Lecture 10

Visual areas can be grouped into “what and “where“ streams”

- **Dorsal** [Parietal stream]: Where?
    - Motion
    - Spatial relationships
- **Ventral** [Inferotemporal stream]: What?
    - Form
    - Color

Ventral stream areas at different levels of the hierarchy are thought to have different functions

```
Luminance edges to Semantic categories
```

1. Retina
2. Thalamus (LGN)
3. Intermediate Visual Areas
    - V1, V2, V3, V4
    - Lateral Occipital Cortex
4. FFA (Fusiform Face Area)
5. EBA (Extrastriate Body Area) and PPA (Parahippocampal Place Area)

Receptive field size grows across the visual hierarchy

- The further in the visual processing processes, the receptive fields cross each other and converge into a non lateralized representation

Complexity of preferred shapes from across the visual hierarchy

- Neurons in intermediate visual aras prefer shapes of intermediate complexity

Possible features that might be represented in intermediate human visual areas

1. Synthetic naturalistic movie (15Hz)
2. Ground truth
    - Object silhouettes
    - Surface normals
    - Depth
3. Feature spaces
    - Silhouette contours
    - Orientation discontinuities
    - Depth discontinuities
    - Medial axes
4. Discretize feature space into feature channels
    - Degree of curvature
    - Orientation
    - Location, scale
5. Complessive output nonlinearity (log)
6. Temporal downsample (15 to 1 Hz)

The object silhouette model is best in V4/LO

- The object model is a semantic model (doesn't know about the shape)

- V4 likes the object silhouette, less the scene contours
- V4 likes the scene contour, less the object silhouette
- **V4 Image segmentation and grouping!**

Neurons in inferior temporal cortex are selective for complex shape

- Selectivity for Faces and Persons
    - Orientation
    - View point
    - Posture
    - Direction of gaze

Neurons in inferior temporal cortex are selective for complex shape

- Shape selective columns and slabs
- Sketchy
- Type 4 result: we want it to be true but we don't have enough evidence

Higher-order human visual areas are selective for complex semantic categories

A semantic category model for high-level vision

- Wordnet (1980s) by George Miller
- Hand-drawn tree of the isorelationships between all the nouns in the English language
- Indicator matrix
- Regression to find out how does the voxel response changes on the presence of a specific object

Predictions of the motion-energy versus the semantic category models

- Motion-energy model predicts lower-order visual systems
- Semantic category model predicts higher-order visual systems
- Principal component analysis:

  http://en.wikipedia.org/wiki/Principal_component_analysis

Object and action category maps

- **Blue**: indoor scenes
- **Pink**: vehicles and lots of motion
- **Red**: movement
- **Green**: People
- **Yellow**: animals