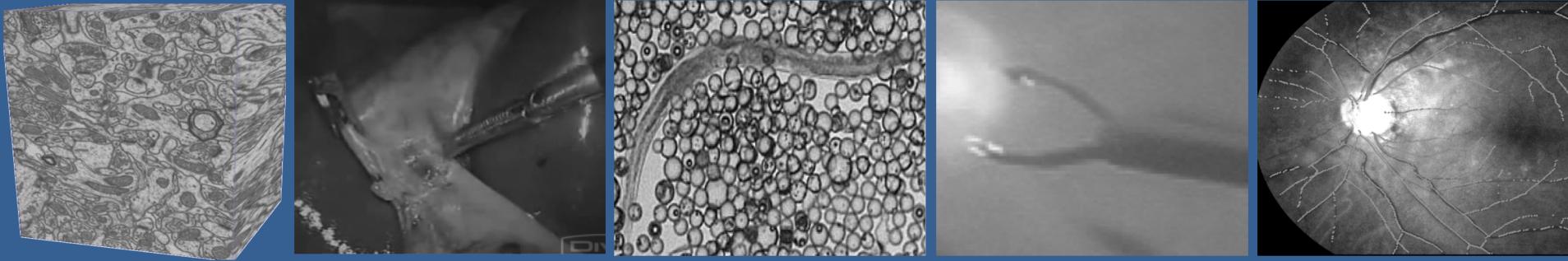


Introduction to Signal and Image Processing

Spring 2019

Lecture 0:
Course introduction



Course introduction

Lectures:

- Wednesdays, 14h15 to 17h00
- Once a week: Start: 20/02/2019 - End: 29/05/2019
- Hörraum 206, Hauptgebäude H4

Instructor:

Prof. Dr. Raphael Sznitman

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Teaching Assistants:

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Course Evaluation

Deliverables

- Midterm Exam (18/04/2018) 15%
- Final Exam (TBD) 35%
- Homeworks (3) 35%
- Group Project 15%

Note: If your final exam grade is higher than your midterm, then your midterm grade will be changed to that of your final grade.

Note: Practice midterm and final will be provided

Note: Feedback of homeworks will be given as quickly as possible

Course Evaluation

Group Project:

- Teams of 2/3 people
- Will last 3-4 weeks
- Project will be the same for all groups and set up as a competition
- Groups will present solutions at the end project
- Small report (2-3 pages) will be required

Homeworks

- To be done individually
- Hand-in will be done electronically and must be done by a specific time and date. 0 will be given if late.
- Will consist of written and Python code exercises
- Will take between 8-10 hours to complete
- Hand-in will be electronically.

Course objectives

- An introductory level understanding of algorithms for signal and image analysis
- Build a competence in programing for image processing
- A broad understanding of signals and images for the purpose of analysis.

To do this you will:

- Learn about algorithms
- Theory behind signals and mathematical formulations
- Understand the models underlying methods and their limitations
- See the impact of algorithmic complexity

Tentative course schedule

Lecture #	Title	Date
1	Course introduction and basics	20/02/19
2	Introduction to Images and Perception	27/02/19
3	Interpolation and Sampling	06/03/19
4	Linear Filtering	13/03/19
5	Edges, Corners, Lines (I)	20/03/19
6	Edges, Corners, Lines (II)	27/03/19
7	Midterm Exam	03/04/19
8	Midterm Post-mortem & Texture Analysis (I)	18/04/19
9	Texture Analysis (II)	02/04/19
10	Image segmentation (I)	01/05/19
11	Image segmentation (II)	08/05/19
12	Image denoising (I)	15/05/19
13	Image denoising (II)	22/05/19
14	Final Preparation & Project Presentations	29/05/19

Will try to post slides before each class on ILIAS.

