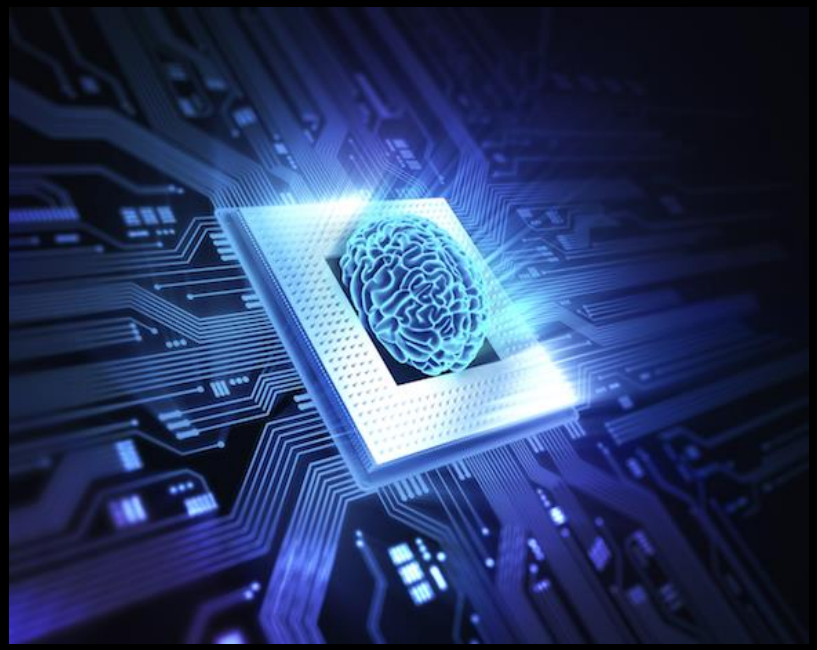


Unraveling the complexity of the brain

Session Co-Chairs:

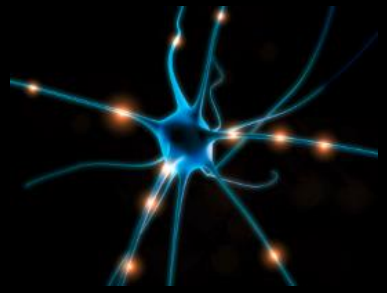
Xue Han,
BU BME

Maryam M. Shanechi
USC EE

Human Brain

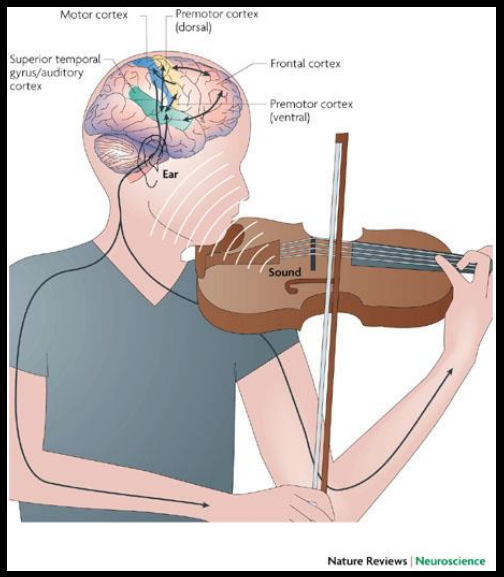
86 billion neurons

Representing our emotions, thoughts and actions

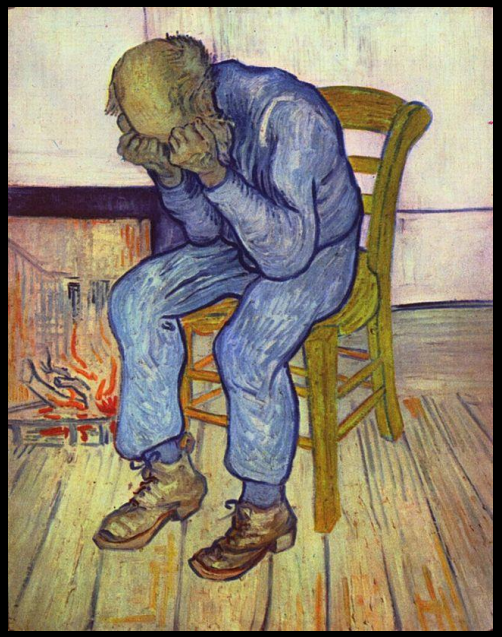


Neural activity not only represents the brain function …

