





Main research topics @ <u>KEG</u> Neuroscience (NS)

Knowledge Engineering Group

Computer Science, AC, UTC-N

rodica.potolea@cs.utcluj.ro mihaela.dinsoreanu@cs.utcluj.ro camelia.lemnaru@cs.utcluj.ro raluca.portase@cs.utcluj.ro richard.ardelean@cs.utcluj.ro vlad.negru@cs.utcluj.ro









⁶NS: Detection of brain oscillations Time-Frequency Breakdown Method



- Advanced methods for brain signal analysis in order to identify brain oscillations
- What are oscillations? Rhythmic synchronized patterns of neural activity
- Omnipresent and linked to cognitive brain functions
- TFBM segments images and finds local maxima



NS: TFBM industrial applications



- Spectrograms from various domains
 - Any signal transformation into spectrograms
 - Example: radar data, seismology, medical diagnostics
- It can be used as a pre-processing step (part of a pipeline) to extract the most informative parts of the data, then:
 - feature extraction of detected blobs
 - separation into classes
 - anomaly detection
- Applications:
 - Seismology Identifying earthquake signatures in seismic spectrograms.
 - Medical Diagnostics Detecting anomalies in heart rate variability (ECG) or muscle activity (EMG).
 - Industrial Monitoring Detecting faults in machinery via vibration or acoustic spectrograms.

Radar marine data:



Wen, Baotian & Wei, Yanbo & Lu, Zhizhong. (2022). Sea Clutter Suppression and Target Detection Algorithm of Marine Radar Image Sequence Based on Spatio-Temporal Domain Joint Filtering. Entropy. 24. 250. 10.3390/e24020250.



NS: Clustering expertise on complex data

- Development of new clustering algorithms for specific problems
 - SBM/ISBM a grid-based clustering algorithm, developed for neuroscience data
 - DRC a density-based clustering algorithm, solves the classical issues of DBSCAN with different density data
- Development of a new distance computation
 - Applications in clustering, ED-K-means allows for clustering of non-convex data
 - Applications in evaluating clustering performance, three internal performance metrics have been adapted to correctly evaluate non-convex data





NS: Clustering expertise on complex data





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- Current collaboration: Transylvanian Institute of Neuroscience, Dementia Research Institute, Cambridge, UK
- Open to **collaboration** opportunities in the following areas:
 - Consultancy & Advisory Services
 - System Architecture & Solution Design
 - Proof of Concept Development
- Research Collaborations & Joint Proposals in:
 - Advanced data analysis & processing for multi-dimensional and complex datasets
 - Clustering overlapping + imbalanced datasets
 - Symbolic analysis of complex data
 - \circ Other relevant topics open to discussion





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Thank you for your time ! @ <u>KEG</u> Neuroscience (NS)

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