1 explains the true positive, true negative, false positive and false negative errors. The statistical errors have been evaluated from the input ten samples.

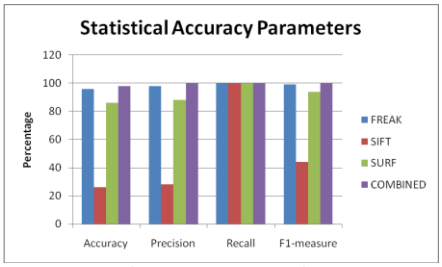

Figure 3: *Performance measures for 50 test cases*

The figure 3 shows the performance measures calculated over the obtained 50 samples. The proposed model and other models based on SIFT, SURF and FREAK has been recorded with the variable percentage measured for all of the performance measures.

Table 2: Performance measures for 50 test cases

Feature Descriptor	Accuracy	Precision	Recall	F1-measure
FREAK	96	98	100	99
SIFT	26	28	100	44
SURF	86	88	100	94
COMBINED	98	100	100	100

The Table 2 shows theperformance measures calculated from the randomly selected ten testcases. The designed model recorded with the highest values as per the other feature descriptors with support vector machine classification

Analysis with 100 test cases: The second experiment has been conducted over the 100 test samples, which has been randomly selected out of the given image set. from the given dataset, the randomizer module generates the random index containing the twenty image ids, which are collected.Such samples which are collected randomely are further processed and analyzed under the desgined model for the result evaluation.

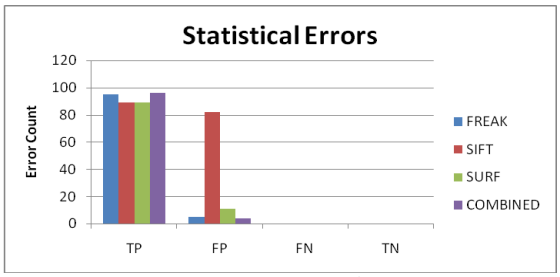

Figure 4: Type 1 & Type 2 errors for 100 test cases

The figure 4 tell the statistical errors of Type1 & Type2 from the twenty random samples obtained from the dataset. The variation can be clearly detected from the above bar graph in the figure 4. The proposed model based on SIFT has been found with the maximum true positive cases, which shows the robustness of the proposed model.

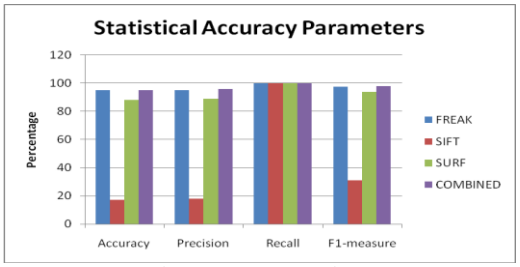

Figure 5: Performance measures for 100 test cases

Performance measures for 100 test cases The figure 5 explains the performance measures obtained from the table 3 which defines the statistical errors. The performance measures has been considered according to the equations defined in this section.

Table 3: Type 1 & Type 2 errors for 100 test cases

Feature Descriptor	TP	FP	FN	TN
FREAK	95	5	0	0
SIFT	89	82	0	0
SURF	89	11	0	0
COMBINED	96	4	0	0

The table 3 tells the recorded statistical parameters (Type 1 & Type 2 errors) from the experimental scenario with twenty test cases. Most of the accurate samples (in the form of true positive or true negative) have been obtained under the proposed model, which depicts the robust performance.

Table 4: Performance measures for 100 test cases

Feature Descriptor	Accuracy	Precision	Recall	F1-measure
FREAK	95	95	100	97.4359
SIFT	17	18	100	31
SURF	88	89	100	94
COMBINED	95	96	100	98

The table 4 tells the performance measures calculated from the table 3 over the twenty randomly selected samples from the given dataset

V. CONCLUSION and Future Scope

The designed model is entirely based upon the robust feature description with flexible classification algorithm based over the probabilistic deep neural network (PDNN) for the target object recognition by means of the image analysis for the category evaluation by the vital means of the target object recognition. The proposed copy has been designed on the basis of the various feature descriptors for the target object recognition. The image feature extraction methods play the important role in the target object recognition by extracting the useful features which are evaluated to analyze the category of the input query image. The low level feature descriptor reduces the visual properties of the images, which makes it easier to find the stronger regions within the image data. The stronger regions are inter-matched by using the efficient classification method in order to appraise the target object recognition in the given image data. In this research, the active object detection method (AODM) along with the multi-class deep learning has been proposed for the target object recognition. The probabilistic classification with the multiclass support vector machines has been utilized for the robustness in the classification. The proposed model has undergone several experiments and has been found better

than the previous option in the expression of accuracy, recall, f1-measure and overall accuracy and AODM based model has outperformed the other descriptors with deep learning classification. In the future the designed model can be improved by using the hybrid low level feature extracted along with the efficient color illumination to find the dual-mode attacks over the images to determine the type of object in the image data.

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Authors Profile

Ranjana kapila is doing M.Tech From Cec landran. .She completed her b.tech from Cec landran in 2015.Her area of expertise are software engineering and digital image processing.

Heena wadhwa ia an Assistant Professor in Dept. of Information Technology at Chandigarh Engineering College, Landran (Mohali). She completed her B.Tech in Information Technology from Rayat Institute of Engineering and Information Technology, Ropar in Year 2007. She received her M.Tech degree in Computer science and Engineering from Baba Banda Singh Bahadur Engineering College, Fatehgarh Sahib in year 2013. She has been in teaching profession for the last 10 years and Ph.D. in Computer Science from Lovely Professional University, Jalandhar in the area of Cloud Computing. Her areas of interest are Cloud Computing, Operating Systems and Software Engineering

