



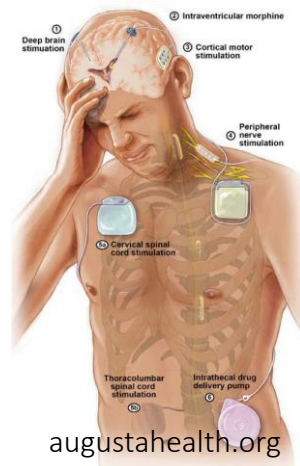
Behnaam Aazhang
J.S. Abercrombie Professor
Electrical and Computer Engineering
Rice University

Questions

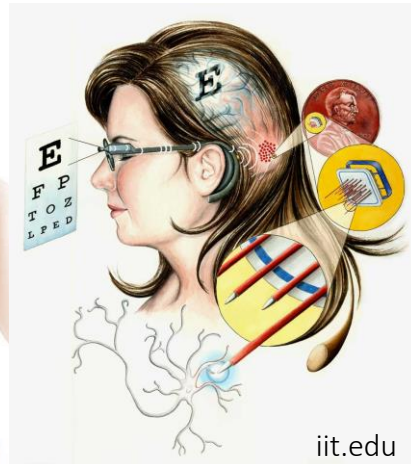
- What is NeuroEngineering?
- Why engineers?
- Why now?
- Why us?
- What am I excited about?

What is NeuroEngineering?

