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Face Recognition with Real-Time Framing Based on Multi Task Convolutional Neural Network: A Case Study

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Abstract: The face recognition model has been applied to detect and compare between faces has been investigated with avoid the thief from stealing from another houses and to identify the image of the criminal additionally the alarm issue is a very necessary in these times to get a response from model and based on increment the frame number of image captures to set the both accuracy and loss depend on learning rate and iteration number with a Convolutional Neural Network (CNN) has ability to identify the capture margins 150*150 that belong to the size of capture framing continuously with the comparison with the captured original image based webcam to get a cropped detected image and the number of threshold has been set in four cases of frame number 25, 50, 100, 150 respectively to check the two factors accuracy and loss are 100% on all four cases that mentioned above, this model has been applied utilize MATLAB R2021a.

Keywords: Face Recognition Model, Thief Detection, Convolutional Neural Network, Webcam, MATLAB

1. Introduction

In these times, the face recognition in a computer vision has a high research interest [1]. It has included two main important of sub mission it also known as face identify and face verify from the settings of open sets, the face identifies classify the faces to identify feature, while the face verify contain double input facing receive from the identical uniformity via measure the similar in the space of characteristic [2]. In the virtual apps, the space of label for sets of trained data is difference from this set of check or test, the face recognition can be a one of the most important issue in rise technologies and because of enhancement in the surveillant webcams or cameras to the verity of purpose especially in security and crime of monitor and due to the needed algorithms development that can be a desired appropriation to the handle the imaging kind that received via those webcams. The concept of face recognize model is a similar to verity of some systems of a biometric. In this paper, the captured and cropped features was commonly used that based on fully connected layer and classification layer by set the rate of learning in 0.00001 in utilize a trained network for three main features, trained network, classification layer and learning rate initialization by utilize an improved Convolutional Neural Network (CNN), the main topic in this research is discussed to avoid the thief from the stealing and to prevent this part is to increase the frame number of captures for cameras should to test by set a case study for frames to make a comparison between original input tested images and detected cropped image and also the alarm part is a very necessary to solve the stealing problem and because of the alarm can be important issue to alert the thief from nearly get close from the cameras by initial the alert in the beginning when the cameras detect the first initial variation from the original input image, two main subjects has been tested in this research to check the accuracy and losses rates for both these cases that based on cascade object detector that belong to the face detector [3].

2. Face Recognition Method

The cascade object detector has been used in this model of face recognition by set 150*150 for overall margins in a real time with various thresholds, additionally the two cases of subjects has been take and tested for a recognition process by make a point tracker for both of them via set a maximum bidirectional error to take a probability for overall error in additional to that, the error check is very necessary for this task [4]. The main factor in this article is to use a high resolution camera with high pixels and image capture response could give a high difference especially in the recognition task, therefore the size and video frame number for these features are became required in these times. For a real time, process, the positions for video player and frame sizes has been set 100*100 and 2*1 for position and frame size respectively [5]. The video frame is required for snapshot and video frame gray for a conversion process and it's a huge process due to achieve the boundary boxes with the detection mode additionally to find the corners points

for each detected regions. The crop face and crop with save is the main functions has been used for a recognition process, the first one make the detection with boundary boxes and crop, the second one make a counting for each one of label when the variables set by one to two and save the cropped image in allocated folder and this task achieved when the true face is detected and the Convolutional Neural Network (CNN) was used in this process to achieve all the probabilities for the image recognition process and also known as Alex net method [6].

3. Multitask Convolutional Neural Network

Nowadays, the convolutional neural network and it's also known as a deep-CNN and it is responsible for analyzing the input images for the objects classify and detecting and it is alternative for the compression and the images splitting task [7].

The huge numbers of images is dealing with the computer but in the convolutional neural network it is reduce the images numbers by make it's probability additionally due to it is facilitate of use and work with the input image with a direct process and face detection with no need to resort to the pressurization and noising and based on weights as the shown figure below.

