



University of Juba

School of Computer Science and Information Technology

Course: Artificial Intelligent

Title: Face Recognition for Access Control

Authors:

- 1. Akuei Kuol Joseph**
- 2. John Bol Mayuek**

Instructor: Dr. Felix Gonda

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1.0 Introduction

A Face Recognition Access Control System is usually a door lock or turnstile system that allows entrance to an authorized person based on facial recognition algorithms. It is used for keyless and seamless access control and door entry.

With every passing day, we are becoming more and more dependent upon technology to carry out even the most basic of our actions. Facial detection and Facial recognition help us in many ways, be it sorting of photos in our mobile phone gallery by recognizing pictures with their face in them or unlocking a phone by a mere glance to biometric information in the form of face images in the unique ID database as an acceptable biometric input for verification.

This project proposal will lay out the basic terminology required to understand the implementation of Face Detection and Face Recognition using Intel's Computer Vision library called 'OpenCV'. It will also show the practical implementation of the Face Detection and Face Recognition using OpenCV with Python embedding on both Windows as well as macOS platform. The aim of the project is to implement Facial Recognition on faces that the script can be trained for. The input is taken from a webcam and the recognized faces are displayed along with their name in real time.

A face recognition system could also be a technology which is very capable of matching a personality's face from a digital image or a video frame which it has or use it as a reference to map and identify against a database of faces. Researchers' area unit presently developing multiple ways throughout that face recognition systems work. The foremost advanced face recognition methodology, that is to boot used to manifest users through ID verification services, works by pinpointing and mensuration countenance from a given image.

1.1.Problem Statement

Random movement in the building uncontrollably is dangerous to the office and people working Face detection is able to immensely improve surveillance efforts which can greatly help in tracking down of people who might be threat to the security of the building and the people collectively.

1.2. OBJECTIVES

The objective of this project was to implement a face recognition system that will control access to the offices within the University main administration building to study the various means of recognizing faces with more accuracy and reducing the error rates while recognition.

Facial Recognition system will be “Capable of uniquely identifying or verifying a person by comparing and analysing patterns based on the person’s facial contours

The system will be able to identify and grant access to workers within the building

1.3 Significance of the Project

Face recognition access control systems have gained significant importance in various domains due to their unique capabilities and advantages. Here are some of the key significances of face recognition access control:

1. **Enhanced Security:** Face recognition access control provides a higher level of security compared to traditional access control methods such as keycards or passwords. Since each person's face is unique, it becomes difficult for unauthorized individuals to gain access by using stolen credentials.
2. **Non-Intrusive and User-Friendly:** Face recognition systems are non-intrusive and user-friendly. Users can gain access simply by looking at a camera, eliminating the need for physical contact or remembering passwords. This convenience makes face recognition systems more user-friendly and efficient.
3. **Accuracy and Reliability:** Face recognition technology has significantly improved in terms of accuracy and reliability. Advanced algorithms can accurately identify individuals even in challenging conditions such as low lighting, different angles, or partial face occlusions. This ensures that only authorized individuals are granted access.
4. **Scalability:** Face recognition access control systems can be easily scaled to accommodate a large number of users. Whether it's a small office or a large organization, face recognition systems can handle a high volume of individuals without compromising on accuracy or speed.
5. **Audit Trail and Analytics:** Face recognition access control systems can provide valuable data for auditing and analytics purposes. They can generate logs of access events, including

timestamps and images of individuals who gained access. This information can be used for security investigations, attendance tracking, and overall system analysis.

1.4 Methodology

As we are observing the accuracy of different facial recognition algorithms, so our research methodology is experimental, figure 1 illustrate the comprehensive pipeline of our methodology.

