IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-6, June 2019 E-ISSN: 2347-2693

Performance Analysis of Dense Micro-block Difference and SURF Method for Texture Classification

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DOI: https://doi.org/10.26438/ijcse/v7i6.479482 | Available online at: www.ijcseonline.org

Accepted: 10/Jun/2019, Published: 30/Jun/2019

Abstract**—** The paper proposes a novel picture portrayal for surface characterization. The ongoing headways in the field of fix based highlights compressive detecting and highlight encoding are joined to plan a hearty picture descriptor. In our methodology, we initially propose the neighbourhood highlights, Dense Micro-square Difference (DMD), which catches the nearby structure from the picture patches at high scales. Rather than the pixel we process the little squares from pictures which catch the miniaturized scale structure from it. DMD can be figured productively utilizing vital pictures. The highlights are then encoded utilizing Fisher Vector strategy to get a picture descriptor which thinks about the higher request measurements. The proposed picture portrayal is joined with straight SVM classifier. The analyses are led on the standard surface datasets (KTH-TIPS-2a, Brodatz, and Curet). On KTH-TIPS-2a dataset the proposed strategy beats the best revealed outcomes by 5.5% and has a practically identical exhibition to the best in class techniques on the different datasets.

Keywords**—** *Compressive Sensing, Descriptors,SURF, Texture classification*

I. INTRODUCTION

Surface characterization is a method for gathering comparable things as indicated by regular attributes that empower us to procure data about the picture. This data can be gotten by separating picture highlights. With the assistance of highlights we can depict tremendous measure of information precisely. Advances in computerized innovation have made gigantic gathering of computerized pictures which requires a proficient and clever strategy of surface arrangement.

Picture characterization manages arranging pictures as per various classes are given. For the most part we have preparing data for example contribution just as testing information for example yield. At that point, we train a classifier to group a picture dependent on various classes gave. For instance, you can prepare a classifier to discover whether water is available in given picture or not. Initial phase in characterization is to prepare a classifier for various picture classes for example water, vegetation or even plane, vehicles and so on. The second step is to give a legitimate grouping of a picture by utilizing distinctive AI calculation. We are concentrating on one such calculation called SVM for example Bolster Vector Machine.

Surface characterization is the procedure to isolate surface highlights into surface classes. First phase of order is highlight extraction process in which highlights are removed from picture by utilizing its surface. In second stage, highlights are changed over into surface classes by utilizing a classifier. Numerous surface order strategies have been presented like Gray Level Co-Occurrence Matrices (GLCM), Gabor channels, Local Binary Pattern (LBP), wavelet change techniques, and Independent part examination and channel banks.

II. RELATED WORK

Effective and vigorous picture descriptors for GUI object arrangement developed by A. Dubrovina et al. in 2011.In this paper, a novel picture descriptor grew explicitly for GUI objects which is hearty to different changes in the presence of GUI items, for example, different screen goals just as different working framework related issues. This picture descriptor is additionally utilized with SVM and analyses have demonstrated the descriptor power to the above changes and its better execution looked at than existing picture descriptors [1]

Surface grouping from irregular highlights were additionally proposed by Li Liu and Pawl W. Fiegnth, in 2012.Here they had portrayed a characterization technique dependent on speaking to surfaces as a little arrangement of compacted, irregular estimations of nearby surface prompting results coordinating condition of workmanship execution. Closest neighbour is utilized here. We can improve the framework by

utilizing SVM classifier. Moreover, proposed approach can be installed into the mark/EMD system as is as of now explored in surface investigation structure [2].

A. Wojnar and A. Pinheiro exhibited explanation of therapeutic pictures utilizing the SURF descriptors in 2012. Here, Fast Hessian framework is utilized to concentrate highlights and order is given by SVM with a quadratic pieces. The testing of created framework was performed on IRMA radiographic pictures. At that point aftereffects of SURF highlights are contrasted and SIFT highlights and results demonstrated that SURF highlights have better precision of 96%. The comment execution will be expanded by actualizing different classifiers [3]

Surface order utilizing cosine-adjusted wavelet was proposed by M. Mushrif and Y. Dubey. In this technique, better discriminability and low usage cost of the cosine balanced wavelet has been productively used to yield better highlights and progressively exact order results. The proposed methodology has improved order rates contrasted with the customary Gabor wavelet based methodology, pivoted wavelet channel based methodology, DT-CWT and DLBP. The proposed calculation for surface grouping yields extremely high exactness with low computational multifaceted nature and it plainly beats the current strategies [4].

