EEG-Based Saliency Maps

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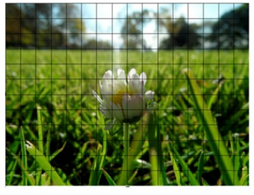
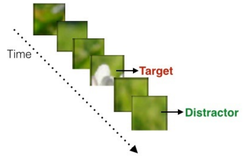
Introduction

➢This research explores new applicabilities of Brain Computer Interfaces (BCI) within the multimedia field. Particularly, we present system to generate a new way of saliency maps purely based on user's brain reaction after seen a patch of an image.

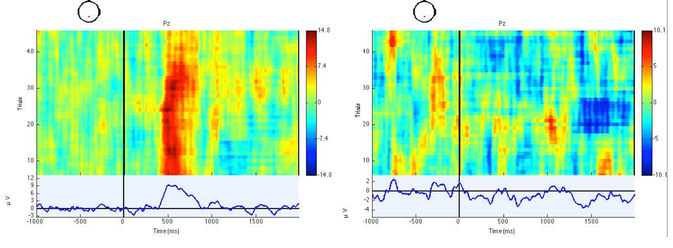
Capturing User's attention

➢In the system proposed in [1], images were divided into non-overlapped windows that were presented sequentially to a user in a Rapid Serial Visual Presentation (RSVP) at 5Hz.



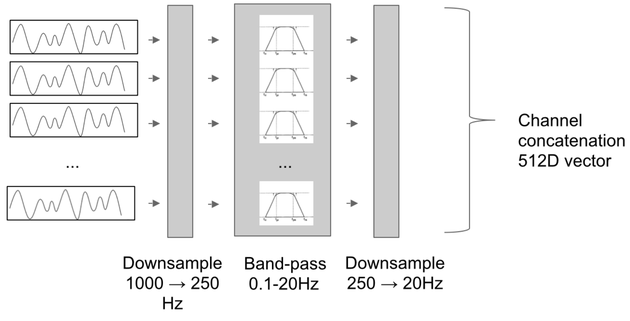


➢When users detect a target window, a peak his/her electroencephalography (EEG) signals is generated known as P300.



EEG processing and P300 detector

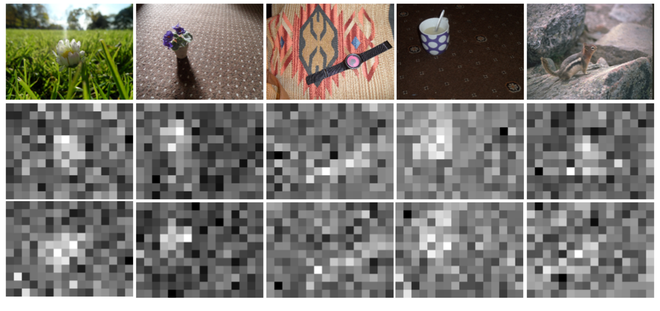
➢EEG signals related to each window presentation (from 200ms to 900ms after the window presentation) were extracted, band-pass filtered and down sampled to generate a feature vector.



➢A linear SVM model was trained with the feature vectors obtained from 17 images and tested on the features obtained from 5 images.

➢For each predicted feature in the test set, we display the distance in the feature space to the hyperplane and display each value on the corresponding window location on the image.

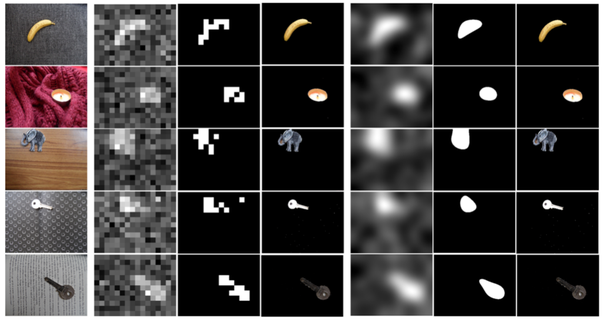
EEG-Saliency map



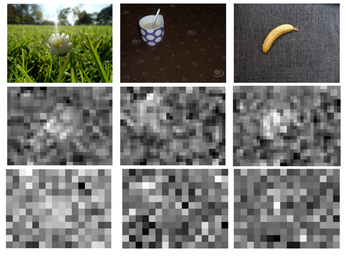
Object detection based on EEG-saliency maps

➢Maps binarized are combined with Grabcut to generate an accurate object segmentation.

➢Averaging maps across different reduce noise on the maps



Future Work



➢Multiresolution and overlapped windows to reduce noise

➢Context aware window presentation instead of only display the window patch

➢Display images without an specific attentional oriented task

Conclusions

➢The system presented generates maps based on user's brain reaction that contain useful information to detect which image regions capture the most their attention.

➢The processed EEG-maps in combination with Grabcut algorithm produces an accurate object segmentation of the image.

➢The system is hand-free and represents an alternative to the saliency maps generated by eye-tracker devices.

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[1] Mohedano E. Healy H., McGuinness K., Giró-i-Nieto, X., O'Connor N., Smeaton A. "*Object Segmentation in Images Using EEG Signals*", ACM International Conference on Multimedia, 2014, Orlando, Florida (USA)