Rough lecture schedule:

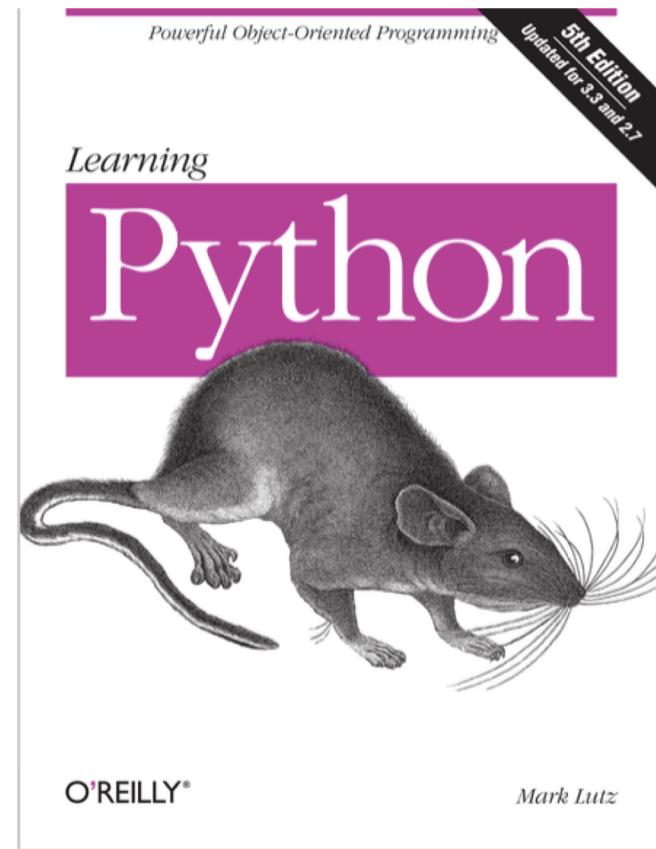
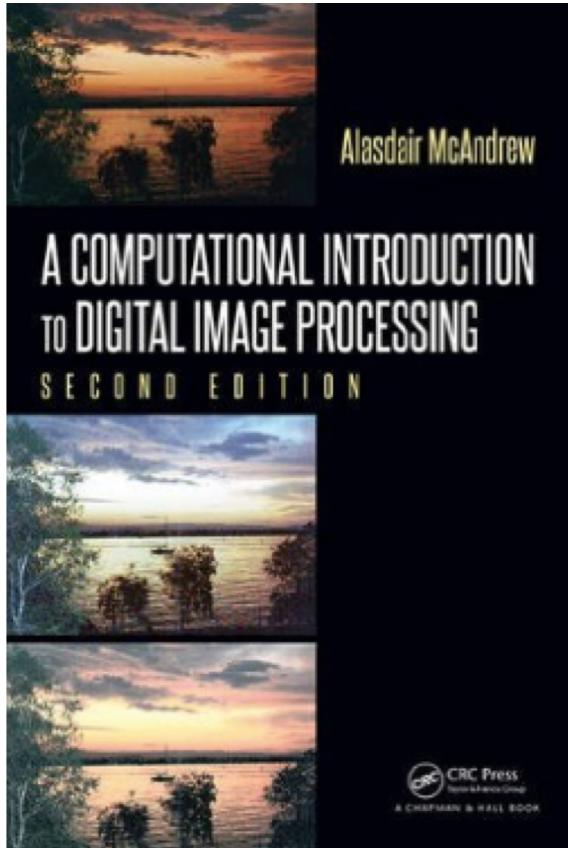
- 2 hours of course material (including break)
- 1 hour for homework support (led by two TAs)

Last comments

Comment 1: We will set up a message board on ILIAS. Please free to use.

Comment 2: Lectures will be a mixture of slides and on the board derivations / examples. We will provide course slides and try to provide you with board material as much as we can.

