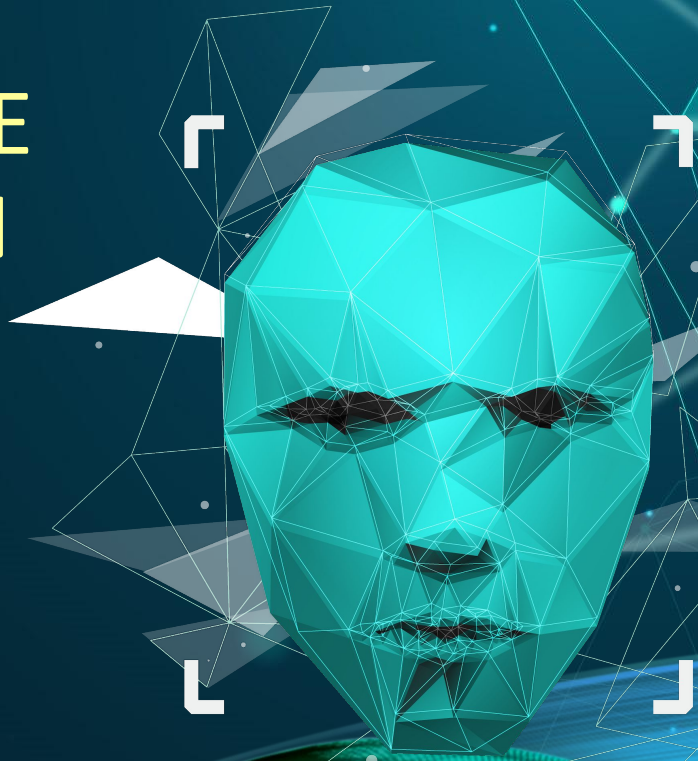
FACIAL OPTICAL FACE MASK RECOGNITION



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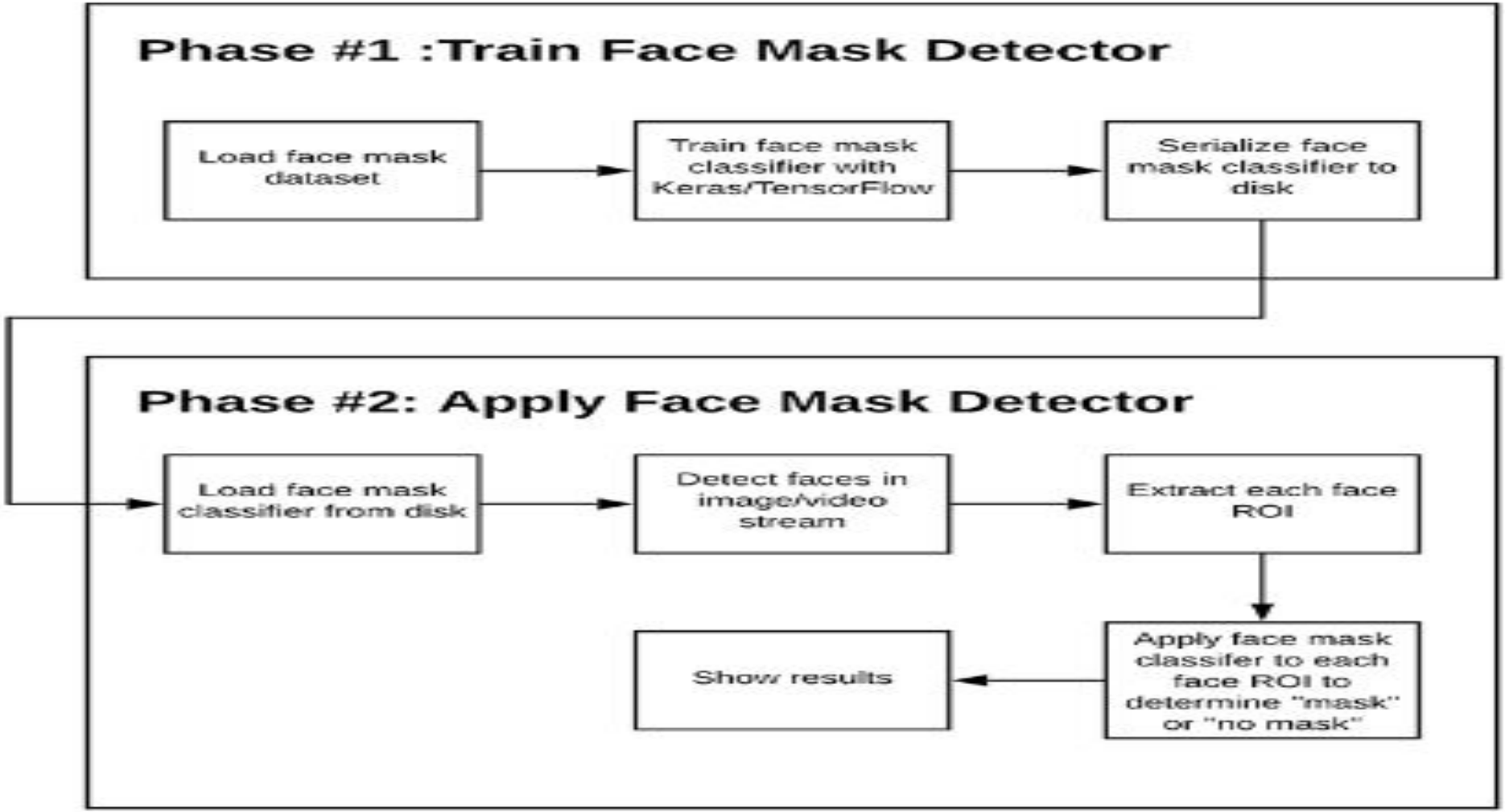
INTRODUCTION