J. Sanchez et al. proposed picture arrangement utilizing Fisher vector in 2013.It is fix encoding procedure which has favourable circumstances like proficiency in figuring, great outcomes, and insignificant loss of precision. Inside Fisher vector structure, pictures are portrayed by first extricating a lot of low dimension fix descriptors and after that processing their deviations from an all-inclusive generative model. Anyway being high-dimensional and thick, the Fisher vector ends up unrealistic for enormous scale application because of capacity restriction [5]

Execution development of surface grouping was proposed by D. Sanghai and S. Maniar in the year 2013. In this paper, surface arrangement is depicted by utilizing Wavelet Statistical Features (WSF), Wavelet Co0occuramce Features (WCF) and a blend of wavelet measurable highlights of wavelet changed pictures with various element databases can results better. To characterize pictures wavelet decaying is utilized with code arranged in MATLAB. Results have indicated achievement rate of 96.57% for a mix of WSF's and WCF's [6].

Dr Y. Venkateswarlu et al. displayed paper on surface order procedure dependent on semi uniform LBP in 2014. The conventional LBP utilizes just uniform examples and consolidation all non-uniform examples into one class. It can't portray surface qualities productively and they are delicate to commotion. These disservices are overwhelmed by proposed strategy called 'Neighbourhood Directional Patterns' descriptor. It is progressively steady within the sight of commotion and brightening changes, since edge reaction extent is steadier than pixel power [7].

A. Vupputuri and S. Meher, in 2015, proposed outward appearance acknowledgment utilizing neighbourhood parallel example and Kulluback Leibler Divergence. This paper has utilized nearby paired examples for facial element extraction and Kullback Leibler difference for arrangement. Proposed technique gives exactness superior to anything separation based order however there is still lies disarray with characterizing pitiful and dreads classes. This technique can be expanded powerful outward appearance acknowledgment from video grouping [8].

P. Prashar and H. Kundra, proposed Hybrid Approach for Image Classification utilizing SVM Classifier and SURF Descriptor. In this paper SURF highlights are contrasted and SIFT and grouping is given by SVM. Results got demonstrated that SURF highlights are better as far as exactness and time. Examination diagram is plotted which shows proposed strategy has more prominent precision than more established one [9].

D. Nghi and L. Chi Mai created strategy, preparing information choice for help vector machines model in 2011. At the point when parameters of SVM are connected to an enormous dataset, it requires quite a while for preparing so the model choice assignment and its exhibition can be debased. To diminish the ideal opportunity for model choice this paper has proposed a preparation information determination strategy at that point connected the model choice on decreased preparing set. Results demonstrated that a lot of time for model determination can be spared without debasing the exhibition [10].

III. METHODOLOGY

Classification of texture using DMD and SVM. Input images used for experimentation are taken from UMD dataset available free on internet. Then DMD features are extracted for input color image. To reduce the dimensions of DMD features Random Projection technique is used. Further these low dimensional features are converted into descriptors in encoding block and finally classified by SVM classifier.

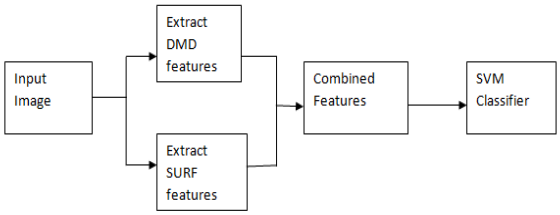

Figure *1 Architecture of Proposed System*

DMD and SURF features are extracted from input image which is taken from UMD dataset available free on internet. Here, DMD and SURF features are appended with each other and single vector is formed. Various ways of combining these two features have been tested for finding best classification performance. Further, classification is done with multilevel SVM classifier.

IV. Results and Discussion

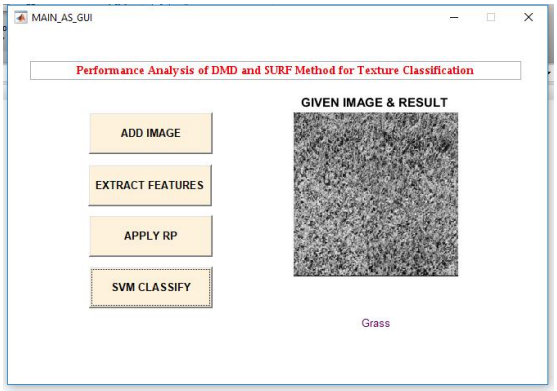

Figure *2 Resultant image showing classification (grass) of test image*

The resultant image shows that the test image from the dataset has features similar to that of image from the trained set of images which resembles grass.

