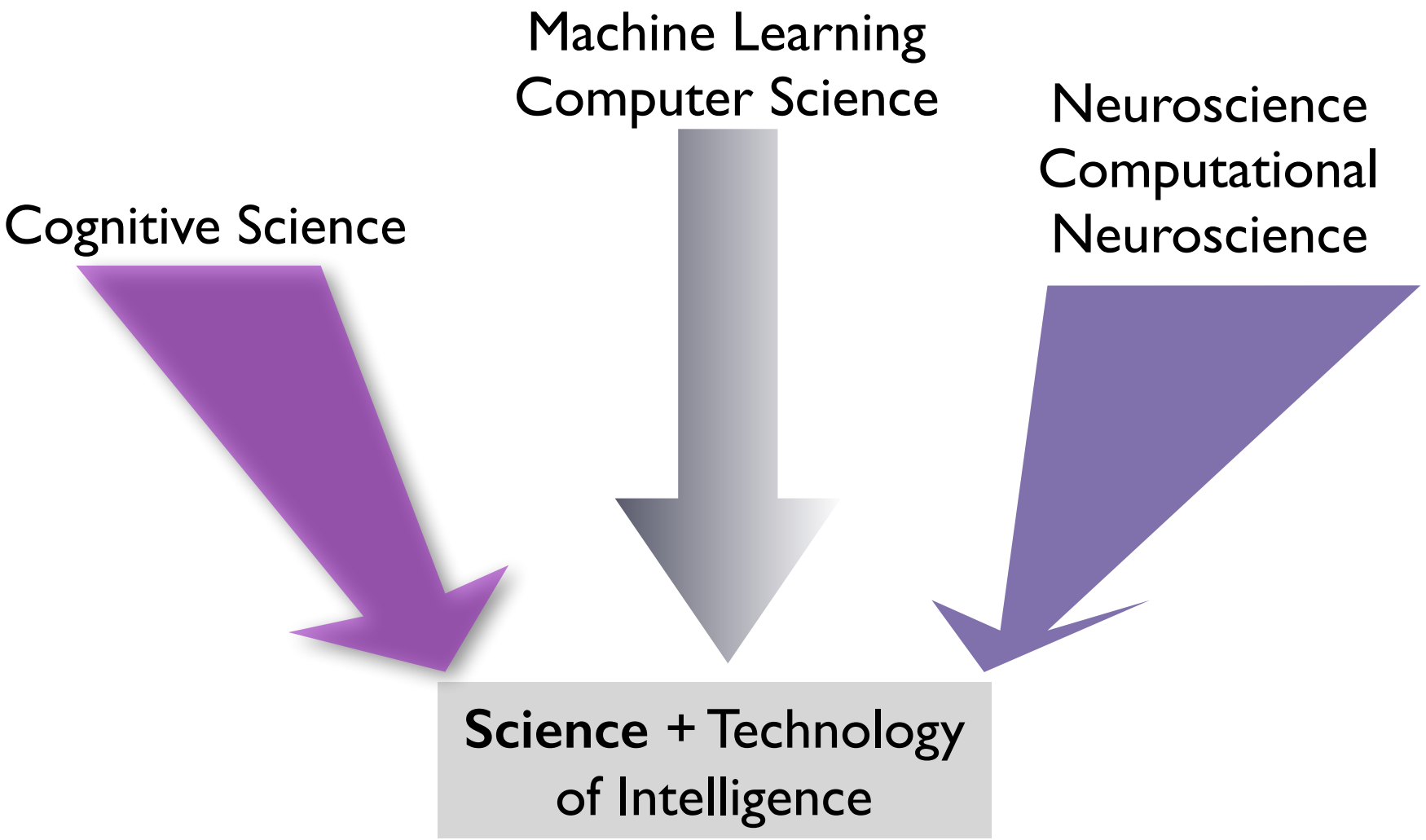
Brains, Minds, and Machines

Tomaso Poggio
MIT

Brains, Minds, and Machines
Summer Course 2015

Why now


Machine Learning
Computer Science
Neuroscience
Computational
Neuroscience
Cognitive Science
Science + Technology
of Intelligence

