Team Warriors

STARTERNITY <HACK\> 1.0

Problem Statement

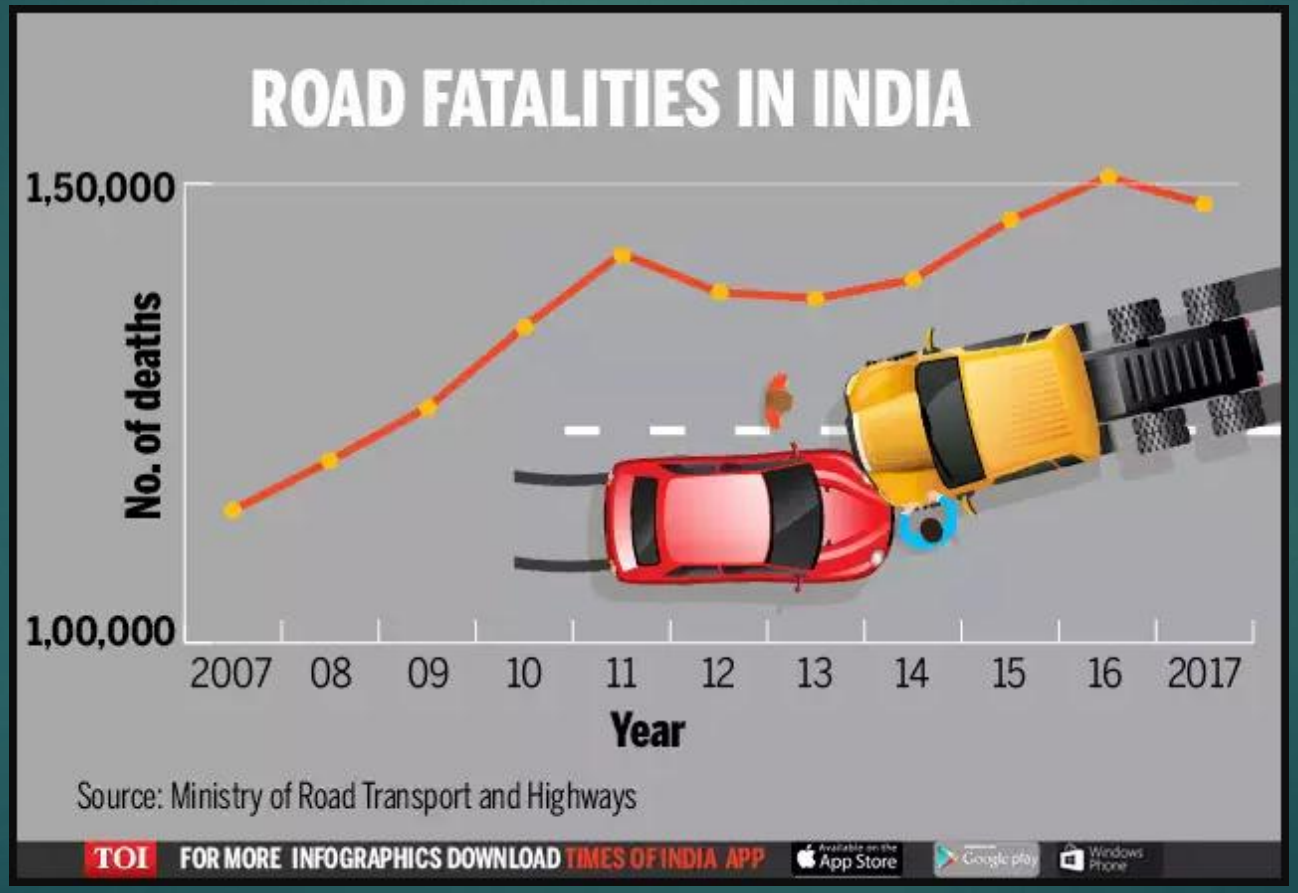
To build an integrated system to detect driver drowsiness and generate alert for the same.

- Industry targeted: Automobile
- Technology used: Machine Learning, On Board Diagnostics(CAN)
- Frameworks used: Tensorflow, openCV, dlib
- Language used: Python

Motivation

- There are concrete statistics available to justify this statement. In India, the total deaths due to road accidents is around 1,50,000 per year which is equal to 400 accidents per day. In 2018, road accidents led to 3 deaths every 10 minutes.
- The statistics provided by Ministry of Road, Transport & Highways, 2017 - The overall road accidents in 2017 accounted for 4,64,910 wherein 1,47,913 lost their lives and 4,70,975 faced severe injuries.
- Further, the maximum accidents (50.5%) have happened in open areas based on the road environment. Considering road features, the maximum accidents (64.2%) have happened on the straight road. Finally, if the impact of weather is considered, then the majority of the accidents have happened in clear/sunny weather (73.3%)

Road Fatalities Stats



Accidents due to Driver Drowsiness

- According to a survey among nearly 150,000 adults:

1. 4% reported that they had fallen asleep while driving at least once in the previous 30 days.
2. People who snored or usually slept 6 or fewer hours per day were more likely to report falling asleep while driving.

- Drowsy driving contributes to 4-6% of total road accidents in India.
- An estimated 6% of all crashes in which a vehicle was towed from the scene, 7% of crashes in which a person received treatment for injuries sustained in the crash, 13% of crashes in which a person was hospitalized, and 21% of crashes in which a person was killed involved a drowsy driver.