Some references of interest

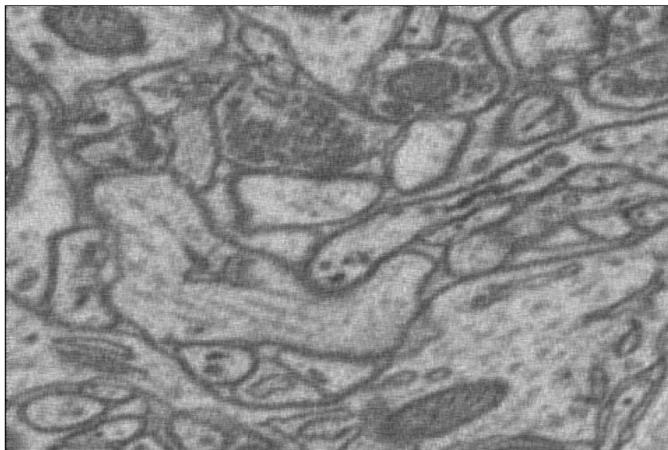
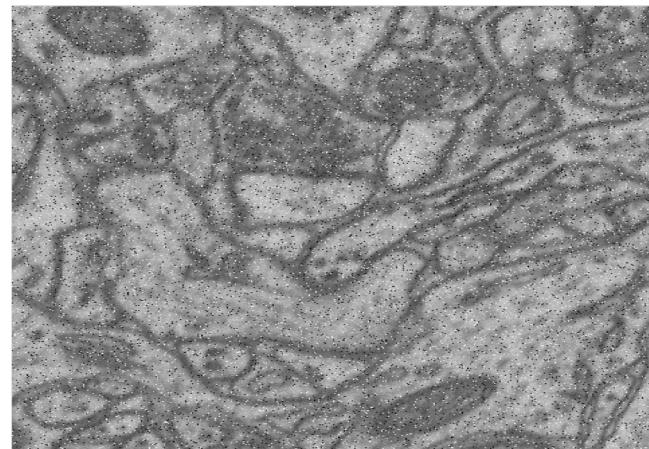