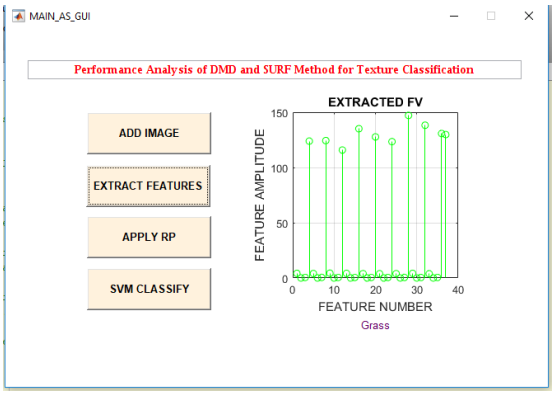

Figure *3 Resultant image showing the feature amplitude for specific feature number.*

The resultant image shows the amplitude of various features in the test image for different feature numbers which are extracted by fisher vector encoding which is used for feature selection.

Table 1 Overall performance of proposed methods

Feature Extraction Algorithm	Performance parameters			
	TPR	***PPV***	***FNR***	***ACC***
DMD	0.9425	1	0.0575	0.9425
SURF	0.895	1	0.105	0.895
Combined	0.9975	1	0.0025	0.9975

Summary of performance parameters which include sensitivity or true positive rate (TPR), precision or positive predictive value (PPV), false negative rate (FNR) and accuracy (ACC) of three proposed methods is listed in the above table. The performance parameters have been calculated using confusion matrix on basis of following formulae.

1. True positive rate (TPR): It measures the proportion of positives that are correctly identified.

$$TPR = \frac{TP}{P} = \frac{TP}{TP + FN}$$

2. Positive predictive value (PPV): It is the ratio of positive results in statistics and diagnostic tests that are true positive.

$$PPV = \frac{TP}{TP + FP}$$

3. False Negative Rate (FNR): It is the ratio of positives which yield negative test outcomes with the test i.e. the conditional probability of a negative test result given that the condition being looked for is present.

$$FNR = \frac{FN}{P} = \frac{FN}{FN + TP}$$

4. Accuracy (ACC): It is the proximity of measurement results to the true value.

$$ACC = \frac{TP + PN}{P + N} = \frac{TP + TN}{TP + TN + FP + FN}$$

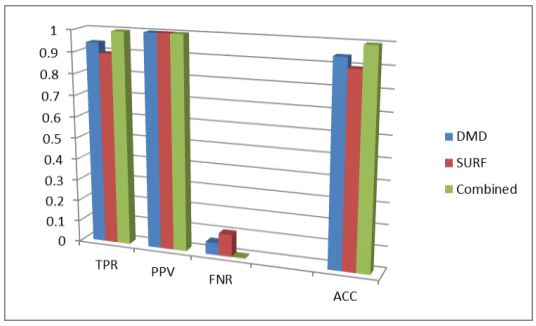

Figure *4 Graph showing comparison between DMD, SURF and combined techniques for different parameters.*

The above graph shows the comparison between DMD, SURF and combined technique for various performance parameters such as true positive rate (TPR) or sensitivity, positive predictive value (PPV) or precision, false negative rate (FNR) and accuracy (ACC).

V. Conclusion and Future Scope

First strategy for surface order displayed is DMD technique. In this system, we initially have exhibited that the surface

pictures are exceptional class of pictures and highlights for their portrayal ought to have some particular properties. Data from pictures is caught by taking a shot at fix based nearby highlights. Further, Fisher encoding is performed which gives descriptors. Fisher encoding catches higher request insights and give corresponding data along these lines results in a discriminative picture descriptor. This picture descriptor is at long last given to the staggered SVM classifier which changes over highlights into legitimate surface classes. DMD are extremely quick to process, low in dimensionality and simple to execute. Broad tests were directed on five surface classes of UMD dataset and execution parameters are determined with the assistance of disarray lattice. The outcomes demonstrate that exactness of DMD technique is 0.9425 with quick computational time.

Another strategy displayed is surface arrangement by utilizing SURF highlights. In this technique, focal points are established by determinant of Hessian network and portrayal is given for each focal point. Here Surf highlights are separated as key-focuses which show up in red circles. These got highlights are given to the staggered SVM classifier. Examinations performed on pictures of UMD dataset demonstrate that precision of SURF highlights is 0.895.

So also arrangement is performed on consolidated methodology of DMD and SURF highlights and results are gotten. Broad examinations are directed on UMD dataset and results are shown utilizing GUI. Results show that combined technique for highlight extraction has best exactness than individual DMD or SURF strategy for example 0.9975.

ACKNOWLEDGMENT

I am thankful to the Department of Electronics & Telecommunication of JSPM Narhe Technical campus, Pune for providing all facilities to me related to my research work.

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