Drowsiness Detection

- **Risk Factors**

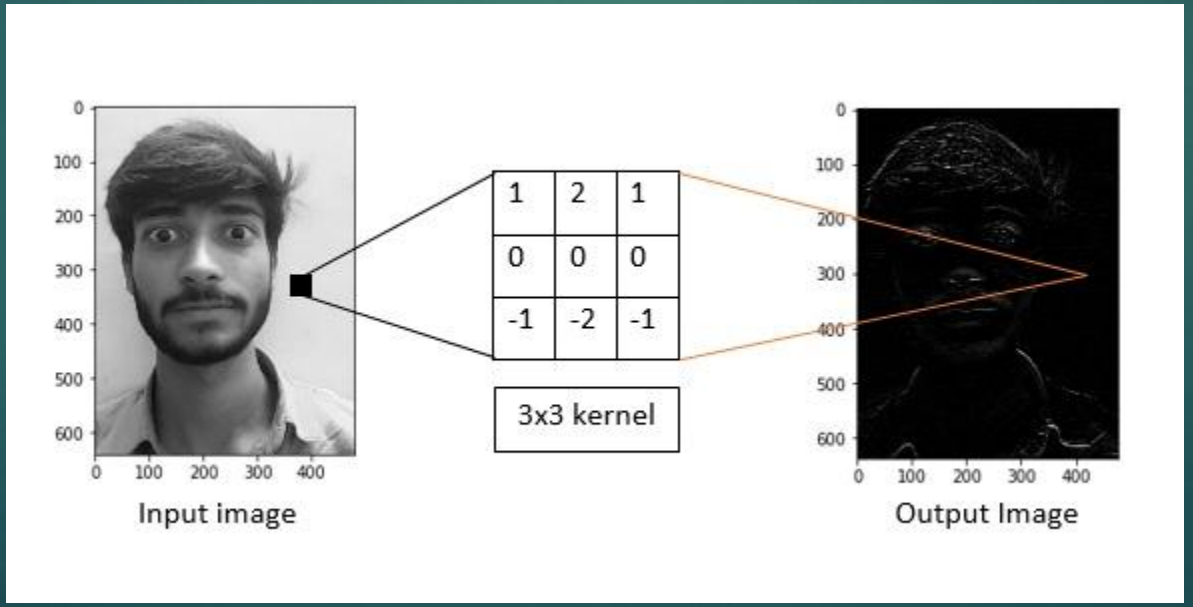
1. Untreated Sleep disorder
2. Shiftwork
3. Medication side-effect

- **Warning Signs Considered**

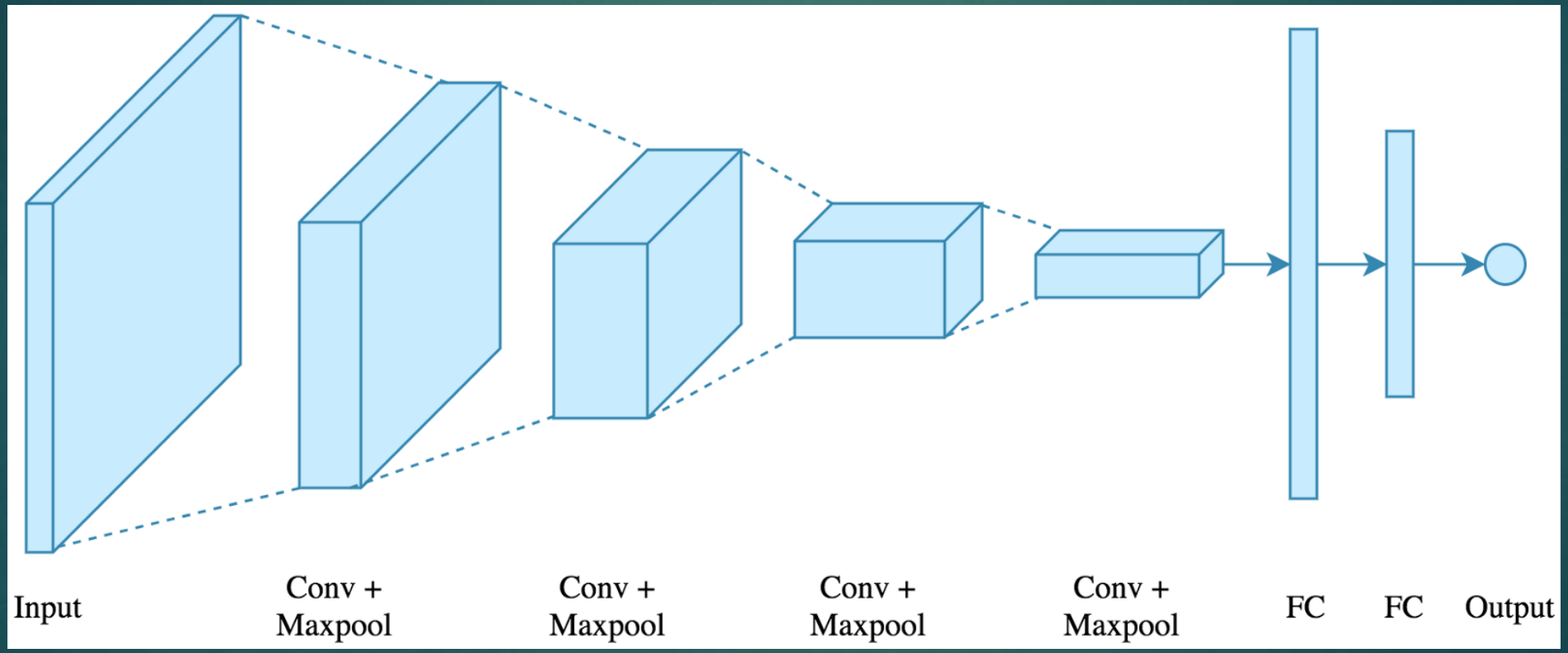
1. Yawning
2. Inability to keep eyes open
3. "Nodding off" and trouble keeping your head up
4. Drifting into other lanes or onto rumble strips on the shoulder

