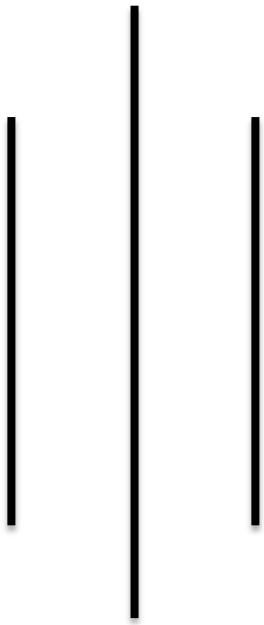
# 7th sem-Project Proposal

CSIT (Tribhuvan Vishwavidalaya)

# National College of Computer Studies

## Paknajol, Kathmandu



# Proposal on

# Driver Drowsiness Detection Project

**Submitted to**

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Date:14 July,2021

# 1. Introduction

Fatigue and microsleep at the wheel are often the cause of serious accidents. However, the initial signs of fatigue can be detected before a critical situation arises. Over the past three decades, we have seen changes in driving conditions and driver safety due to the vast efforts of research studies and government agencies. According to available estimates [1], more than 1.3 million people die per year, and about 20 to 50 million people suffer non-fatal injuries due to road accidents.

Drowsiness and fatigue, immediately after high speed and alcoholism [2], are the main causes of traffic injuries in many areas such as aviation [3], the military sector [4] and driving [5]. However, drowsiness detection (DD) research [6,7] have been a subject of interest in recent years. This is now a real up to date problem in the current Covid-19 pandemic [8] where medical equipment is commonly overbooked. We will be making a drowsiness detection system. A countless number of people drive on the highway day and night. Taxi drivers, bus drivers, truck drivers and people traveling long-distance suffer from lack of sleep. Due to which it becomes very dangerous to drive when feeling sleepy.

Drowsiness [9] is an intermediate state between wakefulness and sleep. This state is mainly defined by heaviness in terms of reaction, changes in behavior, reflex reduction, and the difficulty of keeping the head in the frontal position of the vision field.

In this Python project, we will be using OpenCV for gathering the images from a webcam and feeding them into a Deep Learning model which will classify whether the person's eyes are 'Open' or 'Closed'. The aim of this study was to construct a smart alert technique for building intelligent vehicles that can automatically avoid drowsy driver impairment. But drowsiness is a natural phenomenon in the human body that happens due to different factors. Hence, it is required to design a robust alert system to avoid the cause of the mishap. In this proposed paper, we address a drowsy driver alert system that has been developed using such a technique in which the Video Stream Processing (VSP) is analyzed by eye blink concept through an Eye Aspect Ratio (EAR) and Euclidean distance of the eye.

## 2. Problem Definition

Road crash deaths and injuries in Nepal have been on a sharp upward trajectory since the early 2000s .In fiscal year 2017– 18, 2,541 road deaths were officially reported in Nepal, which is equivalent to a fatality rate of 8.59 per 100,000 population. In the same period, 4,144 serious injuries and several minor injury victims were also officially reported. However, according to World Health Organization data the estimated fatality rate in 2016 was 15.9 per 100,000 population, which is nearly double the official estimate. In 2016, vulnerable road users accounted for around 72 percent of all road fatality victims, among the highest levels in the region, with pedestrians accounting for half of these.[10]

## 3. Objective

The main objectives of this project are as follows:

- To detect that a person's eyes are closed for a few seconds.
- To prevent road accidents.

## 4. Research Methodology

To address the above difficulties, in this study, we consider deep convolutional neural networks (CNNs) [11–14]. CNNs have developed rapidly in the field of machine vision, especially for face detection [15, 16]. Viola and Jones [17] and Yang [18] pioneered the use of the Haar algorithm to train different weak classifiers, cascading into strong classifiers for detecting faces and nonhuman faces.

In 2014, Facebook proposed the DeepFace facial recognition system, which uses face alignment to fix facial features on certain pixels prior to network training and extracts features using a CNN. In 2015, Google proposed FaceNet, which uses the same face to have high cohesion in different poses, while different faces have low coupling properties. In FaceNet, the face is mapped to the feature vector of Euclidean space using a CNN and the ternary loss function. In 2018, the Chinese Academy of Sciences and Baidu proposed PyramidBox, which is a context-assisted single-lens face detection algorithm for small, fuzzy, partially occluded faces. PyramidBox improved network performance by using semisupervised methods, low-level feature pyramids, and context-sensitive predictive structures.