Faces Recognition for

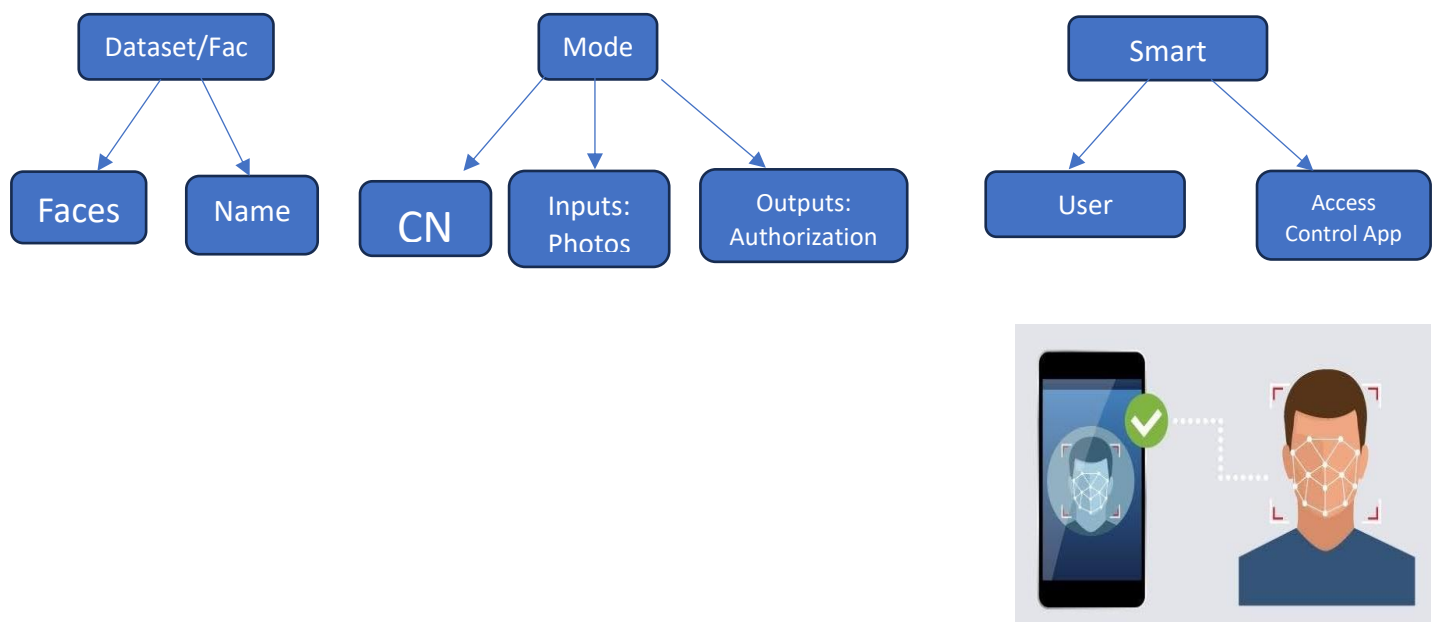


Figure 1 showing our comprehensive Illustration Diagram

1.5 Data Collection

Our dataset of interest were the datasets reflecting pose variation in the x-axis, for this reason we have downloaded two publicly available dataset that are available on Wild Home face databases. This dataset contains the 25 random images

1.6 Training

We selected 25 random images of known individual and fed them through our CNN.

Training Data Visualization



Labeled Faces in the Wild Home

Gary B. Huang and Marwan Mattar and Honglak Lee and Erik Learned-Miller. Learning to Align from Scratch. NIPS, 2012

<https://vis-www.cs.umass.edu/lfw/>

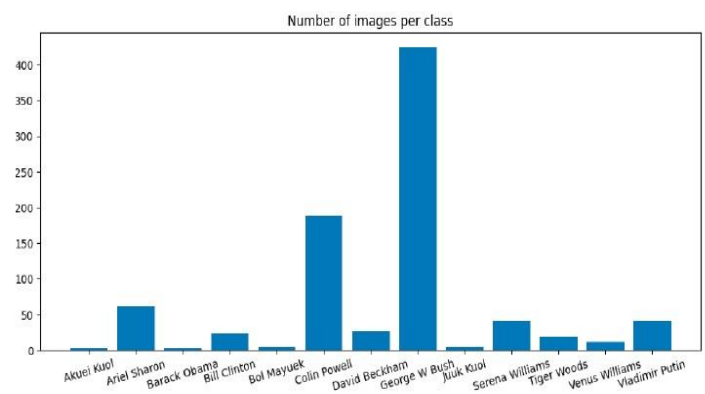


Figure 2. show the random 25 images and chart of images per class

1.7 Results

Results: Model Evaluation on Test Data

True Label \	Akuei Kuol	Ariel Sharon	Barack Obama	Bill Clinton	Bob Mayruek	Colin Powell	David Beckham	George W Bush	Juak Kuol	Serena Williams	Tiger Woods	Venus Williams	Vladimir Putin
Akuei Kuol	2	0	0	0	0	0	0	0	0	0	0	0	0
Ariel Sharon	0	11	0	0	2	0	0	1	0	0	2	0	0
Barack Obama	0	0	0	0	0	0	3	0	0	0	0	0	0
Bill Clinton	0	0	0	2	2	0	0	0	0	0	2	0	0
Bob Mayruek	0	0	0	0	44	0	2	1	0	0	0	0	0
Colin Powell	0	0	0	0	0	2	1	1	0	0	0	0	0
David Beckham	0	0	0	0	3	0	99	1	1	0	2	0	0
George W Bush	0	0	0	0	1	0	1	10	0	0	0	0	0
Juak Kuol	0	0	0	0	0	0	0	2	2	0	0	0	0
Serena Williams	0	0	0	0	0	0	0	4	1	1	0	0	0
Tiger Woods	0	0	0	0	1	0	1	0	0	0	6	0	0
Venus Williams	0	0	0	0	0	0	0	0	0	0	0	0	0
Vladimir Putin	0	0	0	0	0	0	0	0	0	0	0	0	0
	Akuei Kuol	Ariel Sharon	Barack Obama	Bill Clinton	Bob Mayruek	Colin Powell	David Beckham	George W Bush	Juak Kuol	Serena Williams	Tiger Woods	Venus Williams	Vladimir Putin
	Predicted Label												



Figure 3. Showing the result of the training.

