

# Measurement Errors in EEG Analysis

**WHAT?** Electroencephalogram (EEG) is a medical imaging technique of brain electric oscillations related to cognitive processing.

The changes in the brain electric activity is observed in different frequencies such as Beta (>13 Hz.), Alpha ( 8-13 Hz.), Theta( 4-8 Hz.) and Delta(0.5-4 Hz.) by electrodes attached to a cap placed in the 10-20 placement system (Figures 1,2).

The signals from the electrodes follow a long way before converted to time-frequency representations (TFRs) for analysing (Figures 3,4).

**WHY?** Many artifacts occur during data gathering. The body itself acts like an antenna, the scalp has different thickness, the electrodes have impedance and effect on each



Figure 1.

<http://web.utk.edu/~lubar/lab.html>

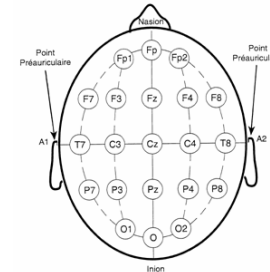


Figure 2.

[http://www.sfar.org/sfar\\_actu/ca97/html/ca97\\_002/97\\_02.htm](http://www.sfar.org/sfar_actu/ca97/html/ca97_002/97_02.htm)

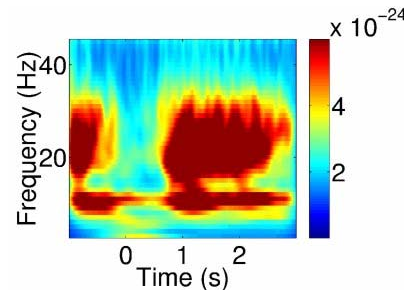


Figure 3.

<http://www.lce.hut.fi/publications/annual2002/node8.html>

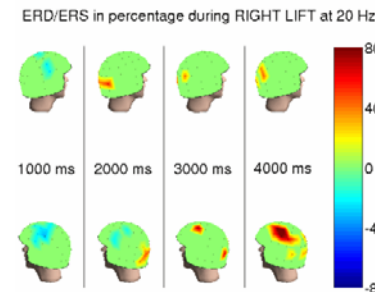


Figure 4.

<http://www.lce.hut.fi/publications/annual2002/node8.html>

other and besides, the signal exhibits great intra- and inter- individual variation due to unknown causes.

More researches has to be done to find out the subtle differences in EEG signals during cognitive processing in order to model the normal variation in the signal.

**HOW?** TFRs have been analyzed generally by using nonparametric statistical tests. Modelling the measurement errors in EEG data and using multivariate statistics, simulation, MCMC, and data mining algorithms are aimed to use in this study. This research is collaborated with Brain Oscillations and Cognitive Processes Research Project (<http://www.helsinki.fi/~ckrause/index.html>)