Face mask detection involves the use of computer vision and machine learning to identify whether individuals in images or video streams are wearing face masks correctly, incorrectly, or not at all. This technology is being deployed in various environments such as airports, hospitals, retail stores, and public transportation to ensure compliance with mask mandates and public health guidelines.

HOW FACE MASK RECOGNITION WORKS?

Face mask detection utilizes computer vision and deep learning techniques to analyze images or video streams and determine whether individuals are wearing face masks. This involves training a convolutional neural network (CNN) on a dataset of images containing people with and without masks. The trained model learns to classify images based on features extracted from the input data. Once deployed, the model can process real-time images or videos, making predictions about mask-wearing behavior . This technology helps enforce mask-wearing policies in public spaces, workplaces, and other settings to prevent the spread of contagious diseases like COVID-19.

HOW FACE MASK RECOGNITION WORKS?


Phase #1 :Train Face Mask Detector
Load face mask dataset
Train face mask classifier with Keras/TensorFlow
Serialize face mask classifier to disk
Phase #2: Apply Face Mask Detector
Load face mask classifier from disk
Detect faces in image/video stream
Extract each face ROI
Apply face mask classifer to each face ROI to determine "mask" or "no mask"
Show results

DESCRIPTION AND PROBLEM DEFINITION

Our project aims to leverage the power of TensorFlow, a widely-used machine learning framework, to implement robust and efficient face detection capabilities. By harnessing deep learning algorithms and neural networks, we seek to develop a system that can accurately detect and localize human faces in images or video streams in real-time.

NEED?

01 **PUBLIC HEALTH COMPLIANCE:**

Many public health authorities and governments worldwide have mandated the wearing of face masks in public places to reduce the transmission of respiratory droplets

02 HEALTHCARE SETTINGS

In healthcare settings such as hospitals, clinics, and nursing homes, it's critical to ensure that both patients and healthcare workers wear face masks to minimize the risk of infection.

03 **WORKPLACE SAFETY**

Employers have a responsibility to provide a safe working environment for their employees

04 **CROWDED EVENTS AND GATHERINGS**

In settings where large crowds gather, such as concerts, sporting events, and festivals, enforcing mask-wearing rules can be challenging.

PROBLEM STATEMENT

Accuracy: Many existing face detection algorithms struggle to achieve high levels of accuracy, especially in scenarios with varying lighting conditions, occlusions, or facial expressions.

Speed: Real-time face detection is essential for applications such as video surveillance or live video streaming. However, achieving both high accuracy and fast processing speed poses a significant technical challenge.

Resource Constraints: Limited hardware resources, such as CPU or GPU capabilities, can hinder the performance of face detection algorithms, particularly in resource-constrained environments such as embedded systems or mobile devices.

Data Diversity: Training a robust face detection model requires access to large and diverse datasets containing annotated images of human faces. However, collecting and annotating such datasets can be time-consuming and labor-intensive.

HOW FACIAL MASK RECOGNITION WORKS?