Using ML to Detect Drowsiness

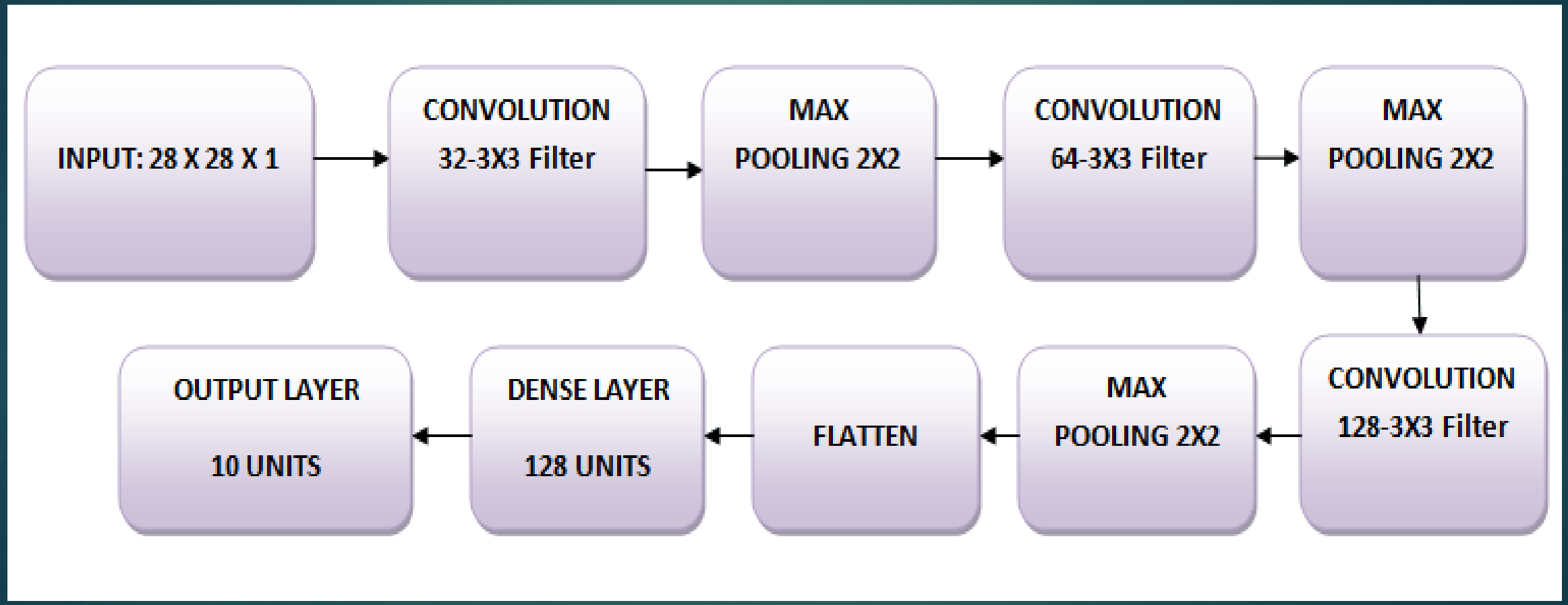
- The basic idea of the CNN was inspired by a concept in biology called the receptive field. Receptive fields are a feature of the animal visual cortex. They act as detectors that are sensitive to certain types of stimulus, for example, edges. They are found across the visual field and overlap each other.



