

# Lecture 25

## Classification, identification and reconstruction

- Stimulus representation
  - Pixel luminance
  - Local contrast
  - Object categories
  - Grating orientations
  - Semantics
- Type of brain activity
  - Neurons
  - Voxels
- Domains of decoding
  - Perceptual decoding
  - Cognitive decoding
  - Motor decoding (opposite of perceptual)
- Types of decoding
  - Classification
    - Object class to which individual exemplars may belong
  - Identification
    - Decoding very specific face
  - Reconstruction

## Encoding vs decoding

Encoding and decoding are scientifically equivalent EXCEPT that you

cannot estimate the noise ceiling for a decoder

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## **Encoding, decoding and optimization**

- The encoding model
- The decoding model
  - Platonic ideal cause we don't know the perfect encoder
- Optimization/estimation

## **Decoding: Identification**

- Very precise symmetry between identification and reconstruction

## **Importance of the prior**

Prior that is a  $1/f$  distribution of Gabor functions (sparse Gabor prior)

## **Models can be combined to improve decoding**

- Different brain areas represent different things
- Decode only from PVC very bad (structural model)
- Decode from PVC image edges, and then higher areas for semantic (semantic + structural)

## **Motion-energy decoding (early vision)**

- Direct decoding: bad
- Prior: 5000 of natural video
- MAP: highest probability video clip

- AHP: average high posterior

## **LDA scene decoding (higher vision)**

- Used in NLP
  - Method for finding the intrinsic topic structure, knowing nothing about the content
  - Use the same for natural images: label all the objects in the images
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## **Decoding and reconstructing visual imagery**

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## **Questions**

- Do you think consciousness is an emerging property of the structure of the brain
- Is your validation set of size 1