1.KNOWLEDGE BASE

This base contains images that are used for comparison and recognizing emotion variations. The images are stored in the database. Every time an input is given to the system, it finds a relevant image from its knowledge base by comparing the stored pictures and the input to come up with an output.

2. PREPROCESSING AND RESIZE

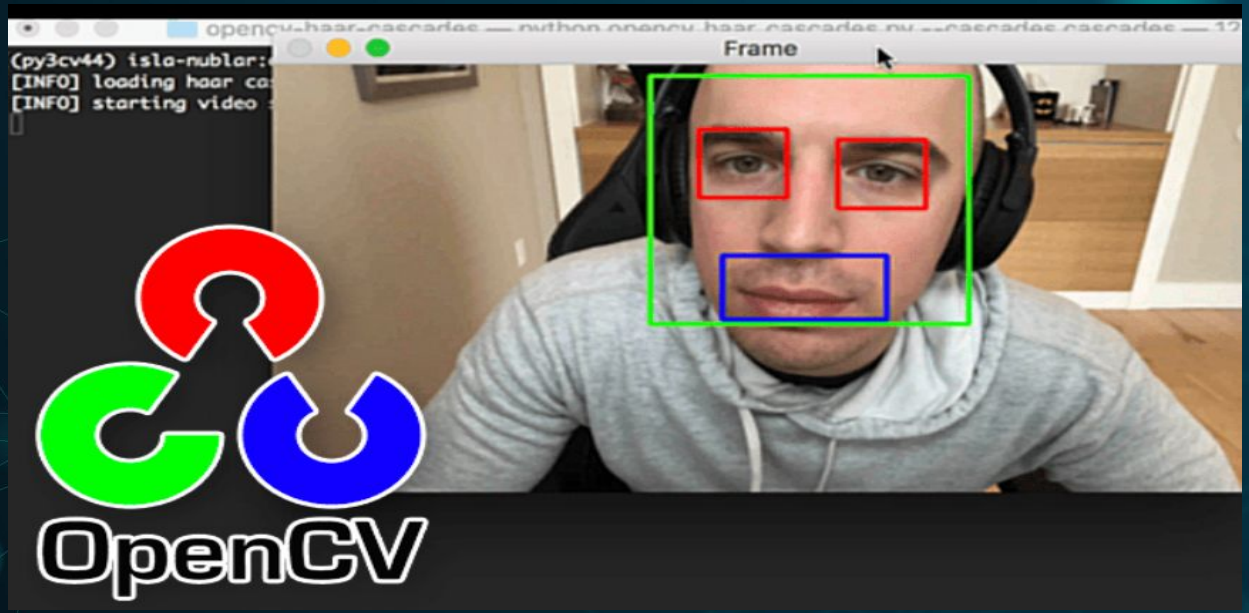
This step enhances the input and removes different types of noises. After that, the input image will be resized, typically with the use of the eye selection method.

3. DIFFERENCE MEASUREMENTS

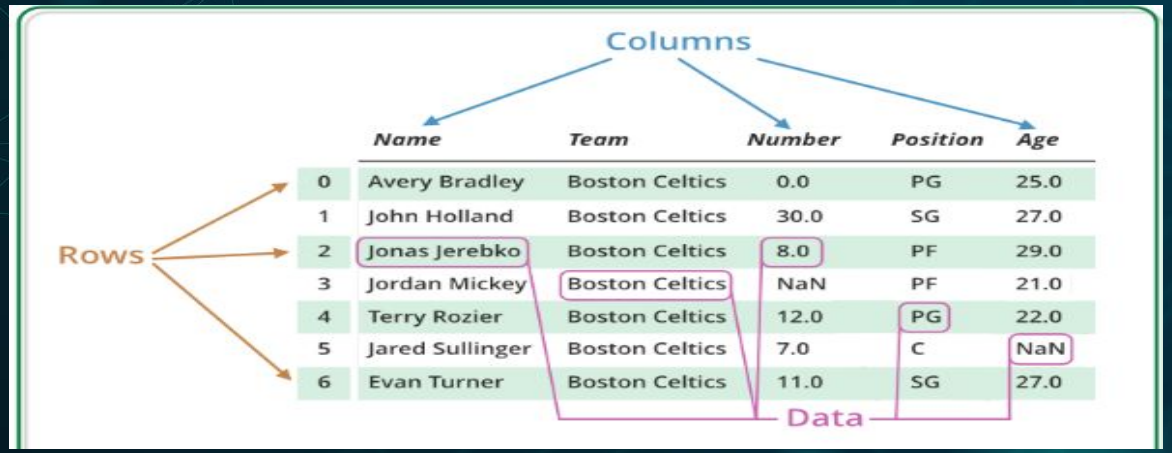
During this step, the system will find any differences between the input image and the stored images and will finally lead to the emotion recognition step.

