

Real - Time Traffic Monitoring System

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CONTEXT

- Traffic Management is an issue which impacts us almost daily. Use of technology and real time analysis can actually lead to a smooth traffic management. The common reason for traffic congestion is due to poor traffic prioritization.

Let us take the scenario of Bengaluru. It is third most populous city of India. While the number of vehicles are increasing at a fast pace, the infrastructure in the city is not being able to match this growth. However, our solution to this problem is not limited to the Bengaluru city only.

It can be used for other urban cities as well where traffic jams during rush hours are becoming a routine affair, especially in the internal sectors where long queues of vehicles can be seen stranded. Therefore, we have tried to address the problem with the help of our project wherein the focus would be to minimize the vehicular congestion. We have achieved this with the help of image processing that can be obtained from surveillance cameras and eventually to deploy a feedback mechanism in the working of the traffic lights where the density of the traffic would also be factored in the decision making process.

Problem Description

To design a system or invent a technology to minimize the number of lives and limbs lost due to road traffic accidents in the Chennai urban metropolitan area.

The technology can be on the vehicle, infrastructure or in person; it could be centrally controlled or can be decentralized and should be:

- Practical and feasible to implement
- Cost-effective
- Robust to various modes of failure



ANALYSIS ON WHY PROBLEM EXISTS

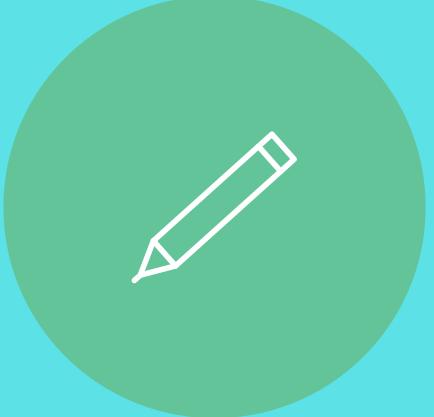
The main reasons for traffic congestion and delay are analysed as follows:

- ▶ Poor Traffic Management
- ▶ Lesser use of automated techniques
- ▶ More number of Vehicles
- ▶ Unrestrained demand
- ▶ Insufficient Capacity
- ▶ Hard coded traffic lights
- ▶ Large Red Light Delays



PROPOSED SYSTEM

► We propose a technique that can be used for traffic control using image processing. Traffic density of lanes is calculated using image processing which is done of images of lanes that are captured using digital camera. According to the traffic densities on all roads, our model will allocate smartly the time period of green light for each road. We have chosen image processing for calculation of traffic density as cameras are very much cheaper than other devices such as sensors.



PROPOSED SYSTEM

- The steps involved in implementing the proposed system are given as follow
 - Image Acquisition
 - Image Pre-Processing
 - Video Acquisition

PROPOSED SYSTEM

► Data Analytics will also be performed which will help in future traffic planning and analysis.

► HARDWARE ARCHITECTURE:

We shall use Raspberry Pi that is connected to 4 sets of LEDs that represent the traffic lights. The captured images and the reference images are fed to the Raspberry Pi. In real implementation, we will have an automated way to do this via a CCTV camera.

► SOFTWARE ARCHITECTURE:

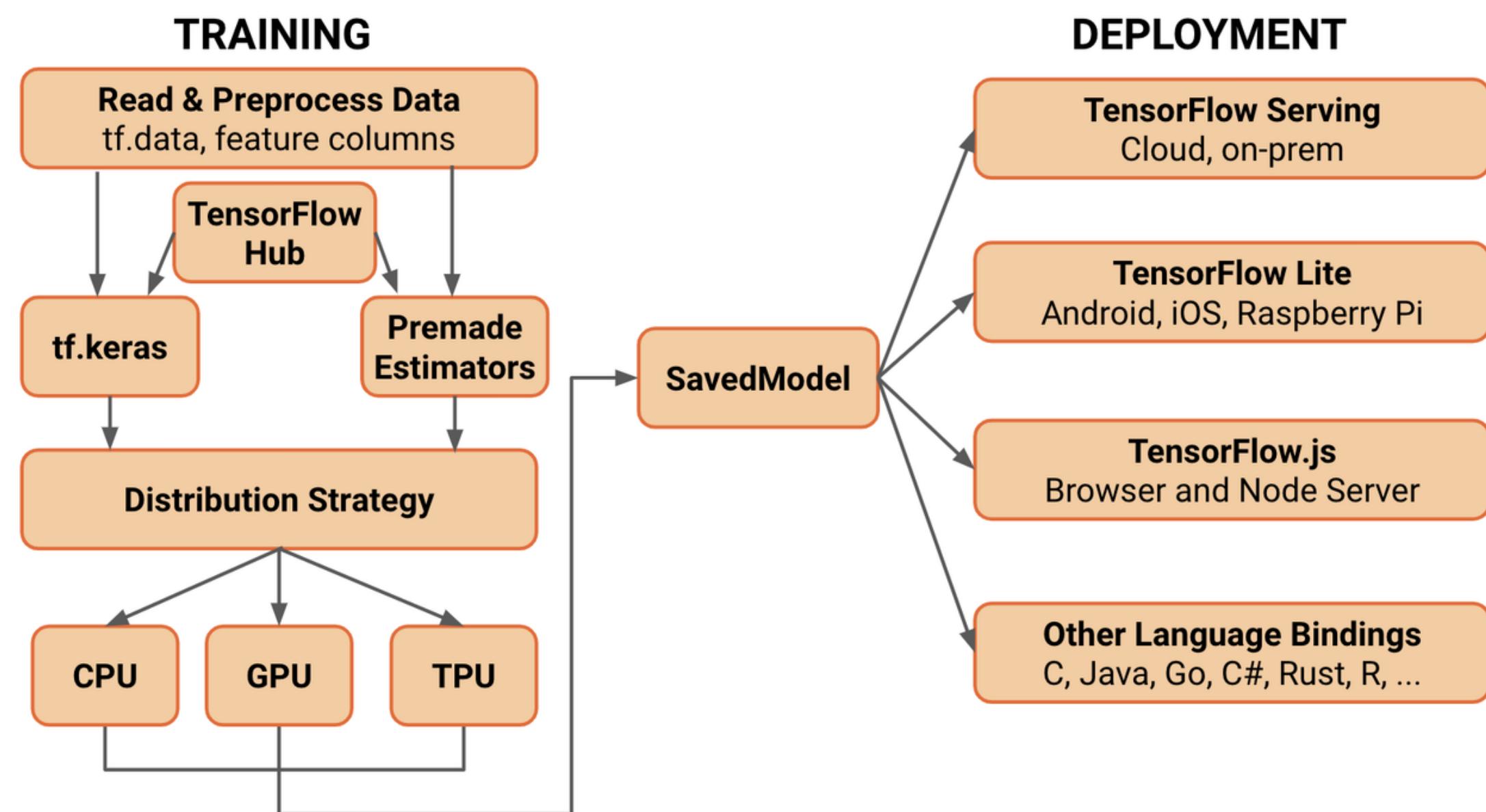
- Python
- OpenCV (Open Source Computer Vision Library)
- Tensorflow Cloud (For data analytics)



