Accuracy Analysis of SIFT and SURF Descriptor based on Gender Classification

Sneha Pai
Department of Compute Science and Engineering
NMAMIT, Nitte, India

Ramesha Shettigar
Department of Compute Science and Engineering
NMAMIT, Nitte, India

***Abstract*—Face gender recognition has become an important research topic for the potential applications, such as biometrics, human-computer interfaces, and surveillance. Although from the face images gender recognition looks like easy task but it is difficult task in some situations because it is affected by variation in face expression, different illumination condition, changes in background and also usage of occlusions. In this paper we compared the performance of Scale-Invariant Feature Transform (SIFT) and Speeded Up Robust Features (SURF). These algorithms will not be effected by changes in the scale, blur, rotation, change in illumination and affine transformation. SURF is same as SIFT performance and but requires less time for computation.**

Keywords—SIFT, SURF, Feature extraction, and Gender recognition

I. INTRODUCTION

The face plays important role in separating male and female face images. From fundamental point of view human can easily recognize gender from the face but using computer vision it is challenging task to identify gender. Although from the face images gender recognition looks like easy task but it is difficult task in some situations because it is affected by variation in face expression, different illumination condition, changes in background and also usage of occlusions.

Using automatic gender recognition, can obtain interaction between human and computer systems (e.g., using robots can find information user such as gender to understand the interaction between human and computer systems) and also, can improve the performance of face or facial expression recognition systems, used in monitoring applications and collect data for commercial purposes (e.g. using camera in store can calculate the number of women and man entering in the store). To find accurate gender classification, we use information from face such as emotional state, ethnic origin, gender, age and so on using this information we can easily classify human, male and female.

However, recognizing and differentiating different face using science is difficult to understand and it is still under research. In this paper, we use Scale Invariant Feature Transform (SIFT) and Speeded Up Robust Features (SURF) for gender recognition. Using this algorithm, we can separate male and female.

SIFT is an algorithm proposed in 2001 by David G Lowe. Local feature of the images can be extracted using SIFT. Main advantage of this algorithm is, it will work better in scale, rotation and work better under illumination change condition and also SIFT keypoints has large amount of information. SIFT implementation consisting of five steps they are:

1) *Scale-space extreme detection*
2) *Eliminating unwanted keypoints*
3) *Direction of keypoints*
4) *Feature description keypoints*
5) *Feature matching.*

SURF is an algorithm proposed by Bay and colleagues. It is same as that of SIFT but processing time is less and less complex. SURF implementation consisting of four steps they are:

1) *keypoint extraction*
2) *Orientation assignment*
3) *SURF descriptors*
4) *Interest point matching*

II. LITERATURE SURVEY

Ping Han Lee et al. [1] We propose a fully automatic system that detects and normalizes faces in images and recognize their genders. Based on eye position, face alignment is done. Using this method gender recognition rate can be boosted. Here first face is divided into several horizontal strips and vertical strips. Then, a regression function for each strip gives an estimation of the likelihood the strip sample belongs to a specific gender. In next stage new feature is formed from strips likelihoods final gender decision is made. Experiment shows that, using World-Wide Web dataset 88.1% gender recognition obtained and using FERET dataset 98.8% gender recognition obtained.

George Azzopardi et al. [2] proposed gender recognition combining COFIRE and SURF descriptors where SURF as domain approach and COSFIRE as trainable features. Proposed method will work better in variation in face, different expression and poses and also different illumination condition. Proposed method is tested on the three different databases they are GENDERFERET, LFW and UNISA Public database. Using GENDERFERET database 94.7% gender recognition rate obtained, LFW database will achieve 99.4% gender recognition rate and UNISA Public dataset has 206 training images where 44 male, 62 female and 200 test images where 139 male, 61 female images it will take image of person in regular walking motion using this database 91.5% gender recognition rate obtained.

Bhaskar Bhattacharya, Minhui Zhu [3] Discussed about overcoming the limitation of SIFT algorithm. To overcome the weaknesses SIFT algorithm, search size of database is increased to a certain degree of acceptance. For the experiment many vertical as well as horizontal variation in poses image is

used. Proposed method will obtain good result in both types of images.

Kirti Bagla, Bharat Bhushan [4] Proposed hybrid SIFT-SVM for face recognition. Using the training image SIFT features are extracted and keypoints are calculated. Then for the testing images SVM is applied for the matching process. Based on age results are obtained. To compute recognition rate, author considered two cases, they are FAR and FRR then result is compared with other existing algorithms. Proposed method will give better result in variation in poses, different illumination conditions and also varies facial expressions.

Kanwal Deep Kaur et al. [5] discussed about gender recognition using full face and half face images. Here manuscript feature is extracted using DWT followed by MMDA. Then features can be obtained using SVM and k-NN classifiers to differentiate between gender. For experiment FERET and FEI database is used using which more than 94% gender recognition are achieved for both half face and full-face images.

Guo-Shiang Lin, Yi-Jie Zhao [6] made use of color information for gender recognition. For result analysis images are captured using low-cost web cam. Experiment shows that this method will archive 80% of gender recognition rate.