Course material examples: image noise and denoising

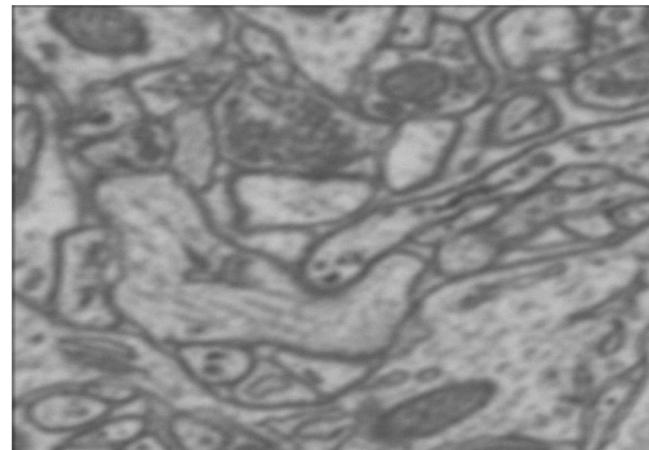
EM Slice Rodent brain sample



Salt and pepper noise



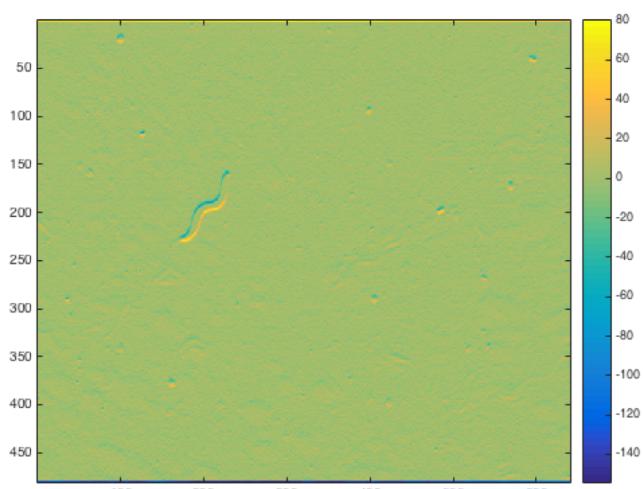
Denoising



Gaussian blurring

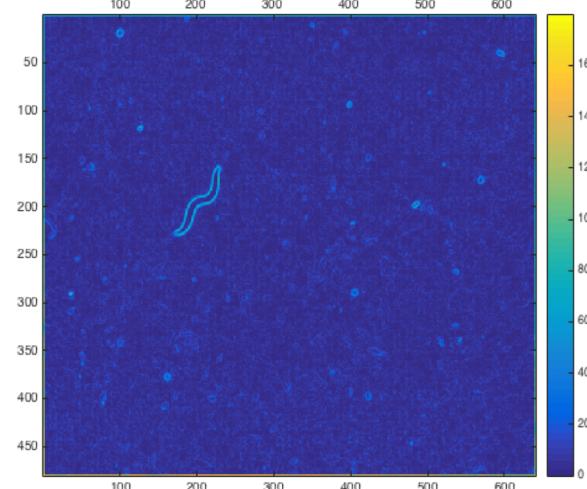
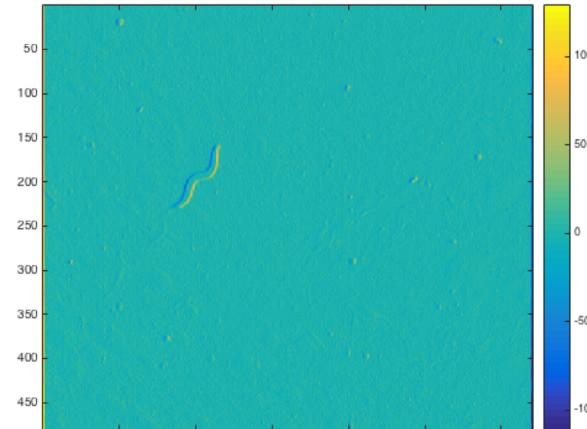
Course material examples: finding edges