Sample CNN

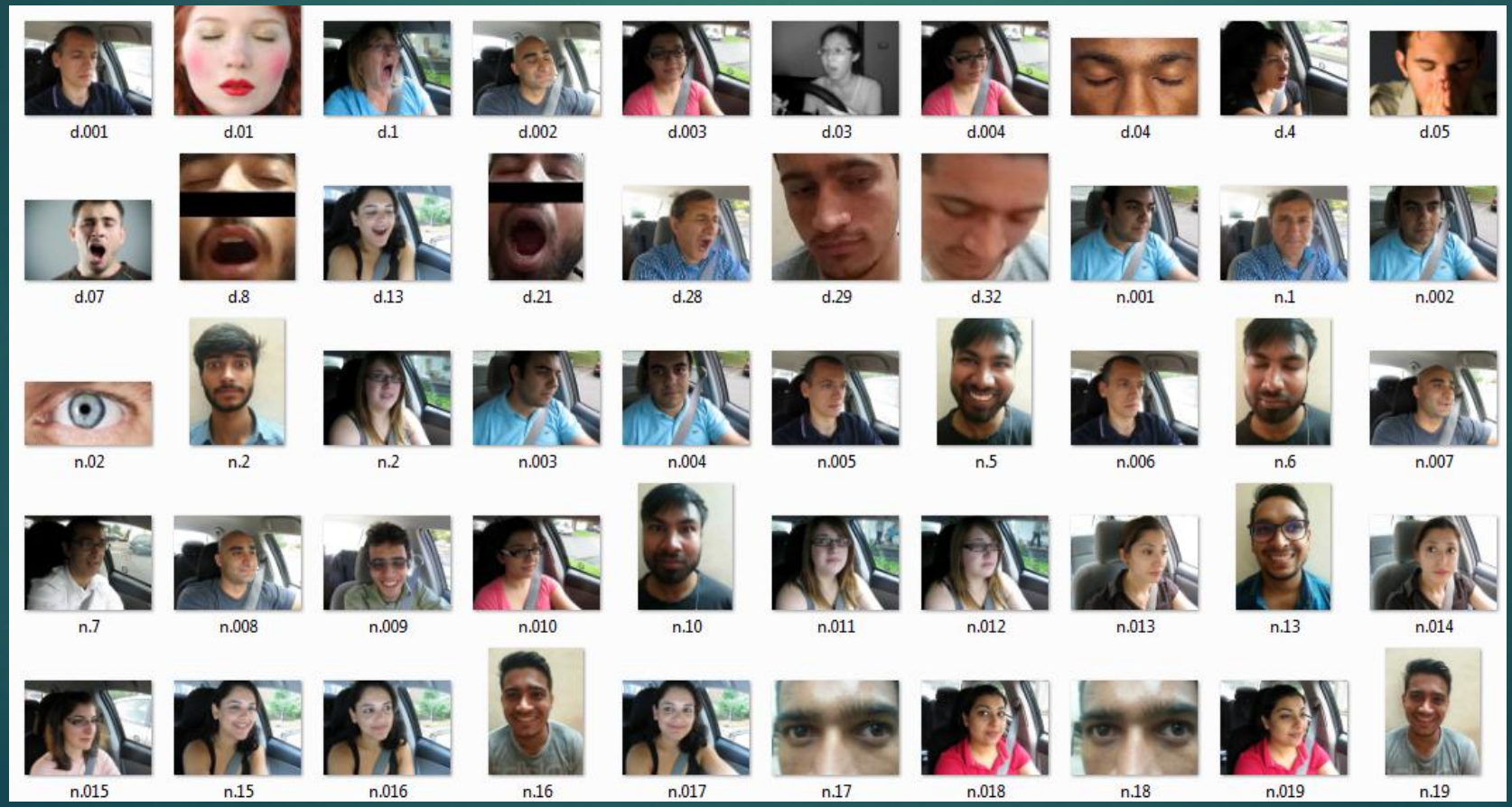

Input
Conv + Maxpool
Conv + Maxpool
Conv + Maxpool
Conv + Maxpool
FC
FC
Output

CNN we Implemented

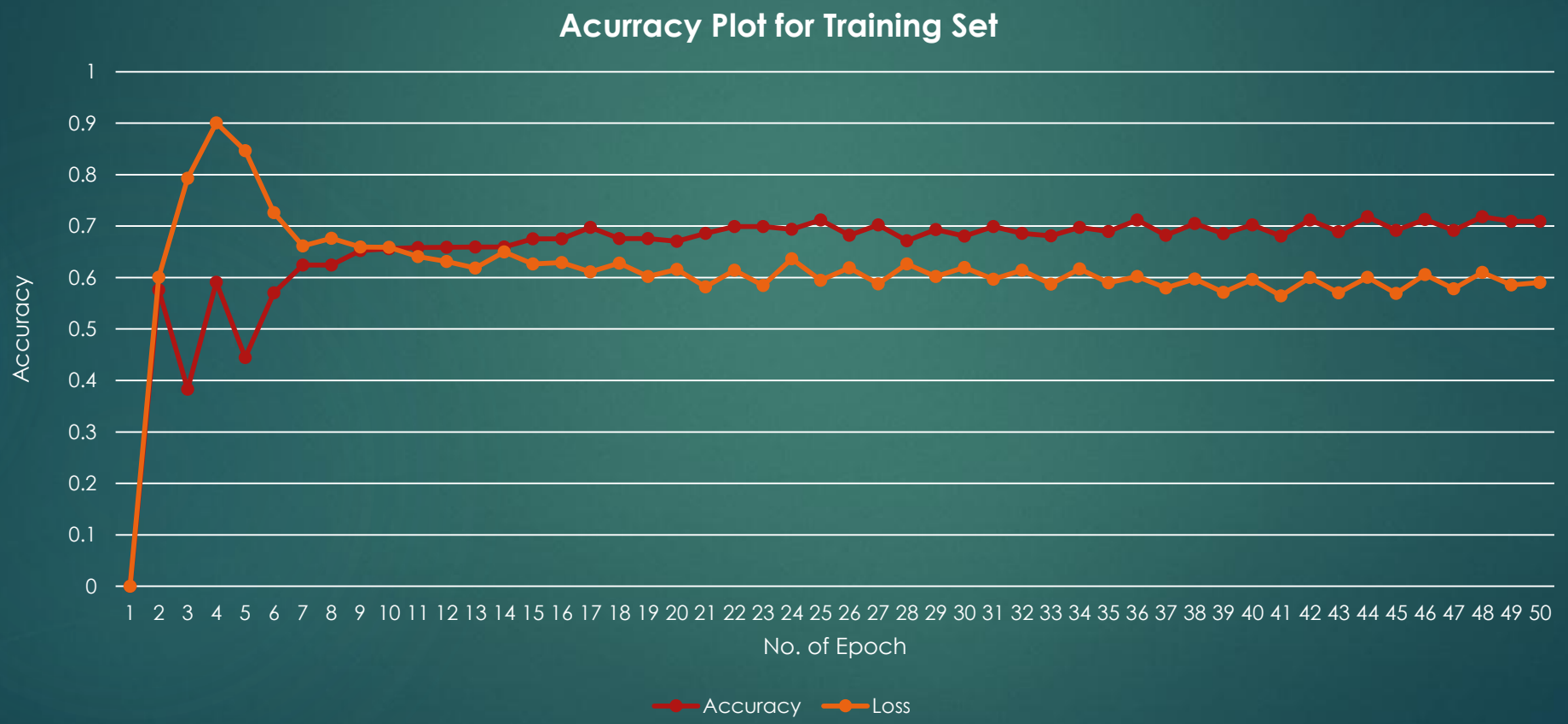


DATASET AND RESULT

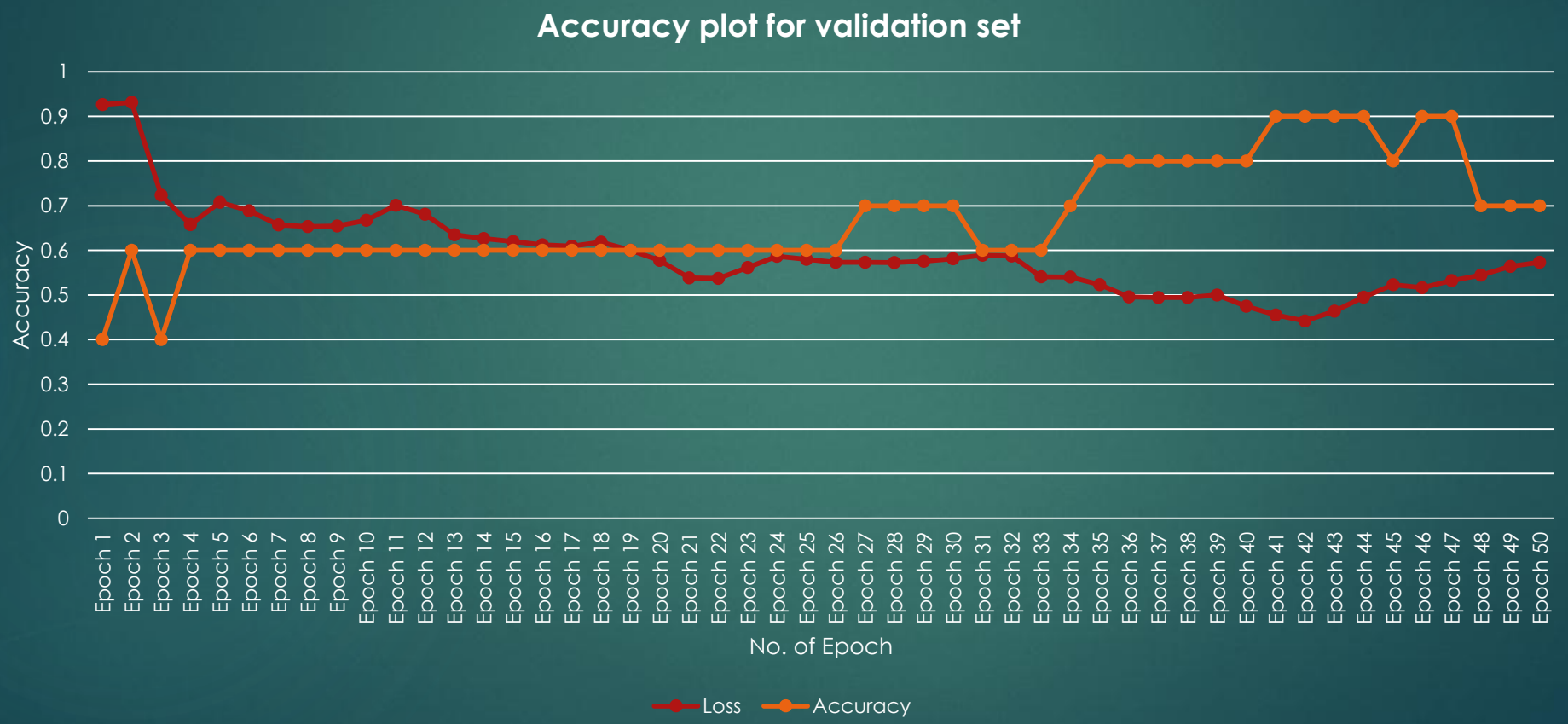
We have used these images to train our model with and obtained a good accuracy. The collected data for training our program are shown below:



Train Results



Results


Accuracy plot for validation set
Accuracy