H. Lin et al. [7] in this paper proposed new gender recognition method by combining Gabor filter, Adaboost learning and SVM classifier. Facial keypoints are extracted by combining Gabor filter banks and Adaboost method. Then these features are given to SVM classifier to recognize the gender from the image. Experiment shows that proposed method will achieve good performance.

Balakrishna Gudla et al. [8] Gender classification using facial features has attracted researcher's attention recently. Gender classification using texture features of faces exhibited promising improvement over other facial features. In this paper facial textures is extracted using LBP algorithm. For each non-overlapping blocks of a face image LBP is computed and LBPs histogram are also computed. This histogram is used as a facial feature vectors for classification of gender. Then classification are done using SVM algorithm. For result analysis FERET and FEI database is used. Using this 96.17% gender recognition rate are obtained.

Liu Tianyu et al. [9] presented feature extraction method called MB-LBP. Then for gender classification authors used SVM classification method. Result shows that combining MB-LBP and linear SVM give better result compared to combination of MB-LBP and RBF method. For the experiment authors used FERET dataset.

Atul Bansal, et al. [10] discussed about gender recognition which are done using iris images. Using wavelets Statistical and texture features are extracted from the iris images. For the gender classification authors used SVM algorithm. Using this method 83.06% gender recognition obtained.

III. SYSTEM DESIGN

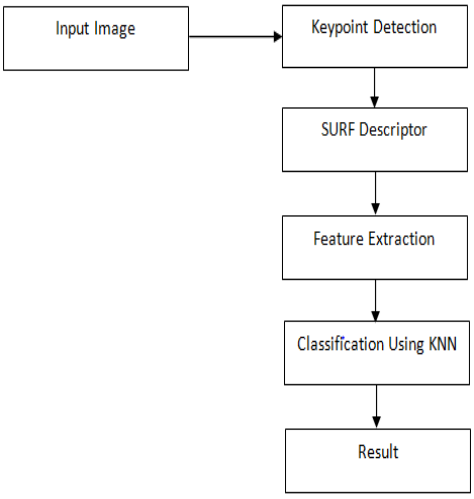

Fig. 1. Flowchart of our proposed SURF algorithm

Figure 1 represent flowchart of gender recognition system using SURF algorithm which consists of following stages of process in the first stage image is taken from the database whose size is 250×250 pixels. Second stage is keypoint detection here we are finding reliable keypoint from the image points such as, edge point spot point etc. In third stage we calculate SURF descriptor using interest points from face. Using responses of Haar wavelet we obtain SURF descriptor. Fourth stage is feature extraction in which extract important features from the image. In fifth stage we are use KNN algorithm for classification which separate data points from the database to form several classes to predict classification. Finally, we get result of selected image is either male or female.

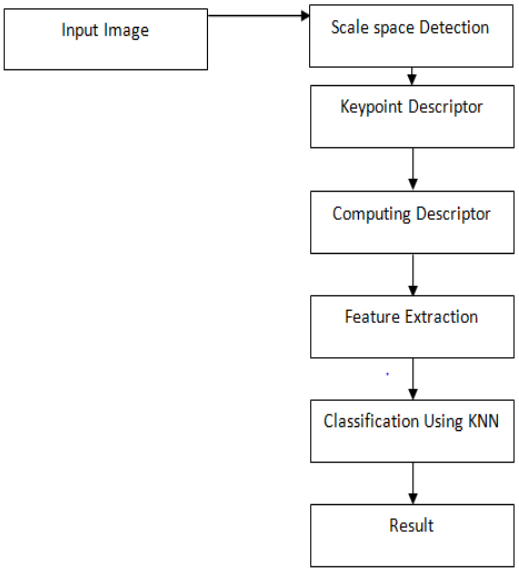

Fig. 2. Flowchart of our proposed SIFT algorithm

Figure 2 represent flowchart of gender recognition system using SIFT algorithm which consists of following stages of process in the first stage image is taken from the database whose size is 250×250 pixels. Second stage is scale space detection that is scaling the image for different size to find the best scale for the image. Third stage is finding keypoint descriptor in which we find stable and fixed keypoint and

remove unwanted keypoint from the image. Fourth stage is computing the descriptor. Using interest points from face, descriptors can be obtained. Fifth stage is the feature extraction here we are extracting important features from the image. In sixth stage we are using KNN algorithm for classification which separate data points from the database to form several classes to predict classification. Finally, we get result of selected image is either male or female.

RESULTS AND DISCUSSION

A. *SURF*

Fig. 3. selected image is male result is male

In figure 3 male image is selected from database with image size 250×250 pixels. Here SURF algorithm is used for gender recognition. Our experiment successfully recognizes that selected image male.