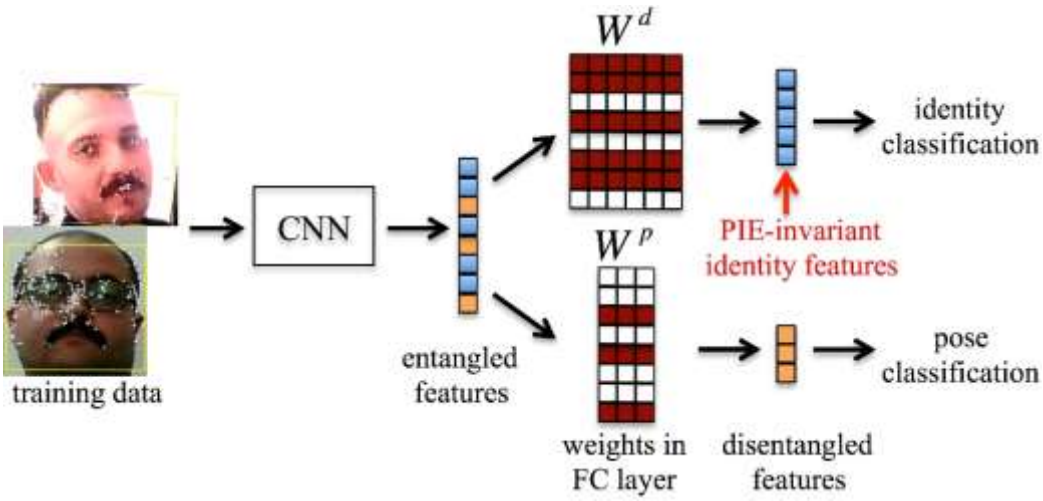


Figure 1: The convolutional neural network with a face recognition training data.

By consider to the training data that known as D with number of images (N) and it's labels:

$$D = \{I_i, y_i\}_{i=1}^{N} \quad (1)$$

According to I_i is the input image and y_i is the count of vector that consists of the label of identity y_i^d is the initialized task and the labels of the partition task. Consider to $W^d \in R^{D*D^d}$ and $b^d \in R^{D_d*1}$ both of them are the matrix of weights and vector of bias in a full associated layer for the classify of identities[8], when D^d is the identities number in D[9]. the overall model of linearization is implemented as the following:

$$y^d = W^{dT}x + b^d \quad (2)$$

y^d is refer to the layer of SoftMax for computing the probabilities to x that belong to the training data for each one of the subjects.

$$softmax\ (y^d)_n = p(y^d = \mathrm{n}|\mathrm{x}) = \frac{\exp(y_n^d)}{\sum_j \exp(y_j^d)} \quad (3)$$

When y_j^d is the element of imaginary in y^d. Additionally, the function of SoftMax is responsible for conversion the y^d to the distributed probability for all subjects. The tasks of side is a very important to achieve the formulation of the losses additionally the weights as $w = \{w^d, w^p, w^l, w^e\}$ describe the matrices for the current mentioned weights for the known classification of person in environment and identities. The terms of bias are rejected for the simplicities [10-14]. As the shown the training data D, multi-task for CNN method is the goals to minimization the set of losses for overall tasks:

$$\alpha_d \sum_{i=1}^{N} L(I_i, y_i^d) + \alpha_p \sum_{i=1}^{N} L(I_i, y_i^p) + \alpha_l \sum_{i=1}^{N} L(I_i, y_i^l) + \alpha_e \sum_{i=1}^{N} L(I_i, y_i^e) \quad (4)$$

When $\alpha_d, \alpha_p, \alpha_l, \alpha_e$ is the important control for tasks. Therefore the model of single task that known by single convolutional neural network while $\alpha_{p,l,e} = zero$ the losses could drive the modelling to understand mentioned parameters Θ for the extract the common properties and the weight for the tasks of classifications, according to the features that set before the layer of SoftMax (y^d) are utilized for the model of the recognition of the face by set a matching face depend on the similarity of cosine. In this research the mini batch SGD is solved the mentioned above problem of optimization for both accuracy and loss when the weights of dynamic are a mean for overall batches of samplings [15-18].

4. Simulation results and analysis

In this part, the proposed multi task convolutional neural network is used in the face recognition with MATLAB software with several times and cases. Additionally, the method was showed four cases of study 25,50,100,150 frame number respectively and the experiments were tested with and without cropped of images and accuracy with loss.

Figure 2: multi-CNN captured original images for the face recognition within 25 thresholds.