Basic python libraries used:

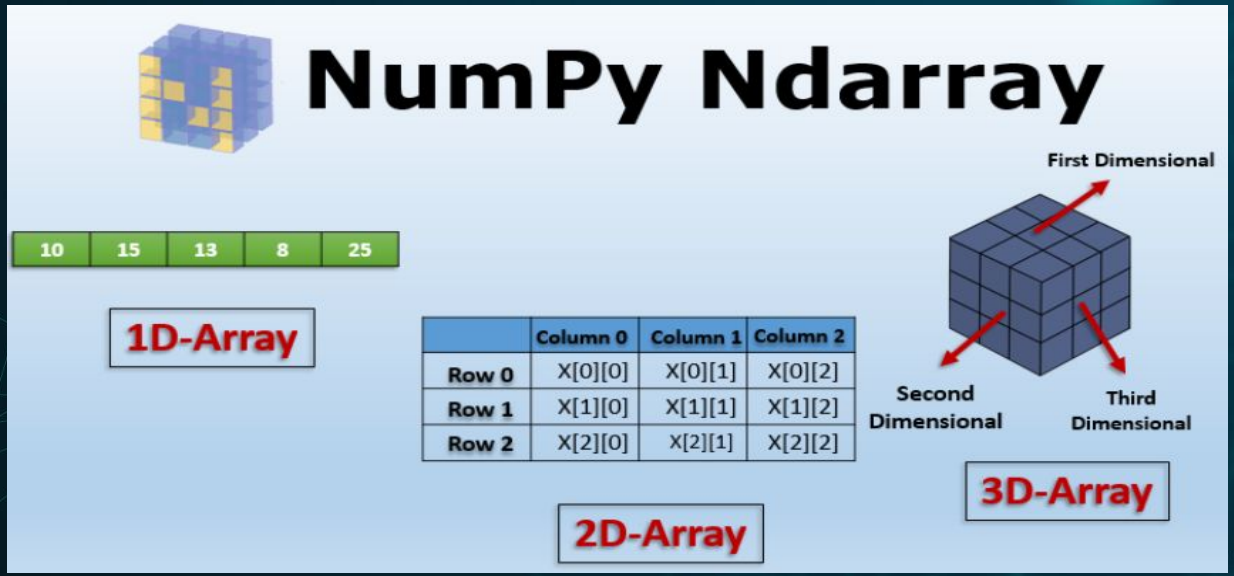
- **OpenCV-** Computer Vision is one of the most interesting and Challenging tasks. It allows computer software to understand and **learn about the visualizations in the surroundings**.



Pandas- Pandas is a software library written for the Python programming language **for data manipulation and analysis**. In particular, it offers data structures and operations for manipulating numerical tables and time series.



- **NumPy-** NumPy is a Python library **used for working with arrays**. It also has functions for working in domain of linear algebra, fourier transform, and matrices.



TensorFlow- TensorFlow is a free and open-source software library for machine learning. It can be used across a range of tasks but has a particular **focus on training and inference of deep neural networks.**

Facial Mask Recognition by Convolutional Neural Network (CNN)

1. **DATA PRE-PROCESSING**
   It refers to all the transformations on the raw data before it is fed to the machine learning or deep learning algorithm. It is the first and crucial step while creating a model.

2. **IMAGE AUGMENTATION**
   It is a technique that can be used to artificially expand the size of a training dataset by creating modified versions of images in the dataset.

3. **FEATURE EXTRACTION**
   It is a type of dimensionality reduction where a large number of pixels of the image are efficiently represented in such a way that interesting parts of the image are captured effectively.

4. **TRAINING**
   It is a dataset of examples used during the learning process and is used to fit the parameters.

MAJOR STEPS OF DATA PREPROCESSING FOR FACE MASK RECOGNITION

1. DATA CLEANING: Incomplete, inconsistent, noisy and duplicate data is removed.
2. DATA INTEGRATION: merges data from various sources.
3. DATA REDUCTION: missing values, low variance and highly corelative data is removed.
4. DATA TRANSFORMATION: standardization or normalization of data is done.
5. DATA DISCRETIZATION: transformation of numeric data to intervals.