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Epoch 1
Epoch 2
Epoch 3
Epoch 4
Epoch 5
Epoch 6
Epoch 7
Epoch 8
Epoch 9
Epoch 10
Epoch 11
Epoch 12
Epoch 13
Epoch 14
Epoch 15
Epoch 16
Epoch 17
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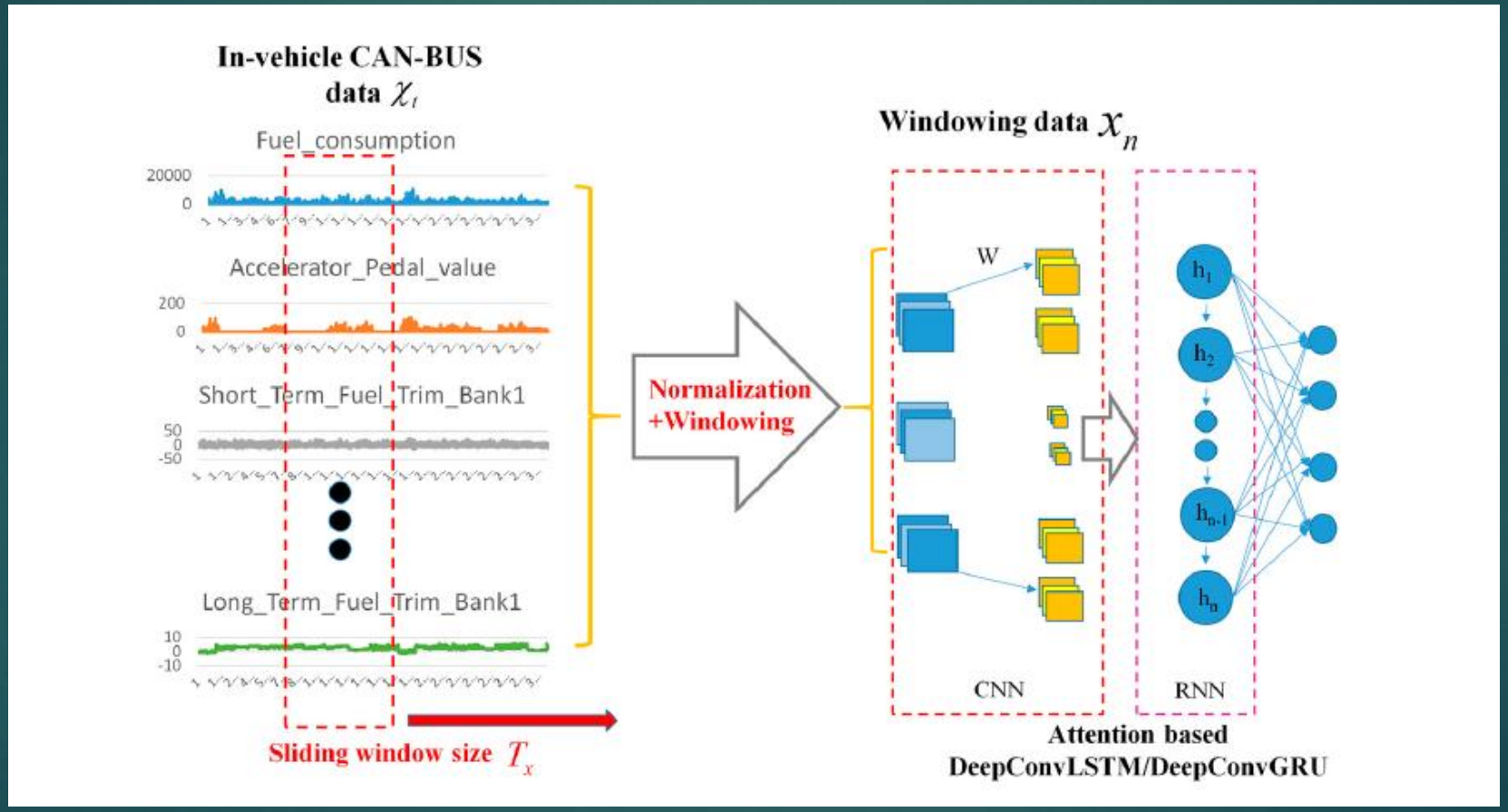
Epoch 35
Epoch 36
Epoch 37
Epoch 38
Epoch 39
Epoch 40
Epoch 41
Epoch 42
Epoch 43
Epoch 44
Epoch 45
Epoch 46
Epoch 47
Epoch 48
Epoch 49
Epoch 50
No. of Epoch
Loss
Accuracy

