

# **SEB4233**

## **Biomedical Signal Processing**

# **EEG Analysis 1: Newborn Seizure Detection**

Dr. Malarvili Balakrishnan



# Newborn Seizure

- Seizures are the most frequent, and often only, clinical sign of CNS abnormality in the newborn.
  
- Neonatal seizures potentially lead to
  - subsequent death, cerebral palsy, mental retardation, epilepsy, attention/hyperactivity disorders, behavioural disturbances and other central nervous system (CNS) based

# Newborn Seizure

- Seizures are defined as paroxysmal, excessive, and/or hypersynchronous discharges of a critical mass of cortical neurons
  
- Causes of seizures
  - hypoxic-ischemic encephalopathy (HIE), intracerebral birth injuries, CNS infections or metabolic disturbances.

# Identification of Seizure

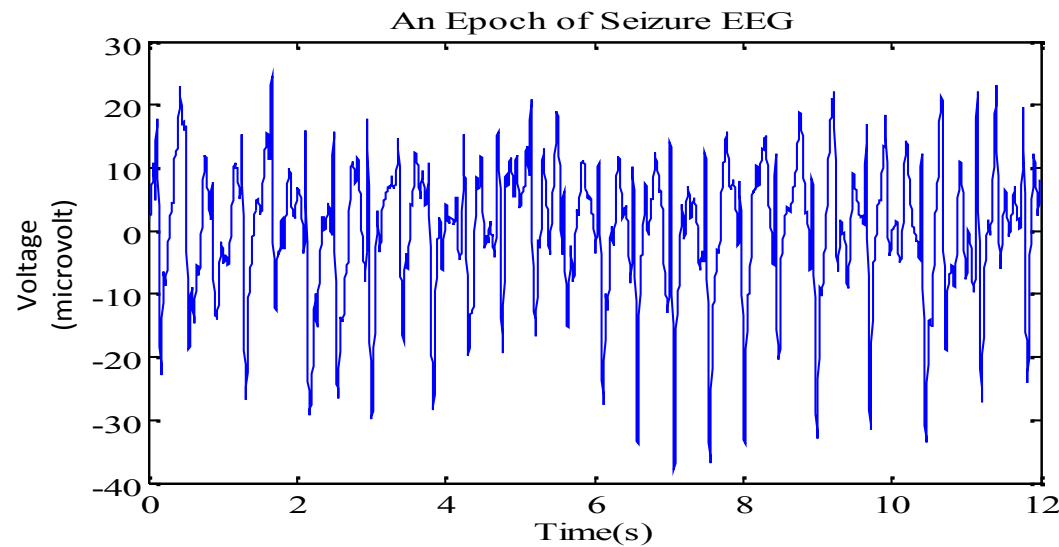
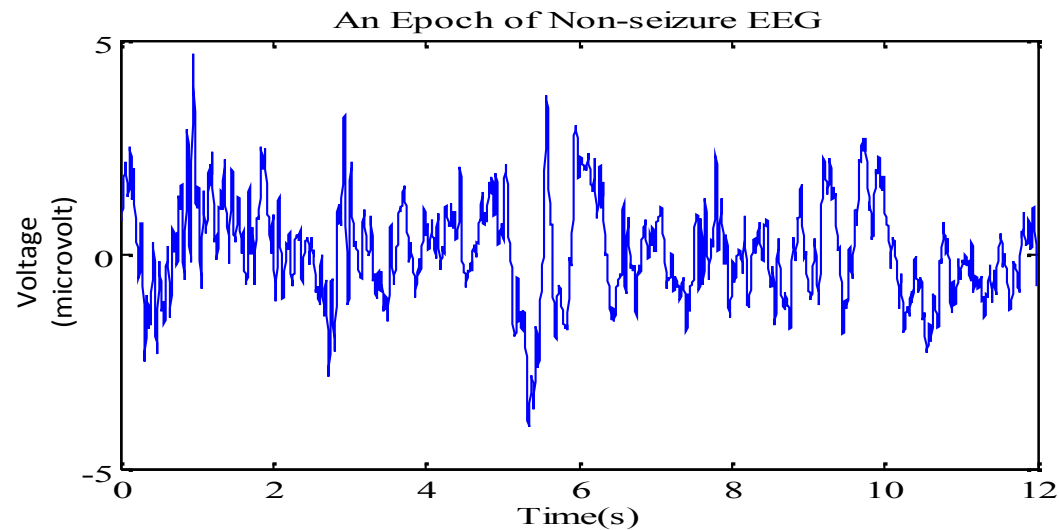
- Newborn seizures can be identified through clinical and/or electrical manifestations.
- In adults, the clinical signs
  - uncontrollable repetitive or jerky movements of the body parts, changes in the patient's state of consciousness and behaviour, such as increased agitation, frightened or confused behaviour, visual sensations, impairment of consciousness and amnesia.
  - In the newborns, these signs are much more subtle
    - sustained eye opening with ocular fixation, repetitive blinking or fluttering of the eyelids, drooling, sucking and other slight facial manifestations.
- These characteristics may also be part of the repertoire of normal behaviour in newborns. Thus, the challenge is to distinguish between normal and abnormal behaviours.