Figure 3: multi-CNN captured cropped images for the face recognition within 25 thresholds.

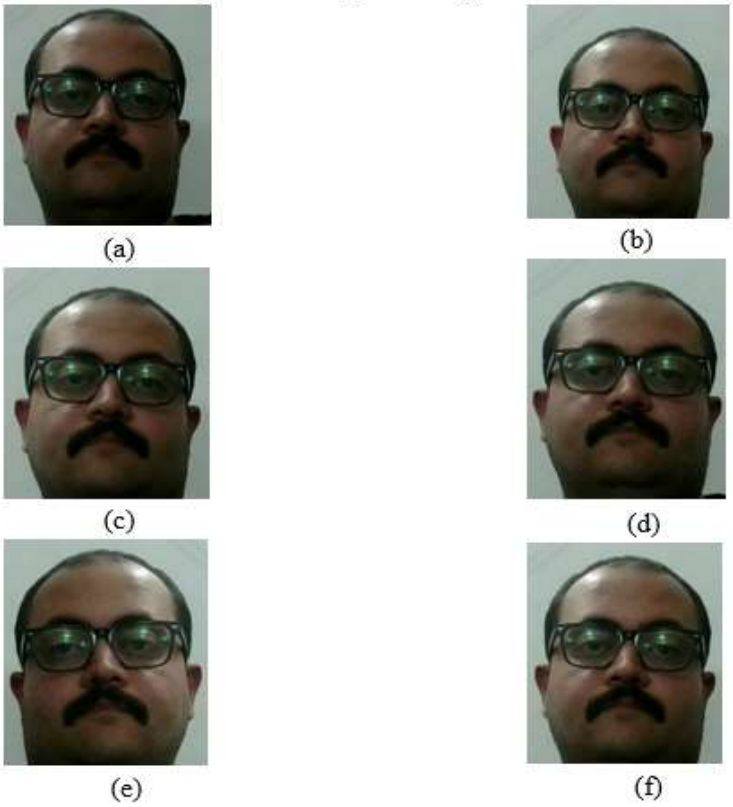


Figure 4: multi-CNN captured original images for the face recognition within 50 thresholds.

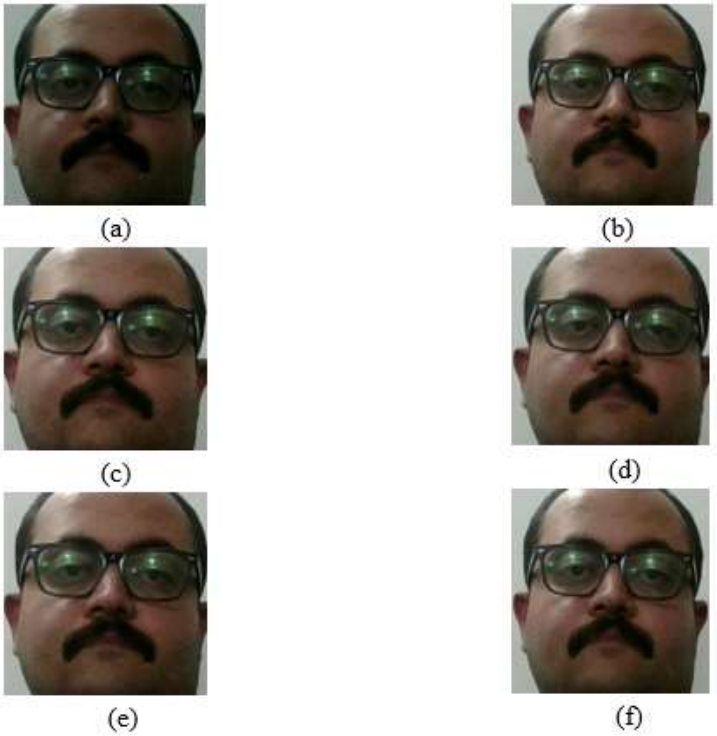


Figure 5: multi-CNN captured cropped images for the face recognition within 50 thresholds.

