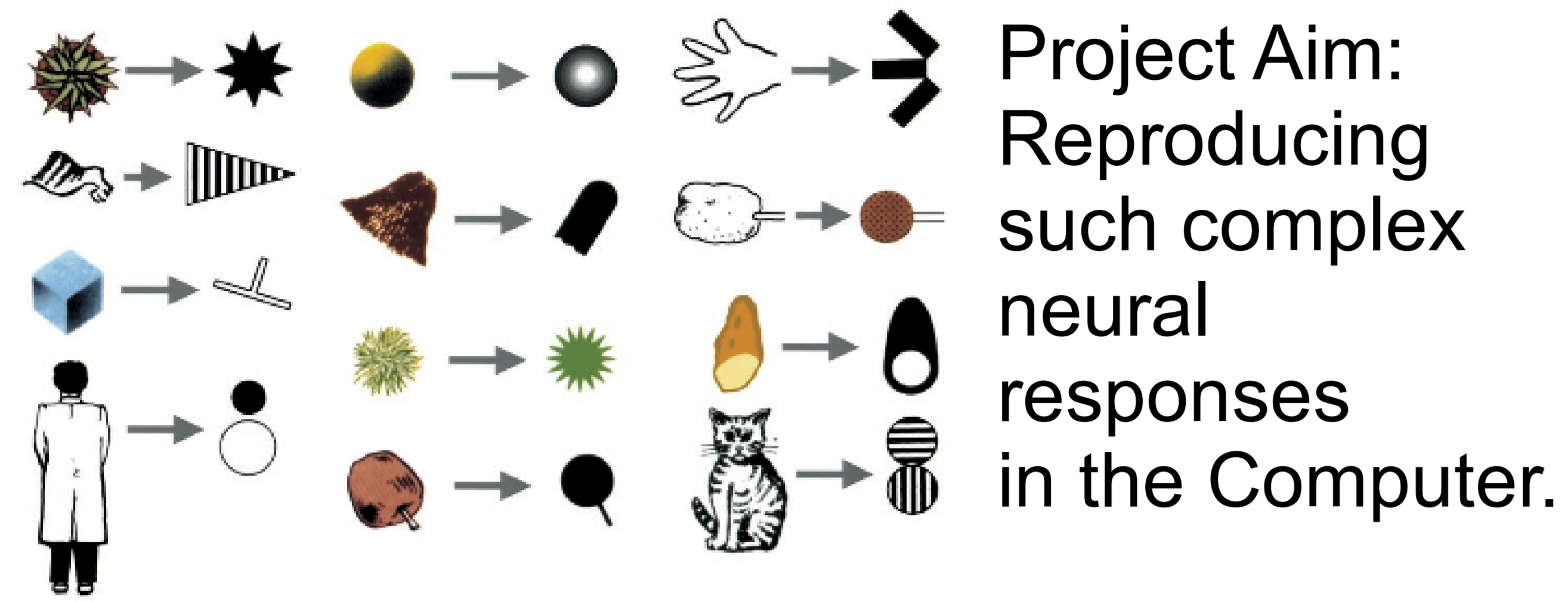


Reproducing Inferior-Temporal Cortex in the Computer: A Project Proposal

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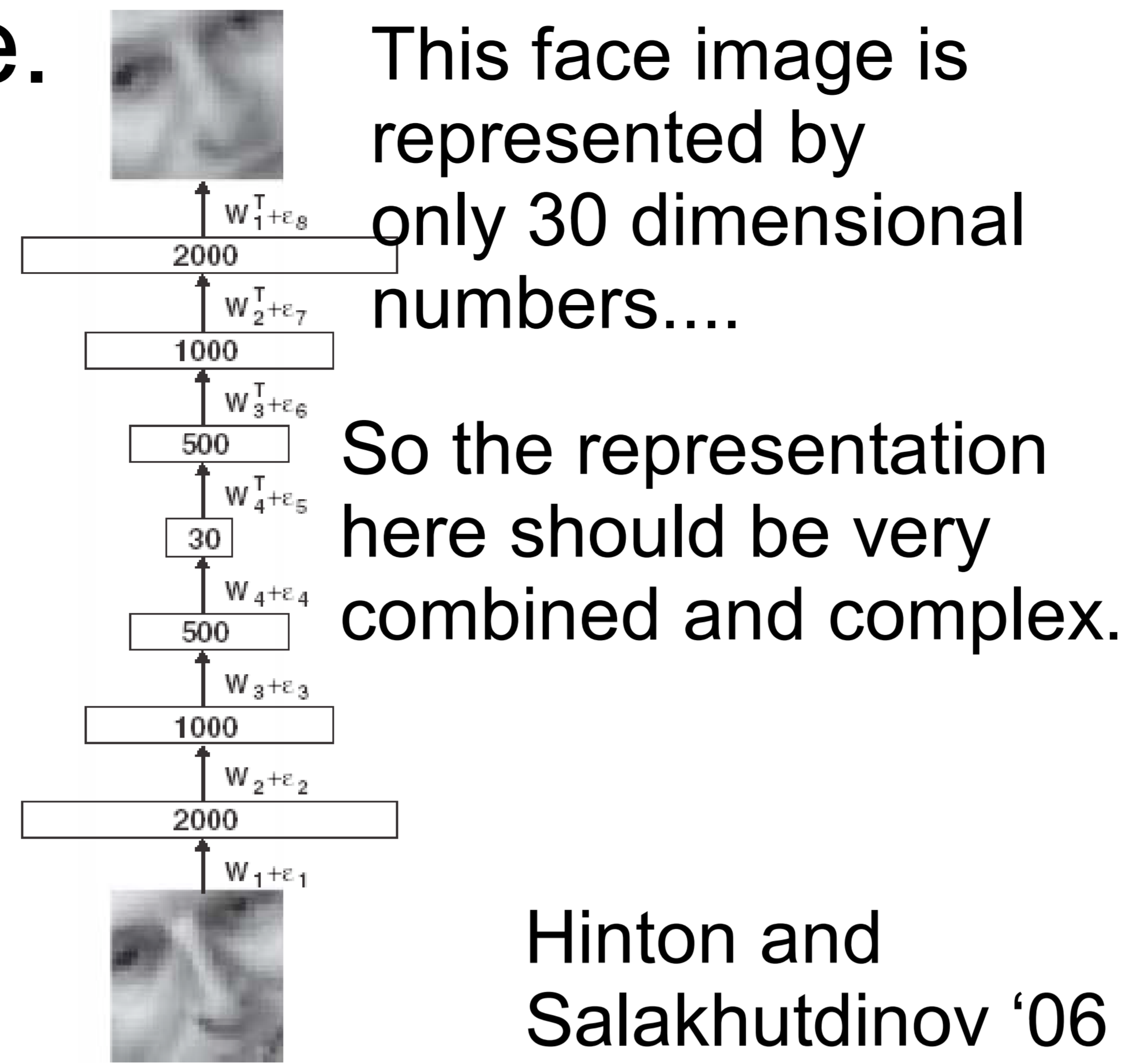
Example of actual complex cortical selectivity



taken from Keiji Tanaka '03

Project Aim:
Reproducing
such complex
neural
responses
in the Computer.

Rise of deep network made it possible.



This face image is represented by only 30 dimensional numbers....