DEPENDENCIES :

-->Python 3.6.10
-->Keras 2.2.4 conda install keras=2.2.4
-->Tensorflow 1.15 conda
--> install tensorflow-gpu=1.15 or conda install tensorflow
-->OpenCV-python
-->PIL
-->NumPy
-->LabelImg

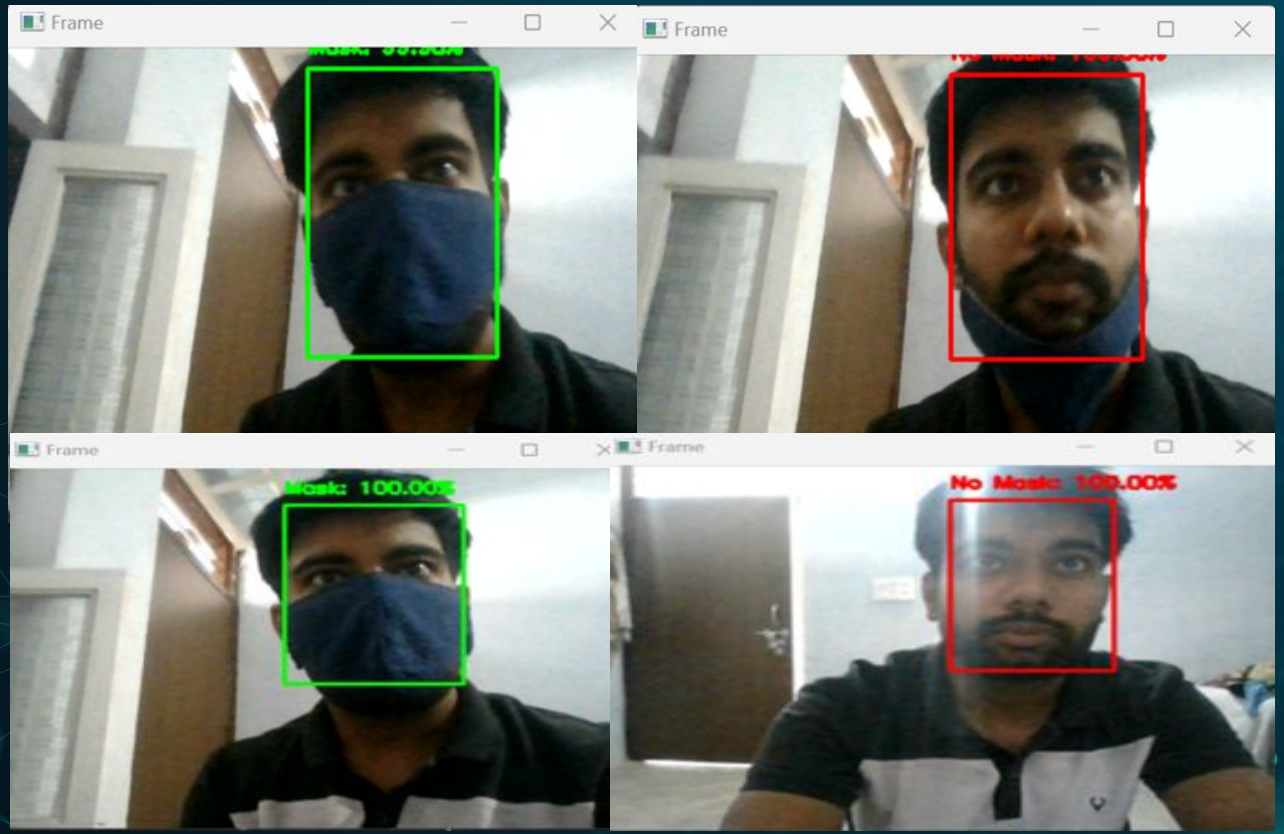
DATASET :

I created the dataset for this project. It is divided into two categories ie "with_face_mask" and "without_face_mask". I downloaded the images for both categories from internet and saved them in respective folder in the local disk.

The most important part is the creation of Annotations and bounding boxes; for that purpose I used the LabelImg annotation tool and created the labels and bounding boxes for each image.

In LabelImg, the annotations files are available in two format ie VOC format(XML file) or YOLO format. So, I got the data annotation file in YOLO format directly from labelImg ie dataset_train.txt file.

SCREENSHOTS



THANK YOU

Do you have any questions?