C. elegans nematodes



Edge in Y-direction

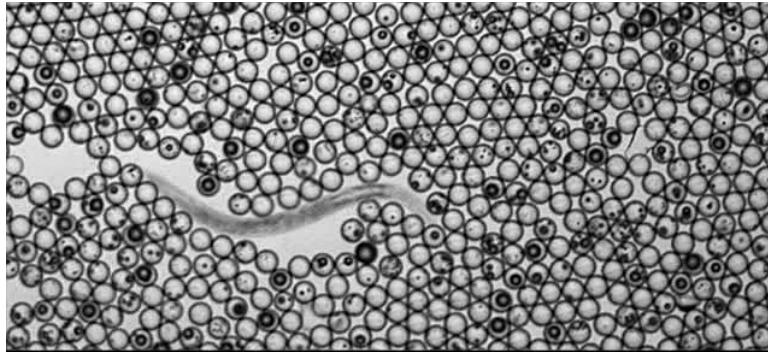
Edges in X-direction



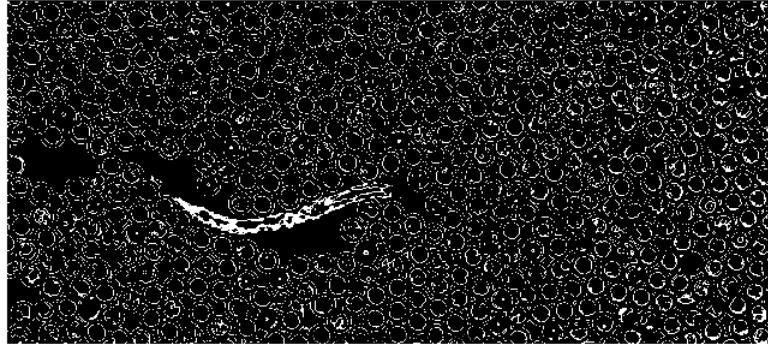
Edges

Course material examples: thresholding and smoothing

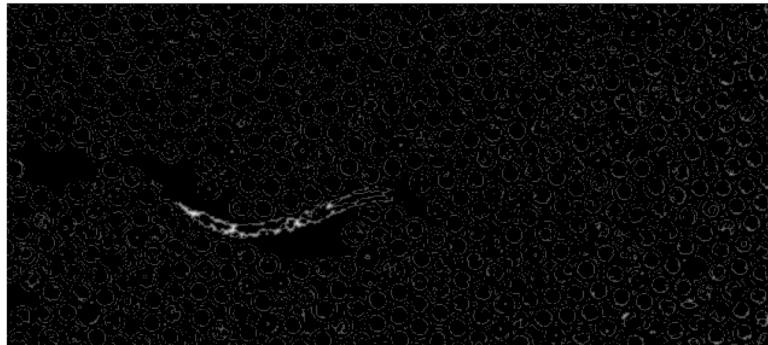
Threshold
segmentation



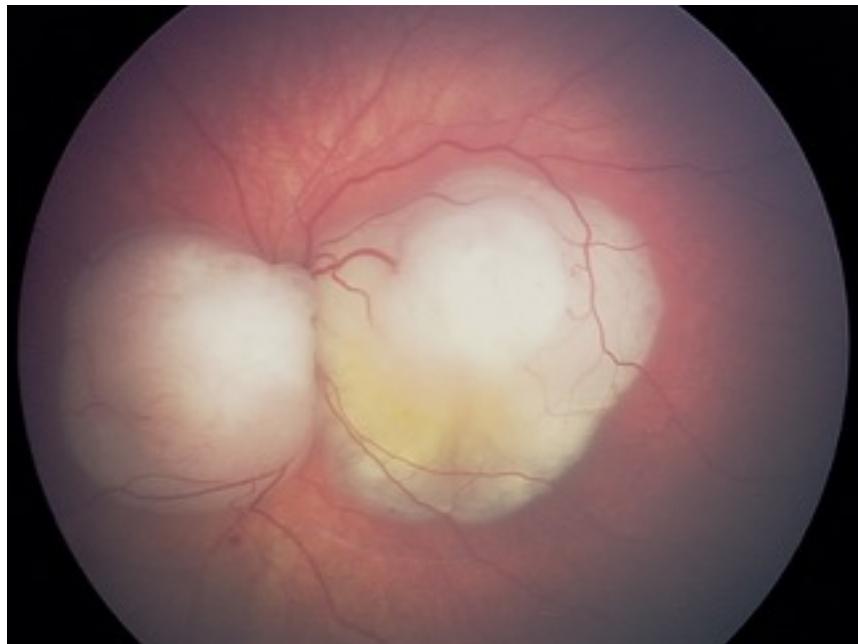
