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# Covease Vaccination Tracker

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**ABSTRACT:** Pandemics like Covid19 often stall the world due to their infectious nature. History has seen many such pandemics such as Plague, Ebola, Spanish flu, Zika, etc.

One major crucial factor to avoid/reduce the impact of such pandemics is the Identify, Isolate and Treat strategy. Being able to identify who has been infected, isolating them from the general public, and treating them plays a crucial role in keeping the infection to a minimum.

Covid19 came in a much modern world, where traveling is easily accessible. Combined with mass migrations of public and public spending power over vacations, The pandemic hit people hard. Even with the best Health Care infrastructure, major countries were not able to control it. The majority of the experts believe in the Identify, Isolate and Treat strategy. However, implementing that strategy with a population as big as India is tough.

This is where modern tech like Facial Recognition, GPS tracking, and Data-driven research comes to the rescue. Combining public UID(Aadhar) and Facial Recognition, we can easily keep track of public infrastructure to access key metrics like vaccination and infection rates at public places like railways, bus stops, hospitals, offices, etc.

Based on these key metrics the Public Health care body could easily access the situation and take appropriate measures.

## I. INTRODUCTION

### 1.Introduction

Pandemics like Covid19 are disastrous for mankind. Causing major casualties, disrupting economies, loss of employment, and other sufferings that harm the general public. Controlling such infections is very crucial to avoid the waves of infections. These major waves of infections break the healthcare system, which is already overburdened in developing countries like India. In 21st Data is the new oil, For such situations, data, analytics, and intel play a very crucial role in health care administration. India has already run a huge campaign for registering the public over UIDAI (Aadhar) and most of the public is already registered into the UIDAI database. Using this as leverage and modern techs like Facial Recognition and Data-driven analytics the health care admins could access, analyze and deduce the situations to reduce casualties and potential infection waves. This system uses the power of Facial Recognition and Modern Infra to collect and track Covid related analytics information.

## II. SCOPE OF WORK

1. To Design a system that tracks faces in public areas and tracks Covid related metrics using facial recognitions.
2. Provide Healthcare Admins with Appropriate metric Dashboard for metric analytics,
3. Ability to work as a separate system yet easy to integrate with other current systems.

## III. MOTIVATION

- a. The key motivating factor was to leverage modern tech to better access situations that could save thousands of innocent lives. Computer vision already has a huge influence over analytics, administration, and military applications.
- b. Considering the developing nature of the country and the demand to modernize the Govt infra and self-reliance this seems like a perfect opportunity to come up with a solution for a very tenacious problem.



#### IV. LITERATURE SURVEY

**Student Attendance System using Face Recognition:** The proposed system meets the objective of achieving high precision and less computational complexity. This system is cost-efficient and less manual work is needed. Using Gabor filters accuracy is highly improved.'

**QR Based administration:** Systems like Cowin generate QR code over-vaccination certificates that help admin personnel verify vaccination and allow the public into a specific place. However not all EMRs are connected to Cowin and do not trigger infection warnings.

**GPS Based Peer Tracking System:** GPS-based tracking was implemented in apps like Arogya setu. These apps tracked individual peers using UID and GPS. These apps required users to install an app on their phone and keep the phone and GPS powered on. Live tracking of peers did trigger some privacy concerns as the system monitored them 24\*7. They do help identify users whether they came in contact with an infected person or not but the privacy concerns, required installation of the app and GPS accuracy did not seem to evaluate into meaningful data for analytics.

**Acceptance of a COVID-19 Vaccine and Its Related Determinants among the General Adult Population in Kuwait:** The objective of this study was to determine the acceptance of a coronavirus disease 2019 (COVID-19) vaccine among the general adult population in Kuwait and assess its determinants. **Subjects and Methods:** A web-based cross-sectional study was conducted by enrolling adults living in Kuwait ( $n = 2,368$ ; aged  $\geq 21$  years). Acceptance of a COVID-19 vaccine was inferred if participants indicated that they "definitely or probably will accept vaccination against COVID-19 once a vaccine is available."

**Medical Images and/ or Symptoms of Patient using Machine Learning Approaches:** The new type of coronavirus COVID-19 virus was first detected in Wuhan-China. A COVID-19 certified patient is characterized by fever, fatigue, and dry cough. The coronavirus (COVID-19) epidemic is spreading worldwide. In this review paper, a database of X-ray, CT-Scan images from patients with common bacterial pneumonia, confirmed Covid-19 infection, and common cases, were used to automatically detect Coronavirus infection. The purpose of the study was to evaluate the effectiveness of COVID-19 acquisition. During the COVID-19 scenario, the number of infected cases rises in huge number globally. Due to this fact, a vital decision had been taken by medical experts and infected patients to adopt various medical facilities within a reasonable amount of time.

