Hybrid Approach for Image Classification using SVM Classifier and SURF Descriptor

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Abstract- Low level features like color etc. of an image are really very important for any image retrieval system. This paper implements image classification technique using SURF descriptor and SVM classifier. SURF method which is advanced version of SIFT is used to match feature points of training and test images. SVM classifier based on the outcome of feature points then classifies images. Through the experiment and analysis of results better results are achieved in terms of accuracy and matching time.

Keywords-SVM, SURF, Classifier, Optimal Hyperplane, Penalty term

I. INTRODUCTION

Image classification is an important branch of Artificial Intelligence. Image classification deals with categorizing imagery according to different classes provided. Generally we have training information i.e. input as well as testing data i.e. output. Then we train a classifier to classify an image based on different classes provided. For example you can train a classifier to find whether water is present in given image or not. It basically involves following steps:

- Training a classifier for different image classes e.g. water, vegetation or even airplane, cars etc.
- Assess the performance of classifier by AP i.e. average precision calculation
- Vary the visual representation of feature vector and feature map used for the classifier
- Obtain training data for new classifiers

Different machine learning algorithms are used for this purpose. We are focusing on one such algorithm called SVM i.e. Support Vector Machine.

II. IMAGE CLASSIFICATION DATABASE

The database contained 25 images of lungs, brain, heart, kidney, knees and so forth. Database designed for testing images was equipped by taking images of brain, skull, kidney etc. Accuracy, matching time and average recognition for all test images are obtained. Figure 1 shows the sample database image.
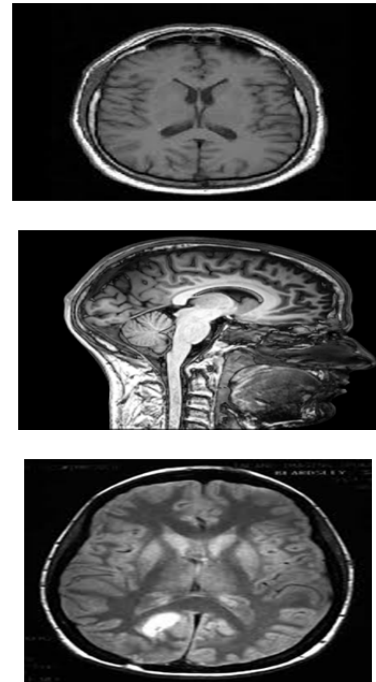

Fig.1 Sample Database Images
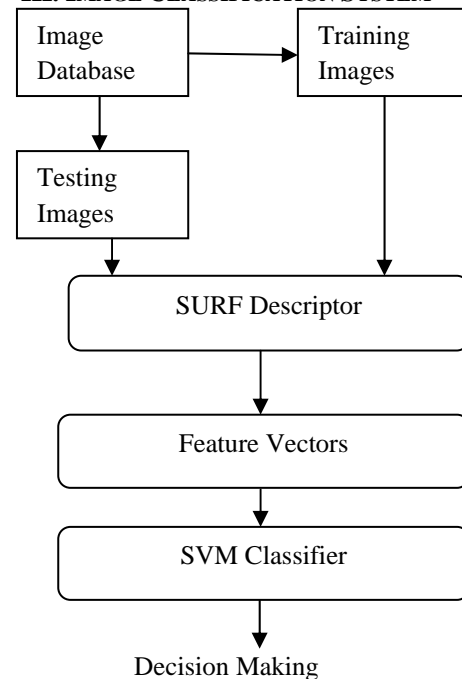
III. IMAGE CLASSIFICATION SYSTEM

Fig.2 Image Classification Architecture

The images from the given database are uploaded and passed for Feature extraction. In Feature withdrawal unit, feature points are extracted using SURF descriptor. Feature points of training and testing images are passed to the classifier unit for the classification of given query image with the knowledge created for the available database. Then SVM matching Classifier is used for finding the closest match. Distance between the points of test image and mean neutral is computed and in the same way distance between the points of train image and neutral is computed and is called Euclidean distance. The minimum difference between any pair will present the best possible matched conclusion. Accuracy, Matching time, MSE, PSNR are calculated for the proposed work.

IV. SURF WITH SVM CLASSIFIER

SURF is a scale and turns invariant identifier and descriptor characteristic. Scale and revolution invariance imply that an article can be recognized despite the fact that if the representation etc. scaled in size or it is pivoted about a hub in its representation in a depiction. Difference happens for the reason that of the approach data exists as a general rule and the inadequacy with which it can be caught from a recording. Invariance is an imperative property of picture peculiarity, seeing that judgment of proximity is conceivable just concerning those gimmicks between two pictures which can't be copied i.e. a peculiarity depicts is special to the information point it portrays [7].

