**Group 6 Project Midterm Report**

**Project Title**: Driver drowsiness detection using deep learning

**Group Members**: Tianhan Jiang, Peiyun Zhao, David Laditan, David Guo, Tobi Lawal

**Contact Email**: [yuhua.guo@ucalgary.ca](mailto:yuhua.guo@ucalgary.ca), [tianhan.jiang@ucalgary.ca](mailto:tianhan.jiang@ucalgary.ca), [peizhao@ucalgary.ca](mailto:peizhao@ucalgary.ca), [oluwapelumi.laditan@ucalgary.ca](mailto:oluwapelumi.laditan@ucalgary.ca) and [tobi.lawal1@ucalgary.ca](mailto:tobi.lawal1@ucalgary.ca)

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. **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. CNN is commonly used to analyze visual imagery, compared to Fully Connected network(FNN),

CNN has the advantage of params sharing and partial connection, as a result, the efficiency of CNN is greatly appreciated.

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.

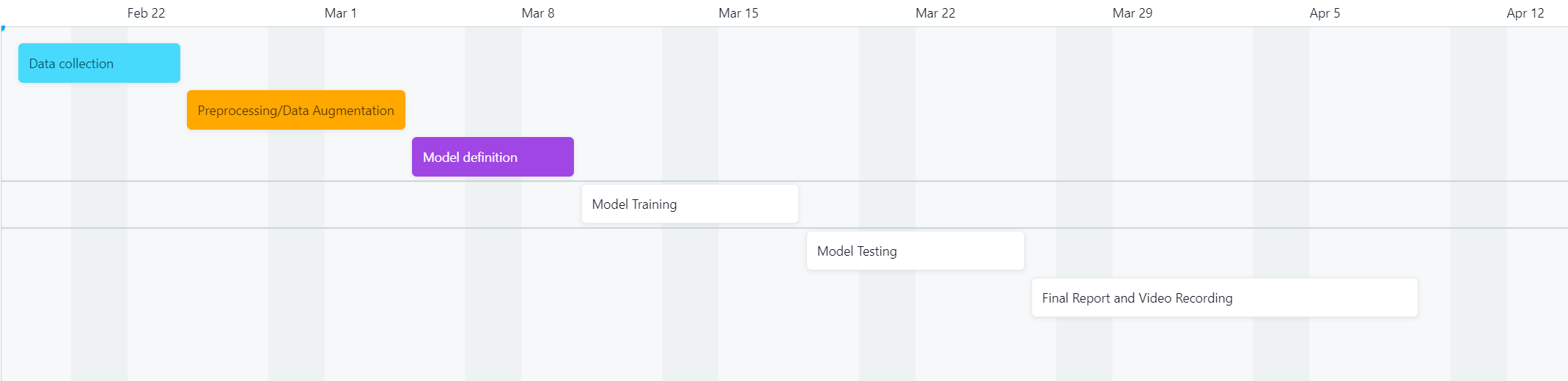
AlexNet is fine tuned to learn features related to drowsiness. The VGG-FaceNet is trained to learn facial features related to drowsiness, which is robust to genders, ethnicity, hairstyle and various accessories adornment. FlowImageNet takes a dense optical flow image extracted from consecutive image sequences and is trained to learn behaviour features related to drowsiness, such as facial and head movements. We are going to apply a transfer-learning approach to our model using one of the above mentioned pre-trained models. We will plan on using the below proposed system architecture in figure 1 as a guideline to complete this project. More so, we will consider different levels of drowsiness according to table 2 below for our final classification or output.

* 1. Dataset to be used

In this stage, we use a [kaggle dataset](https://www.kaggle.com/serenaraju/yawn-eye-dataset-new) that contains close-eye images and yawn images labelled “drowsy”, open-eye images and non-yawn images labelled “non-drowsy”.

**3.0 Results and discussion**

**4.0 Progress**

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| --- | --- |
| **Task** | **Status** |
| Data Collection | Completed |
| Preprocessing and Data Augmentation | Completed |
| Build Model Architectures | Completed, more fine-tuning needed |
| Model Testing | Completed on existing networks |
| Final Report and Video Recording | Not started |

**Figures and Tables**

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**Figure 1. Our Proposed System Architecture**

|  |  |
| --- | --- |
| **SYMPTOM** | **OUTPUT** |
| Eye Open, No yawning | No drowsiness |
| Frequent Blinking, no yawning | Less Drowsiness |
| Eye Closed over 1.5 seconds | Drowsiness |

**Table 2: Level of Drowsiness**

**References**

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

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**Member Contributions**

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

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

|  |  |  |
| --- | --- | --- |
| **Team members** | **Contribution** | 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 the tables and figures section. | 3 |