

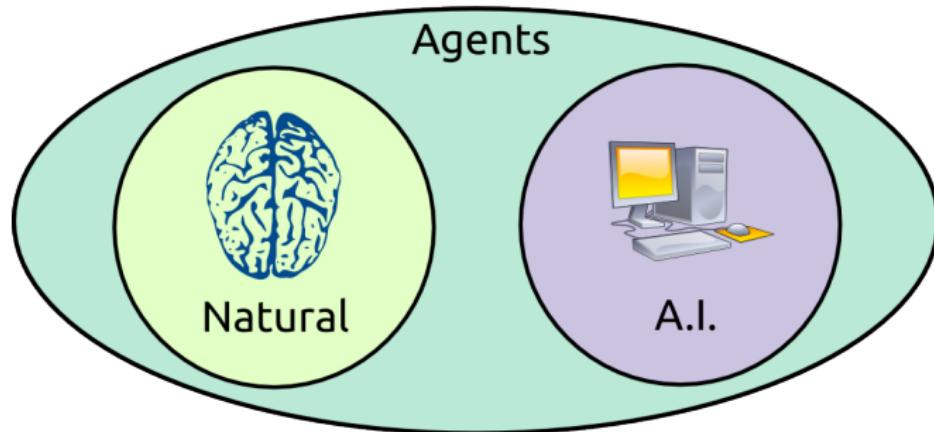
Supervised Evaluation of Representations

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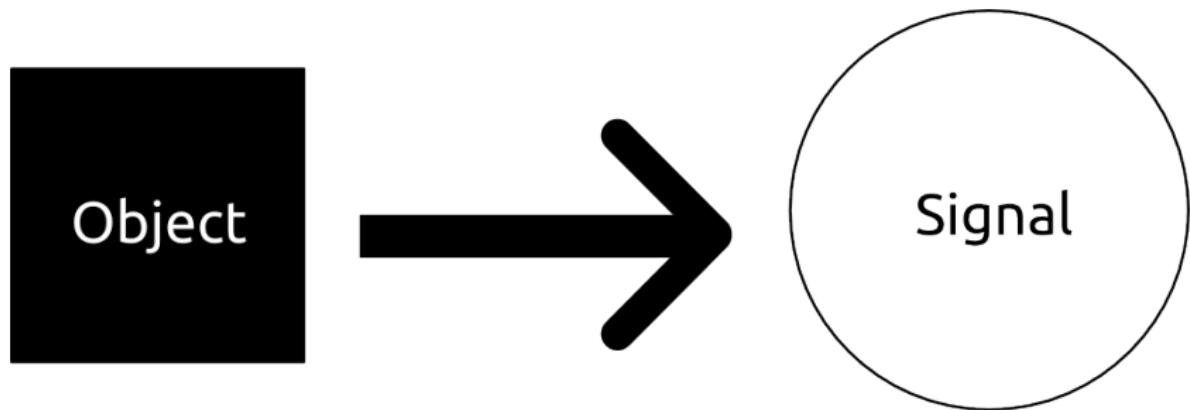
April 25, 2017

Overview



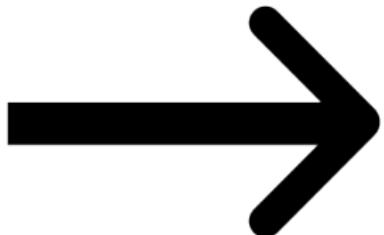
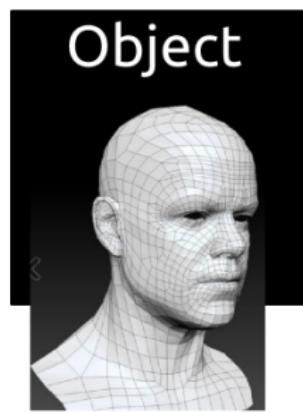
Human brains and machine learning algorithms tackle similar types of problems.