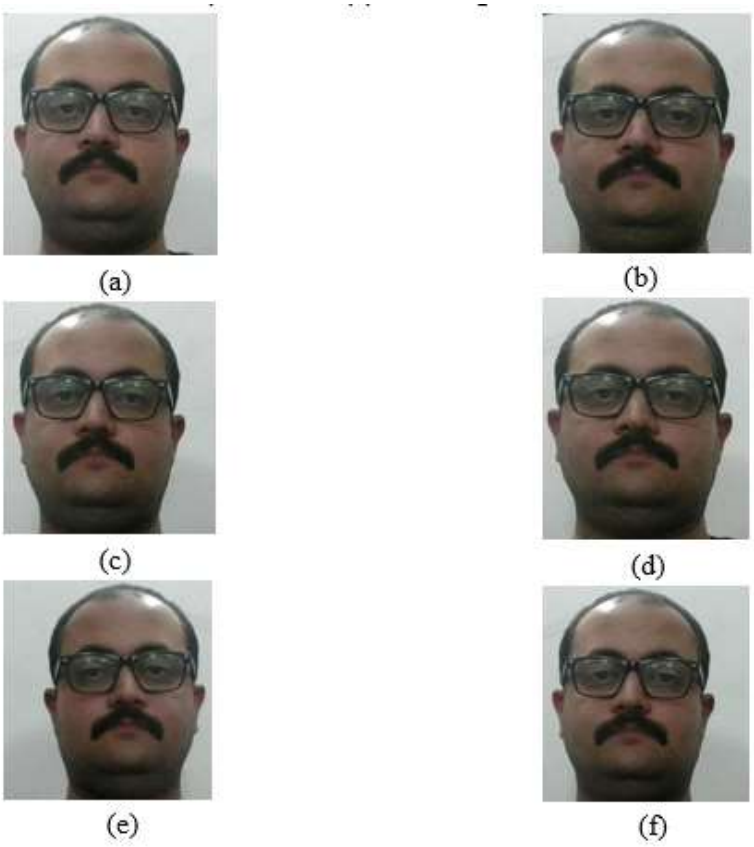


Figure 6: multi-CNN captured original images for the face recognition within 100 thresholds.

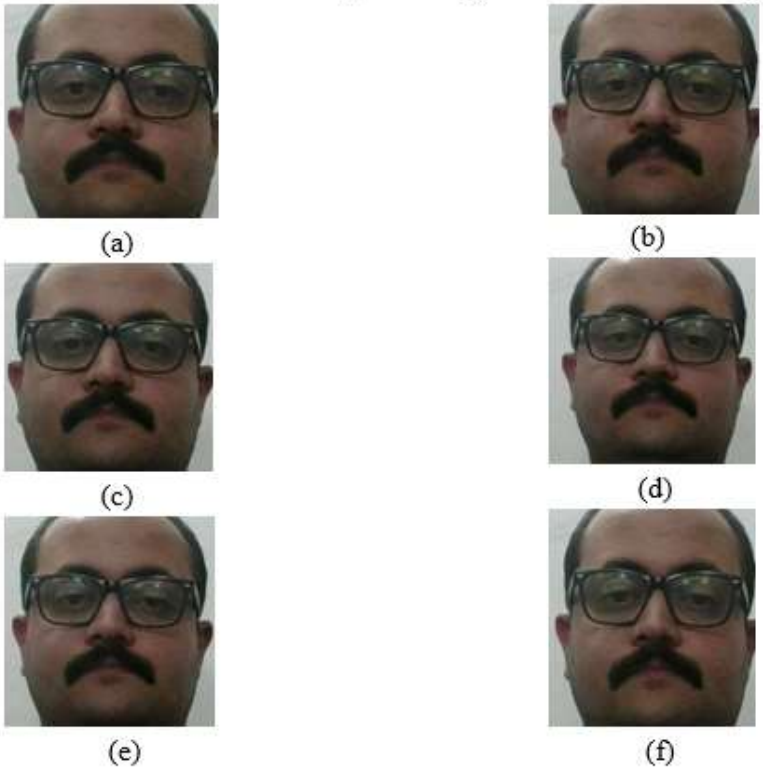


Figure 7: multi-CNN captured cropped images for the face recognition within 100 thresholds.

