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Feasibility of classifying brainwave data extracted from commercially available EEG headset using deep learning techniques

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Electroencephalography (EEG) is the process of observing the electrical activity of the brain. In recent years there has been an increase in the availability of low-cost EEG headsets in the consumer market. This study was conducted using such a device, the Emotiv Insight 5-channel EEG headset. The objective of this study is to visually stimulate the brain and successfully identify the stimulus by classifying the EEG data using deep neural network techniques. Since the used EEG headset only contains 5 electrodes, it is quite difficult to classify the signals without employing learning-based algorithms. By nature, the human brain unlikely to stay idle for a long period. Due to that, the collection of EEG recordings must be done carefully without contaminating the data. To achieve this the proposed method of data collection is done through the help of a Graphical User Interface (GUI) which was programmed using the Python language. The GUI automates the tasks of recording, saving, and managing the EEG data. First, the subject was placed in front of a screen, in a quiet environment and the EEG headset was put on. After the recording begins, the GUI randomly chooses an image from an image-set which was provided beforehand and display it on the screen for 2 seconds while recording the EEG data in the background. After 30 seconds, the recording stops automatically, and the captured data is saved with the necessary information. The above periods were chosen specifically to limit the stress of watching a sequence of images for a long time period. The subject was informed about what types of image classes are shown and instructed to "identify" the class of the image. For the following analysis, 200 recordings of 30-second records from one subject were used. They were recorded using images of "Cats" and "Dogs". The initial results of this study were obtained by employing two data classification methods. The first analysis is done with a 1-Dimensional Convolutional Neural Network (1D-CNN) and it achieved an accuracy of 52%. The second method employed a spectrogram based 2-Dimensional Convolutional Neural Network (2D-CNN) with an accuracy of 54%.

Keywords: Deep learning, EEG, Image classification