Nematode



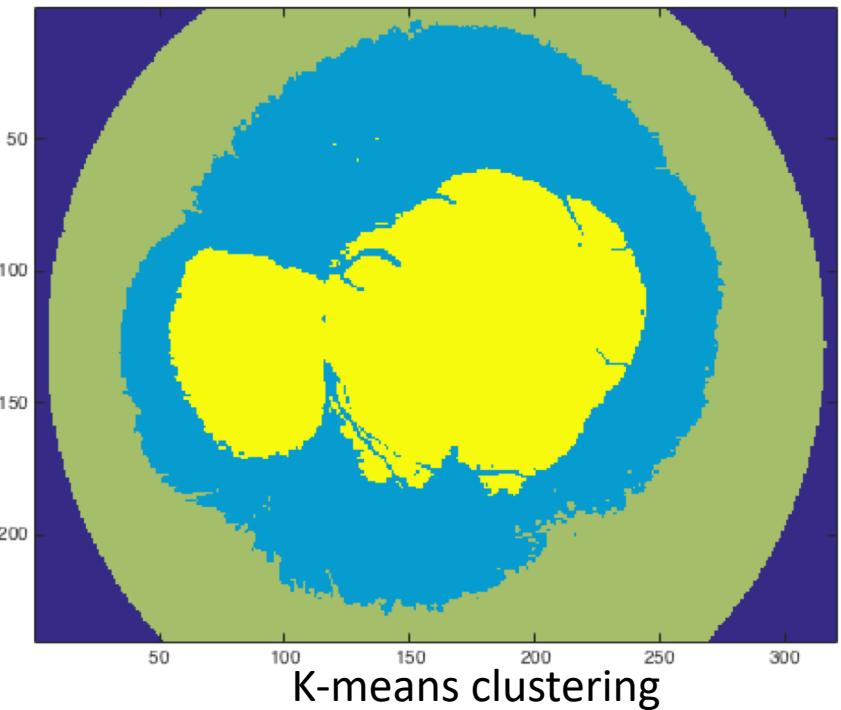
Distance
Transform



Course material examples: region segmentation



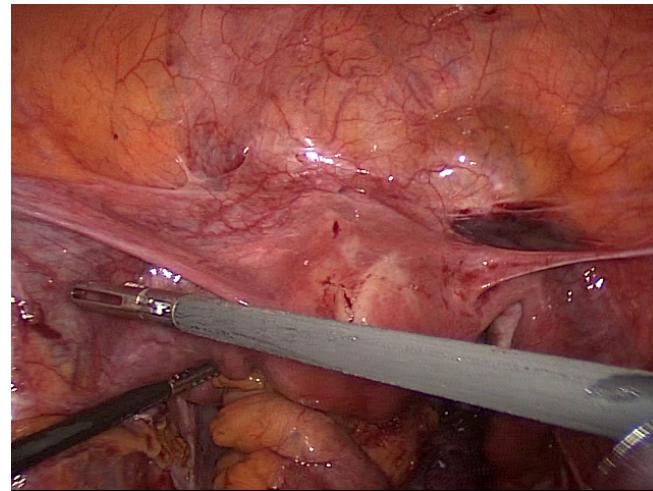
Fundus with eye tumor



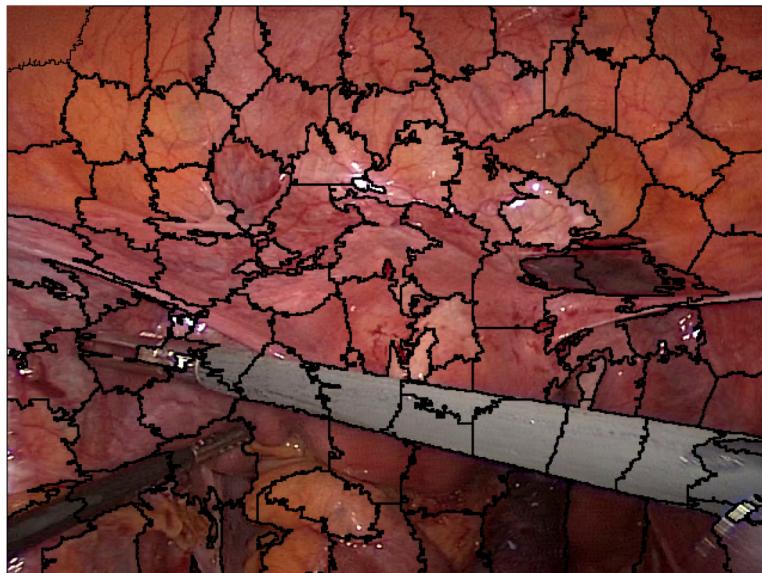
K-means clustering

Course material examples: pixel grouping

