AI-Powered Smart Glasses For The Blind And Visually Impaired

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Abstract- *Vision is one of the most important human senses, and it plays a critical role in understanding the surrounding environment. However, millions of people in the world are experiencing visual impairment. They are facing difficulties in their daily navigations since they cannot see the obstacles in their surroundings and also recognizing a person is one of the major problems faced by them. There are many applications other than automation that use object detection but are not explored in depth till date. This project involves one such application that uses detection to help the visually impaired to identify the objects ahead of them for safe navigation and also proposes a face recognition system with auditory output which can be beneficial for visually challenged people in recognizing known and unknown persons. Voice-based aid would be provided to them through speakers. In this project, we applied deep learning based Faster Region-Convolutional Neural Network (Faster R-CNN), to detect and recognise human and objects in surroundings.The image captured by the camera is processed and classified by the Faster Region Convolution Neural Network algorithm. The identified image is given as an audio input to the audio jockey.Thus, this model helps in assisting the visually impaired people in a more comfortable way than white canes.*

Keywords- Deep Learning, Faster Region-Convolutional Neural Network, Smart Glass, Image and Object Recognition.

I. INTRODUCTION

Artificial intelligence, commonly referred to as AI, is the process of imparting data, information, and human intelligence to machines. The main goal of Artificial Intelligence is to develop self-reliant machines that can think and act like humans.Deep learning's core concept lies in artificial neural networks, which enable machines to make decisions.Today, image recognition by machines trained via deep learning in some scenarios is better than humans.

Existing system – Non Vision

- ***A Kinect-Based Navigation System***

The system described Kinect sensors carried in a backpack, shoulder bag by the user.

- ***Smart Cane***

Simultaneous locating and mapping technology found in Google's Project Tango.

- ***Moovit***

It's offers guidance on the public transport network, managing schedule in real time

Existing system – Vision Based System

- **Histogram of Oriented Gradients (HOG)**

That is utilized to detect objects and face in image processing and computer vision

- **Single Shot Detector (SSD)**

It is a method for detecting objects in images using a single deep neural network.

II. LITERATURE SURVEY

- A Hybrid Algorithm for Face Detection to Avoid Racial Inequity Due to Dark Skin- However, the human face is vulnerable to multiple variations like age, light effects, and expressions of the face, while capturing images and image quality/resolution. These variations act as the challenge for face recognition techniques to yield accurate results .In facial recognition, color acts as a major variant. Classification of human skin color helps to identify a person's skin tone achieved by definition of skin region. This technique has simplified detection rules and helps in generating much faster classifiers
- Exposing Fake Faces Through Deep Neural Networks Combining Content and Trace Feature Extractors - With the breakthrough of computer vision and deep learning, there has been a surge of realistic looking fake face media

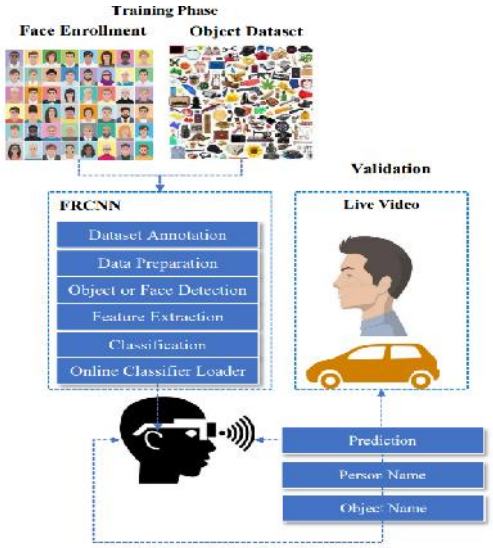
manipulated by AI such as DeepFake or Face2Face that manipulate facial identities or expressions.

- Object Detection in Thermal Spectrum for Advanced Driver-Assistance Systems- Thermal cameras can be used for object detection in both day and night-time environmental conditions. Since it is invariant to illumination changes, occlusions, and shadows it provides improved situational awareness.
- YOLO-FIRI: Improved YOLOv5 for Infrared Image Object Detection - To infrared image object detection using a one-stage region-free object detector YOLO-FIR. The designed feature extraction network extends and iterates the shallow CSP module, which uses an improved attention module.
- Learning Domain-Invariant Discriminative Features for Heterogeneous Face Recognition - To a novel framework for heterogeneous face recognition (HFR), integrating domain-level and class-level alignment in one unified network using domain-invariant discriminative features (DIDF) method.
- Face Detection Based on Receptive Field Enhanced Multi-Task Cascaded Convolutional Neural Networks -To enhance the feature discriminability and robustness for small targets using new face detection model Receptive Field Enhanced Multi-Task Cascaded CNN (RFEMTCNN). The AM-Softmax loss function is introduced to enhance the discriminability of the R-Net.