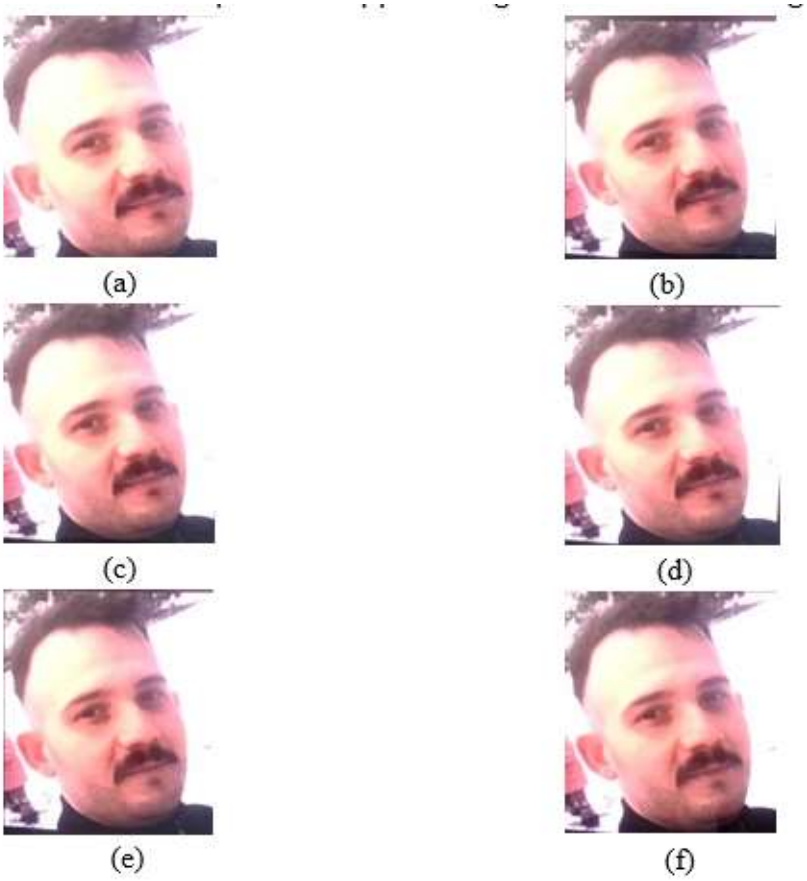


Figure 8: multi-CNN captured original images for the face recognition within 150 thresholds.

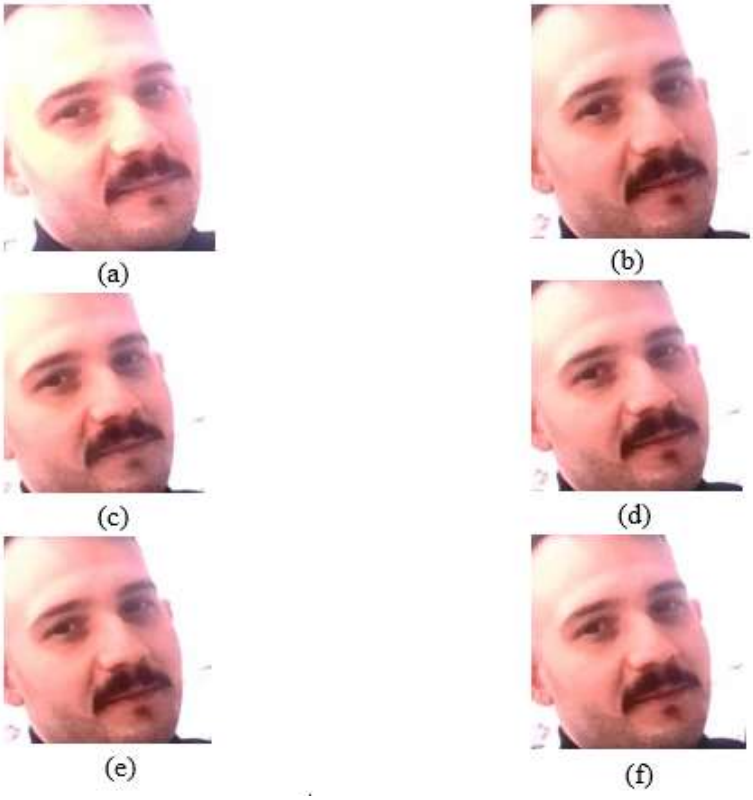


Figure 9: multi-CNN captured cropped images for the face recognition within 150 thresholds.