#### V. METHODOLOGY

##### 5.1 Introduction

Just like any other form of biometric identification, face recognition requires samples to be collected, identified, extracted with necessary (features) information, and stored for recognition. The entire face recognition solution is divided into the following major modules

1. Face Capture
2. Face Detection
3. Face Recognition

##### 5.2 Algorithm

**Summary:** The CovEase server consumes image feed from tracking clients and processes the images. The workflow for face detection is as follows.

- Consume Images from Camera Client.
- Convert and Read images into an appropriate image format.
- Detects the location of Face and Extract Face from the image.
- Derive face embedding data like distances between eyes, nose, lips, sizes, etc from the Face Recognition Landmarks.
- Compare the embeddings and find the closest match.

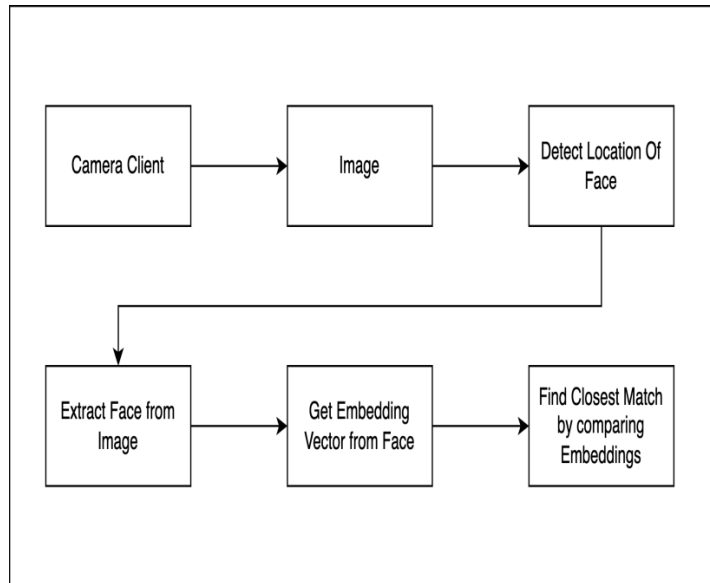


Fig.1.Face Recognition Workflow

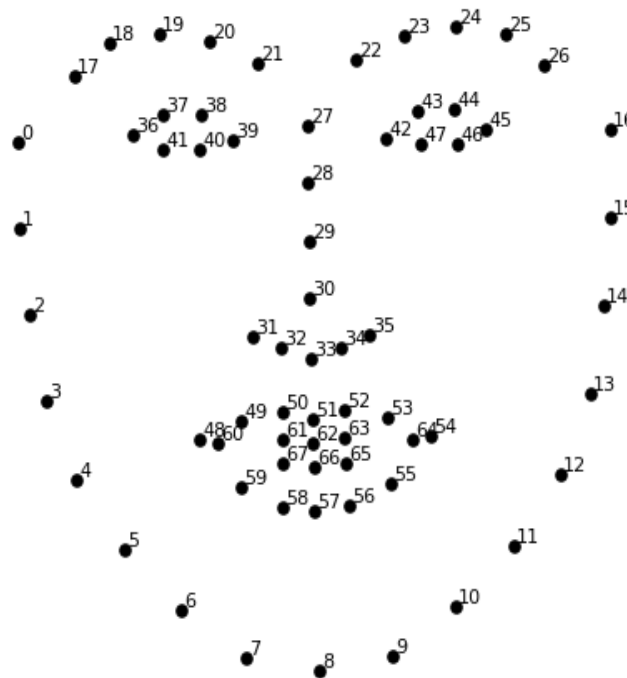


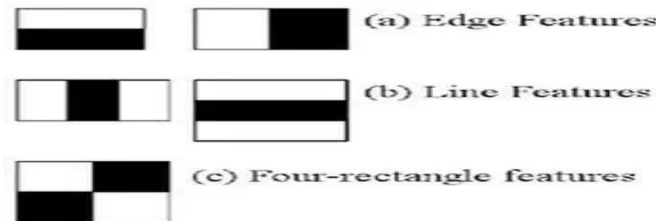
Fig.2 Face Recognition Landmarks

### 5.3 Face Detection

Face Detection is the fundamental step in any of the operations carried out in the face recognition process. The Haar Feature-based Cascade Classifier is a widely used mechanism for detecting faces. In order to train a classifier to detect faces, two large sets of images are formed, with one set containing images with faces, and the other set without. These images are then used to generate classifier models. The classifier is generated by extracting Haar features from the positive and negative images

A Haar classifier is based on an object detection framework proposed by Paul Viola and Michael Jones in their paper, “Rapid object detection using a boosted cascade of simple features.” A single classifier is trained using each feature shown in the illustration below. However, a single classifier alone does not produce high accuracy, and so multiple

such classifiers are cascaded. The final classifier formed is a weighted sum of weak classifiers. Using this method, the classifier provides a classification accuracy of more than 95%.



