Queue management system with photo recognition to estimate wait time

Student – Thomas Herward - 20014189 Supervisor – Dr Vishwash Batra

Aims and Objectives:

In this project I am to research Neural Networks to be able to investigate their effectiveness in being able to provide businesses with vital data on queues within the business.

I aim to create a version of the software used to estimate the queue times to be able to demonstrate the concept and be able to aid in concluding on its effectiveness within businesses. I will demo this software at the end of the project's development.

I aim to conduct an ethical assessment on the final concept of the software and evaluate on the ethical considerations a business would need to consider before implementing the software in everyday use. I also aim to make a review on the accuracy of the software and whether its an improvement on current methods of measuring the queue wait times.

Methodology: The program, made in Python, focuses on three key stages 1 – Image capturing. In this stage the software starts to find faces, if it's a face it has not seen before it will put a red box around them and take a photo, once its done this the box will go green and the person is recognized. All photos are stored for later use. A record is also made of the original photo capture time.

- **2 Facial Recognition**. In this stage the software is looking for faces it already knows, by matching them to the photos taken in stage 1. A green box will appear around there face once its recognized them. After it then deletes the photo and adds the time into the record on when the face was recognized again.
- **3 Processing Stage**. In this stage the software calculates the difference between the records made in stage 1 and 2 to figure out how long the person was waiting in the queue. This information can then be used to find the average wait or trends over time.



So far, an implementation of the project has been produced. Although an early demo of the idea with no UI, it can demonstrate that facial recognition can be used within businesses to gather data on customer flow. The current implementation is able to timestamp when it first sees a customer and then again when it sees them at the other side of the queue. It then calculates the time between these two timestamps. The abstract and the literature review are almost completed on the dissertation

What's Next?

- Further development to the post processing side of the application
- A Comprehensive Literature review
- System evaluation of effectiveness compared to current solutions
- · Evaluation into the system's effectiveness

Libraries being used for facial recognition:

CV2 – This is used in the project for the video capturing and displaying the view on the program.

Face_recognition — This library is a pre-trained neural engine with the capabilities to recognize faces. This is used to first take photos of people when it spots a new face and then to compare the image with the live camera view to recognize faces its already seen.



What this code demonstrates:

This is a while loop in the application. Within this loop the program searches for faces it does not recognize, draws a box around them and captures a photo of them to use at the end of the queue. It also notes the timestamp in the ison file.

This project aims to investigate the use of neural networks and photo recognition capabilities to be able to determine the current wait times in a queue. This will work by using a randomly selected person on entry to the queue and then waiting until the software recognises them again at the end of the line to work out the queue time, harnessing neural network algorithms. The project would have wide use in shops, banks, and theme parks to be able to increase customer satisfaction and give the abilities for companies to have data to improve upon and understand when to allocate extra resources. The project will investigate the effectiveness of the photo recognition system, assessing its accuracy and reliability in estimating queue times.

Why is my project viable in the industry?

Being able to monitor the flow of people in queues with just two cameras offers great value in the data it collects for companies. Companies will be able to know when to schedule more staff to work on peak periods and able to monitor the customers experience by looking at past data the program collects. Not only would this data be valuable to companies but also their clients. Customers would be able to see exactly how long they will be waiting for before joining a queue and also be able to see peak times before even visiting the business. Existing solutions often make use out of RFID cards which are an added cost to the business and not everyone who queues will have an RFID card on them, using facial recognition will allow them to collect the data with minimal requirements.

Project Plan Gantt Chart

Weeks:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Develop Project Plan + Ethics																					
Analysis																					
Research into Neural Networks																					
Designing the potential implemntation																					
Implementation																					
Testing																					
Poster																					
Project Evaluation																					
Report Writing and demo																					
Documentation																					

Some Related literature:

Rinda Parama Satya Hermanto, Suharjito, Diana, Ariadi Nugroho, Waiting-Time Estimation in Bank Customer Queues using RPROP Neural Networks, Procedia Computer Science,

https://www.sciencedirect.com/science/article/pii/S1877050918314339

Hassan Hijry and Richard Olawoyin 2021, Predicting Patient Waiting Time in the Queue System Using Deep Learning Algorithms in the Emergency Room,

https://www.ieomsociety.org/journals/volume3/vol-3-no-1-3.pdf

T. Stahl, S. L. Pintea and J. C. van Gemert, "Divide and Count: Generic Object Counting by Image Divisions," https://ieeexplore.ieee.org/abstract/document/8488575

Using Facial Recognition to Monitor Queues and Passenger Flows in Airports by Allevate.

https://allevate.com/2011/10/25/using-face-recognition-to-monitor-queues-and-passenger-flows in-airports/