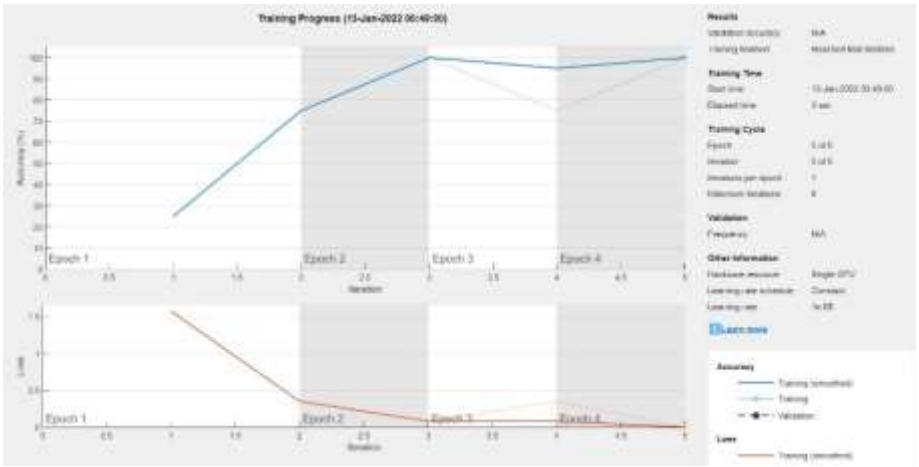
In the current table that describe the numbers of frames when set 25,50,100,150 respectively according to the mini-batch accuracy and loss that conducted with multi-task CNN and the accuracy of these tests is 100% for overall numbers of frames and tested up to five maximum of iterations with achieved at last three seconds with 0.0690 loss of mini-batch at the learning rate for 1.0000e-05.

Table 1: Overall comparison with numbers of frames conducted with multi-task CNN.

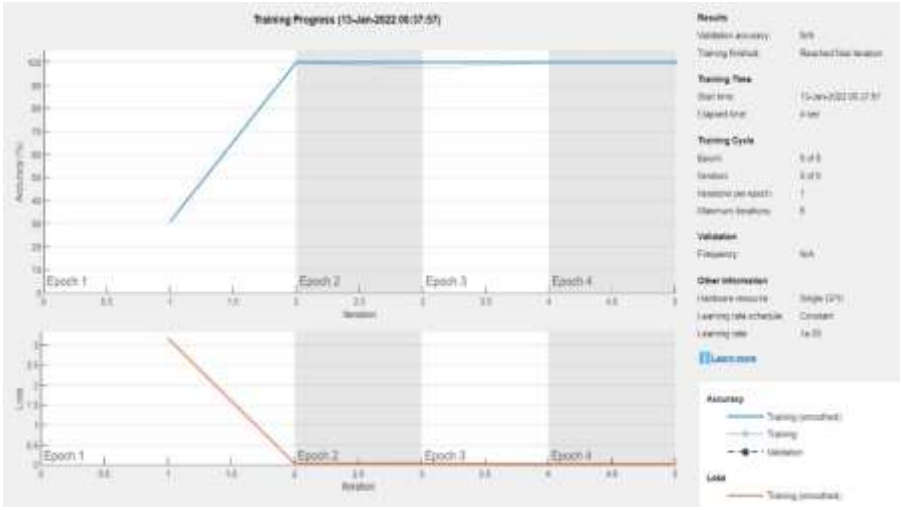
Frame No.	Epoch	Iteration	Time Elapsed (hh:mm:ss)	Mini-batch Accuracy	Mini-batch Loss	Base Learning Rate
25	1	1	00:00:02	25.00%	1.5724	1.0000e-05
	5	5	00:00:03	100.00%	0.0021	
50	1	1	00:00:02	30.77%	3.1674	1.0000e-05
	5	5	00:00:04	100.00%	0.0176	
100	1	1	00:00:03	50.00%	2.0473	1.0000e-05
	5	5	00:00:06	100.00%	0.0004	
150	1	1	00:00:02	87.50%	0.5516	1.0000e-05
	5	5	00:00:03	100.00%	0.0690	

```
[dat,fs]=audioread("Alarm.wav");
ao=audioplayer(dat,fs);
play(ao);
pause;
stop(ao);
clear("ao");
```