III. PROPOSED SYSTEM

- Smart Glass designed to recognizing faces and objects for visually impaired people.
- The Faster R-CNN model uses perform the object detection and classification.
- CNN is used to detect known person.
- A trained assistant who provides spoken feedback about what you are looking at.

System Architecture



IV. MODULES

1. Smart Glass

- In this module we design a AI powered smart glass with an integrated camera which helps the user capture images.
- These images are sent for processing to proprietary FRCNN machine learning models which are deployed on smart glasses.
- Once the images are processed, the speech response is sent to the Smart glass, which the user hears via the built-in speaker on the glass.
- Smart Glass is designed as AI glasses for the blind and visually-impaired.

2. Object Detection and Face Recognition

2.1. Face Enrollment

- This module begins by registering a few frontal face of Blind persons friends, family or other know person.
- These templates then become the reference for evaluating and registering the templates for the otherposes: tilting up/down, moving closer/further, and turning left/right.
- Frames are extracted from video input**.**

3. Object and Face Identification

- Capturing the object or face image from the Smart Glass Camera, the image is given to face detection module.
- This module detects the image regions which are likely to be human.

- The face detection using Region Proposal Network (RPN), face image is given as input to the feature extraction module to find the key features that will be used for classification.
- The face image is then classified as either known or unknown

4. Prediction

- In this module the matching process is done with trained classified result and test Live Camera Captured Classified file.
- Hamming Distance is used to calculate the difference according to the result the prediction accuracy will be displayed.
- Audio output.
- If a data is triggered during processing, voice synthesis is used to alert the user, generating, for example, "stop," if there is an obstacle in the way. Saying that Hi Ramesh.

5. Performance Analysis

- In this module we able to find the performance of our system using SENSITIVITY, SPECIFICITY AND ACCURACY of Data in the datasets are divided into two classes not pedestrian (the negative class) and pedestrian (the positive class).
- Sensitivity, specificity, and accuracy are calculated using the True positive (TP), true negative (TN), false negative (FN), and false positive (FP).
- TP is the number of positive cases that are classified as positive.

V. IMPLEMENTATION

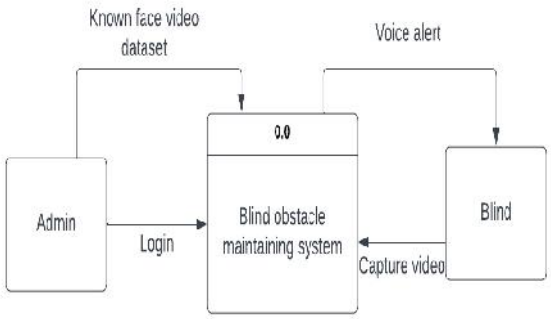
Hardware Requirements

- Processors: Intel® Core™ i5 processor 4300M at 2.60 GHz or 2.59 GHz (1 socket, 2 cores, 2 threads per core), 8 GB of DRAM.
- Disk space: 320 GB.
- Operating systems: Windows® 10, macOS*, and Linux*.

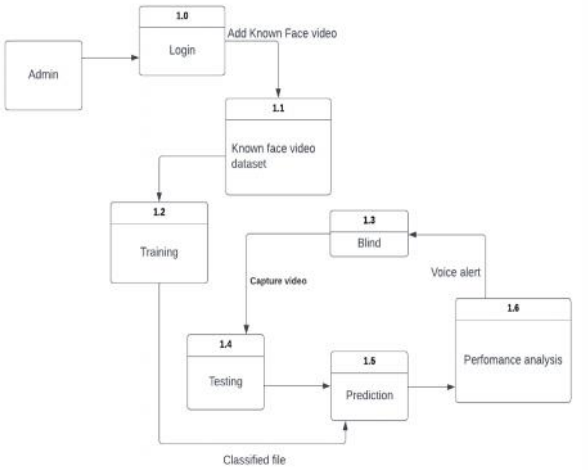
Software Requirements

- Server Side : Python 3.7.4(64-bit) or (32-bit)
- Client Side : HTML, CSS, Bootstrap
- IDE : Flask 1.1.1
- Back end : MySQL 5.
- Server : Wampserver 2i
- DL DLL: TensorFlow, Pandas, SiKit Learn

Data flow diagram – Level 0



Data flow diagram – Level 1



Data flow diagram – Level 2

VI. CONCLUSION

- The device presented here is a smart glass that incorporates the functionality of a machine vision and obstacle detection and recognition sensor.
- It can be conveniently advertised and made accessible to the visually disabled population.
- Let the visually impaired people can interact more closely with the people around them, without fear of being blurred and uncertain.

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