**Project Proposal**

Driver drowsiness detection using deep learning

**Team Members**

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1. **Introduction**

The primary motivation for choosing this topic is to apply deep learning concepts and techniques we learn in the class to a real-life problem with practical use.

Drowsiness is identified as one of the major causes of fatal traffic accidents. Unfortunately, about 20% of drivers tend to show drowsiness while driving, reported by National Safety Council[1]. This project aims to build a deep learning-based real-time drowsiness detection system that will contribute to improving road safety.

1. **Materials and Methods**
   1. Approaches

Drowsiness detection is a supervised binary classification task. We plan to design and implement a deep network consist of one or multiple CNN-based deep networks that may include but not limited to ResNet, VGG-FaceNet[7], InceptionV3, AlexNet[6], FlowImageNet[8] as recommended in some similar works[2][3].

We will train multiple networks separately and ensemble good performing networks to cover all necessary features essential to detect drowsiness[4].

* 1. Models to be used

As listed in section 2.1, we will focus on training various CNN-based networks. As pointed out by previous works[5], eye-based methods and mouth-based methods are the two main categories of drowsiness detection methods. We plan to cover both aspects by using multiple networks.

AlexNet is fine tunned to learn features related to drowsiness. The VGG-FaceNet is trained to learn facial features related to drowsiness, which is robust to genders, ethnicity, hairstyle and various accessories adornment. FlowImageNet takes a dense optical flow image extracted from consecutive image sequences and is trained to learn behaviour features related to drowsiness, such as facial and head movements.

* 1. Dataset to be used

We have several existing datasets found on various sources, including six image datasets from [Kaggle](https://www.kaggle.com/search?q=drowsiness+detection+in%3Adatasets) and one video dataset from [NTHU](http://cv.cs.nthu.edu.tw/php/callforpaper/datasets/DDD/)[9]. Alternatively, we are also prepared to build our own dataset by using online images and photos of team members.

* 1. Metrics to be computed

Since this is a classification task, the most critical metric to tune hyperparameters and to represent training/validation score is accuracy. We will still record other classification metrics such as accuracy, precision, recall, F1-score, ROC, and AUC.

We will use Categorical Cross Entropy (CCE) as a metric in the loss function.

**Reference**

[1] Drivers are falling asleep behind the wheel, National Safety Council. <https://www.nsc.org/road/safety-topics/fatigued-driver>

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[3] Park, Sanghyuk, Pan, Fei, Kang, Sunghun, and Yoo, Chang D. "Driver Drowsiness Detection System Based on Feature Representation Learning Using Various Deep Networks." Computer Vision – ACCV 2016 Workshops 10118 (2017): 154-64. Web.

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[9] Weng, Ching-Hua, Lai, Ying-Hsiu, and Lai, Shang-Hong. "Driver Drowsiness Detection via a Hierarchical Temporal Deep Belief Network." Computer Vision – ACCV 2016 Workshops 10118 (2017): 117-33. Web.

**Figures and Tables**

**Member Contributions**

Each member had a different task and completed various sections of this proposal, and the workloads are distributed equally.

The list below roughly summarizes the contribution of each member followed by individual score:

**Guo, Yuhua**: models to be used section, 3

**Jiang, Tianhan**: stub version of proposal and approaches to be used section, 3

**Laditan, Oluwapelumi David**: metrics to assess the result section, 3

**Lawal, Tobi**: dataset to be used section, 3

**Zhao, Peiyun**: visualize to tables and figures section, 3