

# Novel method to construct epilepsy brain networks

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Epilepsy is a serious neurological disease. More than 50% patients experience onset during childhood. Effective treatment of epilepsy can prevent serious long-term effects such as brain dysfunction.

Recent studies have shown that epilepsy is a brain network disease. The construction of epilepsy networks is therefore significant to the mechanism research as well as [clinical diagnosis](#) and treatment of epilepsy.

Researchers from the Suzhou Institute of Biomedical Engineering and Technology (SIBET) of the Chinese Academy of Sciences recently proposed a whole-brain dynamic resting-state functional network (DFN) computation method to better construct epilepsy brain networks. The method is based on resting-state, low-density electroencephalogram (EEG) recordings in scalp space.

Their study was published in *IEEE Journal of Biomedical and Health Informatics*.

At present, [functional magnetic resonance](#) imaging (fMRI) and EEG are commonly used to construct the epilepsy brain networks. EEG is non-invasive, wearable, cost-effective, and especially suitable for children's brain function monitoring.

Benign epilepsy with centrotemporal spikes (BECTS) is the most common type of [epilepsy](#) among children. Both fMRI and EEG source imaging (ESI) studies have indicated that BECTS is associated with static resting-state functional [network](#) (SFN) alterations (e.g., decreased global efficiency) in source space.

However, the alterations are not significant when the SFN calculations are performed in the scalp space using only clinical routine low-density (e.g., 19 channels) EEG recordings.

Based on the concept of EEG microstates, Liu Yan and his colleagues from Dai Yakang's group from SIBET proposed the DFN computation method.

"The method helps better analyze the dynamic properties of the whole-brain functional states, and on the other hand, realizes the display of the functional subnetworks' topologies in each microstate," said Liu.

The results show that the proposed DFN can reveal significant differences between individuals with BECTS and healthy controls, with lower global efficiency in the Microstate C— $\beta$  frequency band. This makes it superior to traditional SFNs, and enables it to match traditional fMRI and ESI methods in the source space.

"The networks of individuals with BECTS have poorer integration capabilities than those of healthy controls," said Liu.

The new method directly performs DFN computations from clinical routine low-density EEG recordings and avoids complex ESI computations, making it promising for clinical applications, especially in the outpatient diagnosis stage.

In addition, this method may be applied to explore the mechanism of other [brain](#) diseases and assist clinical diagnosis and treatment.

**More information:** Siqi Zhang et al, Whole-Brain Dynamic Resting-State Functional Network Analysis in Benign Epilepsy with Centrottemporal Spikes, *IEEE Journal of Biomedical and Health Informatics* (2022). [DOI: 10.1109/JBHI.2022.3164907](https://doi.org/10.1109/JBHI.2022.3164907)

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