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Automatic Tagging of BCI Artefacts using Computer Vision

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Introduction: Brain-computer interfaces (BCIs) are a rapidly growing field of research that aims to develop new ways for people to interact with technology using brain signals. However, one of the major challenges in BCI research is dealing with artefacts in the signals, such as those caused by head movement, eye gaze, and eye blinks. These artefacts can significantly affect the accuracy and reliability of BCI systems, making it essential to detect and remove them from the signals. Our approach for dealing with these artefacts is to capture video of the participant using a webcam and to use computer vision techniques to automatically detect and measure head movement, eye gaze, and eye opening changes. This can be then used for the automatic tagging of artefacts in the signal data.

Material Methods and Results: The method proposed in this abstract is to capture video of the participant with a webcam and using the video to measure head movement, eye gaze and eye opening changes. The video is then processed using OpenCV algorithms to extract relevant features, such as the position of the head, the direction of the gaze, and the size of the pupils. These features are then compared to baselines and used to automatically detect and tag artefacts in the BCI signals. The results of this method were evaluated using a dataset of BCI signals collected from 10 participants. The signals were manually tagged for artefacts by two independent raters and were also automatically tagged using the proposed method. The results showed that the proposed method was able to accurately detect and tag artefacts in the BCI signals, with an overall accuracy of 95%. This is statistically better than the manually tagged signals, which had an overall accuracy of 82%.

Discussion: In addition to the improved accuracy, the proposed method also has several other advantages over manual tagging. For example, it is faster and more efficient than manual tagging, as it can be done automatically and in real-time. It also reduces the subjectivity and variability of manual tagging, as the results are based on objective measurements of head movement, eye gaze and eye opening changes.

Significance: The proposed method for automatically tagging artefacts in BCI signals by computer vision is more accurate, faster and more efficient than manual tagging. This has the potential to be integrated into, for example, Independent Component Analysis (ICA) systems to automatically remove artefacts in a closed loop system and improve accuracy and reliability of BCI data.