

Readings

- Forsyth Chapter 6 on Texture (uploaded online to LumiNUS)
- Leung & Malik's [original paper](#) on Textons (optional)

Summary

Motivation

- Perceived boundaries in a scene depend not only on image edges but also texture
- Image textures are a visual pattern with repeating elements
- Texture is indicative of material properties and are an important appearance cue which can be leveraged as a feature representation

Filter banks

- Texture can be represented with filter responses e.g. some statistics on the derivative of Gaussian filter responses
- A filter bank is a generalization which has multiple filters
 - d filters extracts d -dim. features; each feature is based on response of a given filter
 - filters vary in their orientation and scale to extract many different patterns
- Gabor filters combine a sinusoid with a Gaussian envelope
 - compact way to express a filter bank mathematically
 - parameters: frequency of sinusoid, scale of Gaussian envelope

Textons

- textons characterize texture by replacing each pixel with an index that represents a “type” of texture, where “type” is based on a characteristic response to a filter bank
- a texton dictionary is found by clustering filter bank responses from training images
- new test images are assigned texton IDs by doing a nearest neighbour search of filter bank response wrt dictionary clusters
- a local region is represented by taking a histogram of texton IDs in a region
- texton histograms can be used for classification or segmentation

Perceived Boundaries

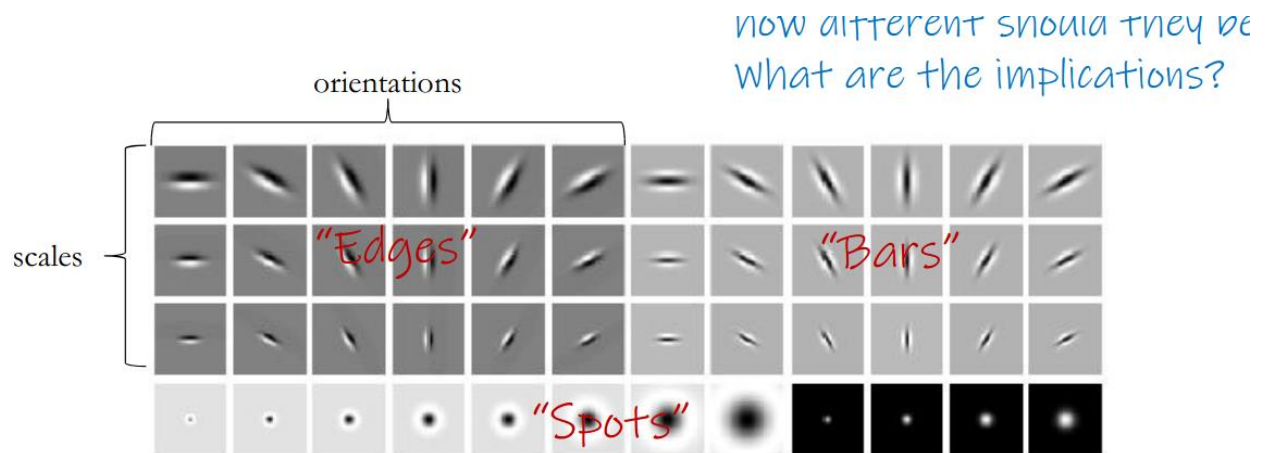
- we can learn better boundary detectors based on what humans segment
 - human perception of regions and boundaries rely gradients and textures
- a texture boundary can be identified by finding the orientation at which the texton histogram has the greatest difference

FAQs

Q: Lecture 6 mentions that "if scale is small compared to the frequency, the Gabor filters can be used as approximate derivative operators". Why would we consider using Gabor filters instead of the derivative operators when they seem more complex?

A: Both are okay. The choice really depends on what you want to achieve. If you want to apply filters for extracting gradients or taking derivatives then using the standard derivative filters that we have defined are okay. If you are already creating a filter bank with Gabor filters (a single API call), then it is more direct to use the Gabor filters.

Q: On slide 15 of lecture 6, what is the difference between edges and bars here?



And will the same filters detect edges and bars?

A: the "edge" filters in the first column are tuned for transition from dark to light, and first column of "bar" filters are tuned for light to dark to light again.