Brain Mapper: A Brain to Canvas Communicator

Vejey Subash Gandyer [a], Krishnamurthy M [b]

[a] Department of Computer Science and Engineering , KCG College of Technology, India
E-mail address: vejeysubash.cse@kcgcollege.com

[b] Department of Computer Science and Engineering , KCG College of Technology, India
E-mail address: mkrish@kcgcollege.com

1. Background/ Objectives and Goals

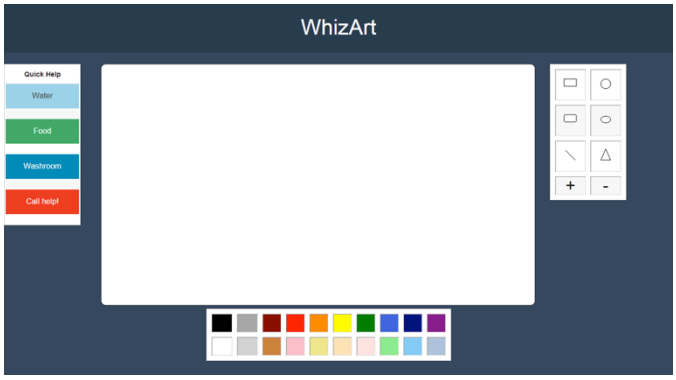
People with spinal cord injury and others who lost their ability to communicate to the outside world are lost forever. The goal is to allow them to communicate with others through a computer interface called Brain Mapper where the user has to watch the computer screen and respond to the visual stimulus that the interface shows them. This paper is intended to examine a paradigm called P300, which is useful for receiving what the brain thinks when the user is introduced with a visual stimulus on the screen.

2. Methods

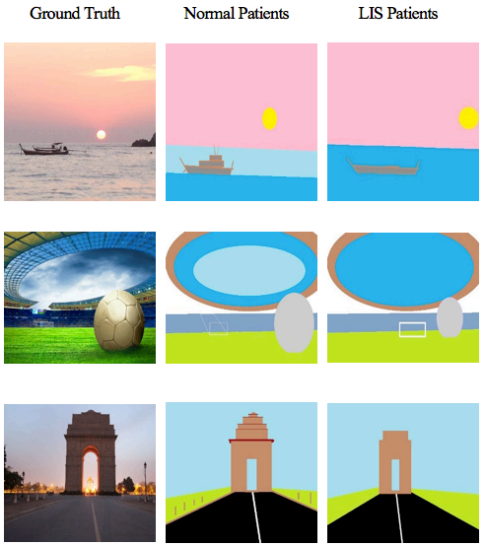
Brain Mapper provides an interface that is exploiting the P300 principle where a user can draw their thoughts with primitive geometric shapes in the form of icons shown on the screen. The user has to choose the shape he/she needs to draw and where it has to be placed on the screen. These parameters from the user are acquired through brain's EEG signals by asking the user to fit an EEG device (Emotiv Epoc or Neurosky Mindwave Mobile) on their head. This device will transmit brain signals to the computer that it is attached to. The computer will monitor for a spike (a sudden increase in potential difference from the EEG signal channels) in the signal. This spike is believed to be caused by the user when his interested icon flashes in the screen. There is an Icon flasher program running behind the scene that flashes a certain row or a column full of icons on the screen. In other words, when he thinks of a certain visual stimulus that is in the form of an icon on the screen (a geometric shape or the location on the screen) flashes, a spike is generated. When this spike is detected in the signal after 300ms, the algorithm backtracks the system to 300ms in time and chooses the icon that was flashing before 300ms. That particular visual stimulus icon is then drawn on the screen's canvas. The icons can be shape icons like circle, square, rectangle or color icons like yellow, blue, green, etc or an eraser icon to erase the previous drawn shape or color. This process continues until the user is satisfied with the drawing that he had in his mind. Various such experiments were done using this Brain Mapper on normal people and Locked-In-Syndrome (LIS) victims and the results are discussed below.

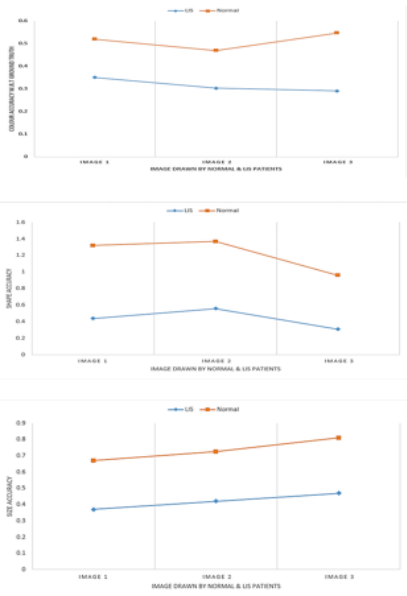
3. Expected Results/ Conclusion/ Contribution

The experiments are conducted using this Whiz Art interface (shown below), which is a part of the Brain Mapper application. The user is presented with a random picture to be drawn on the canvas. The user is then asked to draw the seen picture as close as possible to the original picture using this Brain Mapper application by fitting an EEG device. The results of the users' recreated pictures of Normal and LIS victims are shown below.



In the results of the Brain Mapper application (shown on the left), the first column is the Ground truth (shown picture to the user), the second column shows the output drawn by normal people and the last column is the Brain Mapper Output (drawn by a LIS victim) using Neurosky EEG headset. Graphs for showing color, shape accuracies between normal and LIS victims with both Emotiv and Neurosky headsets are shown below. These graphs show how much LIS victims are deviating from the actual picture that they wanted to draw on the Brain Mapper canvas during experiments.





Thus, a Brain to Canvas Communicator in the name of Brain Mapper is designed, developed and tested with both normal and LIS victims. From the tabulated results, it is evident that LIS victims can communicate effectively with the outside world only with just their thoughts. A BCI system that draw pictures with improvement in terms of accuracy and ease of use for end-users are to be taken care of in the future. Thus it is found that LIS victims are able to use this Brain Mapper for communicating effectively with the outside world and that is a wonderful contribution to those people who cannot communicate to the outside world.

Keywords: P300, Brain Computer Interface, BCI, EEG, Locked-In-Syndrome, LIS