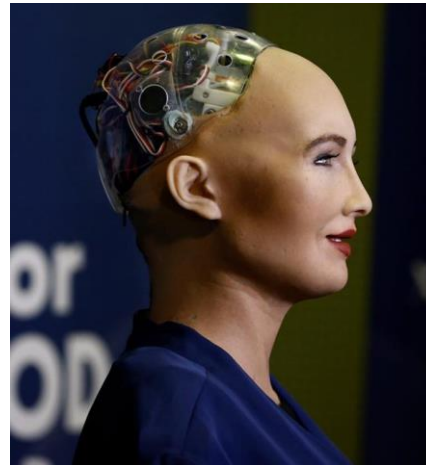
Restore



Reproduce



Enhance

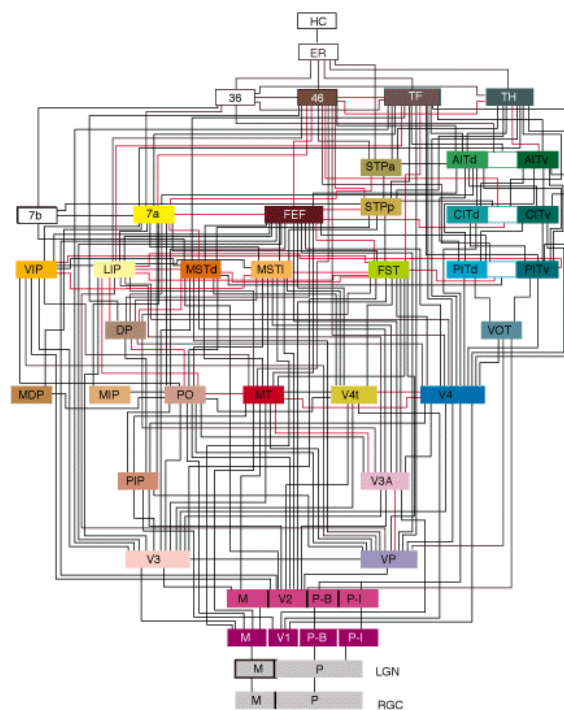


Outcome: Understanding

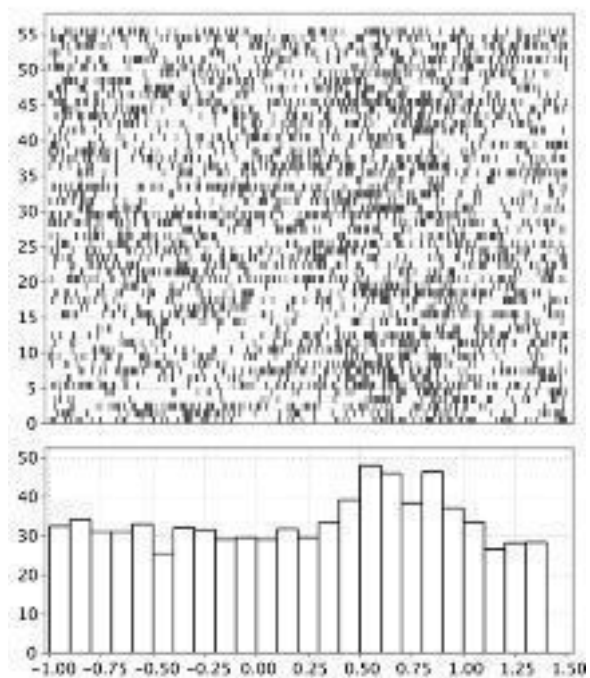
Challenges: Soft, Wet, 3D, Distributed, Nonlinear

Why engineers?

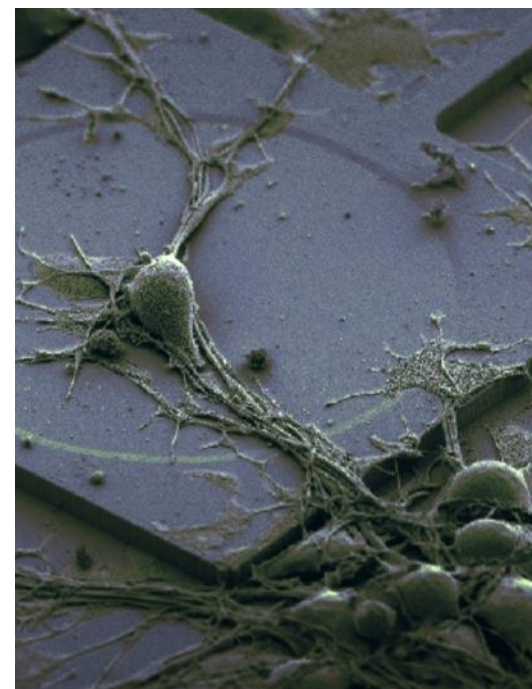
Understanding Network Architecture



Decoding Signals



Developing Hardware/Nanotechnology

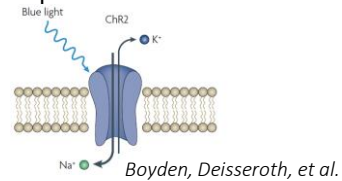


Why now?

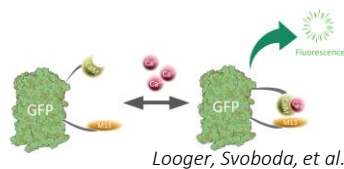
New Technologies

Genetic Engineering

Optical Write



Optical Read

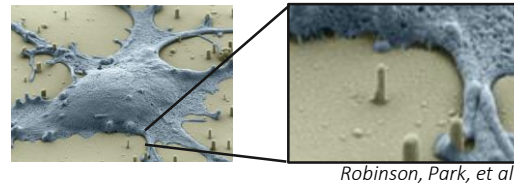


Data Sciences



Nanotechnology

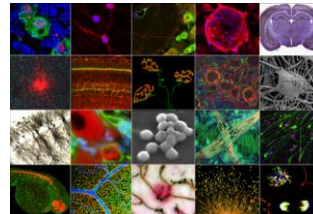
Small & Dense



Tune Material Properties



Microscopy



New Investment

Government

\$100M/yr BRAIN Initiative
\$65M DARPA NESD
\$70M IARPA MICrONS
\$100M NSF NeuroNex

Private Sector

\$715M Google + GSK
\$? Facebook B8
\$100M Kernel
\$25-100M Neuralink

2006 - 12

2013 - 16

Why us?

Get Data (Nanotechnology)



Szablowski



Xie



Luan



Robinson



Veerarag-
havan



Kemere



Raphael

Interpret and Use Data (Signal Processing)



O' Malley



Aazhang

Hardware

Algorithms



Why us?

Get Data (Nanotechnology)



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Interpret and Use Data (Signal Processing)



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Baraniuk



Allen

Hardware

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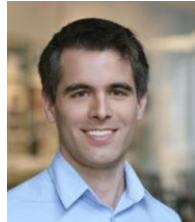


Why us?