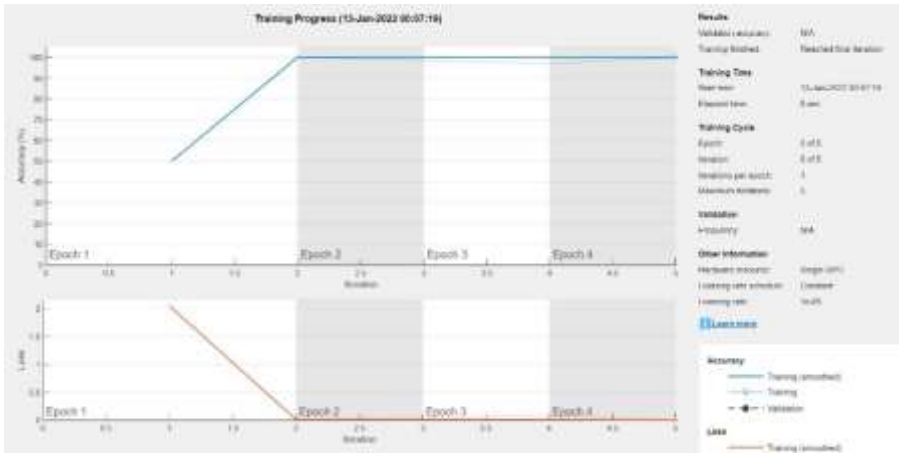
Figure 10: Alarm code with a real time face recognition conducted with Multitask CNN Method



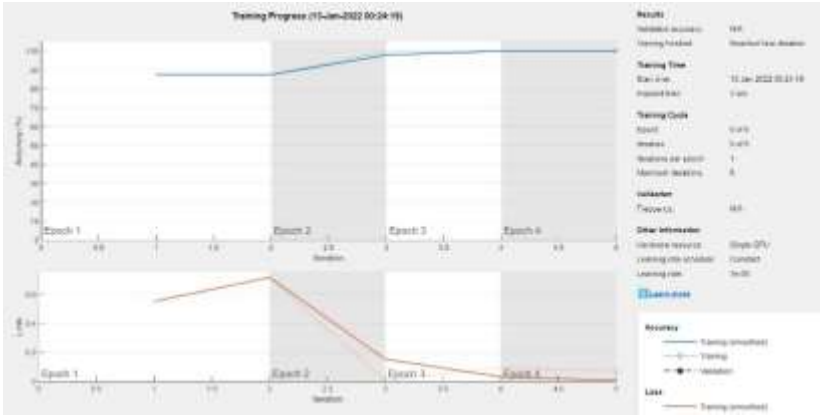
25 thresholds



50 thresholds



100 thresholds



150 thresholds

Figure 11: loss and accuracy curves for overall thresholds conducted with Multitask CNN Method.

5. Conclusions

This article has been highlights on face recognition in order to make fast captured associated with cropped task. The idea is to give the optimum solution with Person In Environment (PIE) by using classics and without classics to avoid the thief from stealing additionally the time and alarm is very important as mentioned in the results section and the number of frames, according to the mini batch that has been solved the main problem of optimization for accuracy and loss while the weights of dynamic are made the mean with overall batches of samplings, four cases has been taken to enhance and proof the performance analysis as shown: 25, 50, 100, 150 where multitask CNN is responsible for reduce the images numbers by take a direct probability process with no need for resorting process for pressurization to the input weights.

References

[1] S. Banerjee and S. Das, “Mutual variation of information on transfer-CNN for face recognition with degraded probe samples,” Neurocomputing, vol. 310, pp. 299–315, 2018.

[2] I. Eldifrawi, M. Abo-Zahhad, M. Abdelwahab, and A. H. Abd El-Malek, “New Face Recognition Algorithm Adopting Wide Fast Embedded Capsule Networks with Reduced Complexity and Preserved Accuracy.”

[3] S. Hemathilaka and A. Aponso, “A Comprehensive Study on Occlusion Invariant Face Recognition under Face Mask Occlusion,” arXiv Prepr. arXiv2201.09089, 2022.