Our results show very promising accuracy, however, there are some areas where our model failed. Example of this failures is the image of Tiger Wood showing as Serena William. This failure can be corrected through more training our model

Visualize training loss and accuracy chart

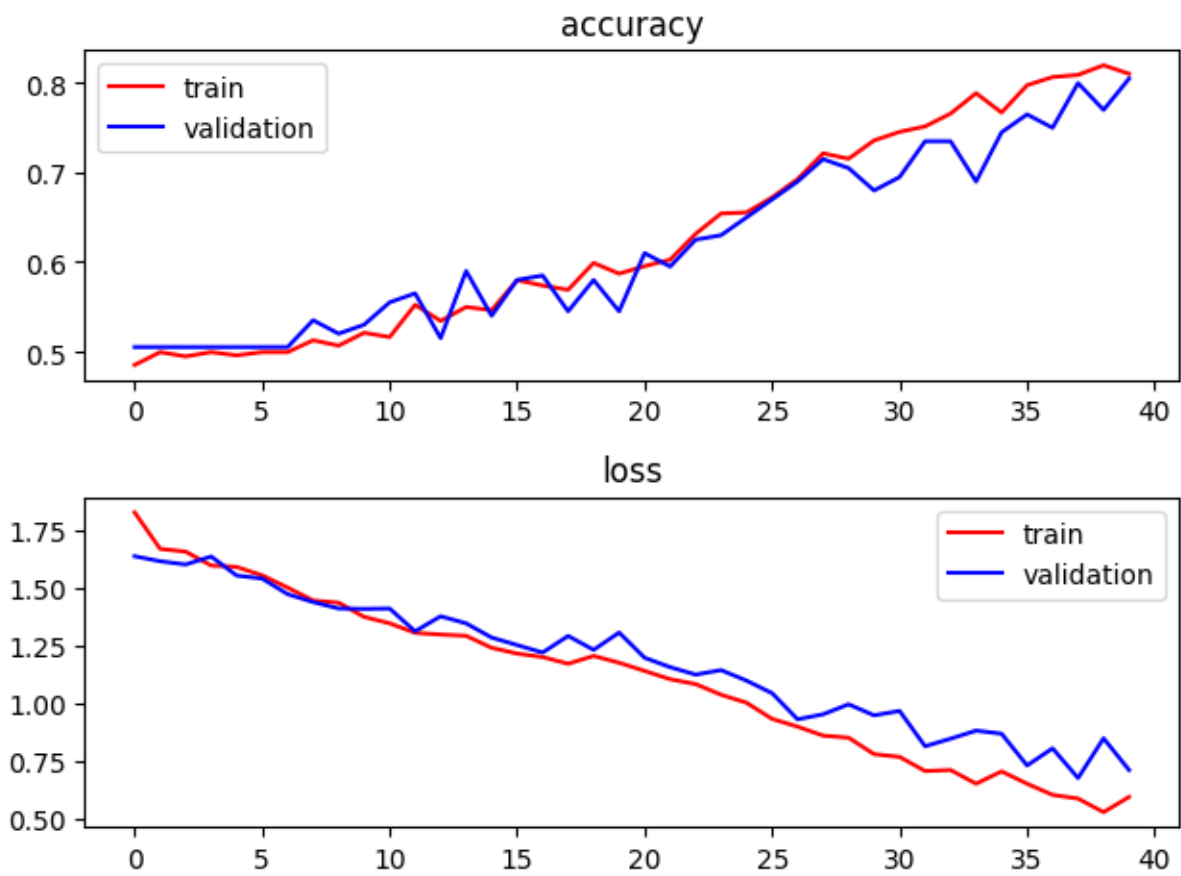


Figure 4. Showing our loss and accuracy chart

Architecture of our Model

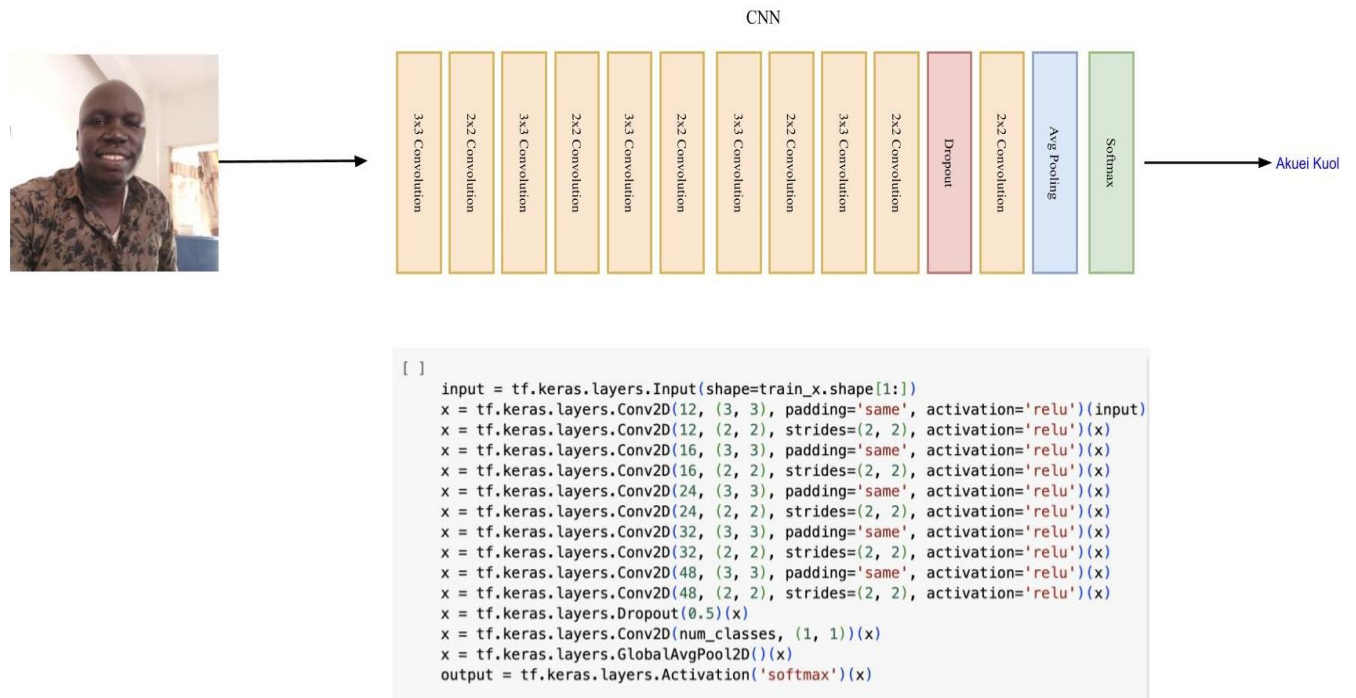


Figure 5. Training model, Our CNN predicted correctly name of the image

References

1. Liao, S.; Jain, A.K.; Li, S.Z. Partial face recognition: Alignment-free approach. *IEEE Trans. Pattern Anal. Mach. Intell.* **2012**, *35*, 1193–1205. [Google Scholar] [CrossRef] [PubMed][Green Version]
2. Jridi, M.; Napoléon, T.; Alfalou, A. One lens optical correlation: Application to face recognition. *Appl. Opt.* **2018**, *57*, 2087–2095. [Google Scholar] [CrossRef] [PubMed]
3. Napoléon, T.; Alfalou, A. Pose invariant face recognition: 3D model from single photo. *Opt. Lasers Eng.* **2017**, *89*, 150–161. [Google Scholar] [CrossRef]
