

Hybrid Computerized Face Recognition System Using Bag of Visual Words and MLP-Based BPNN

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Abstract: Nowadays in a situation like the Covid19 pandemic it is very sensitive to use biometric systems for attendance monitoring of employees. The reason is covid19 spreads from one person to another easily with a biometric system. It has become necessary for any organization to maintain an attendance monitoring system without taking fingerprints of any employee or a student. The automatic Face recognition system is best to alternate for the biometric system. An advanced automatic face recognition technique is proposed in this paper with the classification technique using Bag of Visual Words (BOVW) and Multi-Layer Perceptron (MLP) based Back Propagation Neural Network (BPNN). An Accuracy of 91% is achieved with the proposed methodology.

Keywords— Face Recognition, Biometric, Bag of Visual Words (BOVW), Back Propagation Neural Network (BPNN), Covid19, MLP (Multi Layer Perceptron)

I. INTRODUCTION

In 2020 there have been many changes occurring in the living style of human beings throughout the world.[1] As per the reports to date 25,067,702 covid19 positive cases were tested positive throughout the world and in India, around 3.46 million cases were tested positive. Due to the covid19 virus, it has become very difficult to use one's thing by the other. A biometric system is a machine that is used for a person's identification using fingerprints. [2] Many organizations are using the biometric system for monitoring the attendance of employees or students. To read the attendance of any employee or a student, it is compulsory to give a thumb impression to the biometric device. [3] As the same device has

to be used by many it is very easy for a covid19 to spread from one to another. Face Recognition is a process of identifying the person based upon the features extracted. Using a face recognition system it is very easy to give the attendance without touching the device. [4] An advanced system for face recognition is necessary to give accurate results. Image processing techniques are very much essential for the proposed work.[5] Image processing techniques are a combination of Pre-Processing technique, Segmentation, feature extraction, Training, and Testing.

The full article is arranged in the following manner. The introduction of the proposed work is explained in Section I, and the literature survey is described in Section II. The proposed methodology is depicted in Section III, and the comparison results were discussed in Section IV. The dataset details are represented in Section V, and finally, the conclusion is presented in Section VI. Figure.1 shows the proposed system architecture.

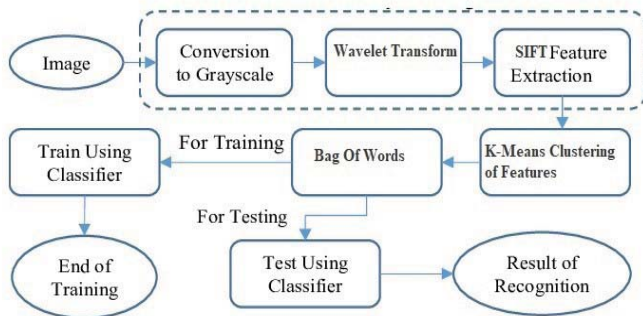


Figure.1 Proposed System Architecture

II. LITERATURE SURVEY

Now a day's face recognition system is popularly in demand. [6]The authors presented the need for images of a single person from different angles to train the neural network effectively. [7] Suggested the necessity of a face recognition system for attendance monitoring in universities. [8] Suggested biometric systems are to be replaced with any modern technology where fingerprints reading only should not be the way to take input for the reading of attendance. As there are many frauds are coming into existence where duplicate fingerprints can be easily obtained and the biometric system can be misused. [9]Suggested the need for an iris scanner for person recognition.[10] suggested the use of face recognition systems in security places like defense. [11] presented in their work how image processing techniques are helpful in the face recognition system.[12] presented different kinds of filtering techniques that can be applied for removing the noise from the image.[13] presented in their work how segmentation techniques are needed for classifying the objects.

III. PROPOSED METHODOLOGY

For the proposed system, a dataset of face images of 100 people in 6 angles each face is taken for training and testing the classifiers. Figure.2 shows a sample set of images of a single person from different angles for training the classifiers. [14]Here an advanced face recognition system with Bag of

Words is proposed. Initially, image compression is done using the wavelet transform. From the compressed image, features are extracted using Scale Invariant Feature Extraction (SIFT) feature extraction technique. [15] All features are clustered using the K-Means Clustering algorithm. Here each cluster is represented with a word using the Bag of Words technique.