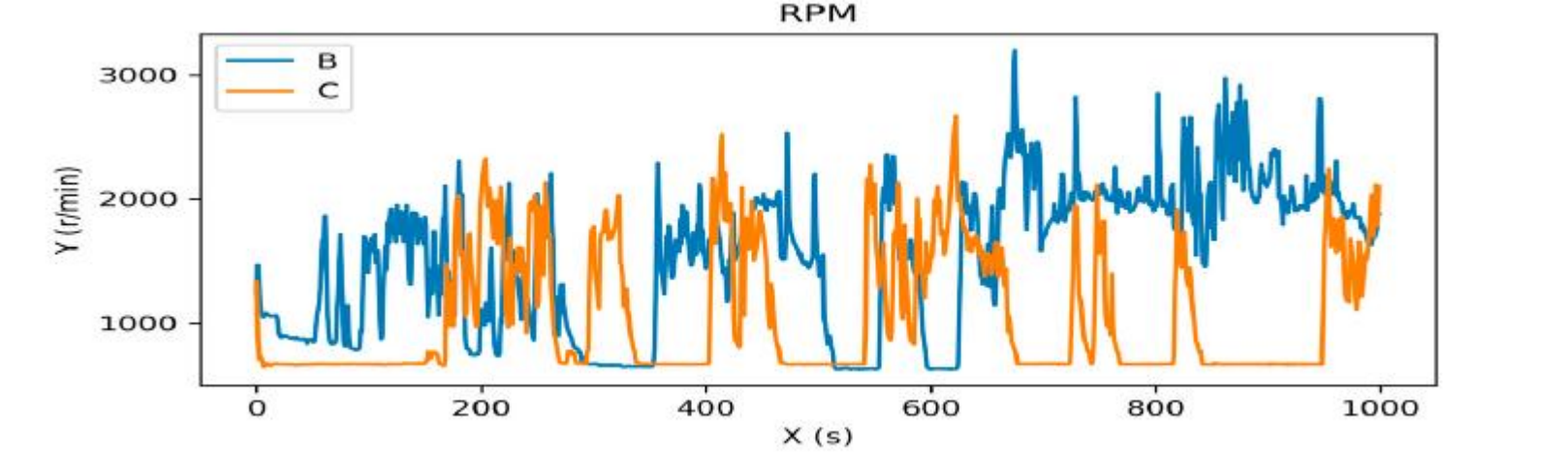
Driving Behavior Identification

- Human driving behaviors are personalized and unique, and the automobile fingerprint of drivers could be helpful to automatically identify different driving behaviors and further be applied in fields like drowsiness detection.
- Current research suggests that in-vehicle Controller Area Network-BUS (CAN-BUS) data can be used as an effective representation of driving behavior for detecting driver drowsiness.
- The proposed method can automatically learn features of driving behaviors and model temporal features without professional knowledge in features modeling. Moreover, the method can capture salient structure features of high-dimensional sensor data and explore the correlations among multi-sensor data for rich feature representations of driving behaviors.

