

Advanced Perception: Lecture 1

Intro, Convolution and Edges

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1 Intro

The first 2 lectures are only us, then we are grouped with some other students who has to have the general introduction.

There will be a miniproject after we are done in the lectures. Group based, and a presentation in front of the class.

We need to program in OpenCV in either

- C++
- Python

1.1 Exam

20 minutes, oral exam.

1.2 Projects of the institute

- Inspection of windmills
- Vision based slaughtering
- etc.

2 Learning objectives

- Feature point algorithms
- Feature selection and reduction
- Motion analysis
- Tracking frameworks
- Advanced perception integrated into robotics

2.1 Features

We will look at more advanced features, detection and recognition, tracking etc. used for tracking cars etc. Features can be used to create panorama images.

3 Image correlation

Find correlation in the input image

$$g(x, y) = h * f(x, y) = \sum_{-n}^n x$$

4 Mean filter

arrange the pixelvalues of the input image in the kernel, and do the average of it. Set the input of the center of the kernel in the output image.

5 Convolution

Convolutional neural networks do classical cross correlation.

The difference between convolution and correlation is in convolution the array is flipped and then run opposite.

6 Edge detection

7 Canny and Sobel

Canny is just sobel with more defined stuff. Canny is better.

8 Laplacian

Uses second order partial derivatives of the kernel.

Laplacian is sensitive to noise, so it is a good idea to use a smoothing kernel.

Can use fourier transform to filter out low frequency information or high frequency. Keep edges = high frequency.

9 Difference of Gaussian

Standard deviation is used to control the level of blurred ness.

10 Canny edge detector

1. Smooth the image
2. Calculate the gradient and magnitude
3. Non-maximum suppression = keep the pixel value which has the highest probability of being an edge.

Find the pixel we want to keep by going along the gradient, and find the pixel with the highest value.

Can potentially use 2 thresholds, to provide an interval.

11 Harris corners

Harris corners will be explained next week. Try today in the exercises. Goal: Match two images. Easier if they are partly overlapping.