Figure.2 Sample set of images of a single person in different angles for training the classifiers

A. SIFT Feature Extraction

SIFT is a special type of feature extraction technique where each point is portrayed with a 28-dimension vector. Scale-space extrema are obtained using SIFT as the first step.[16] Keypoint localization is obtained and placed into the keypoint descriptors.

Figure.3 shows the steps involved in SIFT feature extraction

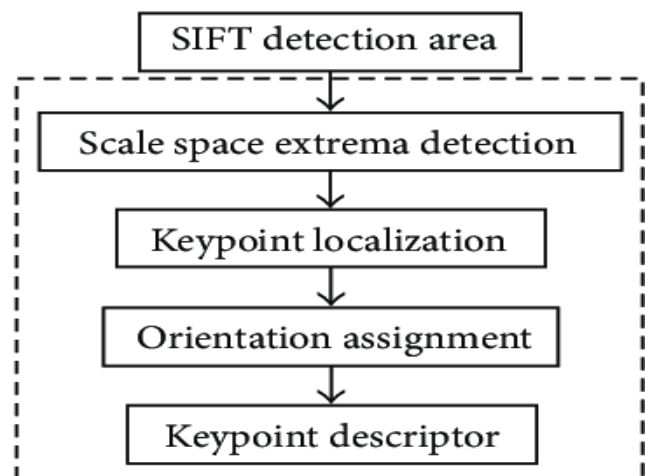


Figure.3 Steps of SIFT feature extraction

B. Clustering of Features using K-Means Clustering

After extracting the features, Clustering is done on those features using the K-Means clustering technique. Euclidean distance is applied to the pixels based upon the cluster centers. Figure.4 shows the resultant image of clustering done using K-Means clustering.

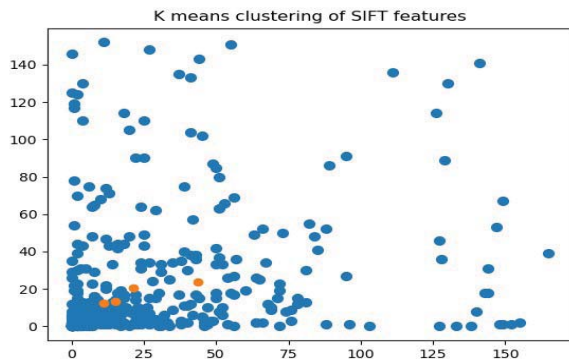


Figure.4 Clustering of features using K-Means.

C. Bag-of-Visual-Words (BOVW)

Bag of words or bag of visual words is a technique in which where each cluster formed using the k-means clustering is considered as a word. Likewise, a group of words is said to be a vocabulary. Here vocabularies of features are sent for training the classifiers.

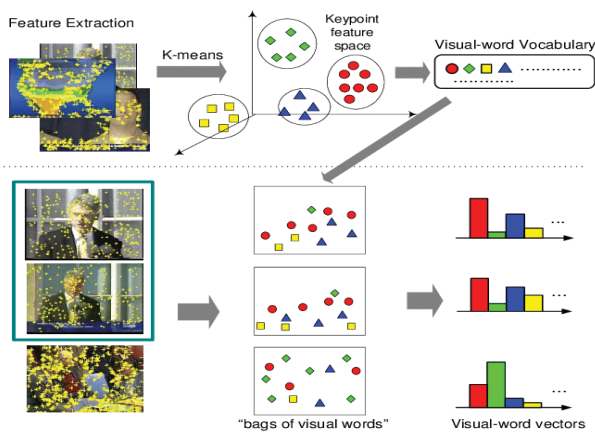


Figure.5 Bag of visual words model

Figure.5 shows the Bag of visual words model how features get extracted and constructed into groups of words.

D. MLP-Based BPNN

[17][18] Vocabularies obtained using BOW are given as input to MLP based BPNN where 1024 input neurons are used which results in either set [1 0] or [0 1] which is considered to be in binary form where [1 0] representation is an indication of image matched and [0 1] is the indication of the image not matched.