An outline to our approach

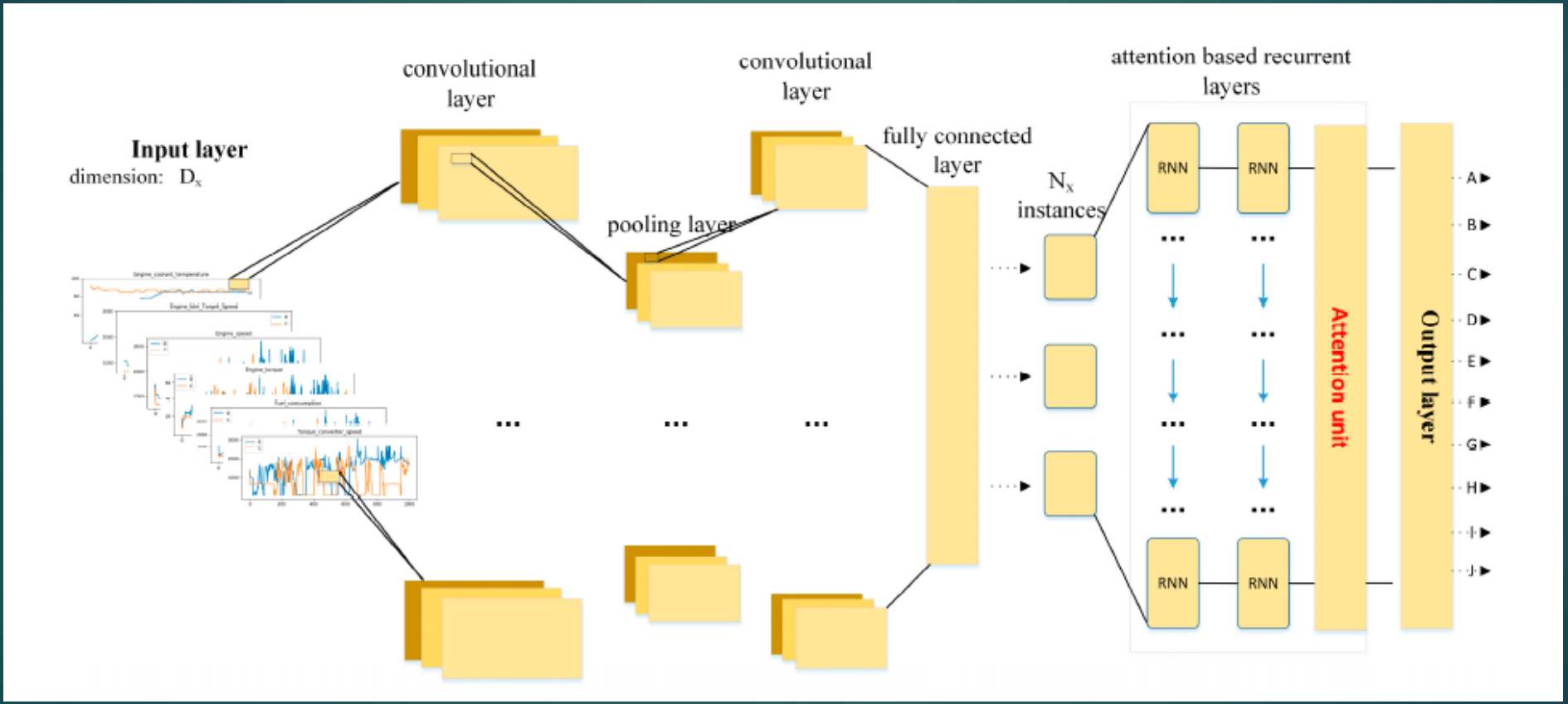


Sample Data (Source: Ocslab Driving Dataset)

