Face Recognition using CNN and Tracking Locations using Image Metadata

Ch. Sushma¹, P Lalitha Surya Kumari²

¹Research Professor, ²Professor
Department of Computer Science and Engineering, Koneru Lakshmaiah Education Foundation, Hyderabad, Telangana, India.
Corresponding Author E-mail: chsushma22@gmail.com

Abstract. In this paper Face Recognition has gain the more attention in the society of network multimedia for accessing information. Emerging Areas like network security, content indexing and extraction, and video compression benefits from face recognition technic because "people" are the center of attention in a lot of video footages. Face detection is advanced research area in the computer science vision. The research under this area is expanding in others areas like psychology. Localization of human face will be first and the initial stage as a study of face detection. In this paper the usage of Convolutional Neural Network (CNN) algorithm in detecting the criminal face and also the process of getting the location from image.

1. Introduction
Face Recognition System is a computer application used to identify humans from a video footage or else a image. It is used for security purposes to track the people who is coming into a location or to search someone in the location. It is not efficient for biometric or iris scanner but it is easier for implementation purpose. This face recognition system will store the images of people in a database for tracking. The face recognition system will use the algorithms to verify that the person in camera or video footage matches with any image in the database or not. one algorithm the images of humans are stored in gray scale format and stores in a database. The Other algorithm searches for a face in the database for verifying purpose. Another algorithm compares whether the shape or area or size of the face matches within the database or not. The above algorithms will verify the image is matching in the stored database or not.

The Convolutional Neural Networks has brought the lot of drastic changes in developing of Face Recognition like a piece of cake[1].

The CNN is the game changers and used in many fields to provides the solutions for the problems related to computer vision. In computer technology the Face recognition process can be utilized in many applications and identifies human faces as digital images. It performs three basic steps which includes as follows detecting face, recognizing face, and extracting face process. The system will encapsulate the image and determines the location of the face where it is located[2].

Face recognition will take an image as input from a camera or video and output as the original image. Facial features may consider the changes in shapes, face, size, face regions, variations in the face structure, face cuts and angles styled and formatted designs. Face extraction process will include grabbing the features from camera. Face detection will include background process of removal and focusing on the eliminating foreground any other features apart from the face regions. The system still have few drawbacks it cannot able to detect the head count due to overlapping of faces or not proper recognizing the two faces having same facial features[3].
In this representation, the facial recognition is performed by using the trained CNN model. After finding the perfect match of the face from the input feed, the same image is given to the Plot function to use the metadata which will be helpful in tracking the location where the image was taken.

1.1. Related Works

The CNN model was built to detect the suspects by using the smart glasses, it was written by Khan et AL. [1]. Their model first detects the faces to make Haar – like features which will be given as feed to the CNN model. They have presented that their model of detection was most likely to be 98% accurate with 3099 features. They are used to transfer learning technique and can implement their proposed method. They have used AlexNet which is popular CNN architecture was used in transfer learning techniques. They have achieved 98.5% accuracy of recognising the suspect faces.

A Face Recognition model was developed by Musab et Al. [2] using CNN model. In their work they have more concentrated to normalize the model by adding the normalization to two of the layers and by using the batch normalization technique. Their model has reached a good accuracy.

The face detection model which was developed by Bogdan Kwolek [3], the gabor filters can be used in additional with the proposed CNN model to extract the face features and improving the accuracy of a model. The detection rate accuracy of the proposed model has reached around 87.5% on testing data and contains 1000 face samples and 10000 non-face samples.

A Varun et Al. [4], a CNN model was used to predict the animals emotions by transforming their voice into the sound wave images. The recognition and mapping of those images was performed with a trained accuracy 100% and the test accuracy 88%.

Boutell et Al. [5], had developed a model that will be differentiating the inside and outside images using the image content and the metadata.

