Human Brain Project

Institut de Neurosciences des Systèmes

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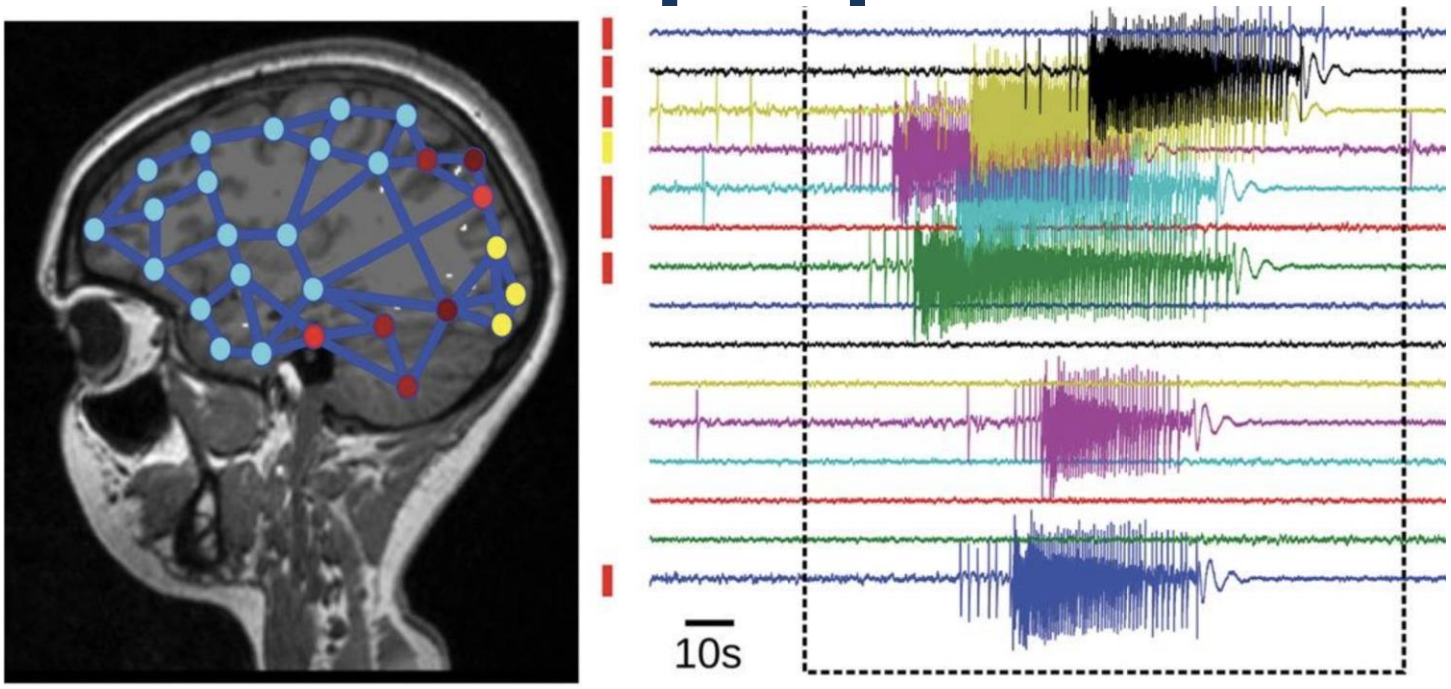
The Virtual Epileptic Patient



Institut de Neurosciences des Systèmes (INS), Aix-Marseille University (AMU)

A new method for improving the treatment of drug-resistant epilepsy

TECHNOLOGY DESCRIPTION

Approximately 60% of all epileptic patients become seizure free with antiepileptic drug treatment, while for the remainder the only hope for relief is surgery. The proper identification of the epileptogenic zone is critical for a positive surgical outcome. Generic approaches are only of limited success, because individual variability strongly effects the outcome of therapies and treatment approaches. For this reason personalization of healthcare to the individual patient is obligatory. We developed a a personalized brain modeling workflow, the Virtual Epileptic Patient Patient (VEP), allowing testing and guiding clinical decision making leading to a better delineation of the epileptogenic zone. The patient's brain network models are derived from non-invasive structural brain brain imaging data and reduce invasiveness.

A novel approach to brain interventions is proposed based on personalized large-scale brain network models.

The approach relies on the fusion of structural data of individual patients and mathematical modeling of brain activations

AREAS

Brain network models | Connectomes | Individualized medicine

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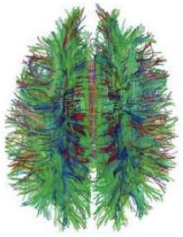
COMPETITIVE ADVANTAGES

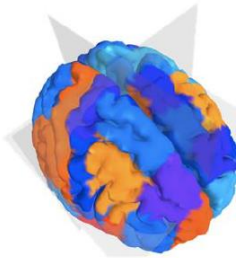
- Personalization by integrating patient specific brain connectivity, and MRI lesions
- High-performance computing for systematic parameter space explorations, fitting and validation of the brain model
- Exploration and discovery of novel intervention strategies and therapies
- Systematic and reliant decision making, free from biases
- State-of-the-art diagnostics and result evaluation using machine learning and artificial intelligence
- Demonstrated performance in small-scale clinical trial with retrospective patients indicating superior surgery outcome (as measured with Engel score)

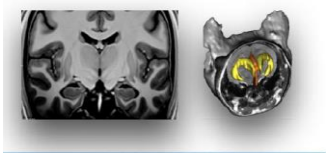
The virtual epileptic patient method is opening up avenues towards discovery of novel clinical interventions

APPLICATION & MARKET POTENTIAL

- VEP software prototype is used in a European clinical trial with 400 prospective patients (2019 - 2022), assessing the impact on the neurosurgery strategies for drug-resistant epilepsy patients as part of the EPINOV projet (www.epinov.com)
- Analysis ranked clinically-validated VEP software highly for market potential in neurosurgery.

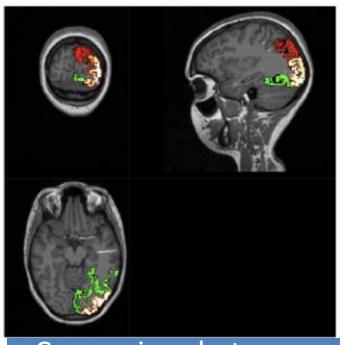




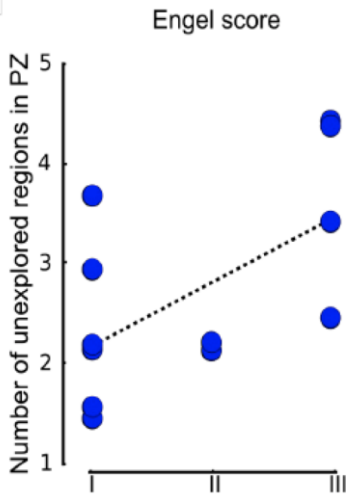


Noninvasive brain imaging

Construction of brain avatar



Comparison between clinical prediction and VEP



TECHNOLOGY READINESS LEVEL

1 2 3 4 5 **6** 7 8 9

REFERENCES

- First application in a clinical trial in France called "EPINOV" (www.epinov.com)
- Partnership with Dassault Systèmes
- Collaboration for technology development with Codebox (www.codebox.de/codebox)
- Collaboration with Charité University Medicine Berlin, Brain Simulation Section
- Collaboration with University of Toronto Rotman Research Institute – Baycrest

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