[4] B. R. Ilyas, B. Mohammed, M. Khaled, and K. Miloud, “Enhanced face recognition system based on deep CNN,” in 2019 6th International Conference on Image and Signal Processing and their Applications (ISPA), 2019, pp. 1–6.

[5] P. Ke, M. Cai, H. Wang, and J. Chen, “A novel face recognition algorithm based on the combination of LBP and CNN,” in 2018 14th IEEE International Conference on Signal Processing (ICSP), 2018, pp. 539–543.

[6] Y.-H. Kim, H. Kim, S.-W. Kim, H.-Y. Kim, and S.-J. Ko, “Illumination normalisation using convolutional neural network with application to face recognition,” Electron. Lett., vol. 53, no. 6, pp. 399–401, 2017.

[7] S. Koley, H. Roy, S. Dhar, and D. Bhattacharjee, “Illumination invariant face recognition using Fused Cross Lattice Pattern of Phase Congruency (FCLPPC),” Inf. Sci. (Ny)., vol. 584, pp. 633–648, 2022.

[8] M. Mehdipour Ghazi and H. Kemal Ekenel, “A comprehensive analysis of deep learning based representation for face recognition,” in Proceedings of the IEEE conference on computer vision and pattern recognition workshops, 2016, pp. 34–41.

[9] P. Mishra, S. Kumar, and M. K. Chaube, “Classifying Chart Based on Structural Dissimilarities using Improved Regularized Loss Function,” Neural Process. Lett., pp. 1–27, 2022.

[10] M. M. Abdulwahid, “Design and Implementation of Motor Speed Control Model by using PLC,” Inform. J. Appl. Mach. Electr. Electron. Comput. Sci. Commun. Syst., vol. 1, no. 1, pp. 54–62, 2020.

[11] M. M. Abdulwahid and N. B. M. Wasel, “Optimum AP Estimation Location for the communication of different mmWave bands,” Inform. J. Appl. Mach. Electr. Electron. Comput. Sci. Commun. Syst., vol. 1, no. 1, pp. 44–53, 2020.

[12] M. M. Abdulwahid and N. B. M. Wasel, “Design and Implementation of Water Level Tank Model by using SCADA System,” Inform. J. Appl. Mach. Electr. Electron. Comput. Sci. Commun. Syst., vol. 1, no. 1, pp. 63–69, 2020.

[13] N. Basil and M. Moutaz, “Design and Implementation of Chirp Fiber Bragg Grating for Long Haul Transmission System using Opti-system,” Inform. J. Appl. Mach. Electr. Electron. Comput. Sci. Commun. Syst., vol. 2, no. 1, pp. 1–7, 2021.

[14] A. R. Ibrahim, N. Basil, and M. I. Mahdi, “Implementation enhancement of AVR control system within optimization techniques,” Int. J. Nonlinear Anal. Appl., vol. 12, no. 2, 2021.

[15] H. M. Marhoon, A. R. Ibrahim, and N. Basil, “Enhancement of Electro Hydraulic Position Servo Control System Utilising Ant Lion Optimiser,” Int. J. Nonlinear Anal. Appl., vol. 12, no. 2, pp. 2453–2461, 2021.

[16] A. M. MM and A. N. Mohammed, “Design and Implementation of 200 G Passive Optical Network,” Inform. J. Appl. Mach. Electr. Electron. Comput. Sci. Commun. Syst., vol. 2, no. 1, pp. 8–13, 2021.

[17] N. B. Mohamadwasel and S. Kurnaz, “Implementation of the parallel robot using FOPID with fuzzy type-2 in use social spider optimization algorithm,” Appl. Nanosci., 2021, doi: 10.1007/s13204-021-02034-9.

[18] N. B. M. Wasel and M. M. Abdulwahid, “Implementation method for Wireless Signal Transfer Using Wincc and Smart Server in SCADA system,” Inform. J. Appl. Mach. Electr. Electron. Comput. Sci. Commun. Syst., vol. 1, no. 1, pp. 70–76, 2020.

[19] A. Nadeem et al., “A Novel Integration of Face-Recognition Algorithms with a Soft Voting Scheme for Efficiently Tracking Missing Person in Challenging Large-Gathering Scenarios,” Sensors, vol. 22, no. 3, p. 1153, 2022.