CNN-based face detection performance is enhanced significantly by using powerful deep learning methods and end-to-end optimization. In this study, we combine eye and mouth

characteristics and use a CNN rather than the traditional image processing method to realize feature extraction and state recognition, and the necessary threshold is set to judge fatigue. The method and concepts used in the existing system are described in this section.

## 4.1 Related Work

- The CNN, which is based on a state recognition network, is proposed to classify eye and mouth states (i.e., open or closed). In machine vision-based fatigue driving detection, blink frequency, and yawning are important indicators for judging driver fatigue. Therefore, this paper proposed a convolutional neural network that recognizes the state of the eyes and mouth to determine whether the eyes and mouths are open or closed. The EM-CNN can reduce the influence of factors such as changes in lighting, sitting, and occlusion of glasses to meet the adaptability to complex environments.
- A method is developed to detect driver fatigue status. This method combines multiple levels of features by cascading two unique CNN structures. Face detection and feature point location are performed based on MTCNN, and the state of eyes and mouth is determined by EM-CNN.
- Binocular images (rather than monocular images) are detected to obtain abundant eye features. For a driver's multipose face area, detecting only monocular's information can easily cause misjudgment. To obtain richer facial information, a fatigue driving recognition method based on the combination of binocular and mouth facial features is proposed, which utilizes the complementary advantages of various features to improve the recognition accuracy.
- Several manufacturers, including Audi, Mercedes and Volvo, currently offer drowsiness detection systems that monitor a vehicle's movements, such as steering wheel angle, lane deviation, time driven and road conditions. When drowsiness is detected, drivers are typically warned with a sound and the appearance of a coffee cup icon.

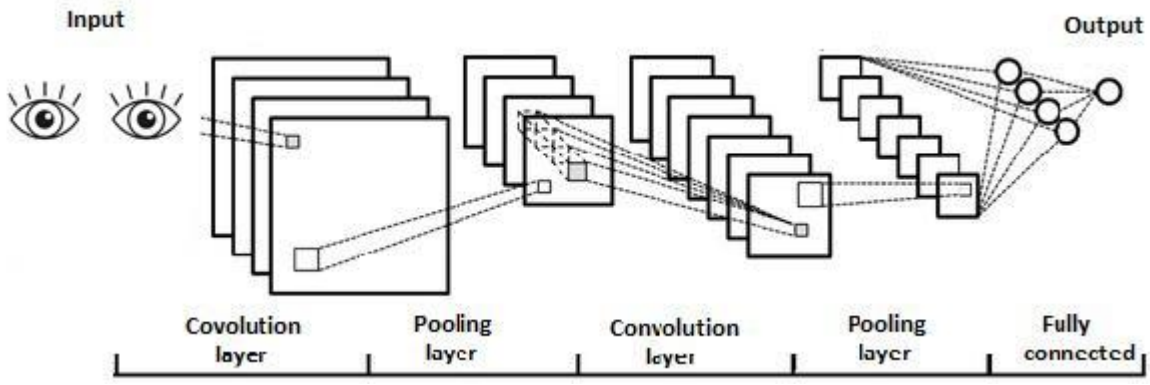


**Figure 1 Use of Convulation Neural Network**

# 5. Proposed Work

The approach we will be using for this Python project is as follows :
Step 1 – Take an image as input from a camera.
Step 2 – Detect the face in the image and create a Region of Interest (ROI).
Step 3 – Detect the eyes from ROI and feed it to the classifier.
Step 4 – Classifier will categorize whether eyes are open or closed.
Step 5 – Calculate score to check whether the person is drowsy.

Each steps are described below:

**Step 1 – Take an image as input from a camera:**
With a webcam, we will take images as input. So to access the webcam, we made an infinite loop that will capture each frame. We use the method provided by OpenCV, to access the camera and set the capture object. And each frame is stored in a frame variable.