Center for Brains, Minds, and Machines

MIT

Boyden, Desimone, Kanwisher, Katz, Poggio, Sassanfar, Saxe, Schulz, Tenenbaum, Ullman, Wilson, Rosasco, Winston

Harvard

Blum, Kreiman, Mahadevan, Nakayama, Sompolinsky, Spelke, Valiant

Rockefeller
Freiwald

Allen Institute
Koch

UCLA
Yuille

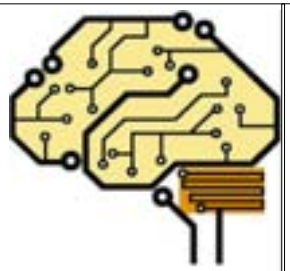
Stanford
Goodman

Hunter/Queens
Epstein, Chodorow, Sakas, Brumberg

Wellesley
Hildreth, Conway, Wiest

Puerto Rico
Bykhovaskaia, Ordonez Arce Nazario

Howard
Manaye, Chouikha, Rwebangira



The Center for Brains, Minds and Machines

A little bit of history
and
background

Why now: recent progress in AI

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Why now: very recent progress in AI

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Source: *Nature Insight* Vol. 521 no. 7553 (28 May 2015). © 2015.

Center for Brains,
Minds & Machines

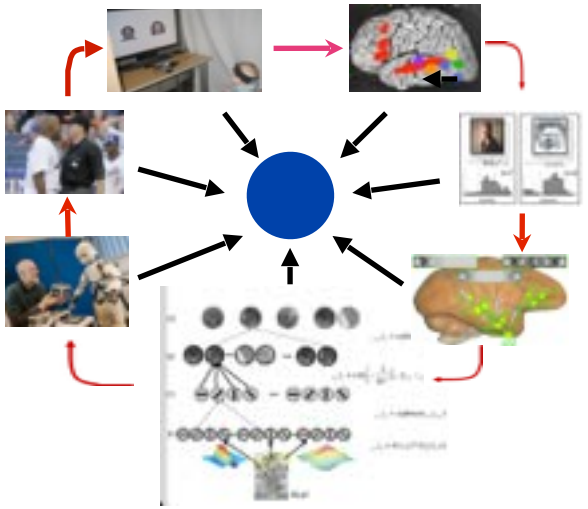
Thus we see great advances in AI based on machine learning research of 20 years ago …
but we are still very far from understanding human intelligence and the brain


What is this?
What is Hueihan doing?
What does Hueihan think about Joel's thoughts about her?

Intelligence and Turing^{++} Questions

- Intelligence —> Human Intelligence
- (Human) Intelligence: one word, many problems
- A CBMM mission: define and "answer" these *Turing^{++} Questions*

Turing^{++} Questions



The challenge is to develop computational models that answer questions about images and videos such as

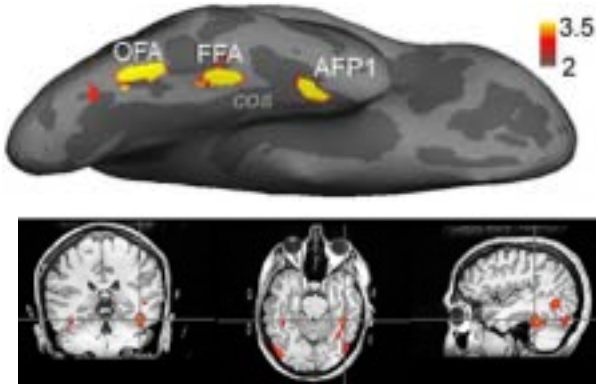
what is there / who is there / what is the person doing