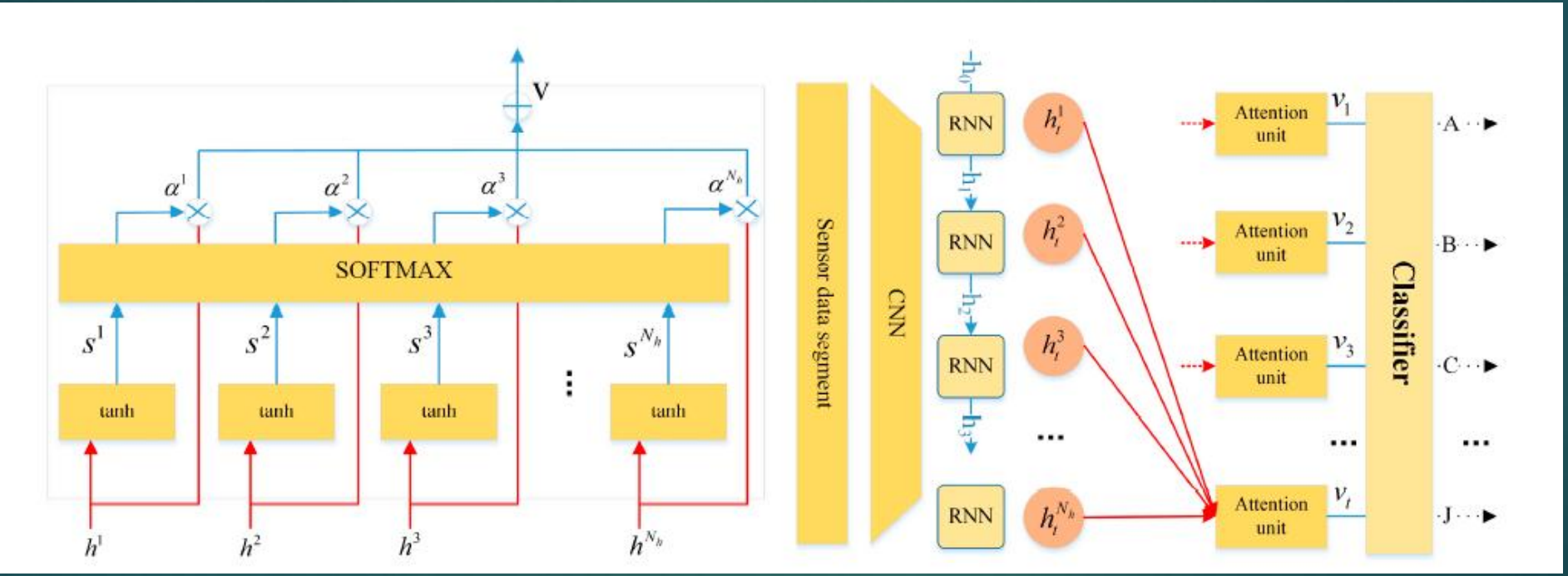


Visualization of RPM of two sample drivers B and C

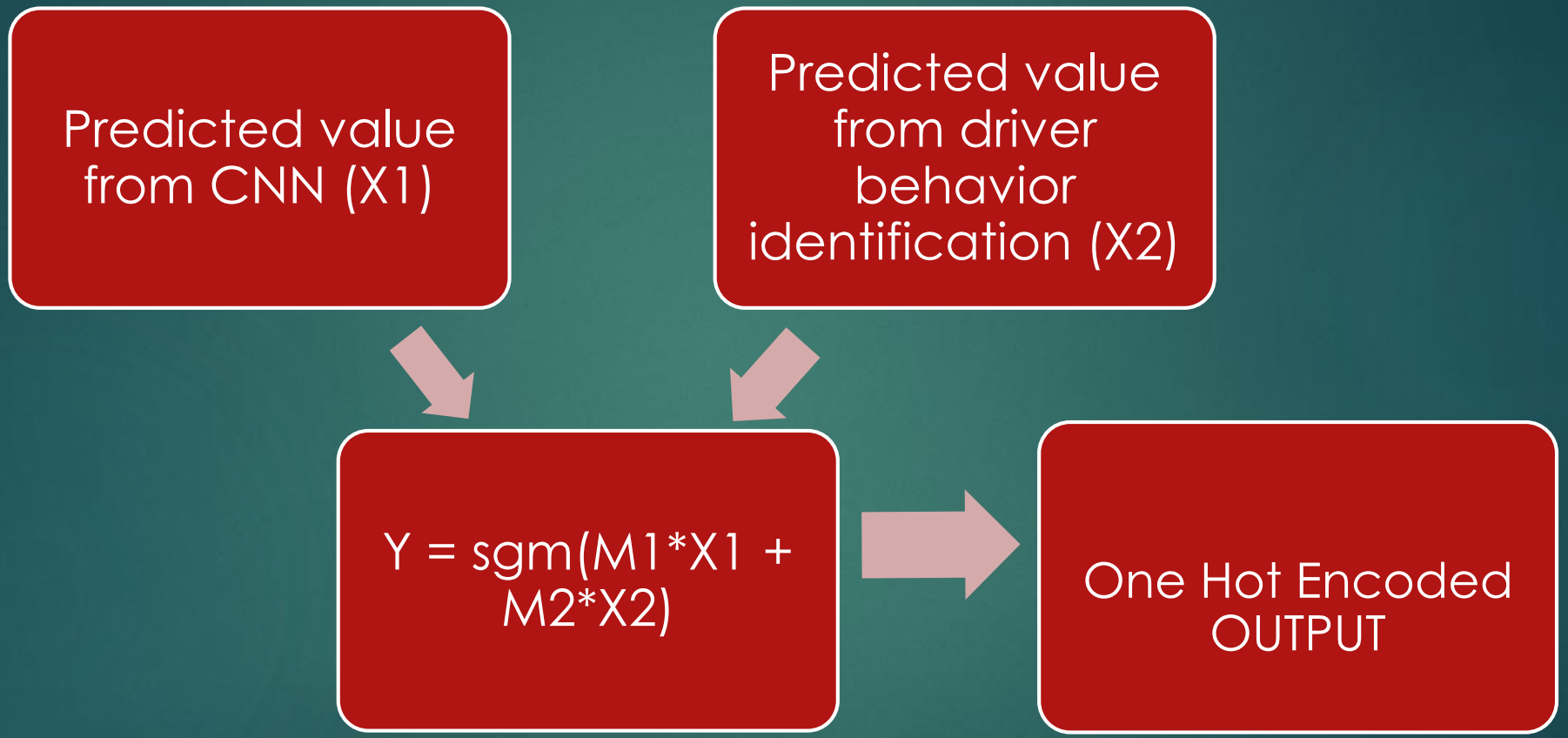
Procedure of our proposed Model



The Attention Unit



Final output prediction

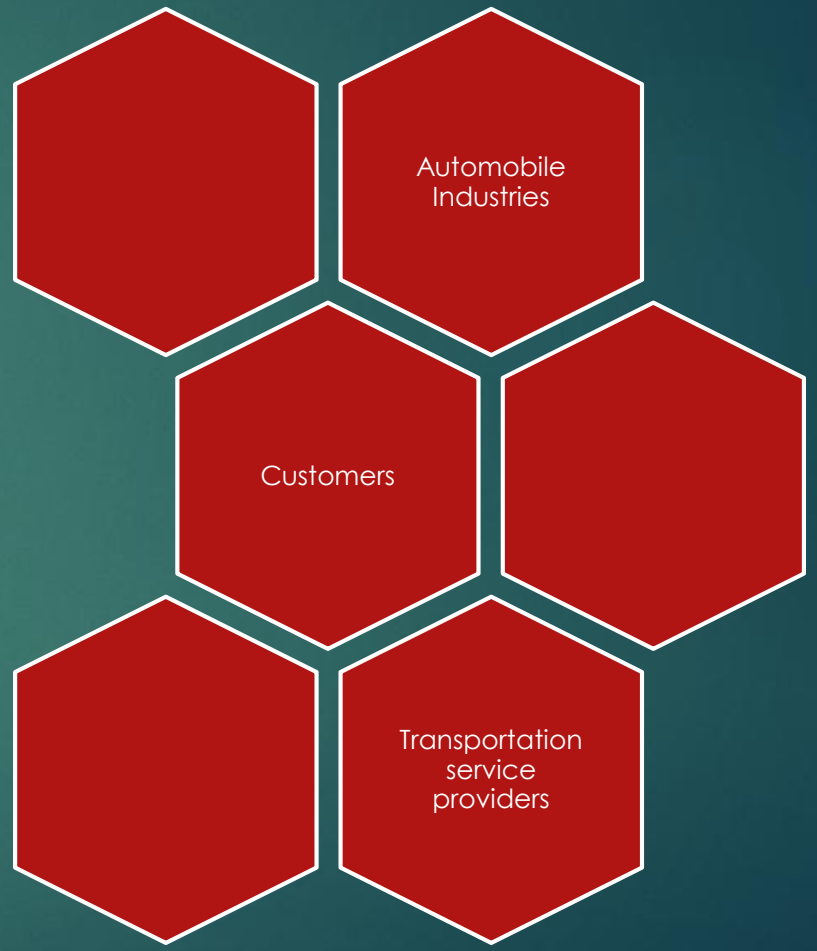


Impact on economy and existing Infrastructure

- Cost of installation per unit: Rs. 4000-5000
- Entities under impact:
- Benefits for automobile companies:

1. More safety features to customers
2. More Sales -> Increased revenue
3. No existing competitor
4. Better Scope for R&D

- No major change required in existing infrastructure.



Conclusion

- Regarding precision in CNN, the results were promising. We showed how a system trained on general image data can be used to detect drowsiness at the time of driving, thus demonstrating the adaptability of the methods.
- By training the CNN with the training images that contain all possible characteristics help in increasing the accuracy thus our system got trained with efficient characters. We have got up to 75% accuracy with our dataset which is good for the detecting drowsiness considering the limited data we had.
- Driver behavior identification will also work with a good accuracy with sufficient training data.
- Overall this detection system can achieve accuracy upto 90% with sufficient training data.

QUESTIONS ?

THANK YOU