**Step 2 – Detect the face in the image and create a Region of Interest (ROI)**
To detect the face in the image, we need to first convert the image into grayscale as the OpenCV algorithm for object detection takes gray images in the input. We don't need color information to detect the objects. We will be using a haar cascade classifier to detect faces.

**Step 3 – Detect the eyes from ROI and feed it to the classifier**
The same procedure to detect faces is used to detect eyes. First, we set the cascade classifier for eyes in leye and reye respectively. Now we need to extract only the eye's data from the full image. This can be achieved by extracting the boundary box of the eye and then we can pull out the eye image from the frame.

**Step 4 – Classifier will Categorize whether Eyes are Open or Closed**
We are using CNN classifier for predicting eye status. To feed our image into the model, we need to perform certain operations because the model needs the correct dimensions to start with. First, we convert the color image into grayscale.Then, we resize the image to 24*24 pixels as our model was trained on 24*24 pixel images.We normalize our data for better convergence and expand the dimensions to feed into our classifier.

**Step 5 – Calculate Score to Check whether Person is Drowsy**
The score is basically a value we will use to determine how long the person has closed his eyes. So if both eyes are closed, we will keep on increasing the score and when eyes are open, we decrease the score. We are drawing the result on the screen using a function which

will display the real time status of the person. A threshold is defined for example if the score becomes greater than 15 that means the person's eyes are closed for a long period of time. This is when we beep the alarm.

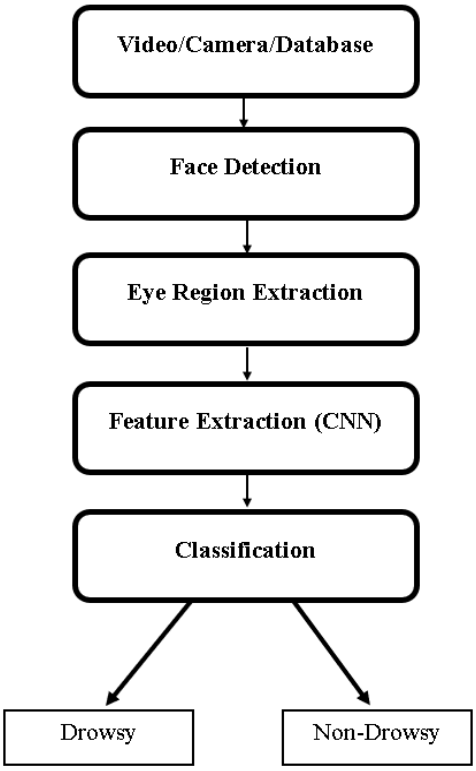


**Figure 2 Proposed Work Diagram**

## 5.1 Data Collection

Data we will use are as follows:

1. Kaggle "All The News Dataset"

## 5.2 Feasibility Study

### 5.2.1 Economical Feasibility

We have all the resources available to do the project thus further expenses is not required.

### 5.2.2 Technical Feasibility

There are few algorithms to implement which is easy to implement and widely used. Thus this project is technically feasible.

### 5.2.3 Schedule Feasibility

We have a proper schedule and enough time to complete this project in time. So this project is schedule feasible.

## 5.3 Implementation

Following are the tools and languages we are going to use for the implementation:

1. Primary coding language: Python 3.9
2. Neural networks libraries: Keras (Convolution Neural Network), Deep NN framework
3. Other required libraries: OpenCV, Numpy, Keras,Pygame libraries.

## 5.4 Testing and Verification

Once the training is completed, we will store the model in the external file. This model will be reused without being generated again. We will test on dataset of size 10% of the training data.

## 5.5 Expected Result

We expect the following outcome after the model is built:

1. The model will be able to detect if the driver is feeling fatigue.
2. The model will provide alert if the driver is feeling sleepy.

## 6. Working Schedule

| | 1st | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | 11th | 12th |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Study and Analysis | 4w | | | | | | | | | | | |
| Data Collection | | | | 3w | | | | | | | | |
| Implementation | | | | | | 5w | | | | | | |
| Testing | | | | | | | | 3w | | | | |
| Documentation | | | | | | | | | | 3w | | |
| Review | | | | | | | | | | | 2w | |
| Presentation | | | | | | | | | | | 2w | |

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