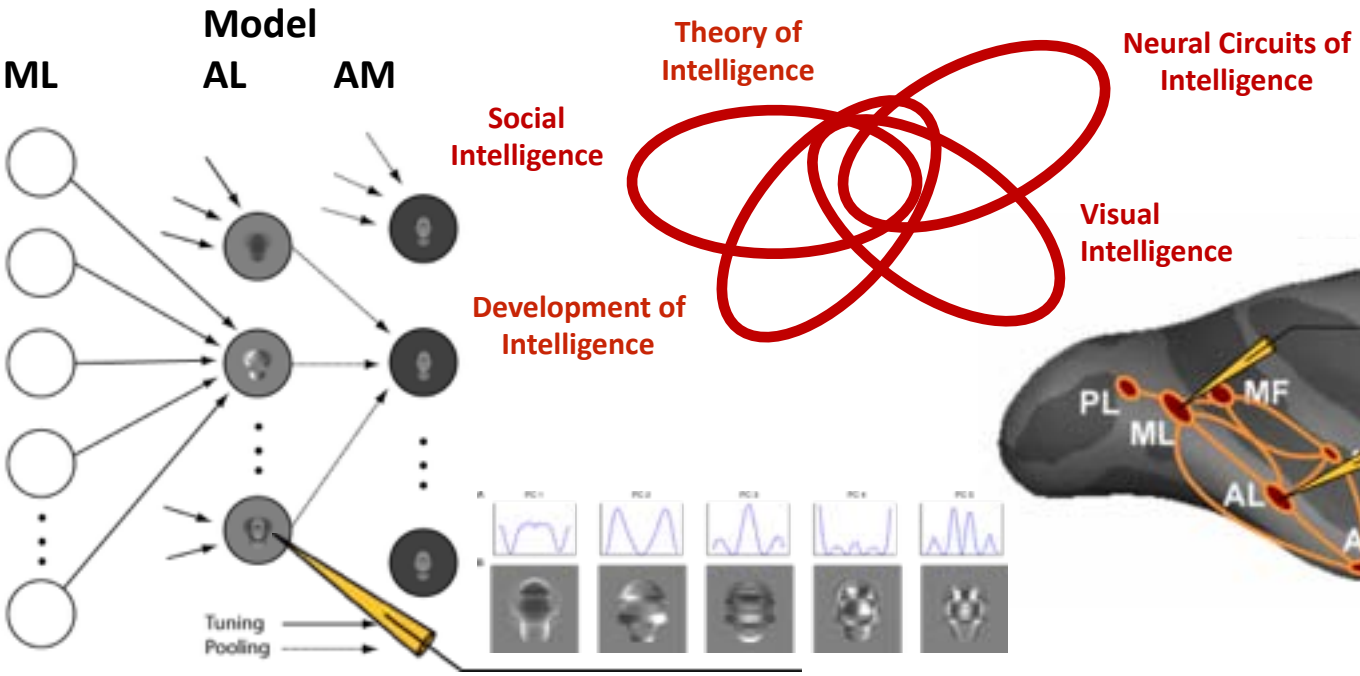
and eventually more difficult questions such as

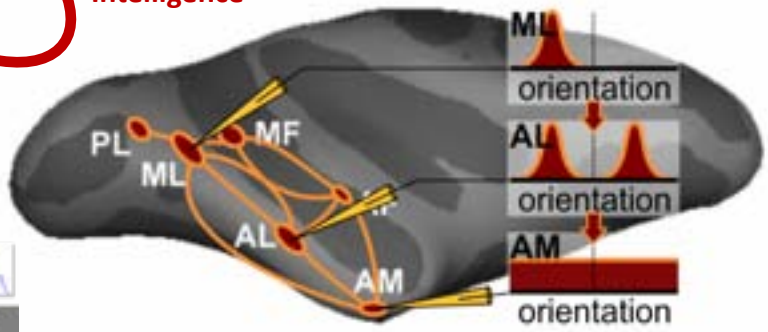
who is doing what to whom? what happens next?

at the computational, **psychophysical** and **neural** levels

The who question: face recognition from experiments to theory







A summary

To understand (human) intelligence, we must:

- Understand what we compute
- How what we compute develops
- How amplified by social interaction
- How implemented in neural tissues

Resource: Brains, Minds and Machines Summer Course

Tomaso Poggio and Gabriel Kreiman