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**1.0 INTRODUCTION**

**2.0 EXPERIMENTAL SETUP**

**2.1 Data acquisition**

For the purpose of collecting data we developed special questionnaire software, and software for detecting eye blinks within EEG signals.

The video stream was captured with a Logitech HD Pro Webcam C920 . Video stream was stored on a disk drive to be processed in the future. Simultaneously EEG signals were recorded. For the recording of EEG signals we employed Mitsar-EEG 201 amplifier and accompanying WinEEG software. The electrodes were placed according to the international “10-20 system”[15]. Electro-gel has been injected into electrodes hollow in order to decrease the electrode-skin resistance. Currently, the EEG signals were recorded with the purpose of eye blink detection. In the future work we are planning to analyze EEG to detect various types of brain activity.

The experimental setup is shown in the figure 1.

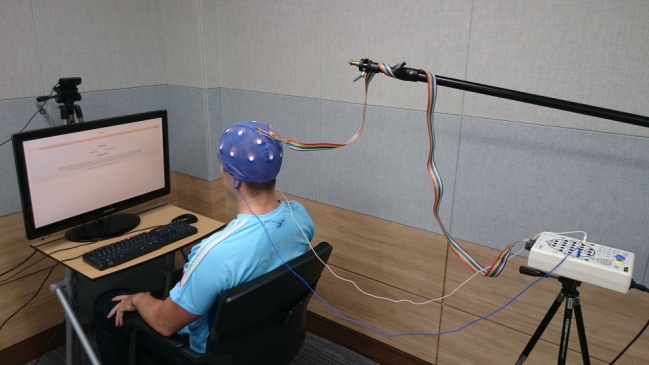


Figure 1 Experimental setup

**2.2 Testing procedure**

**2.3 Eye blinking detection procedure**

**3.0 METHODS**

Electrodes are applied to the head according to 10-20 System. Electrode placement has been standardized in order to fit anatomical skull landmarks. Name ’10-20’ comes from the fact, the distance between nasion, the inion and the head circumference, marking electrode locations based on 10% or 20 % intervals of those distances. We used bipolar montage, which means we determine the potential between Fp1 and Fp3, also Fp2 and Fp4. Figure 2 presents EEG signals for both pairs.

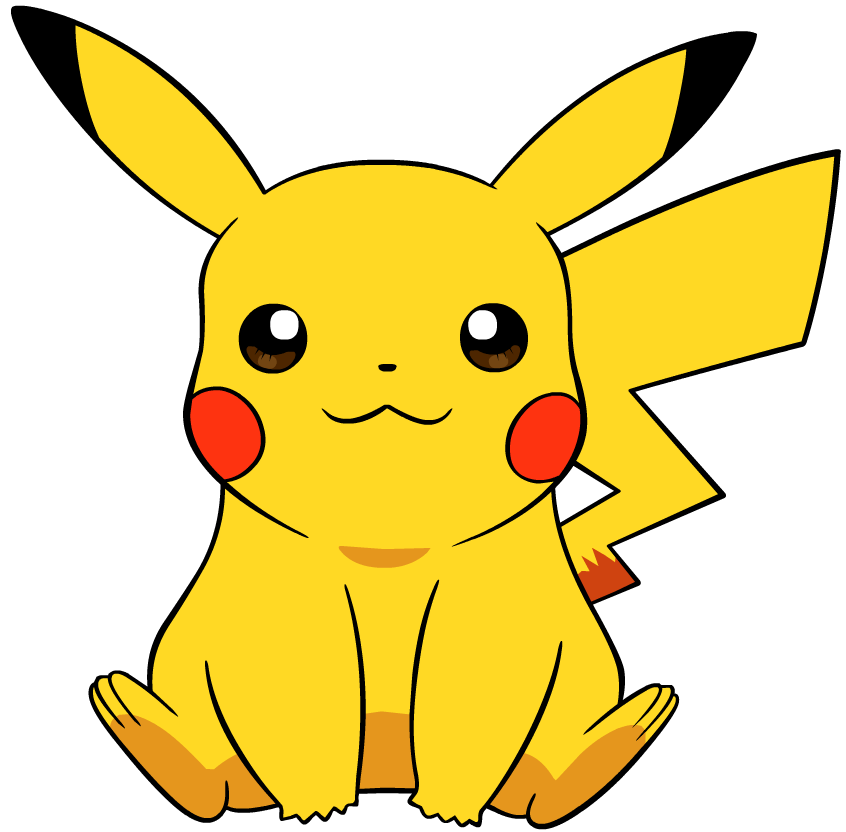
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Figure 2 Fp1-Fp3 and Fp2-Fp4 electrode pairs