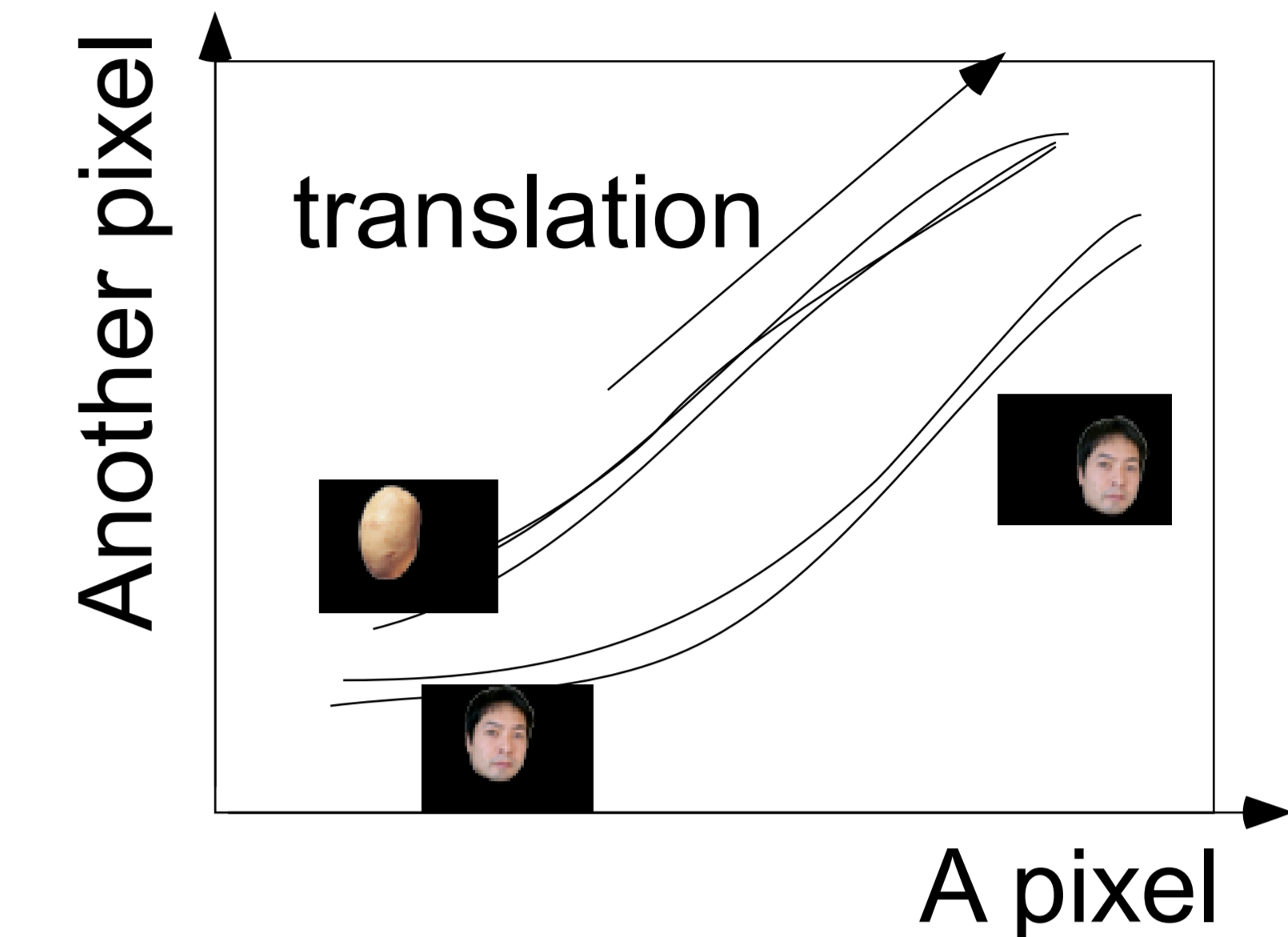
So the representation here should be very combined and complex.

Hinton and Salakhutdinov '06

It was impossible to do highly nonlinear representations. But these days, as is shown, such deep network was made possible by advancement of theory and computer.