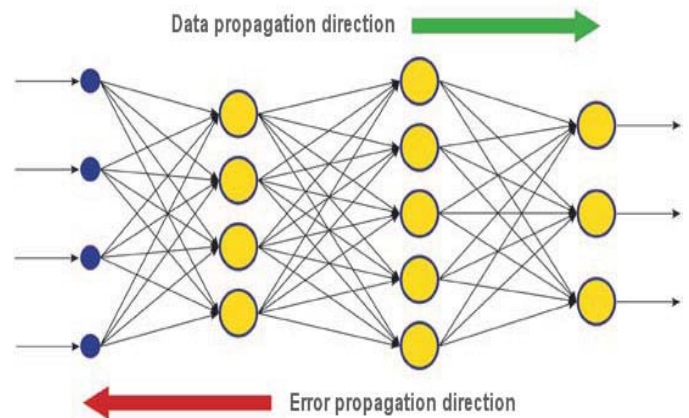


Figure.6 Architecture of Back Propagation Neural Network

Figure.6 shows the architecture of BPNN where input BOW is given as input the neural network which gets propagated along with the weights and passes through the hidden layer and produces the result which is compared with the estimated result and if any difference occurs then error value is calculated and backpropagated with the adjusted weights [19].

$$net_{h1} = w_1 * i_1 + w_2 * i_2 + b_1 * 1 \dots (1)$$

Equation.1 shows the formulae applied in BPNN to get the result for the hidden layer and output layer.

IV. RESULTS AND COMPARISON

After training the neural network, the images from the dataset which are to be used for testing are given as input for testing. MLP based BPNN achieves an accuracy of 91%. Here results are compared with 5 different classifiers Probabilistic Neural Network (PNN), K-Nearest Neighbour (KNN), Adaptive Neuro fuzzy inference system (ANFIS), and MLP-BPNN and results are compared with accuracy, Specificity, and Sensitivity with equation 2, 3, and 4 .

$$Sensitivity = \frac{tp}{tp+fn} \quad \text{-----(2)}$$

$$Specificity = \frac{tn}{tn+tp} \quad \text{-----(3)}$$

$$Accuracy = \frac{tp+tn}{tp+fp+tn+fn} \quad \text{-----(4)}$$

Table.1 shows the results achieved with MLP-BPNN, PNN, KNN, ANFIS, SVM classifiers where an accuracy of 91% is achieved with MLP-BPNN which is the proposed method.

	Accuracy	Specificity	Sensitivity
MLP-BPNN(Proposed Method)	91	90	92
PNN	83	84	87
KNN	86	83	85
ANFIS	88	80	81
SVM	85	86	84

Table.1 Comparison of results

Figure.7 is a graphical representation of results achieved with all classifiers applied.

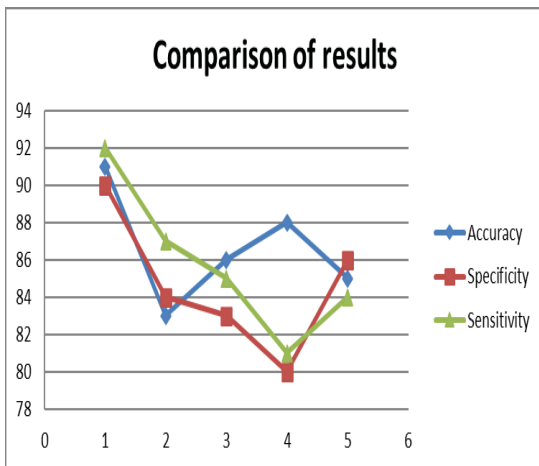


Figure.7 Representation of comparison of results

V. CONCLUSION

Face recognition is very essential in the present pandemic situation of covid19 and the proposed methodology best suits the present situation and an accuracy of 91% shows promising results for automatic face recognition system. The proposed

method is compared with different types of classifiers but Bag of words with SIFT features and MLP-BPNN achieves better results. The proposed work can be extended for image acquisition in a video and detection of an object in videos.