- EEG – standard
- Neonatal electrographic seizures consist of paroxysmal events characterized as a repetitive, evolving, complex and stereotyped waveform.
- EEG background is irregular and without apparent periodicity

# Time approach

- The newborn EEG can be divided into background (non-seizure) state and ictal (seizure) state for detection and classification purposes.

# Time approach (Cont.)



# Frequency Approach to Detect Seizure

- Using fft
- Frequency of the dominant spectral peak;
- Width of the dominant spectral peak;
- Ratio of the power in the dominant spectral peak to that of the background spectrum in the same frequency band.



# Frequency Approach to Detect Seizure

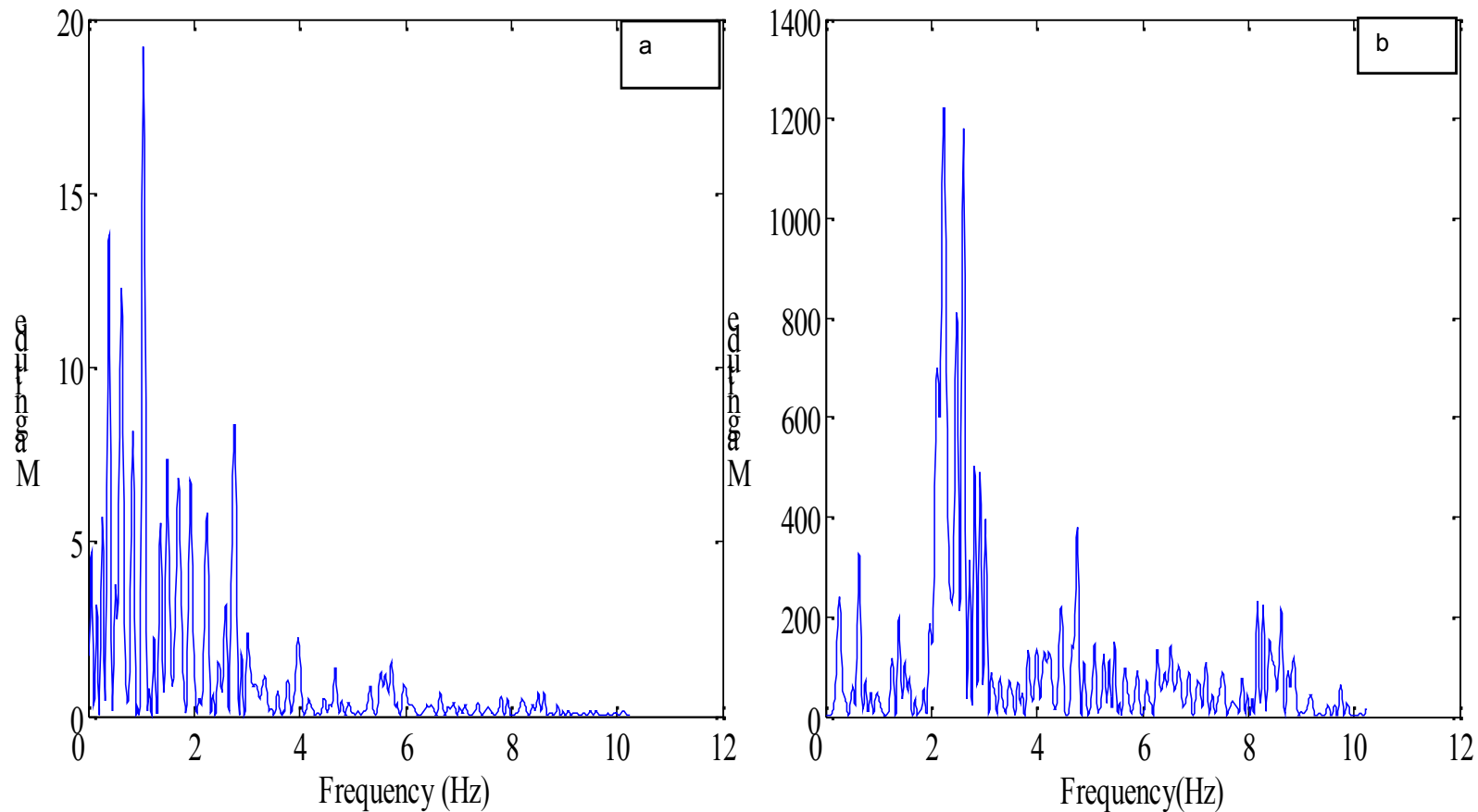


Figure 2.10: Frequency domain representations of (a) seizure and (b) non-seizure epochs.