but also its dysfunction



Movements



Depression

Induced Coma, Anesthesia

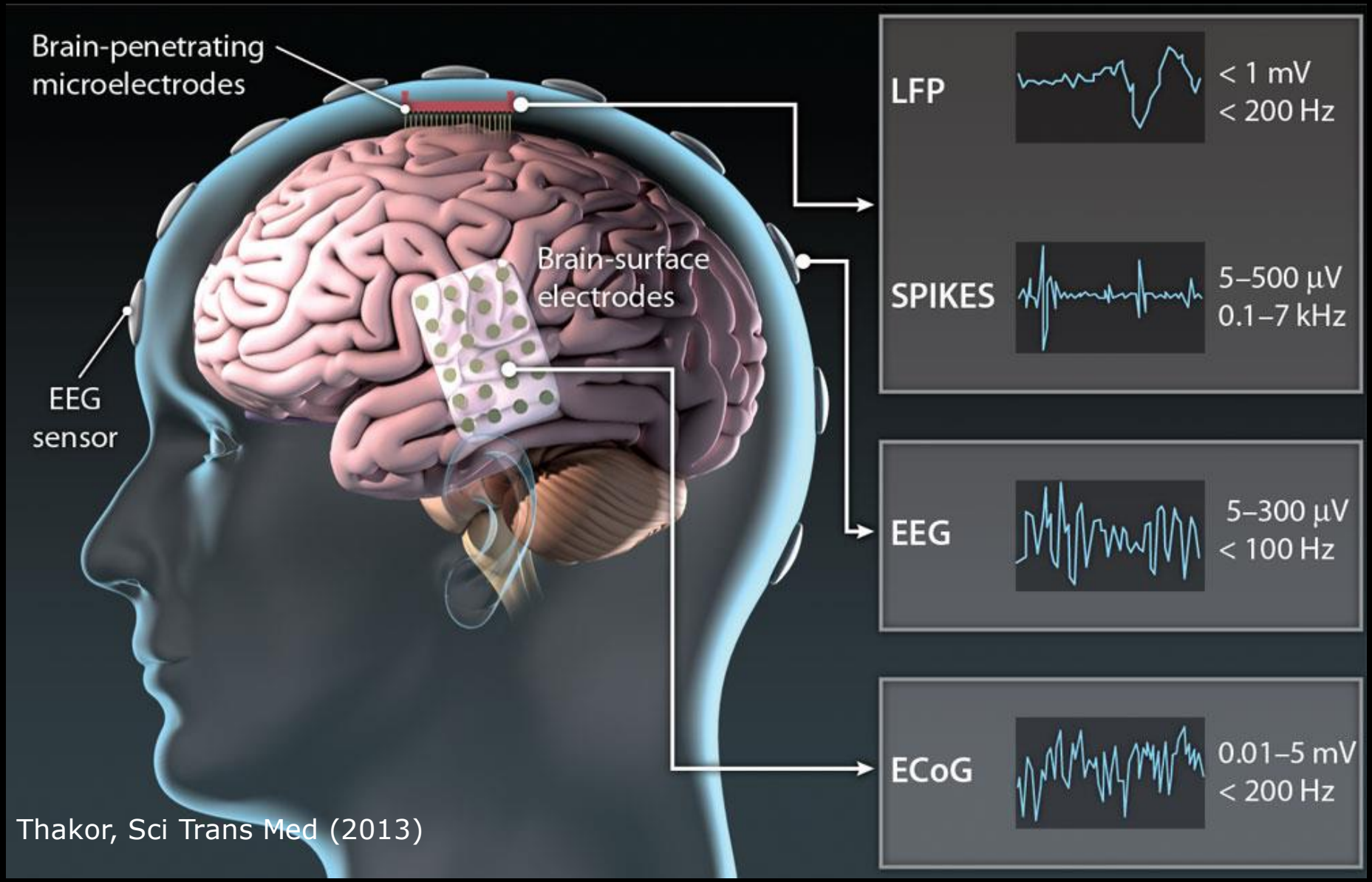
How can engineering help us

Understand

Restore & Treat

Enhance

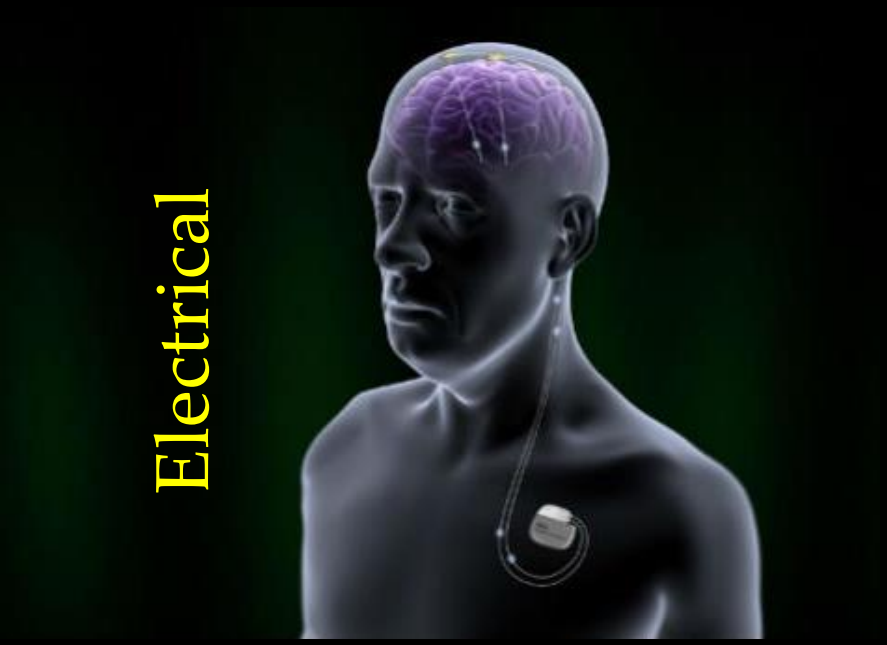
Record Brain Networks



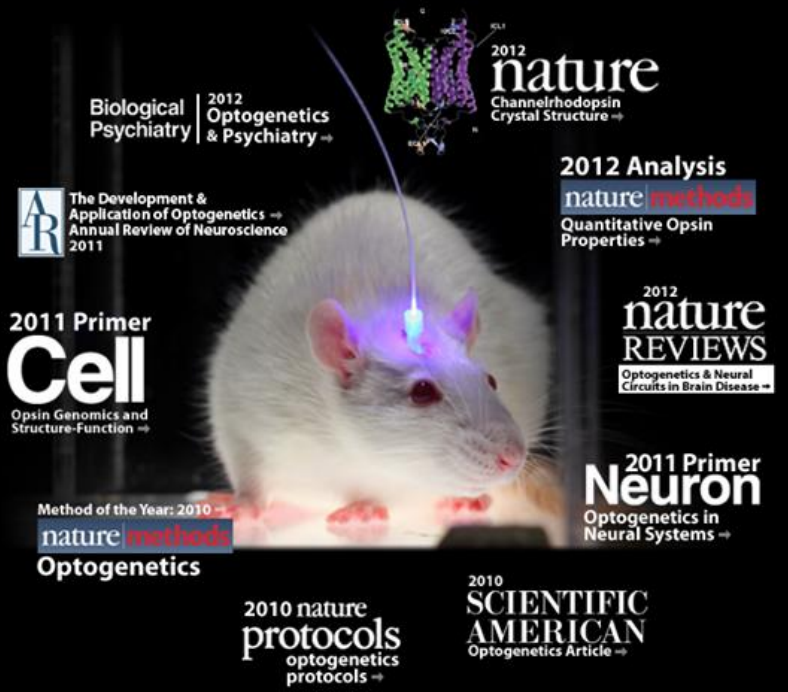
Thakor, Sci Trans Med (2013)

