

УДК 004.8

## METHODS COMPARISON FOR DETECTING HUMAN YAWNING

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**Abstract** In this work we compare the methods used for human yawning detection based on the front view of the person. The comparison depends upon the execution time, used RAM, and the accuracy.

**Introduction** Drowsiness is one of the natural situations of the human, but the drowsiness while doing some jobs like driving or controlling the air traffic in the airport has dangerous consequences. One of the solutions to reduce such accidents is to develop a drowsiness monitoring system that can detect drowsiness situations and alert the person.

Yawning is one of the characteristics of drowsiness that appears in the person's behavior so, yawning detection is one of the methods for drowsiness detection. For drowsiness detection, it is not recommended to detect only one characteristic of drowsiness. There are other drowsiness characteristics such as slow blinking or head tilting.

Many methods have been proposed for yawning detection. Most of these methods measure mouth openness. Using image processing techniques, some methods measure mouth openness depending on the difference in color or texture between mouth, lips, and face. Other methods use a neural network model for extracting facial landmark points around the mouth, which are used for calculating mouth openness.

**Main part** In this work we propose a method that uses a neural network classification-model that can automatically extract the features of the mouth and some other facial features to detect yawning. In this work, we compare our proposed method and the methods that extract facial landmark points (Dlib model) and use these points for yawning detection.

The comparison is done using a small, powerful computer which is "NVIDIA Jetson Nano". We compare the methods depending on the average time it takes to process a frame, used RAM during this processing, and the accuracy of yawning detection.

**Conclusion:** To evaluate our results we used our own yawning detection dataset that contains classified face-images. According to the results of the comparison, we obtain that our method is the best method that can be integrated with a real-time drowsiness detection system.

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