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BE12-S.1

The Application of the Kharhunen-Loeve Transform to Temporal Sequences of Spatial EEG Images, M. Lazar, Z. Koles*, Department of Applied Sciences in Medicine, University of Alberta, Edmonton Alberta, Canada, T6G 2G3

The Kharhunen-Loeve transform (KLT) is a useful technique in analyzing the underlying structure in a set of multivariate data. The transform, when applied to image sequences, yields a set of orthonormal basis images and a set of coefficients such that the mean squared error in reconstructing the image sequence with fewer than the optimal number of basis images is a minimum. From the coefficient sequence related to each basis image the normalized power represented by each basis image may be computed. The basis images once created may also be used to examine other image sequences by projecting the new data onto the basis functions and measuring the normalized power values.
The KLT has been applied to sequences of images representing the spatial activity of the EEG from healthy volunteer subjects, where a 31 electrode montage has been used to spatially sample the scalp voltage distribution with a temporal sampling rate of 120cps. Applying the KLT to up to 2400 images (20s of data) indicates that typically 5 (out of 31) basis images and the respective coefficients are required to represent over 90% of the variance in the original images with an average reconstruction correlation between the original and reconstructed images of over 0.85. Moreover, images from the same individual in the same cognitive state not used in creating the basis images could be projected onto the basis functions with similar results, indicating the indeed the basis images represent common scalp voltage distributions.

BE12-S.2

Spectral Analysis of EEG-A Hartley Approach, P.S. Ravindra* and Rajesh Prabhakaran, Regional Engineering College - Trichy, India.

Non-invasive techniques for the recording and analysis of electrical phenomena of the brain using ELECTROENCEPHALOGRAPH have gained large importance. The EEG waves recorded from the scalp vary in frequency and amplitude. Some of the most important inferences from these recordings may be drawn from their spectra. A manual inference is prone to biasing towards most prominent components and being oblivious of other components that may carry substantial information. Spectrum Analysers using FFT have been developed.

A system that solves the same problem using HARTLEY TRANSFORM may be used to obtain the COMPRESSED SPECTRAL ARRAY of the spectra. The use of this transform decreases the analysis time drastically, compared to conventional spectrum analysers. This feature will expedite the analysis of EEG recordings where amount of data is very large. The mathematical basis to justify the use of this transform is given. A system which incorporates a FAST HARTLEY TRANSFORM PROCESSOR has been designed. It is a real time microprocessor based system.

BE12-S.3

A Quantitative Analysis of the Amplitude Modulation in the Spindle Frequency Band of Sleep EEG in Elderly Subjects.
U. Barcaro, E. Bonanni, F. Denoth, L. Murri, C. Navona, A. Starita* and A. Stefanini, Pisa, Italy

The amplitude modulation of the 12.5-14.5 Hz band activity of sleep EEG was studied by the computation of three parameters: the modulation index (A), the root-mean-square frequency of the modulation (B) and the root-mean-square frequency of the first derivative of the modulation (C). An investigation carried out on 6 elderly subjects showed that: a) for 5 out of them, the mean values of each of the three parameters were able to discriminate between NREM and REM sleep; b) no significant shift was found between the elderly group and a control young group, for both the REM and NREM mean values of each of the parameters.

BE12-S.4

Nonlinear Alpha Wave Response under the Feedback Control of Weak EM Fields, Zhong Jicun*, P.O. Box 422, Zhejiang University, Hangzhou, P.R. China

A general structure of an adaptive control system using MEFP is given. By this control, a synergetic system can evolve into a more highly ordered state. We apply the theory to the induction of high level Alpha waves of human EEG. To this end, a microprocessor based real-time feedback control system was built.
Fifty seven subjects were tested and 86% showed an obvious augment of their Alpha activities during feedback.
Three features of the Alpha wave response have been found: 1) EM feedback will be effective only when the subject is quiescent, relaxing and eye-closed, adn the response can be easily inhibited by any arousal. 2) Only when the feedback signal is within a "window" of optimal parameters can the Alpha waves be mostly activated. 3) Unusual subjective feelings of relaxing were found in subjects with good response.