REFERENCES

- [1] Basha, C. Z., Sri charan, K. M., Dheeraj, C. K., & Ramya Sri, R. (2018). A study on wavelet transform using image analysis. *International Journal of Engineering and Technology (UAE)*, 7(2),94-96.
- [2] S.Z.Li and J. Lu, "Face recognition using the nearest nature line method," *IEEE Trans. Neural Network*. vol. IO, pp. 439-443, Mar. 1999.
- [3] Lakshmi, M. V., Pokkuri, P., & Madhav, B. T. P. (2018). A coplanar waveguide fed asymmetric ground frequency reconfigurable antenna. *International Journal of Intelligent Engineering and Systems*, 11(4), 293-300. <https://doi.org/10.22266/ijies2018.0831.29>
- [4] Suresh Babu, K., & Vemuru, S. (2018). A low-cost software defined radio based Cognitive Radio test-bed for LTE networks. *International Journal of Engineering and Technology(UAE)*, 7(3.1 Special Issue 1), 51-55.
- [5] H. T. Su and R. C. Zhaa, "Face recognition based on wavelet transform and multiple classifier," *Computer Applications*, vol. 22, No. 8, Aug. 2002.
- [6] C. Z. Basha, N. Bhavana, P. Bhavya and S. V, "Rainfall Prediction using Machine Learning & Deep Learning Techniques," *2020 International Conference on Electronics and Sustainable Communication Systems (ICESC)*, Coimbatore, India, 2020, pp. 92-97, doi: 10.1109/ICESC48915.2020.9155896.
- [7] I. B. Gamm and D. L. Yu, "Selecting radial basis function network centers with recursive orthogonal least squares training," *IEEE Trans. Neural Network*. vol. 11, No. 2, Mar. 2000.
- [8] W. B. Zhao and D. S. Huang, "The structure optimization of radial basis probabilistic neural networks based on genetic algorithms," in *IJCNN2002*, pp. 1086-1091, Hilton Hawaiian Village Hotel, Honolulu, Hawaii, May. 12-17, 2002.
- [9] Basha, C. Z., Krishna, A., & Kumar, S. S. (2019). Automatic article detection in a jumbled scene using point feature matching. In *Examining Fractal Image Processing and Analysis* (pp. 188-195). IGI Global. <https://doi.org/10.4018/978-1-7998-0066-8.ch009>
- [10] Y. K. Zhang, P. Du, and C. Q. Liu, "A face recognition method based on principal component analysis and support vector machine," *Journal of Shanghai Jiaotong University*, vol. 36, No. 6. Jun. 2002.
- [11] D. S. Huang, "Radial basis probabilistic neural networks: Model and application," *International Journal of Pattern Recognition and Artificial Intelligence*, 13(7), pp. 1083-1101, 1999.
- [12] Krishna, A., Basha, C. Z., Savarapu, P. R., Nayak, S. R., & Sivakumar, S. (2019). Multi target tracking access with data association in distributed camera networks. *International Journal of Recent Technology and Engineering*, 8(2 Special Issue 11), 412-417.
- [13] Boddapati, M., & Kishore, P. (2018). Bandwidth enhancement of CPW-fed elliptical curved antenna with square SRR. *International Journal of Intelligent Engineering and Systems*, 11(2), 68-75. <https://doi.org/10.22266/ijies2018.0430.08>

- [14] Basha, C. M. A. K. Z., Swetha, G., Likhitha, A., & Bhargavi, J. (2019). Service now based course registration system. *International Journal of Innovative Technology and Exploring Engineering*, 9(1), 1643–1646.
- [15] Zeelan Basha, C. M. A. K., Rabab, T., Sravanthi, Y., & Anila, Y. (2019). Servicenow based advanced and robust leave management system. *International Journal of Innovative Technology and Exploring Engineering*, 9(1), 1958–1961.
- [16] Basha, C. Z., Sricharan, K. M., Dheeraj, C. K., & Ramya Sri, R. (2018). A study on wavelet transform using image analysis. *International Journal of Engineering and Technology (UAE)*, 7(2), 94–96.
- [17] Jacob, I. Jeena. "Capsule network based biometric recognition system." *Journal of Artificial Intelligence* 1, no. 02 (2019): 83-94.
- [18] Chen, Joy long Zong. "Smart Security System for Suspicious Activity Detection in Volatile Areas" *Journal of Information Technology* 2, no. 01 (2020): 64-72.
- [19] Amarendra, K., Jagapathibabu, K., Bhargavi, K.R. & Ratna, E. 2019, "An efficient and secured network to prevent distributed denial of service attacks and data security", *International Journal of Innovative Technology and Exploring Engineering*, vol. 8, no. 6, pp. 1057-1059.