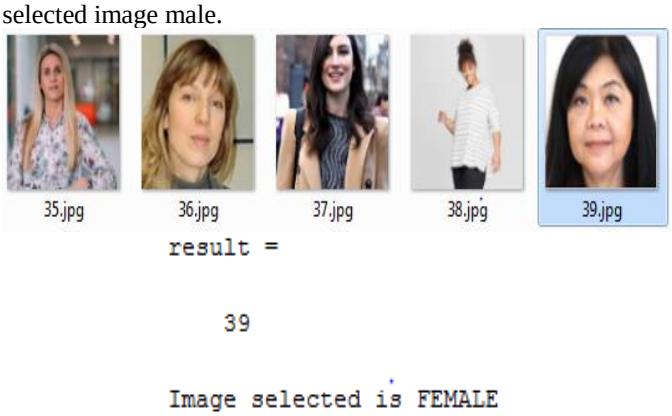

Fig. 4. selected image is female result is female

Similarly, in figure 4 female image is selected from database with image size 250×250 pixels. Here SURF algorithm is used for gender recognition. Our experiment successfully recognizes that selected image female.

B. *SIFT*

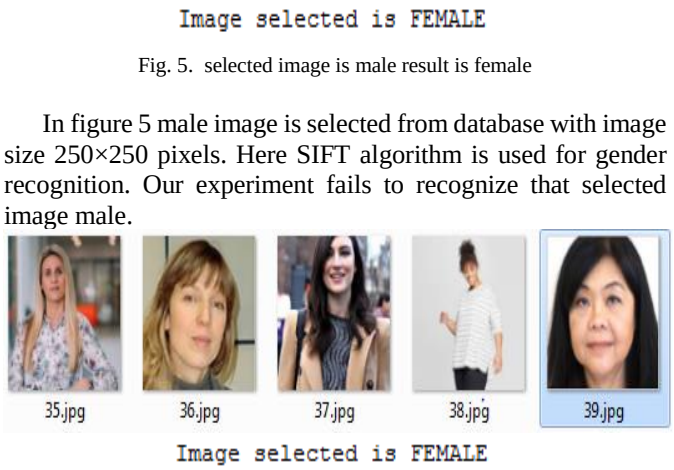

Fig. 5. selected image is male result is female

In figure 5 male image is selected from database with image size 250×250 pixels. Here SIFT algorithm is used for gender recognition. Our experiment fails to recognize that selected image male.

Fig. 6. selected image is female result is female

Similarly, in figure 6 female image is selected from database with image size 250×250 pixels. Here SIFT algorithm used for gender recognition. Our experiment successfully recognizes that selected image female.

We compared SIFT and SURF algorithm by taking 50 images where 25 male faces and 25 female faces. Results show that SURF identify gender accurately compared to SIFT and also SIFT female identification is 100% but male identification is less.

IV. CONCLUSIONS

Here we compared two methods they are Scale Invariant Transform (SIFT) and Speeded up Robust Feature algorithm (SURF). SURF is same as that of the SIFT but give better accuracy. Gender recognition is better using SURF then SIFT. Using SURF gender recognition is 100% but using SIFT female recognition is 100% but male recognition is less. Execution time of SIFT is more compared to SURF.

REFERENCES

[1] P. H. Lee, J. Y. Hung, Y.P. Hung, “Automatic gender recognition using fusion of facial strips,” 20th International Conference on Pattern Recognition, pp. 1140 – 1143, Aug 2010 .
[2] G. Azzopardi, A. Greco, A. Saggese, M. Vento, “Fusion of Domain-Specific and Trainable Features for Gender Recognition From Face Images,” IEEE Access, pp. 24171–24183, April 2018.
[3] B. Bhattacharya, M. Zhu, “Handling pose variation in face recognition using SIFT,” IEEE Applied Imagery Pattern Recognition Workshop (AIPR), pp. 1 – 4, Oct 2011.
[4] K. Bagla, B. Bhushan, “A novel approach for face recognition using hybrid SIFT-SVM,” IEEE 1st International Conference on Power Electronics, Intelligent Control and Energy Systems (ICPEICES), pp. 1-6, July 2016.
[5] K. D. Kaur, P. Rai, P. Khanna, “Gender classification system for half face images using multi manifold discriminant analysis,” 7th International Conference on Cloud Computing, Data Science & Engineering - Confluence, pp. 595 – 598, Jan 2017.
[6] G. S. Lin, Y. J. Zhao, “A Feature-Based Gender Recognition Method Based on Color Information,” First International Conference on Robot, Vision and Signal Processing, pp. 40 – 43, Nov 2011.
[7] H. Lin, H. Lu, L. Zhang, “A New Automatic Recognition System of Gender, Age and Ethnicity,” 2006 6th World Congress on Intelligent Control and Automation, pp. 9988 - 9991 June 2006.
[8] B. Gudla, S.R. Chalamala, S.K. Jam, “Local Binary Patterns for Gender Classification,” 3rd International Conference on Artificial Intelligence, Modelling and Simulation (AIMS), pp. 19 – 22, Dec 2015.

[9] L. Tianyu, L. Fei, W. Rui, "Human face gender identification system based on MB-LBP," 2018 Chinese Control And Decision Conference (CCDC), pp. 1721 - 1725, June 2018.

[10] A. Bansal, R. Agarwal, R.K. Sharma, "SVM Based Gender Classification Using Iris Images," Fourth International Conference on Computational Intelligence and Communication Networks, pp. 425 – 429, Nov 2012.