All Image Retrieval Systems have some common features like image feature extraction, storage and retrieval. The image features determine the interesting feature points in an image and the subsequent matching mechanisms retrieves the best matched features as efficiently as possible.

SURF METHODOLOGY

There are around with three stages which are as follows:

i. The first phase is processing the imagery along with extracting SURF descriptors. Steps used are:
   a. Each picture is understood in sequence, as a grayscale image an obligation of SURF algorithm.
   b. SURF awareness point detector is to apply on each picture to become aware of points of interest in the picture.
   c. SURF descriptor extraction is useful on the detected points which may or may not return a descriptor for the above intended point [13].

ii. The second phase consists of storing the SURF descriptors, in such a behavior that comparable descriptors are stored mutually in addition to be easy to get to in a speedy approach.
   a. The kd-tree acts as part of storage space and learn method, as it supplies the majority of similar vectors commonly, productively when creates clusters of similar vectors.
   b. The training point is used to decide on the number of leaf nodes of the kd-tree that will be well thought-out to accomplish a detailed exactitude.

iii. The third period is taking the inquiry representation from the client extracting SURF descriptors from the figure as well as finding its neighboring counterpart.

a. A rapid estimated seek out algorithm based on randomized kd-trees is used. Step 2 creates an index of coordinated features for quick recovery; here formed using kd-tree data organization.

b. The algorithm follows the greatest bin first strategy although manipulating the paramount nearest matches for a predetermined amount of neighbors. In this technique nearly all queries return nearest neighbor or especially close to neighbors.

c. The finest coordinated picture is designed by adding up the amount of features that are harmonized to the query picture plus finding the figure amid maximal matches.

Support Vector Machine

It chiefly consists of subsequent steps:
- Preprocessing of the imagery in the catalog
- Partition of the database in preparation as well as check sets
- Picking of illustration of the input information
- Picking of the mode of training to be used:
  - Mode of multi-class preparation
  - Worth of the penalty term C
  - Option of the kernel
  - Training/ Preparation

Check plus estimation of the performance SVM desires to secure the penalty term for misclassification i.e. C. When preparation data is not divisible this stable value has to be selected cautiously. But while dealing with imagery, the measurement of the input gap is great compared to the dimension of the training set, in order so as to the data are in all-purpose linearly noticeable. As a result now the C value doesn't make difference moreover is permanent to a random great one [4].

V. EXPERIMENTAL RESULTS

The training database consisted of more than 50 images and the test database consisted 25 images that are randomly chosen for every inquiry image. The major parameters which are used to estimate the classification of images are: Matching time, Accuracy and Average Recognition rate. The accuracy of proposed work is around 98%. Figure 3 reveals the comparison graph of proposed work.
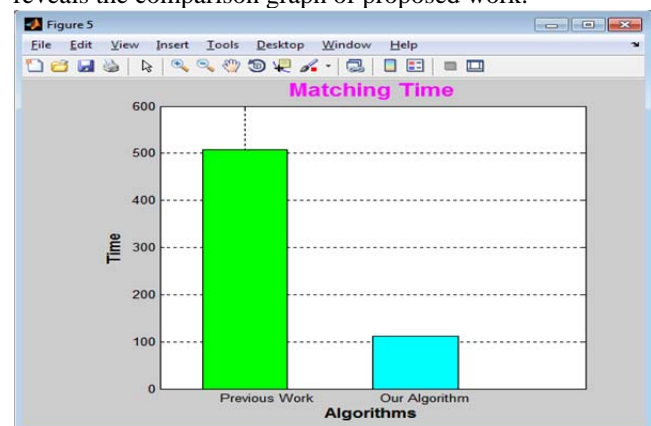

Fig. 3 Comparison Graph of Matching Time of Previous Work and Our Proposed Work
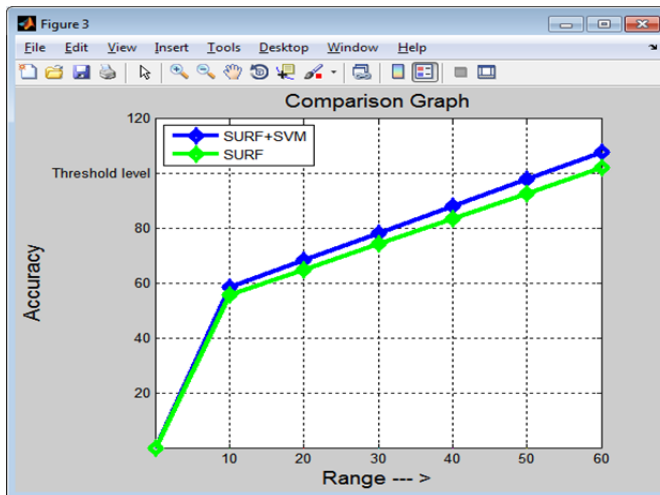
Fig. 3 Comparison Graph of Accuracy of Previous Work and Our Proposed Work