2. Methodology

The development of this methodology for the purpose of the facial recognition along with metadata of the image for tracking the location. Due to the improvement of technology the tracking system has also been improved. The basic architecture of the proposed face recognition model is shown in the above figure. At first, the images from the social media or from any means are taken is pre-processed in which the size of the images are modified to the required size for the CNN model to be trained on. The other phase is the training of the model. In this phase the proposed CNN model is developed by using convolution and dense layers of artificial neurons.
2.1 To fit the image into the model for training in the pre-processing as follows:

- Initially take all the images as a group and save them in a folder.
- The respective classes and images are stored in Blank multidimensional array.
- The images are can be read by computer vision library OpenCV, images will be converted into the numerical arrays.
- File is used for a set of 100 images after the combination of the [image_array, class] to save.
- To read all images along with their respective class the below file is used.
- The images and their respective class of the images which is stored in a file will be shuffled and saved in another file.

2.2 A Proposed CNN network is described below:

- The above created file is imported and adjustment of size from multidimensional array to compressed array to fit into the proposed CNN model.
- Firstly, 3 layers of Convolutional 2D layers are built and along with the respective softmax activating functions and pooling functions.
- The sequential network is designed with five layer is builded with three layers as hidden layers.
- For resizing the data and flattening layer is utilized which is known as initial layer.
- The neural network nodes with the initial hidden layer and rectified with the linear activation function as second layer.
- To construct 512 neural network nodes and relu activation function the third layer is used i.e second hidden layer.
- Taking 128 nodes relu as activation function and neural network as the fourth layer.
- Soft maximum to normalize the k real numbers into probability with a same number of nodes with available classes and activation function is a final layer.
- Compilation will done By using the Adam Optimizer
- With the help of sparse categorical cross entropy process and track the damage in the network.

After training the images with the above mentioned proposed model and it is ready for the testing process where the images are pulled from anywhere and can be pre-processed to find the accurate match or class. The next process is the node to node plotting in which the metadata of the images are considered.

Generally, in any image there will be metadata which is attached with the image that contains the details about the flash light, location, device name, camera quality, and more. But it is not visible to everyone as it is integrated or hidden inside the image. In this methodology, we have pulled out the information that is available in the metadata and then we make use of location i.e., coordinates information for plotting in a map. The example of the plotting is as shown in the figure 2.

![Figure 2: MapPlot Example](image-url)
3. Results and Discussion

The accuracy of the Machine Learning or Deep Learning model is very much important in decision making. If there is any chance of getting the wrong decisions that will lead to a huge impact on the decision and the total process may become wrong. So, to achieve the good accuracy the model will be trained with good amount of data which will not under fit or over fit the model. The under fitting or over fitting will lead to false accuracy and the in the real time environment the model will not work well. In the training phase the proposed CNN model started its loss at 83% and reduced to almost 0% within 25 epochs. And the accuracy has started at 56% and has risen up to 100% at 29th epoch or iteration but the validation accuracy was shown as 99.86%.

4. Conclusion

The paper used in developing of the Convolutional Neural Networks model for the purpose of recognizing face. A matched face images are used to plot in the map using the metadata of the image. These models can be implemented in the criminal tracking or suspects tracking and even help in the form of gathering digital footprints. The image will provides the details like flash light, location, device name, camera quality. It will be helpful in tracking the criminals and provides security.