Perception

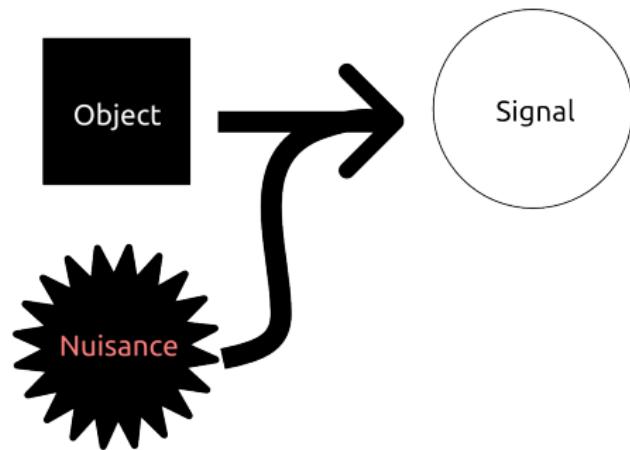


Perception: the problem of inferring *objects* in the environment given observed *signals*.

Example: face recognition

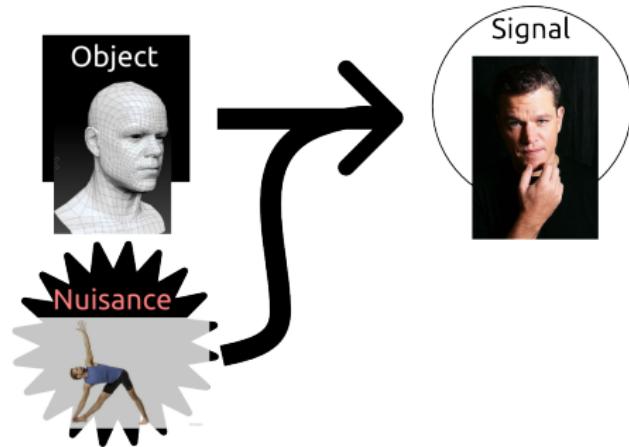


Perception



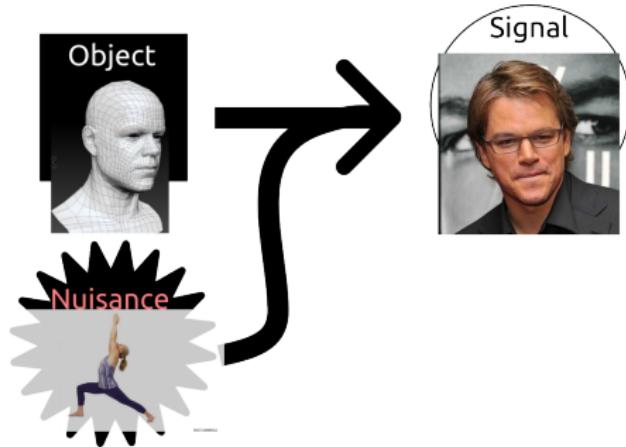
The problem is complicated because there exist some *nuisance parameters*, so the mapping from object to signal is not one-to-one.

Example: face recognition



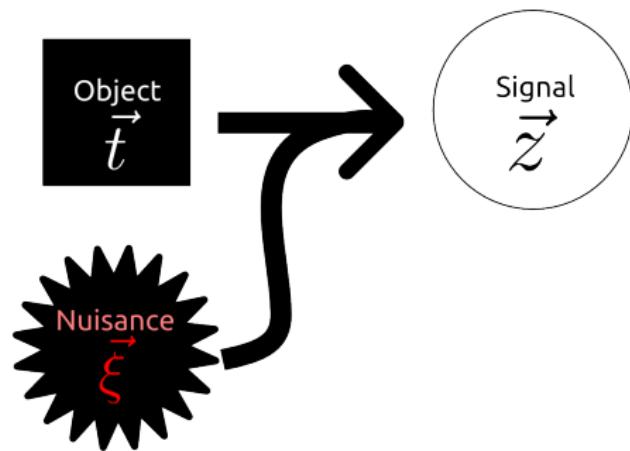
In face recognition, the *pose* (including hairstyle) and *lighting* are nuisance parameters.

Example: face recognition



The same object can map to multiple signals.

