CS 231A Computer Vision (Y2011-2012 Fall) Midterm Topics

Dear CS231A students,

In order to help you study for the midterm exam, we have compiled below a list of topics that we expect you to have learned so far. Some topics are bolded, indicating a greater emphasis placed on them. The midterm exam questions will come from any of the following topics. But it is reasonable to assume that the majority of the questions will be selected from the bolded topics.

We hope this helps!
Fei-Fei

1 Face Recognition

- **Principle Component Analysis (PCA), eigenfaces (set up the problem; know the practical algorithm; know why eigenvalue/vector is a solution)**

- Difference between Eigenfaces (PCA) vs. Fisherfaces (LDA) (theory and algorithm)

- **Boosting (algorithm level)**

- **Definitions of recognition problems: difference between classification and detection**

2 Image Structure

1. Linear Filters:

    - Linear Shift Invariance
    - Convolution, **Correlation**, Discrete Fourier Transform
    - Sampling, **Aliasing**, Nyquist Sampling theorem
    - Blurring, Smoothing, Low pass filtering
    - **Pyramid Representation (algorithm for down-sampling an image)**

2. Finding lines:

    - **Canny Edge Dectection (algorithm level)**
    - **Hough Transform, pros and cons**

- **RANSAC, pros and cons**

3. Segmentation and Clustering:

    - Gestalt principles and cues
    - **k-means clustering**
    - **mean-shift segmentation**
    - **Mixture of Guassians, Expectation Maximization (EM) algorithm**
        - **Be able to compare and contrast the above methods (theory and understand when each should be used)**
    - Spectral clustering
    - **Normalized cut (theory and practical approximation, how to set up the problem, and obtain eigensolutions)**

3 Camera models

- Pinhole Camera Geometry

- **Homogeneous Coordinates**

- **Different camera models: weak, affine, projective**

    - How are parallel lines mapped?

- **Vanishing points and lines**

- **Intrinsic and extrinsic parameters (definitions, properties)**

- Affine camera model (properties)

- Camera calibration

- **Epipolar geometry**

    - **Essential matrix**
    - **Fundamental matrix**
    - **8-pt algorithm**
    - **Rectification: what is it? why is it useful?**

- Stereo vision

    - Correspondence
    - **Reconstruction**

- Structure from motion

    - **Factorization algorithm**

4   Technical tools

- **Least square, langrangian, system of linear equations (Ax=b)**

- Linear algebra

- **Classification: boosting**

- Unsupervised clustering

    - **EM**
    - **Eigensolutions**

- Correlation, convolution

- Image normalization