References

[1] S. Khan, M. H. Javed, E. Ahmed, S. A. A. Shah and S. U. Ali, "Facial Recognition using Convolutional Neural Networks and Implementation on Smart Glasses," 2019 International Conference on Information Science and Communication Technology (ICISCT), Karachi, Pakistan, 2019, pp. 1-6, doi: 10.1109/CISCT.2019.8777442.
[2] M. Coşkun, A. Uçar, Ö. Yildirim and Y. Demir, "Face recognition based on convolutional neural network," 2017 International Conference on Modern Electrical and Energy Systems (MEES), Kremenchuk, 2017, pp. 376-379, doi: 10.1109/MEES.2017.8248937.
[3] Kwolek, Bogdan. (2005). Face Detection Using Convolutional Neural Networks and Gabor Filters. 3696. 551-556. 10.1007/11550822_86.
[4] Totakura, Varun & Jammanchi, Mohana & Hussan, M.I.. (2020). Prediction Of Animal Vocal Emotions Using Convolutional Neural Network. International Journal of Scientific & Technology Research. VOLUME 9. 6007-6011.
[5] Boutell, Matthew & Luo, Jiebo. (2004). Photo Classification by Integrating Image Content and Camera Metadata.. 4. 901-904. 10.1109/ICPR.2004.1333918.
[6] Mullan, Patrick & Riess, Christian & Freiling, Felix. (2019). Forensic source identification using JPEG image headers: The case of smartphones. Digital Investigation. 28. S68-S76. 10.1016/j.diin.2019.01.016.
[7] “Facial Recognition System for Suspect Identification Using a Surveillance Camera” V. D .Ambeth kumar ISSN 1054-6618, Pattern Recognition and Image Analysis, 2018, Vol. 28, No. 3, pp. 410–420. Pleiades Publishing.
[8] Fahad P, M.d. Mahmudul, Md. Atiqr, Susan M, Mosleuddin M, Pandian VFace recognition based real time system for surveillance. Intelligent Decision Technologies, IOS Press (2017), pp. 79-9211(2017)
[9] Karthik HS, and Manikandan J. (2017) "Evaluation of relevance vector machine classifier for a real-time face recognition system." International Conference on Consumer Electronics – Asia, Bangalore, India, 5–7 October, IEEE Press, pp. 26–30.
[10] Shalmoly M, and Soumen B. (2016) "Face Recognition using PCA and Minimum Distance Classifier." Fifth International Conference on Frontiers in Intelligent Computing: Theory and Applications, 16–17 September, Bhubaneswar, India, Springer, pp. 397–405.
[11] Kukreja S, and Rekha G. (2011) "Comparative study of different face recognition techniques." International Conference on Computational Intelligence and Communication Networks, 7−9 October, Gwalior, India, pp. 271−273.

[12] Hu H, Shah A, Bennamoun M, and M Molton. (2017) "2D and 3D face recognition using convolutional neural network," IEEE Region 10 Conference, 5−8 November, Penang, Malaysia, pp. 133−132.

[13] Bansal Prachi, Mittal Saurabh, Gupta Maanak Using locality preserving projections in facial recognition. International Journal of Engineering Technology, Management and Applied Sciences, 2 (3) (2014), pp. 99-108

[14] Survey on Stress Emotion Recognition in Speech, Reddy, L.L., Kuchibhotla, S. Proceedings - 2019 International Conference on Computing, Communication, and Intelligent Systems, ICCCIS 2019 january

[15] Abdelmoghit Zaarane, Ibtissam Slimani, Abdellatif Hamdoun, et al. Real-time vehicle detection using cross-correlation and 2D-DWT for feature extraction J. Electrical and Computer Eng, 2019 (2019), 10.1155/2019/6375176

[16] Ibtissam Slimani, Abdelmoghit Zaarane, Abdellatif Hamdoun, et al. Traffic surveillance system for vehicle detection using discrete wavelet transform J Theor Appl Inf Technol, 96 (17) (2018)

[17] Kenji Nakahira, Tetsuji Kodama, Shin Morita, et al. Distance measurement by an ultrasonic system based on a digital polarity correlator IEEE Trans on Instrumentation and Measurement, 50 (6) (2001), pp. 1748-1752

[18] Facial expression detection of all emotions and face recognition system Jahnavi, P., Vamsidhar, E., Karthikeyan, C. International Journal of Emerging Trends in Engineering Research 2019 volume issue12,778-783

[19] I. Slimani, A. Zaarane, A. et Hamdoun Convolution algorithm for implementing 2D discrete wavelet transform on the FPGA Computer systems and applications (AICCSA), 2016 IEEE/ACS 13th international conference of. IEEE (2016), pp. 1-3