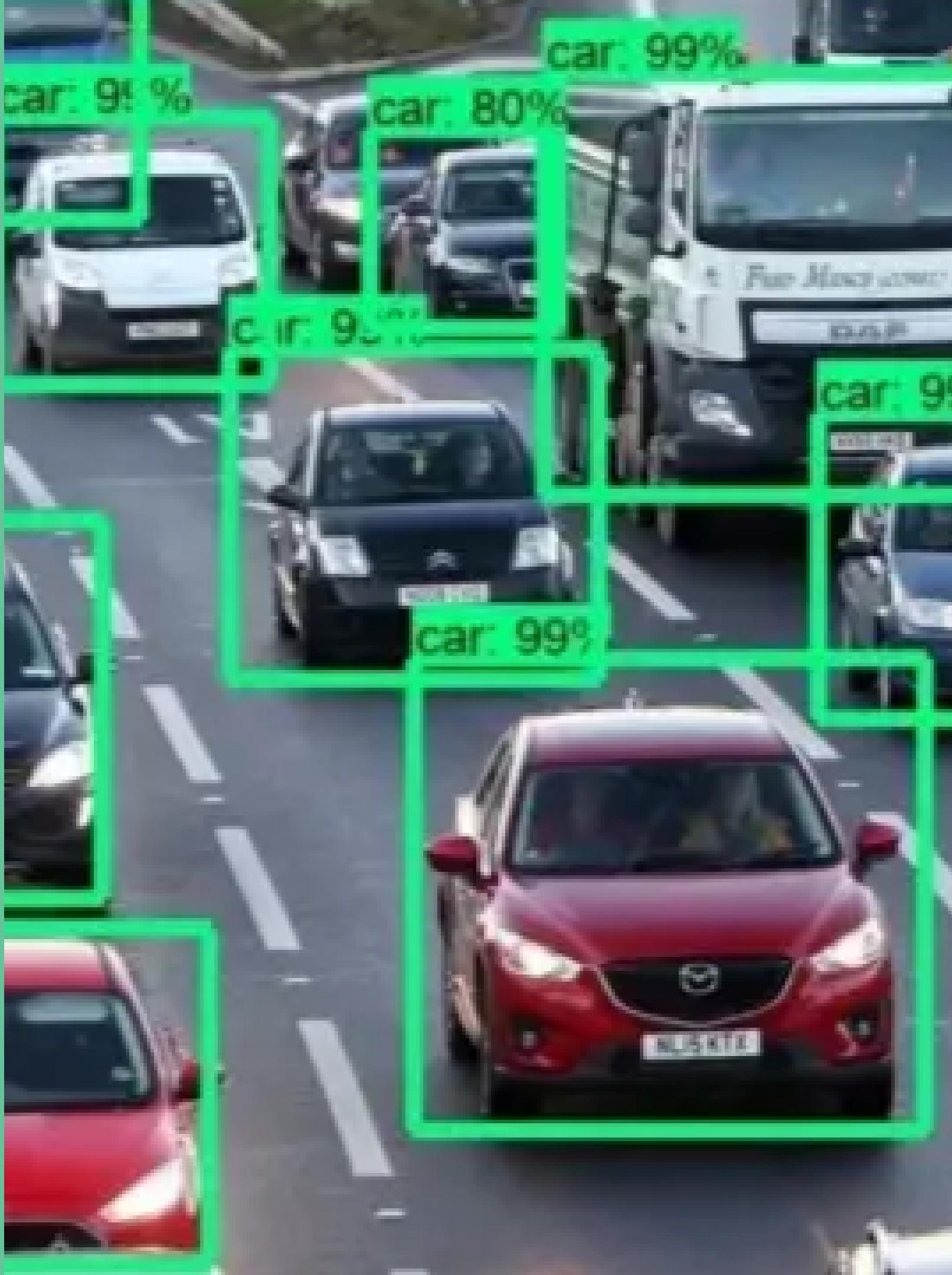
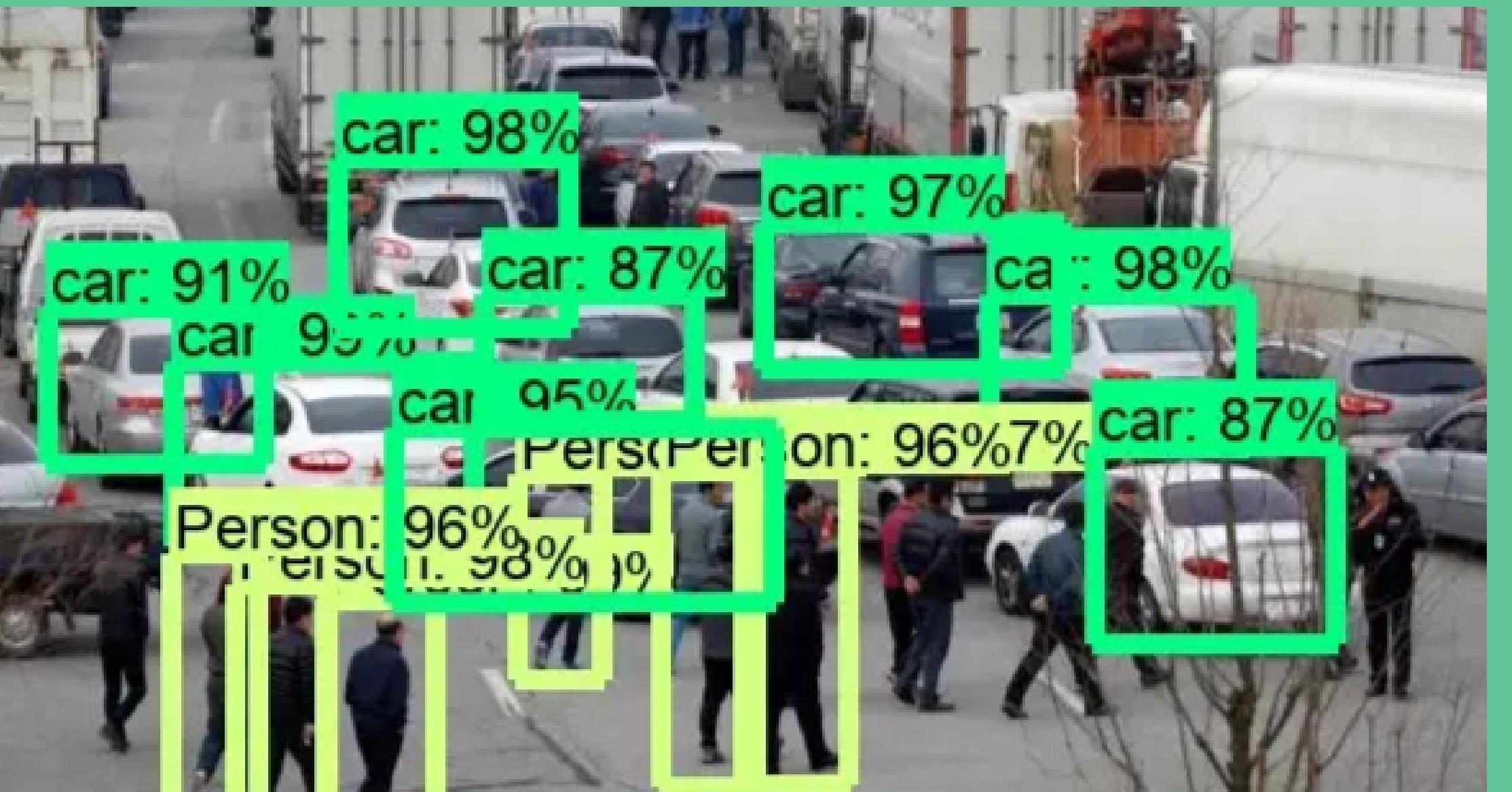


Here, a real time traffic monitoring application is developed using python. I have trained a faster R-CNN model with car, bus, truck, persons and few traffic signs such as 'speed limit' and 'U-turn prohibited'. Details about the faster R-CNN network can be studied in. Developed system can detect objects in live video streams, pre-recorded video and captured image. I used 200 images and annotated with a labeling tool available at my GitHub repository. Annotation of image is time consuming and it took around 4 hours for me to annotate 200 image manually. I trained model with 30k steps and it took around 20 hrs at my CPU with 6GB RAM. It is suggested to train your own model with up to 40k steps if your database size is large. Following figures show outputs of the application when tested with image and video.

FLOWCHART FOR TENSORFLOW OPERATIONS



Some Images of Image & Video Acquisition



Conclusion

Autonomous vehicles are the next generation of future road traffic. This concept can be used to develop self-driving cars, in fact, Tesla already tested automated vehicles but still needs improvements..



Some Useful Links :

— GitHub Code Repository

— GitHub/Shashwat

— Instructions on how to execute the code are included in the above mentioned GitHub Repository in the ReadMe File.

Let's use technology to make our country move
forward!

Thank You!
Jai Hind

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