

Computational Intelligence and Predictive Analysis for Medical Science



A Pragmatic Approach

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Jisu Elsa Jacob

Pertinence of signal processing techniques in EEG analysis

Abstract: EEG (electroencephalogram), the signal obtained from the brain, contains immense information about the working as well as malfunctioning of the brain. Almost all neurological diseases can be effectively diagnosed with EEG signals if powerful signal processing algorithms can be incorporated with such data. This chapter combines the various analysis techniques of EEG that can be used for the diagnosis of various neurological diseases. EEG signal, a noninvasive, easy and low-cost method of data acquisition, can be a good way for neurologists to diagnose if more sophisticated signal processing techniques can be incorporated, ignoring the subtle information embedded in it. Such techniques can be used to report all neurological diseases. They need to be assessed and compared for implementing with EEG machines or for the development of automated diagnosis of various diseases, based on EEG.

Keywords: Electroencephalogram, encephalopathy, dementia, Alzheimer's disease

1 Introduction

Electroencephalogram (or EEG) signals are brain signals obtained by placing the electrodes on the scalp of a patient. These highly complex signals completely describe the electrical activity of all parts of the brain. The electric signal starts when nerve cells in the brain are stimulated.

This current signal involves sodium, potassium, calcium and chlorine ions that pass through channels in the membranes of the neuron, based on the potential. Electrical activity is related to the flow of ions by the synaptic excitations of the dendrites in the pyramidal neurons of the cerebral cortex [1]. The various probes kept all over the scalp can measure the current flow, which is recorded as EEG.

EEG signals are highly complex and nonstationary signals. All physiological signals, including EEG, are chaotic and show nonlinear behavior. Figure 1 shows an EEG signal recorded in a 10–20 electrode system. EEG is generally considered not that effective for early detection of dementia, prognosis of various neuropathologies or for differentiating between acute and chronic illnesses. It is used as an aid by neurologists along with other variety of diagnostic techniques and clinical examination. Therefore, more apt signal processing techniques can extract much more valuable

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