Efficient solutions to complex perceptual problems can be found by adopting novel forms of processing based on structural computational paradigms.

Computation proceeds by constructing internal “model structures” of the observed dynamic environment.
Neuroscience ↔ IT

Available data ↔ First principles
Predictions ↔ Algorithm and systems

Engineer problem
What can IT do for Neuroscience?

- **Infrastructure**
  - Databases
  - Interoperability across different disciplines

- **Tools**
  - Recording techniques
  - Descriptive models
  - Interpretative models
Interpretative vs descriptive models

**Descriptive models:**
- Character: data-driven
- Primary purpose: to describe phenomena NOT explaining them

**Interpretative models:**
- Character: problem-driven
- Primary purpose: testable hypotheses on why the nervous system operates as it does
New interpretative models at supraneural scale of observation

traditional *inductive* analysis of the exp. data

*deductive* analysis, which starts from the task

- A solution to the problem is formulated through computational resources we expect to be available in the brain
- The “dynamics” of processing of such models would be more directly comparable with the neural observables of the “brain-in-action”
Example: binocular stereopsis

1960 Hubel & Wiesel
1970 De Valois et al.
1987 Jones & Palmer
1990 Ohzawa et al.
1996 Ohzawa et al.
2001 Anzai et al.

Daugman 1985
Adelson & Bergen 1985
Sanger 1988
Fleet & Jepson 1990-96
Qian 1997, 2000
Concluding remarks

Focus on concrete instances of a more general problem (e.g., understanding/emulating cognitive functions)

1. start from a concrete problem
2. define reachable objectives
3. avoid mere methodological research for which it is difficult to define criteria to measure the success in achieving the goals