Usually we want to get rid of ocular artifacts from EEG signal, as the eye blink is artifact and leads to interpretation problems[24]. This time we are going to extract blinks from EEG. In order to do that we employ fastICA[28] algorithm for solving Blind Source Separation (BSS)[29], which allows us to separate neural activity from muscle and blink artifacts[30]. ICA algorithm consist of two stages. First is decorrelation or whitening, we remove any correlations in the data.

Let be the data whitened using the mean vector and the covariance matrix .

Second stage is separation, which is orthogonal transformation of whitened signals (rotation of the joint density). The task is to find orthogonal matrix such that has independent components[28]. One by one we are looking for the rows of the matrix so a measure of non-Gaussianity is maximized by such that the length of is one and orthogonal to rows . The function can be any nonquadratic function, which is twice continuously differentiable with and with first and second derivative functions and .

The derivative function is called the nonlinearity. Variety of optimizing criterions (cost functions) can be used. By choosing kurtosis measure we obtain the nonlinearity ( . Functions () and () with parameters suggested in [31]. The s g(z) = z 2 (skew) we can get from skewness measure. There exist some general directions of choosing nonlinearity for fastICA algorithm. The nonlinearity , for example, is considered efficient for sources with light-tailed distributions, whereas tanh and gaus are preferable for heavy-tailed sources. The nonlinearity skew finds skew sources but fails in the case of symmetric sources. In practice, tanh and gaus seem to be common choices

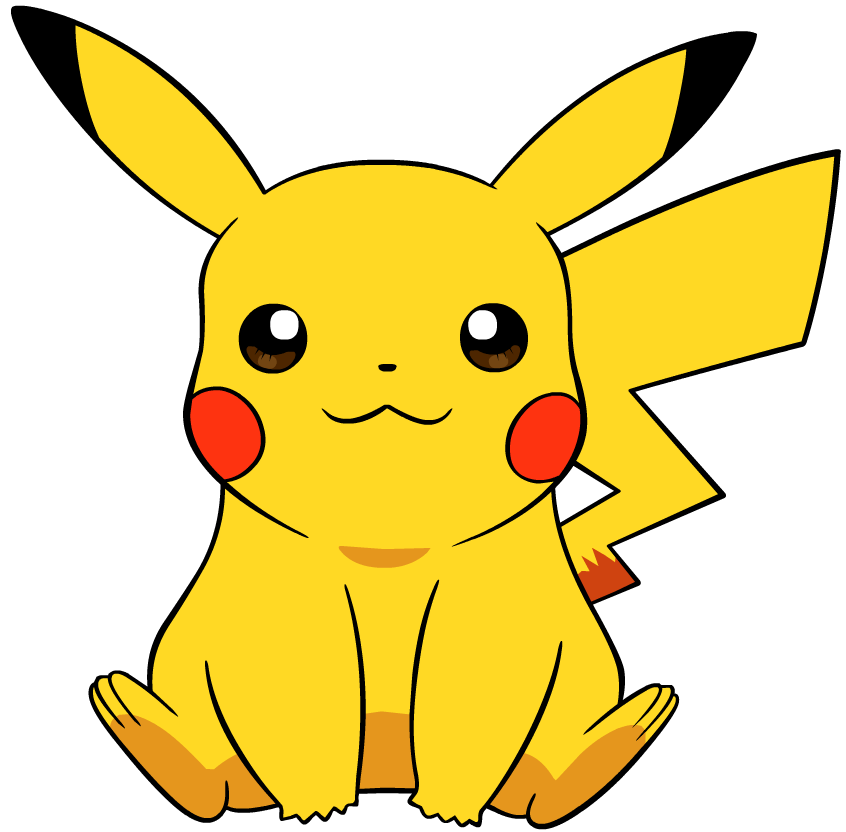
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Figure 3 Independent components

**4.0 CONCLUSIONS**

**Acknowledgments**

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