Get Data (Nanotechnology)



Szablowski



St. Pierre



Xie



Luan



Robinson



Seymour



Veerarag-
havan



Kemere



Raphael

Interpret and Use Data (Signal Processing)



O' Malley



Pitkow



Aazhang



Patel



Baraniuk



Allen

Hardware

Algorithms

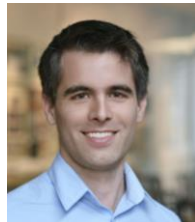


Interface

Get Data (Nanotechnology)



Szablowski



St. Pierre



Xie



Luan



Robinson



Seymour



Veerarag-
havan



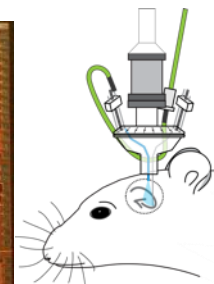
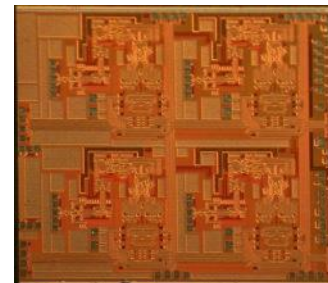
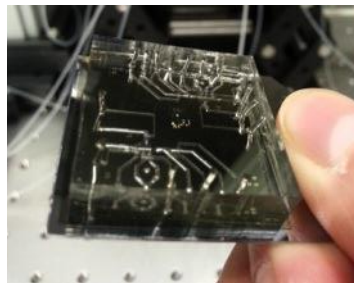
Kemere



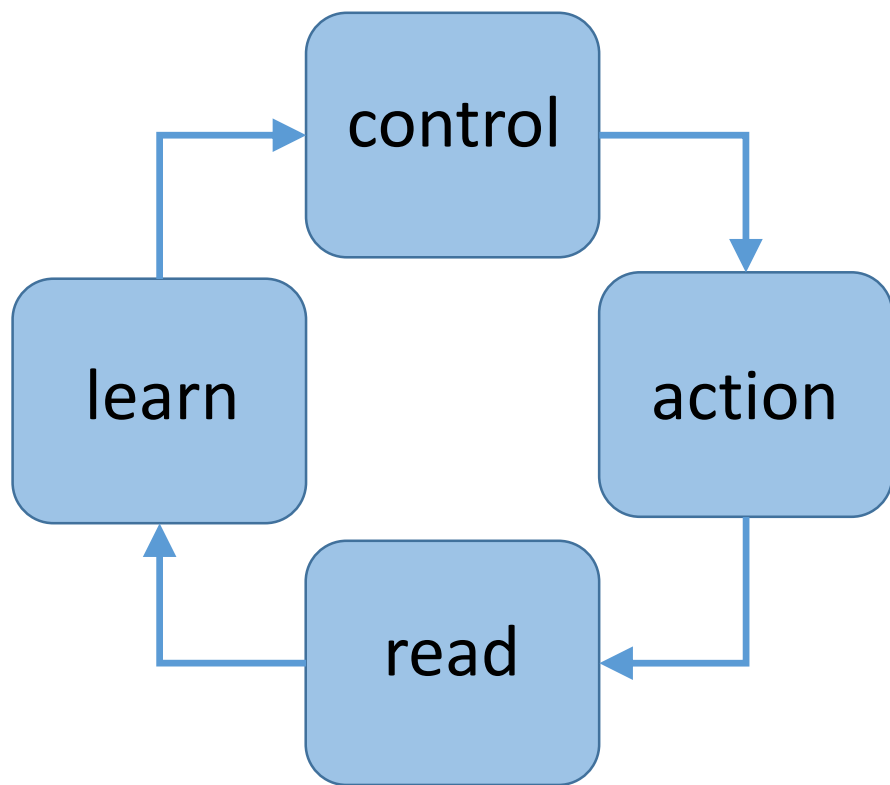
Raphael

Hardware

Algorithms



Inference, learn, control



Interpret and Use Data (Signal Processing)



O' Malley Pitkow Aazhang Patel Baraniuk Allen

Hardware

Algorithms



What am I excited about?

- non-invasive deep brain stimulation
- wireless multisite modulation of the diseased heart
- real-time closed-loop modulation for depression
- learning and socialization in primates
- understanding olfactory circuit
- modulation of epileptic circuit