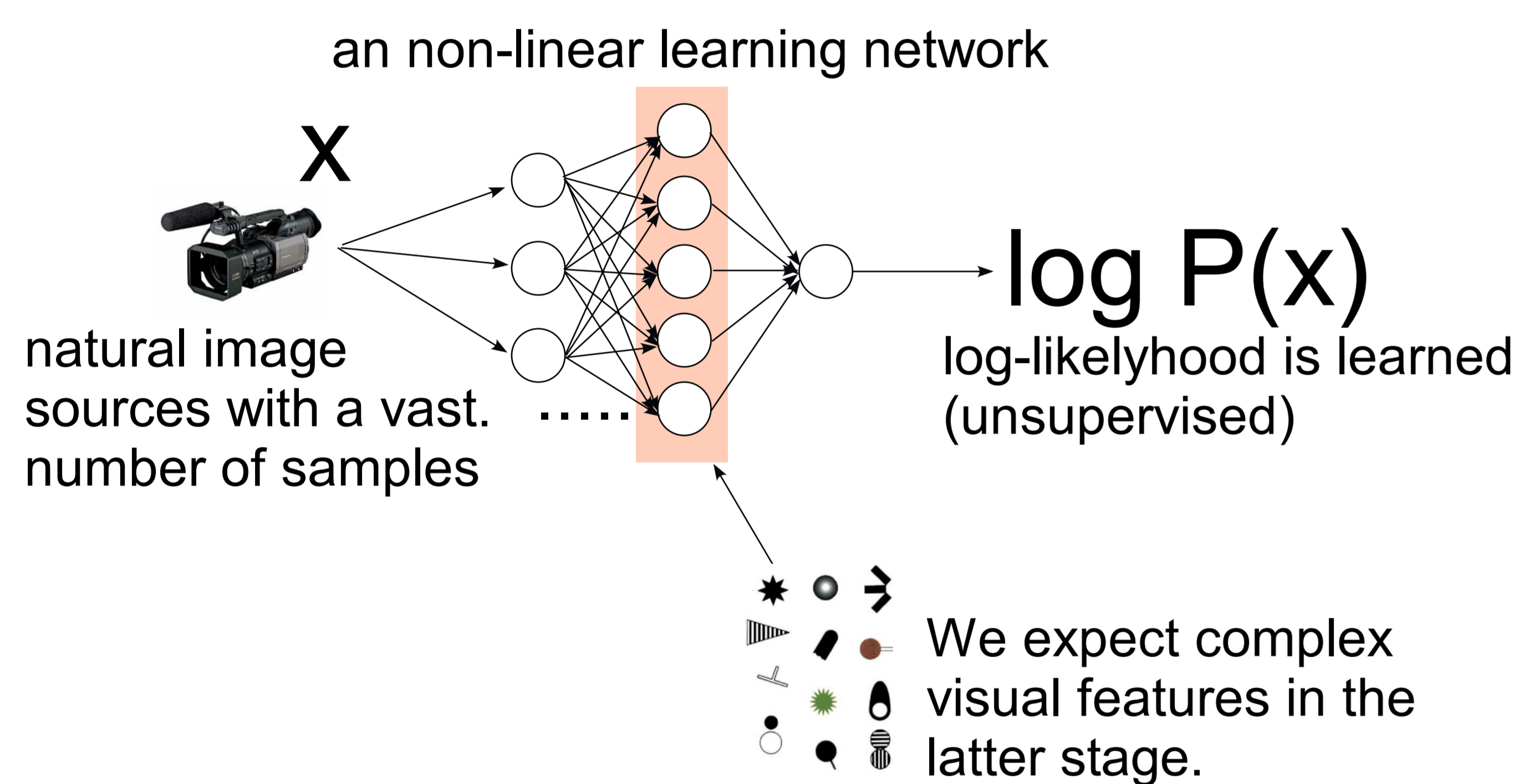
Challenge

- Huge dimension of x (input)
- Building Fast Computer
- Highly skewed and nonlinear transf. for $P(x)$