### 5.4 Face Recognition

Face detection went mainstream in the early 2000s when Paul Viola and Michael Jones invented a way to detect faces that were fast enough to run on cheap cameras. However, much more reliable solutions exist now. We're going to use a method invented in 2005 called Histogram of Oriented Gradients — or just HOG for short.

A HOG is a feature descriptor generally used for object detection. HOGs are widely known for their use in pedestrian detection. A HOG relies on the property of objects within an image to possess the distribution of intensity gradients or edge directions. Gradients are calculated within an image per block. A block is considered as a pixel grid in which gradients are constituted from the magnitude and direction of change in the intensities of the pixel within the block.

In the current example, all the face sample images of a person are fed to the feature descriptor extraction algorithm; i.e., a HOG. The descriptors are gradient vectors generated per pixel of the image. The gradient for each pixel consists of magnitude and direction, calculated using the following formulae:

$$g = \sqrt{g_x^2 + g_y^2}$$

$$\theta = \arctan \frac{g_y}{g_x}$$

In the current example,  $G_x$  and  $G_y$  are respectively the horizontal and vertical components of the change in the pixel intensity. A window size of 128 x 144 is used for face images since it matches the general aspect ratio of human faces. The descriptors are calculated over blocks of pixels with 8 x 8 dimensions. These descriptor values for each pixel over 8 x 8 block are quantized into 9 bins, where each bin represents a directional angle of gradient and value in that bin, which is the summation of the magnitudes of all pixels with the same angle. Further, the histogram is then normalized over a 16 x 16 block size, which means four blocks of 8 x 8 are normalized together to minimize light conditions.

Now we will come up with 68 specific points (called landmarks) that exist on every face — the top of the chin, the outside edge of each eye, the inner edge of each eyebrow, etc. Then we will train a machine-learning algorithm to be able to find these 68 specific points on any face.

### 5.5 Mathematical Model

Let 'S' be the system

Where,

Set of input, set of output

P=Set of technical processes

Fs=Set of Failure State

Ss=Set of Success State

Identify the Input Data  $I_1, I_2, \dots, I_n$

I = (Input Data (Text, Image), Dataset (Face encodings))

Identify the output applications as  $O_1, O_2, \dots, O_n$  (Face Recognition)

Identify the Process as P

P = (Image pre-processing, Face Detection, HOG feature extraction, Face encoding evaluation, Classification, show result)

Identify the Failure state as Fs

Fs = (If data set not loaded, If not predicted if more time required to predict

• Identify the Success state as Ss



P = (Correct prediction within time)

## VI. RESULT ANALYSIS

### 6.1 Introduction

Live detection system provides an edge over manual or heuristic efforts, as the system is purely data-driven, The extracted information could potentially save thousands of lives. The ability to keep track of public infrastructure to access key metrics like vaccination and infection rates at public places like railways, bus stops, hospitals, offices, etc could be done on a scale across the world.

Based on these key metrics the Public Health care body could easily set up crucial protocols to access, analyze and diffuse the various hazardous situations. This system can also serve as a base to data drive facial governance systems.

### 6.2 Application

- Live Pandemic analysis
- Historical data analysis
- Face detection based e-Governance

### 6.3 Advantages

- Ease of tracking and accurate information with minimal human intervention.
- Live metrics that help reduce health care task force decisions.
- Ease of onboarding UIDs from external systems.
- Ability to download processes and analyze data from the system.

### 6.4 Limitations

- The system is dependent on multiple tracking client cameras and a powerful Server system that requires a modern GPU. Thus is a big initial investment to the infrastructure.
- Due to its nature, the system might generate noise in the data which the analytics team would need to mitigate.
- The system might trigger privacy concerns due to lack of laws over computer vision in India.

## VII. CONCLUSION

Face tracking systems like CovEase would help mitigate not only Covid19 infection waves but also other infectious diseases that might occur in the future. This system also serves as a base model for all other face detection-based e-Governance systems.

Currently, the system is a monolithic server that could be separated and distributed horizontally to optimize it further. Analytics plugins could be built into the system to help the Admin view the metric better.

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