Manipulate Brain Networks

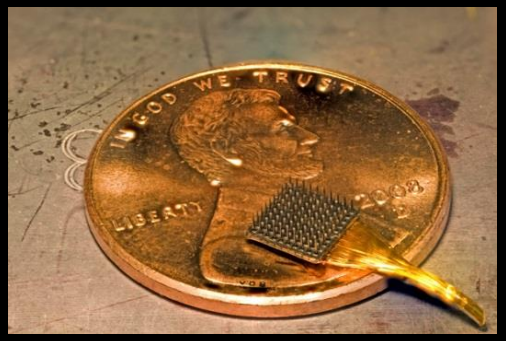
Electrical



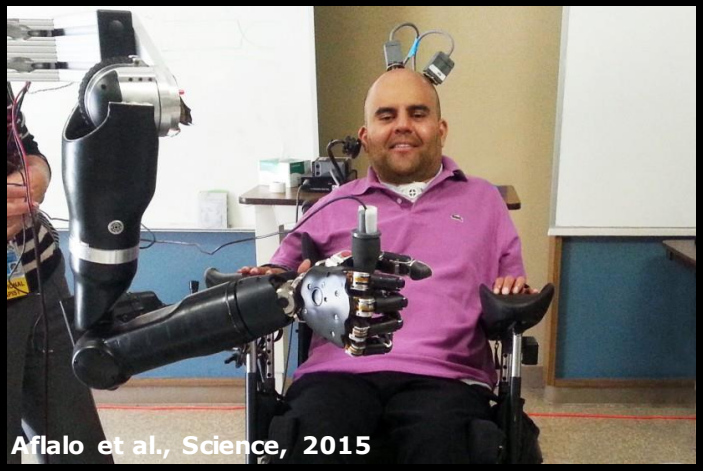
OPTOGENETICS



Build Interfaces to the Brain



Neuroprosthetics



Deep brain stimulation

Automatic anesthetic delivery

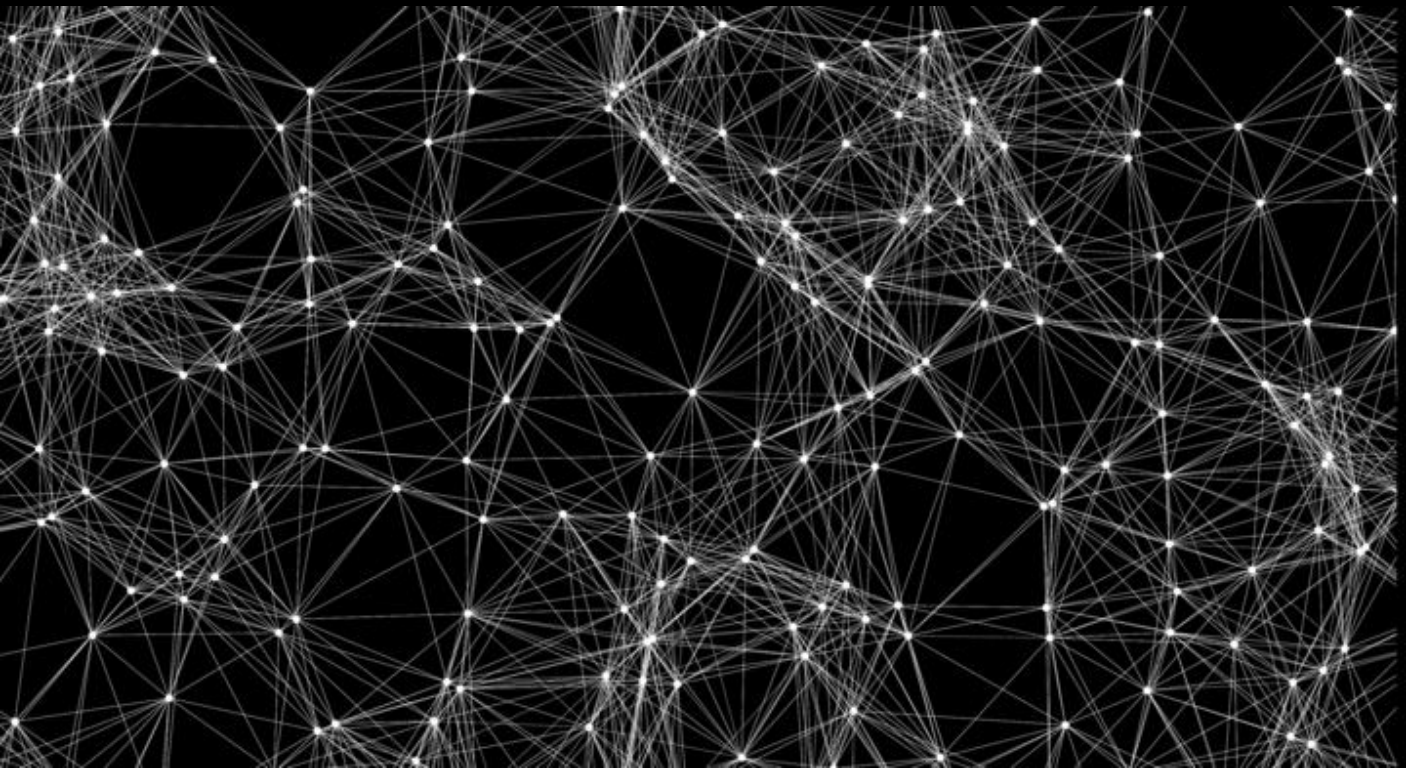
Algorithms for Neural Systems

Machine Learning & Statistical Inference

Decode brain states

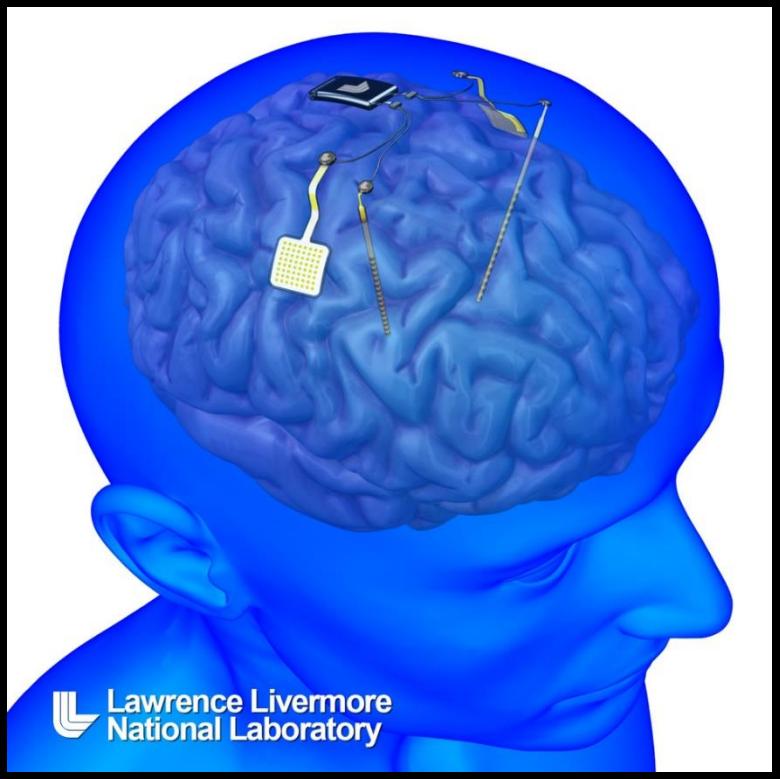
Control Theory

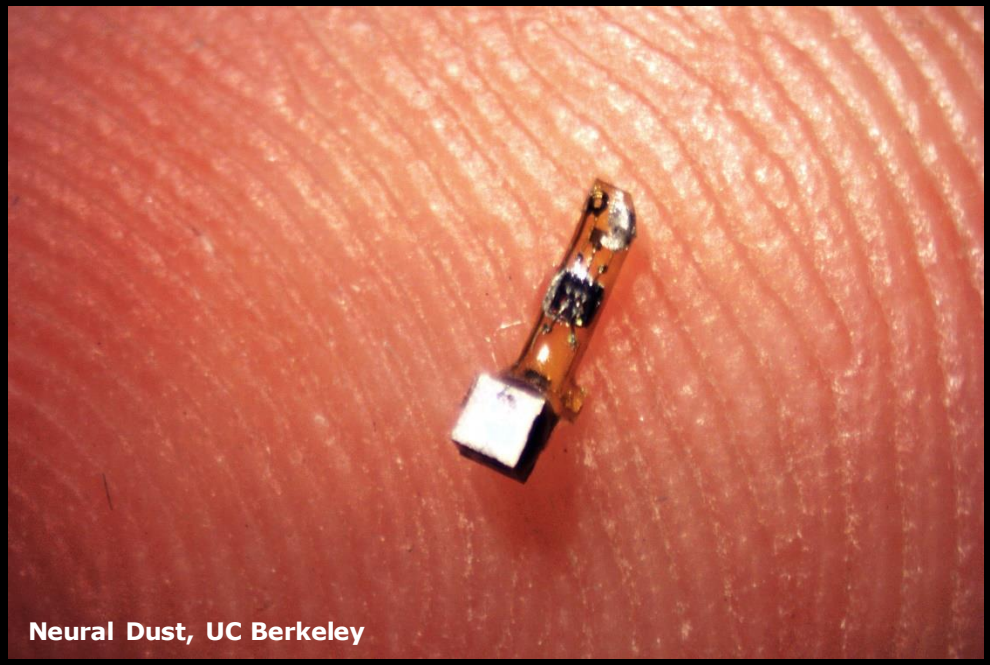
Build closed-loop interfaces



Implement on Integrated Circuits

Low-power, miniaturized, efficient, biocompatible





Ellis Meng (USC)
Technologies to interface to the brain for recording and modulation

Jose Carmena (UC Berkeley)
Brain-machine interfaces for neuroscience & clinical translation

Konrad Kording (U Penn)
Rethinking the role of machine learning in biomedical science

Azita Emami (Caltech)
Efficient feature extraction and classification in neural interfaces