Review Guide for CS455+555: Machine Vision

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Contents

1 Overview

This is a summary of the topics that will be covered on the midterm exam to guide your preparation and studying.

2 Camera Calibration & The Camera Matrix

1. Be able to explain the camera matrix.

2. Why is camera calibration important?

2.1 Camera Parameters

1. What are the essential camera controls/parameters? Know what the following mean/refer to.

   - Shutter Speed
   - ISO
   - Resolution
   - Aperture
   - Focal Length
   - Focal Distance

3 Image Preprocessing

1. How do we...

   (a) create an image mask?

   (b) remove noise from an image?

   (c) reduce an image from 3 color channels to 1?

2. Blurring

3. Filtering/Image Gradients

3.1 Affine Transformations

What are Affine transformations? What do they apply to and what significant properties do they have?

3.2 Thresholding

Be able to describe thresholding, inputs, types of thresholds, and what their output is.

3.3 Morphological Operations

What are these? Be familiar with generall affect of each and what significant properities they have(size preservation).

3.4 Convolution & Kernels

Be able to explain what convolution is doing. What are kernels, how are they used for convolution, filters, blurring, *etc.*

3.5 Color Space Transformations

- What does a color space transformation do?

- What is the main color transformation used in our examples?

- What effects does this transformation have on the output image representation?

3.6 Foreground Detection

- What are we creating when "detecting the foreground"?

- In a binary image mask, which pixels represent the foreground? The background?

- What are some techniques we can use to reduce noise and improve mask quality?

3.6.1 Image Moments

- What are image moments describing?

- What is invariance? How does it relate to image moments?

4 Motion Detection

- What is the essential pixel quality we are monitoring between images to detect motion?

4.1 Background Subtraction

What is the underlying principle of background subtraction? How does it work and what conditions could cause it to fail?

4.2 Temporal Averaging

How is temporal averaging detecting motion? What is a weakness of this method?

5 Keypoints, Descriptors, & Feature Detectors

- Keypoints
  1. What are they?
  2. How are they important to feature detection and object detection?
- Descriptors
  1. What are they?
  2. How are they related to keypoints?
  3. They are produced by feature detection algorithms. What are they used for/by?

6 Feature Matching

Be able to explain what feature matching does and know at least one example of a feature matching algorithm.

7 Cascade Classifiers

What can a Cascade Classifier do? What are they related to?