4. Kennedy O kokpujie, Etinosa Noma-Osaghae, Olatunji J. Okesola, Samuel N. John, Okonigene Robert, International Conf on Computational Science and Computational Intelligence (2017).
5. Paul viola and Michael J. international J of computer vision, *57*, **2**, 137-154 (2004).
6. Rajesh Kumar Misra, Satyanrayan Padhy, Sandipan Pine, Prabhat Kumar Patnaik, N.Jeevaratnam, Indian J of Natural Sciences, *13*, 72 (2022).
7. Marian Stewart Bartlett, Member, Javier R. Movellan, Member, Terrence J. Sejnowsk, *IEEE transactions on neural networks*, *13*, 6, (2002).
8. C. Havran, L. Hupet, J. Czyz, J. Lee, L. Vandendorpe, M. Verleysen, *IEEE Trans on Neural Networks*, *13*, 6, (2002).
9. Shahrin Azuan Nazeer, Nazaruddin Omar, Marzuki Khalid, *International J of Security and its Applications* *10*, 3, 81-100 (2016).
10. Thai Hoang Le, *Advance in Artificial Neural System*, *17* (2017).
11. K. B. Pranav, J.Manikandan, *Third International Conf on Computing and Network Communications* *25*, (2018).
12. Neel Ramakant Borkar; Sonia Kuwelkar, *International Conf on Computing Methodologies and Communication (ICCMC)*, (2018)
13. Zaid Alyasseri in *International J of Computer Applications* *126*(3), 34-38(2015).