POLSKY Center for Entrepreneurship and Innovation
THE UNIVERSITY OF CHICAGO

Analytical Suite for Improved Time-Varied Data Segmentation

SUMMARY

Time matters. Photo albums that just contain pictures of where you've been without a timeline give you no information about the journey itself. Researchers at the University of Chicago have developed a data-intensive analytical suite (CENA) that improves the segmentation of time-variant data by providing moment-by-moment information about the entire spatio-temporal dynamic of complex data set. This analytical suite solves the issue of incomplete, sporadic, and unreliable temporal state detection. Initially developed for brain analyses, this analytical suite can be used to improve the automatic (data-driven) segmentation of any data with a temporal component, including atmosphere monitoring, weather analyses, stock market, and biomarkers in tailored medicine.

KEY RESULTS

The data-intensive analytical suite has been developed and applied to segment the complex, high-density activity of the human brain in response to various stimuli. Using this method, the precise spatio-temporal nature and structure of standard neural activity evoked in response to various stimuli was verified over background signal through theoretical simulations and empirical investigations.

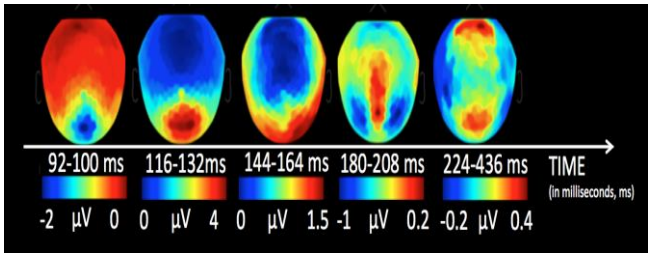
ADVANTAGES

- Improves time-varied data segmentation.
- Produces complete, robust, and reliable results often missed by conventional clustering methods.
- Differentiates transition states from stable states.
- Statistically generates optimal parameters.

APPLICATIONS

- Big Data analysis
- Image Processing
- Medical Imaging
- Surveillance

CENA Temporal segmentation for human brain activity



Example of brain states identified with CENA analytical suite of tools. The temporal brain segmentation of 1,267,200 data points revealed five stable (and robust) brain states, each one potentially sustaining different brain generators. The value of this data-intensive analytical suite improves not only the identification of when a stable state occurs (compared to non-stable and sporadic states) but also where it precisely occurs by improving the signal-to-noise ratio.

TECHNICAL DESCRIPTION

This data-intensive analytical suite optimizes the segmentation of large time-varied data sets using a combination of various tools, such as root-mean square error, cosine distances, and bootstrapping. Unlike conventional *k*-cluster methods that are dependent on hand-picked parameters, this suite of quantitative methods allows the robust and automatic (data-driven) detection of event-related changes in the global pattern of brain activity, putatively reflecting changes in the underlying neural locus for information processing in the brain, reduces data bias, improves replicability, and allows for comparison within and between data sets.

REFERENCE
UCHI 2382

DEVELOPMENT STAGE
In-Use, Release Candidate

SCIENTIFIC AREAS
Software
Healthcare IT
Image Segmentation
Imaging

PUBLICATION
Cacioppo, et al. 2014 *Journal of Neuroscience Methods* 238

INTELLECTUAL PROPERTY
Patent Pending

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