ENGINEERING PSYCHIATRY
research program

FACULTY MENTOR
Dr. Jyoti Mishra

PROJECT TITLE
Training the Neural Basis of Empathic Awareness in Physician Trainees Leveraging Real-time Virtual Reality

PROJECT DESCRIPTION
Our two main goals for this project are:

- Aim 1. To investigate EEG-based closed-loop neurofeedback of the AI-ACC circuit as a complement to digital meditation in medical student trainees. And
- Aim 2. To investigate the plasticity of objective cognitive processes, and cardiac-respiratory biorhythms driven by the digital meditation + neurofeedback training in medical students.

This project can accommodate both remote and in-person students

INTERNS NEEDED
2 Students

PREREQUISITES
- Must have experience in MATLAB programming language
- Should be passionate to learn in developing innovative technology to help Psychiatric patients

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PROJECT TITLE
Targeted Cognitive Neurostimulation for Depression

PROJECT DESCRIPTION
The novel idea of this project is to develop a next-generation, and notably, clinically feasible neurostimulation approach, which (1) selects depressed individuals for rTMS treatment based on an EEG biomarker of DLPFC hypoactivity (new diagnostic), and (2) pairs rTMS treatment with depression-relevant cognitive states that engage the DLPFC target (new treatment).

Significance. Decades of neuroscience research has shown that brain plasticity occurs when neurons are active together - "neurons that fire together wire together" (Hebb, 1949). Thus, timing stimulation to when the brain is active vs. at rest may be more effective at eliciting brain plasticity. This principle has guided our novel Cog-TMS treatment approach. In order to pair rTMS with specific cognitive states that are relevant to depression and activate DLPFC (the standard rTMS brain target), we have developed and validated two EEG-based cognitive tasks: (1) an externally-oriented emotional distractor task, and an internally-oriented attentive breathing task. These tasks were developed on the basis that individuals with depression have difficulties regulating their attention to emotionally salient stimuli, and likewise, have difficulty regulating internal emotional states/thought-processes and are subject to much negative rumination/mind-wandering.

This project can accommodate both remote and in-person students

INTERNS NEEDED
2 Students

PREREQUISITES
- They should have basic programming skills.
- They should be interested in the role as an experimenter to collect and analyse data from depression patients.