Live sLORETA Brain Imaging & Biofeedback using a Normative Database

Thomas F. Collura

BrainMaster Technologies, Inc. & Brain Enrichment Center
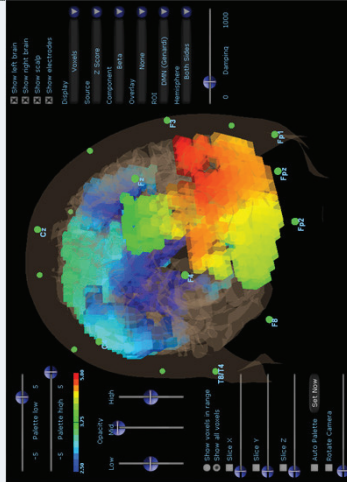
BrainMaster Technologies, Inc.

Introduction

A new method for brain imaging was constructed by combining the sLORETA localization algorithm with a reference database. Using this approach, it is possible to reconstruct brain electrical activity in real-time, and produce accurate 3-D images of brain activation in a range of EEG component bands. All 6,238 voxels of brain activity are computed in real-time (8 frames per second) in 8 frequency bands, and converted into z-scores reflecting the instantaneous current-source density compared to a normative population.

Above: A live reconstruction and imaging using sLORETA. It depicts training within the Cingulate Gyrus.

Above: Z-scores reflecting the instantaneous current-source density compared to a normative population within Regions of Interest (ROI) and Network Z-Scores.

Methodology

The sLORETA algorithm was described by Pascual-Marqui (2002), and the normative reference is based on the database first described by John et al. (2000). The examples that follow demonstrate its dynamic functionality.
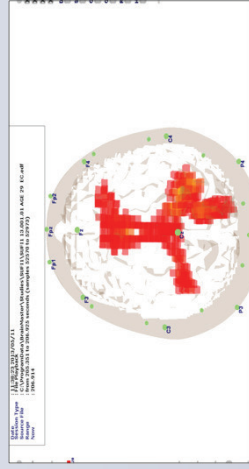

Above: Genardi's Default Mode Network shown within 3-D reconstruction using a normative database.

Specific results are shown demonstrating the ability of this technique to isolate brain functional regions including networks and hubs, as a function of instantaneous brain state.
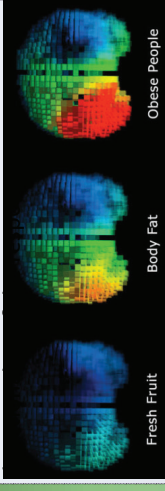
1. Individual State Patterns

In one case of extreme pain control, a hub of awareness was detected at the -3.0 z-score level.

In this image of gamma activity, a profound excess is found in the mesiotemporal regions, corresponding to an internalized state

2. Isolation of Brain Functional Regions

In other cases of extreme performance, individual patterns reflecting states of

3. Complementary Activation – Sender & Receiver

Another example, in a case of energy healing, showed a unique pattern of complementary activation between the sender and receiver
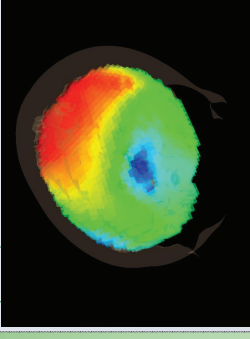

4. Ipsative Responses to Cues

Using BrainAvatar™, the process examines the asymmetry in the prefrontal cortex identifying gamma wave bursts to assess the underlying subconscious decisions behind these self-reported responses, at the very moment of decision-making. This process provides scientific evidence that an evoked emotionally laden response results in corresponding brain activity and exposes the match to self reported explanations. The process documents both the intensity of human emotional response as well as the

Fresh Fruit   Body Fat   Obese People

Above: Dominant gamma wave activity in the left prefrontal cortex signifies acceptance & increased activity in the right represents avoidance (Bonstetter, et al., 2012a; Bonstetter, et al., 2012b).

Left: Focal deficit in Broca's Area in an elderly individual with a speech deficiency.

References

John, E. R., Prichep, L.S. & Eaton, P. (1987). Normative data banks and neurometrics: Basic concepts, methods and results of norm construction. In A. Remond (ed.), *Handbook of electroencephalography and clinical neurophysiology:* Vol. III. *Computer analysis of the EEG and other neurophysiological signals* (pp. 449–495). Amsterdam: Elsevier.

Pascual-Marqui, R.D. (2002). Standardized low resolution brain electromagnetic tomography sLORETA): technical details. *Methods & Findings in Experimental & Clinical Pharmacology,* 24D:5–12

Bonstetter, R., Collura, T. F., Bonstetter, B.J., & Hebets, D., (2012a). Trait and state-based depression indicators measured using sLORETA imaging and quantification. Presented at the 2012 meetinf of the International Pharmaco-EEG Group (IPEG), New York, New York, November, 2012.

Bonstetter, R., Collura, T. F., Hebets, D., & Bonstetter, B.J. (2012b). Uncovering the belief behind the action. *Neuroconnections, Winter 2012,* 20–23

General Motors, Inc. (2013). 2014 Corvette Stingray Biometric Test Drive. Accessed from http://vimeo.com/channels/corvette.

Peper, E. & Hall, H. (2013) Sufi self-piercing with EEG monitoring demonstration. Presented at the 2013 meeting of the Association for Applied Psychophysiology and Biofeedback, March 15, Portland, Oregon.

Contact Information

BrainMaster Technologies, Inc.:
www.brainmaster.com

Thomas F. Collura: tomcl@brainmaster.com