VI. CONCLUSION

The critical summit of the proposal to accomplish an image recovery agenda was successfully satisfied moreover its implementation was also, intended along with bust down. At the back of investigating the consequences it can be rational that image recovery lives up to potential so far with small obvious success rate along with that this charge is reflected for the major hundred pictures recovered by the proposed framework for an investigation image.

REFERENCES

[1] Anna Wojnar and Antonio M. G. Pinheiro, "*Annotation of Medical Images Using The SURF descriptor*", 2012 IEEE

[2] Michael S. Lew, Nicu Sebe, Chabane Djeraba, Ramesh Jain, "Content-Based Multimedia Information Retrieval: State of the Art and Challenges, ACM Transactions on Multimedia Computing, Communications, and Applications," vol. 2, issue 1, 2006, pp. 1-19.

[3] Johannes Kopf, Dani Lischinski, Depixelizing Pixel Art, ACM Transactions on Graphics (Proceedings of SIGGRAPH 2011), 30(4), Article no. 99.

[4] Bertalmio, M.; Vese, L.; Sapiro, G.; Osher, S, "Simultaneous structure and texture image inpainting," Image Processing, IEEE Transactions on, Volume: 12 Issue: 8, Aug. 2003. Page(s): 882 -889.

[5] A.N. Netravali and B.G. Haskell, Digital Pictures: Representation, Compression, and Standards (2nd Ed), Plenum Press, New York, NY (1995).

[6] M. Rabbani and P.W. Jones, Digital Image Compression Techniques, Vol TT7, SPIE Optical Engineering Press, Bellvue, Washington (1991).

[7] G. Siolas et al. "*Support vector machines based on a semantic kernel for text categorization*". In *IJCNN*, volume 5, pages 205–209. Published by the IEEE Computer Society, 2000.

[8] I. Guyon, J. Weston, S. Barnhill, and V. Vapnik. "*Gene selection for cancer classification using support vector machines*". Machine Learning, 46(1):389–422, 2002.

[9] M.F. Akay. "*Support vector machines combined with feature selecion for breast cancer Diagnosis*" in Expert Systems with Applications, 36(2):3240–3247, 2009.

[10] Giorgos Mountrakis , Jungho Im, Caesar Ogole "*Support vector machines in remote sensing: A review*" in International Society for Photogrammetry and Remote Sensing 2010

[11] Ch.Srinivasa Rao, S.Srinivas Kumar, B.Chandra Mohan "*Content Based Image Retrieval Using Exact Legendre Moments And Support Vector Machine*" in The International Journal of Multimedia & Its Applications (IJMA), Vol.2, No.2, May 2010

[12] Anastasia Dubrovina, Pavel Kisilev, Daniel Freedman, Sagi Schein, Ruth Bergman "*Efficient and robust image descriptor for GUI object classification*" Copyright 2011 Hewlett-Packard Development Company, L.P.

[13] Dang Huu Nghi, Luong Chi Mai "*Training Data Selection for Support Vector Machines Model*" in International Conference on Information and Electronics Engineering IPCSIT vol.6 (2011) IACSIT Press, Singapore

[14] Mehmet Gonen, Ethem Alpaydınv "*Multiple Kernel Learning Algorithms*" in Journal of Machine Learning Research 12 (2011) 2211-2268

[15] Paulo Gaspar, Jaime Carbonell and Jose Luıs Oliveira, "*On the parameter optimization of Support Vector Machines for binary classification*". Journal of Integrative Bioinformatics, 9(3):201, 2012

[16] Subhransu Maji, Alexander C. Berg, and Jitendra Malik "*Efficient Classification for Additive Kernel SVMs*" in 2012 IEEE

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Parul Prashar has received her B.Tech degree in Computer Science Engineering from Punjab Technical University, Kapurthala in 2012. She is in her final semester of her M.Tech in Computer Science Engineering from Rayat IEIT Railmajra, Punjab Technical University. She has published 02 papers in Internation Journal and also presented 01 paper in TIMES national seminar 2013.