Perception



Assume there exists a function ψ that maps objects and nuisance parameters to signals:

$$\vec{z} = \psi(\vec{t}, \vec{\xi}).$$

What is a representation?

- It is often hypothesized that *complex objects* (images, sounds, etc.) can be mapped into a *low-dimensional* space
- A *representation* is a nonlinear, dimensionality-reducing mapping

Why do we care?

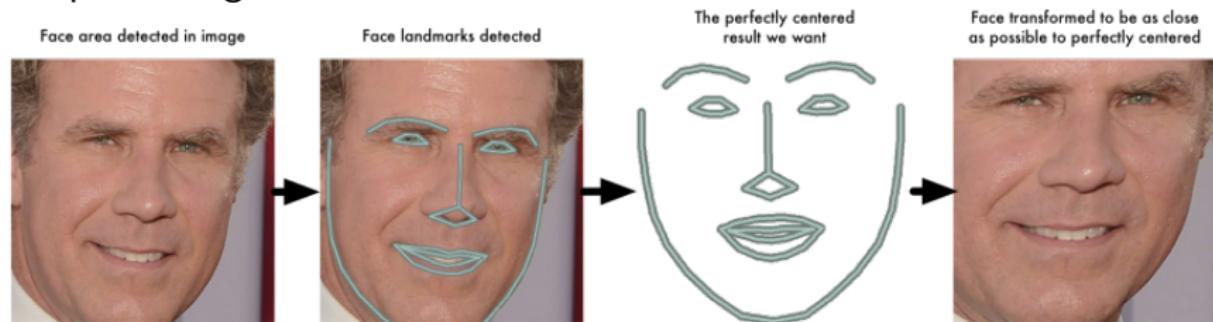
- Application 1: Neuroscience. Different regions of the brain have different representations of the same sensory stimuli.
- Application 2: Machine learning. A good representation leads to more accurate prediction.

Example: Facial recognition

- Used to tag images in software, security

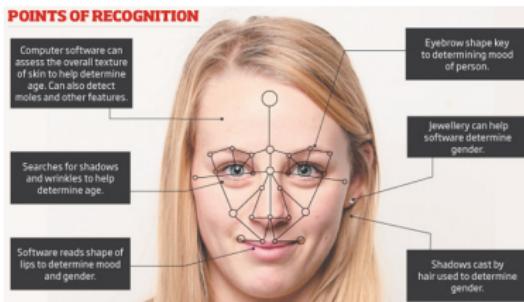
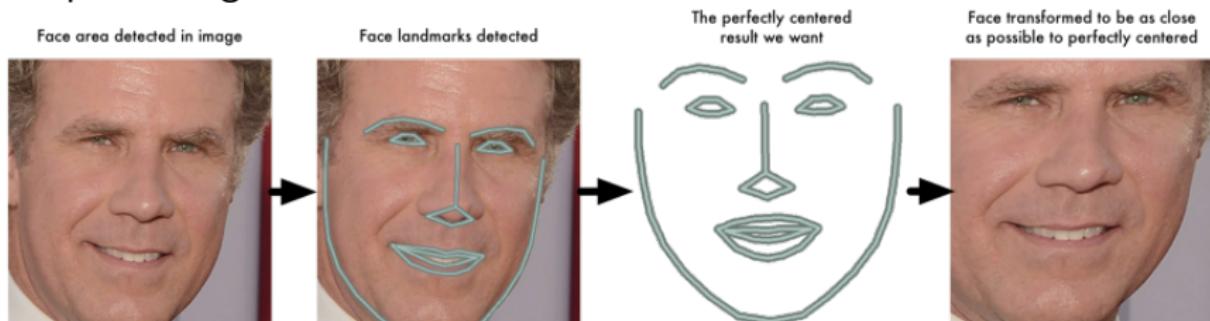
Example: Facial recognition

- Used to tag images in software, security
- Preprocessing



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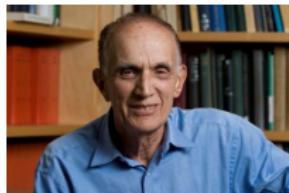
- Feature extraction

What defines a good representation?

Section 2

Acknowledgements







Section 3

The end