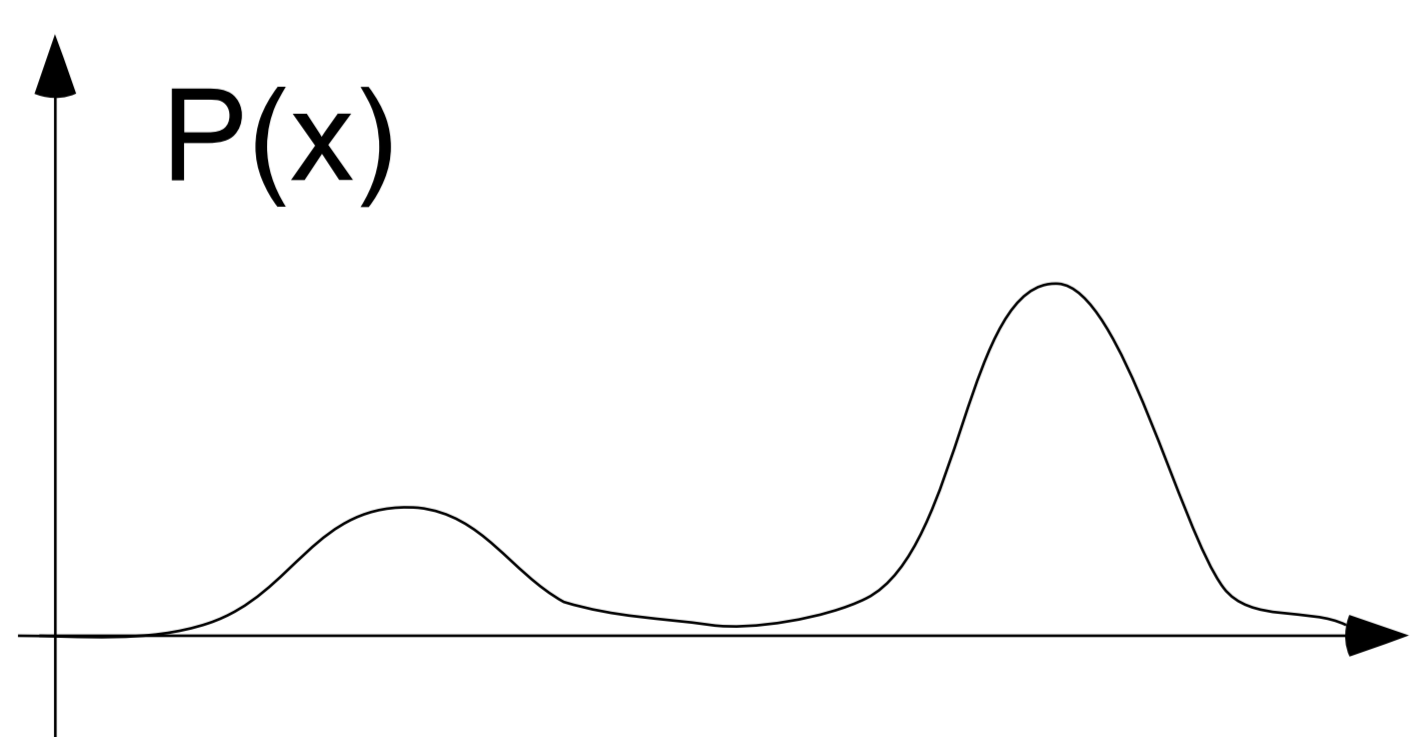


Different objects are close in pixel based dimension if the position is close. Same kind object with different identity are even closer to each other (adjacent lines).

Practically it is simply doing...



Why only obtaining $P(x)$ can naturally leads to object discrimination?



Different natural object is naturally separated in its image. But we don't know how, because the separated dimension is highly nonlinear in pixel based representation.

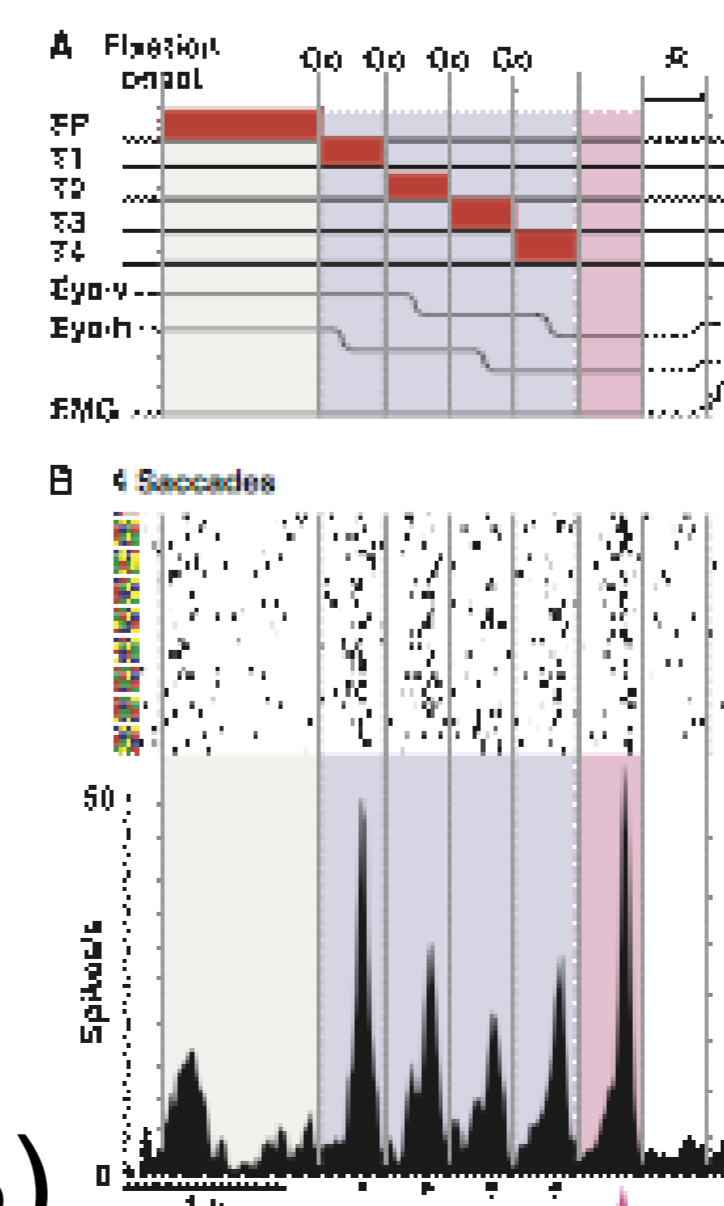
An extended project: Orthogonalizing probability distribution

Orthogonalizing probability can be:

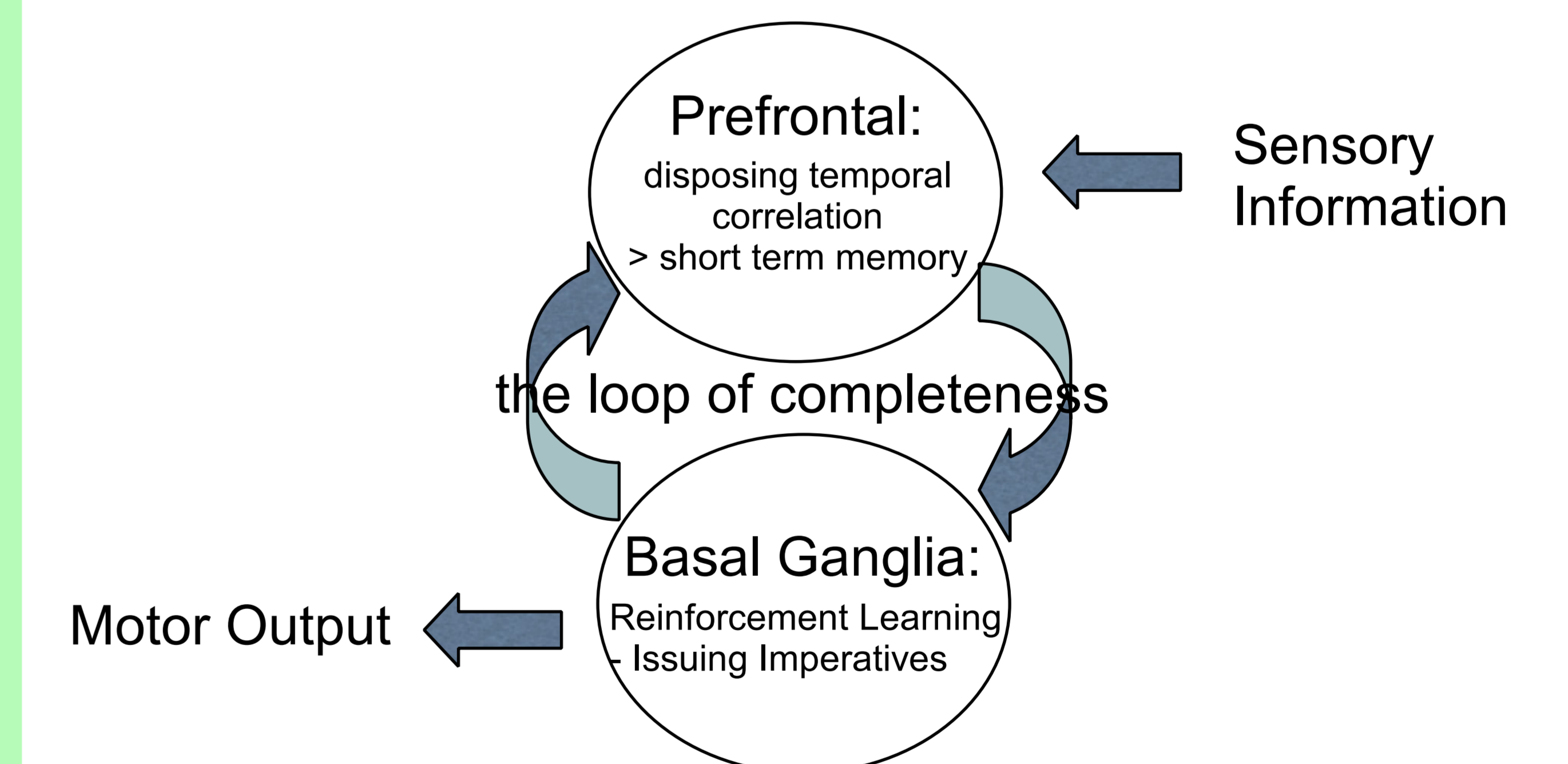
- Disposing of spatial correlation, that is, visual discrimination
- Disposing of temporal correlation, that is, motor sequence analysis and synthesis
- short term memory and self monitoring
- Disposing of redundant sequence: compression
- what is not redundant in word sequence? That is meaning.

In my opinion, such sequence selectivity can be understood by considering that the cortex is disposing of redundancy.

(Fujii and Graybiel '03)



The next project: Turing Completeness is the key to omnipotence of intelligence



Turing completeness is a natural consequence of short term memory and reinforcement learning. Short term memory works like a register of a computer, and Imperative memory works like a program.

Cortex needs some student

- Cerebellum: Kawato etc.
- Basal Ganglia: Doya etc.
- Cerebral Cortex: ???