Laparoscopic scene



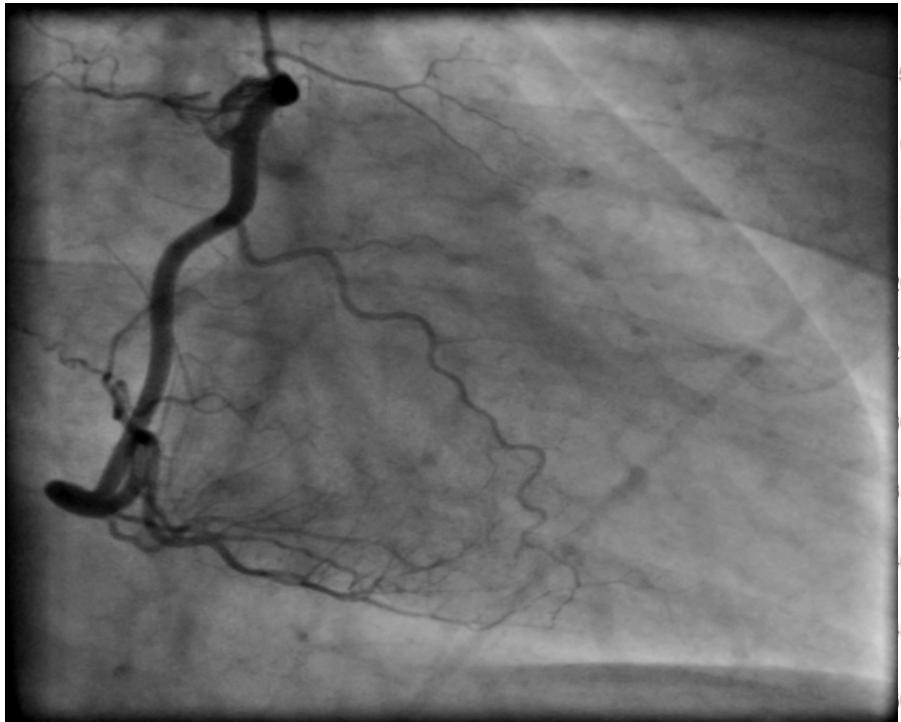
Super-pixelation



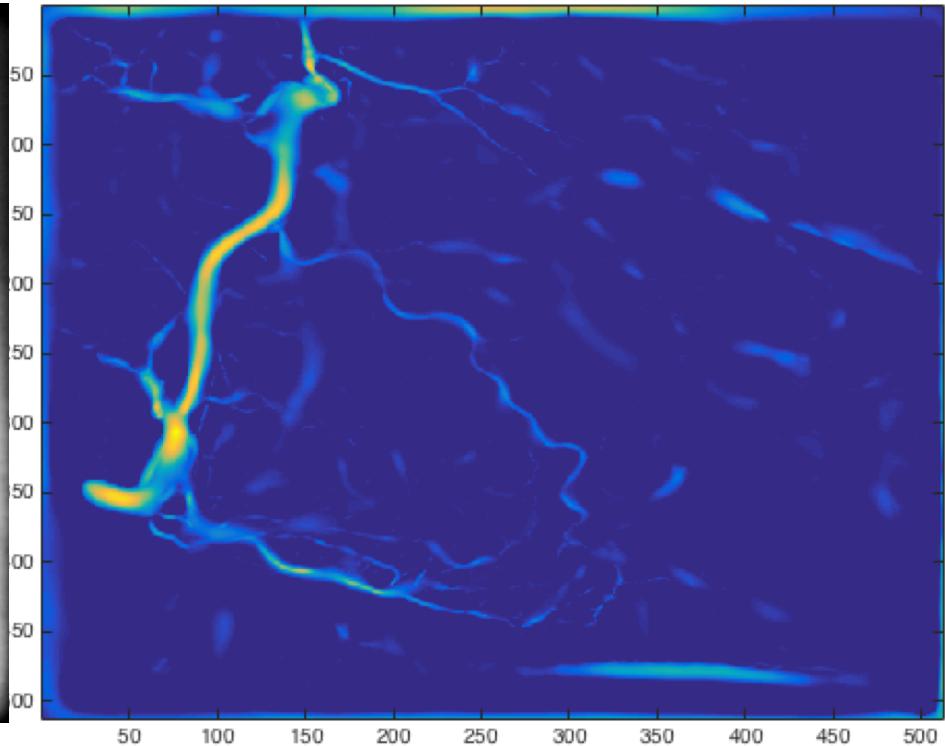
Watershed grouping



Course material examples: vessel segmentation



Heart Angiogram

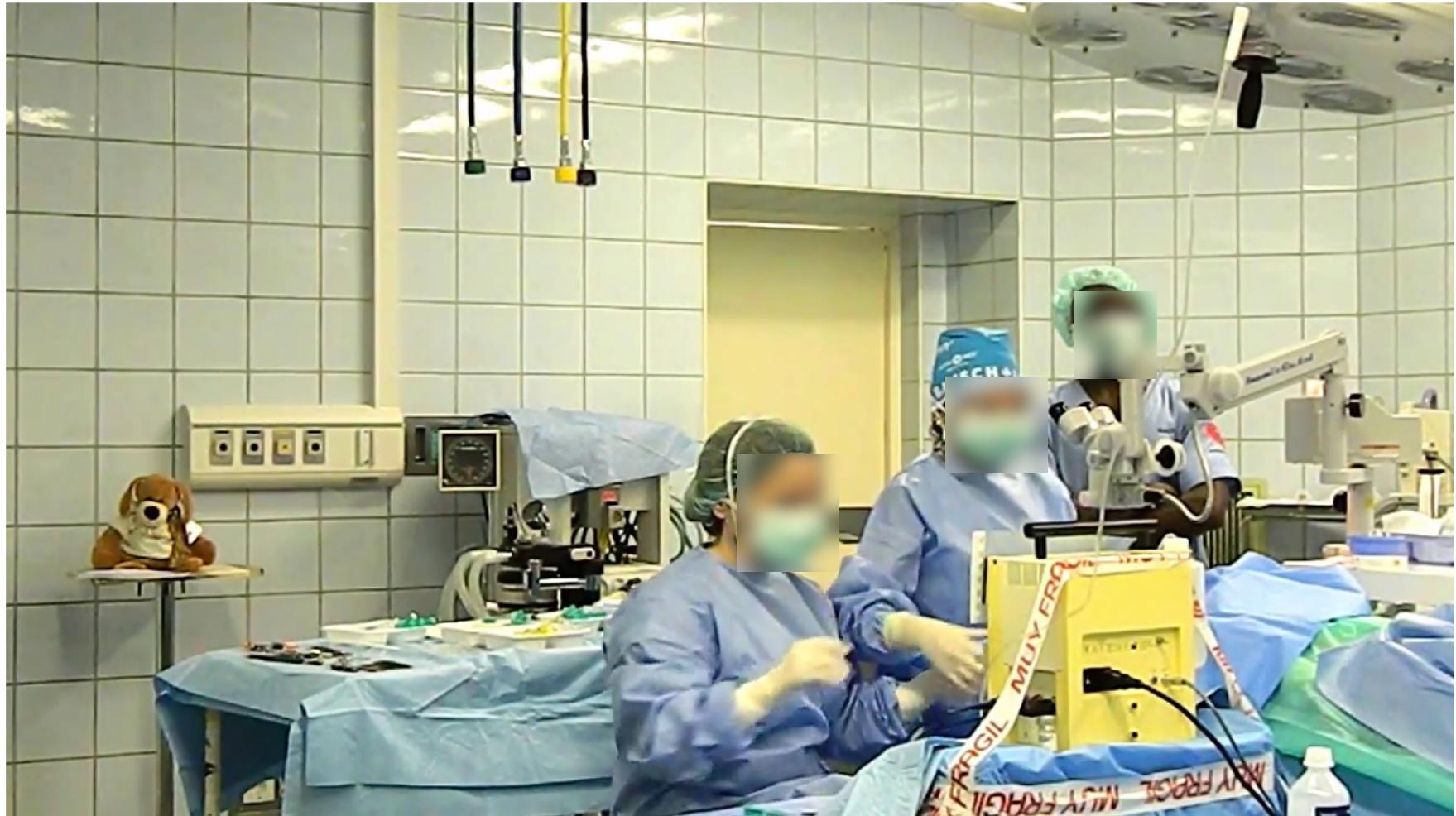


Linear structure filtering

Course material examples: previous project



