Drowsiness Detection Report

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# I. Introduction

# II. Research Used for Drowsiness Detection Project

## 2.1 Google Open-source MediaPipe

### 2.1.1 Facemesh

# III. Drowsiness Detection Algorithm

## 3.1. Eye Angle

Eye coordinates, acquired from MediaPipe, are indexed from 0 to 15, representing the progression from innermost to outer upper to outermost to inner bottom points. The green indicates the index of landmark points, and the red shows the index of connected lines.



Figure 1: Eye angle landmarks and slopes

Notably, open or non-yawning eyes exhibit a greater rate of change - derivatives - in eye circumference compared to closed or yawn eyes. Connect the consecutive landmarks to a line. To ascertain the steepness of connected lines, absolute slopes between consecutive coordinates are calculated (3.1), disregarding directional signs.

(3.1)

Further, the absolute difference between consecutive slope squares is computed (3.2) to avoid erroneous predictions caused by inherent eye tilting, which might lead to falsely steep slopes.

(3.2)

Weighting is applied: 1.5 to indices 0, 1, 6, and 7 due to pronounced differences between open and closed eyes; 1.2 to indices 2 and 5 for noticeable but lesser distinctions. Indices 11 and 12, offering subtler differences, receive a weight of 0.7. Formulas are like below (3.3).

(3.3)

The sum of weighted values yields a unified indicator to discern open versus closed eyes, based on a predefined threshold.

(3.4)

When both eyes are predicted to the same class, the prediction ends. However, in instances of disparate class predictions for each eye, an average of sums is computed, followed by a reassessment against the threshold for final classification. Formulas are like below (3.5).

(3.5)