Course material examples: previous project



Motivation



Motivation

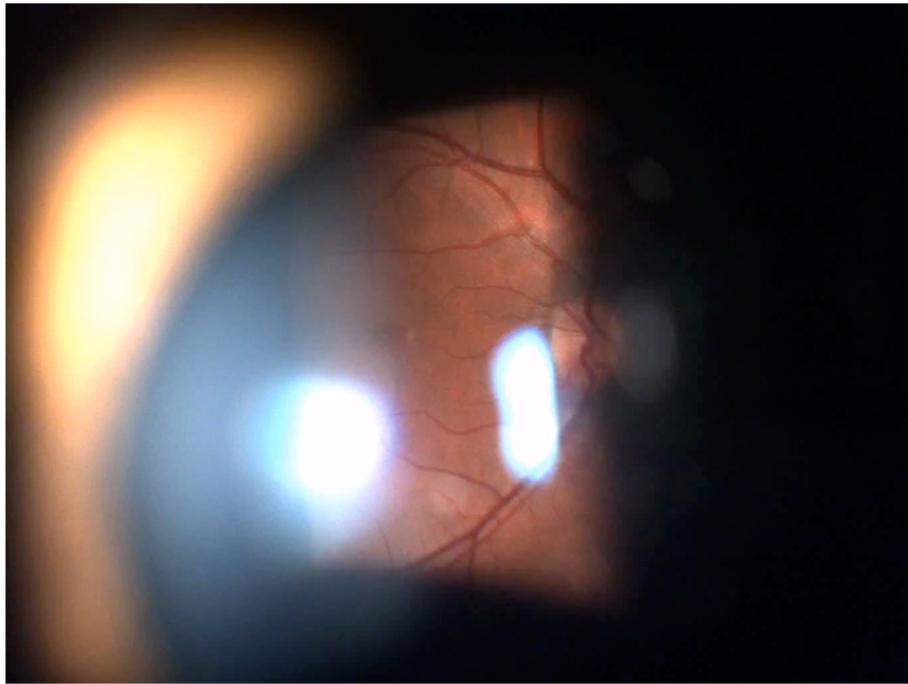


Lane departure warning



Pedestrian detection

Motivation



previous project



This years project: Biomarker detection in OCT scans

Does this scan have fluid or not?

