Bauhaus-Universität Weimar

Image Analysis and Object Recognition

Final Exercise

Summer Semester 2024

(Course materials for internal use only!)

Computer Vision in Engineering – Prof. Dr. Rodehorst
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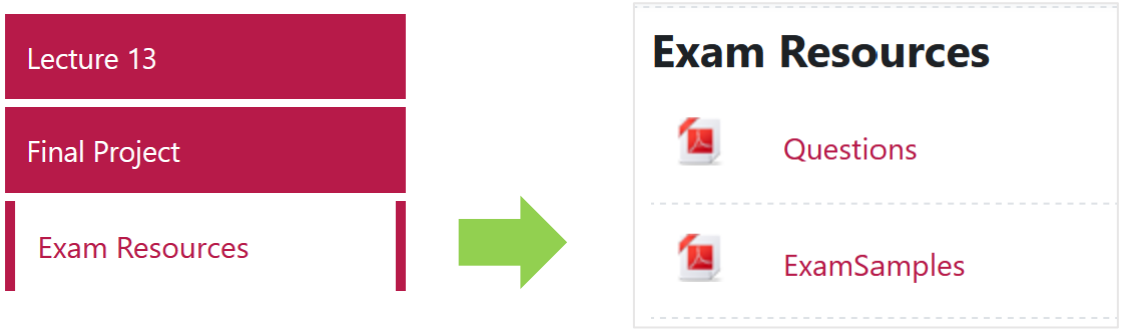
Exam Information

- Date: 6th of August 2024 (Tuesday)
- Staring time: 11 am
- Place: Audimax, Steubenstraße 6
- Duration: 90 minutes (plus some additional time for initial instructions)
- Auxiliary resources: None
- Also good to know:
  - We will provide you with paper to write on!
  - The use of calculators will NOT be allowed! (You won't be needing such either.)
  - Bring your student ID (THOSKA)
- Preparation material:
  - List of questions
  - Old exam samples



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Agenda

Topics:

Assignment 1.	Image enhancement, Binarization, Morphological operators
Assignment 2.	Gradient of Gaussian filtering, Förstner interest operator
Assignment 3.	Shape detection based on Hough-voting
Assignment 4.	Frequency domain filtering, Shape recognition via Fourier descriptors
Assignment 5.	Clustering and Region Growing for Image Segmentation
Assignment 6.	Convolutional neural networks for image classification
Final Project.	**Implementation of Basic Crack Detector**

Agenda

Start date and submission deadlines:

Assignment 1.	~~18.04-24 – 01.05.24~~
Assignment 2.	~~02.05.24 – 15.05.24~~
Assignment 3.	~~16.05.24 – 29.05.24~~
Assignment 4.	~~30.05.24 – 12.06.24~~
Assignment 5.	~~20.06.24 – 26.06.24~~
Assignment 6.	~~27.06.24 – 10.07.24~~
Final Project.	**11.07.24 – 22.09.24**

Wednesday by 23:00
(Central European Time)

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Final Project:
Basic Crack Detector

General Information

Organizational details:

- Work in groups of up to 3 students
  - in case you are not registered for a group yet, or would like to join a different group notify me per email (mariya.kasiheva@uni-weimar.de)
  - single submission per group is sufficient

- Submit via Moodle
  - submission deadline 22.09.24, 23:00 (no extensions possible)
  - uploaded solutions should include **source code**, input **images**, project **documentation** as PDF

Project Overview

Topics:

- Data acquisition, annotation and augmentation
- Thresholding
- Morphological filtering
- Connected components analysis
- Feature engineering
- Supervised (shallow) machine learning

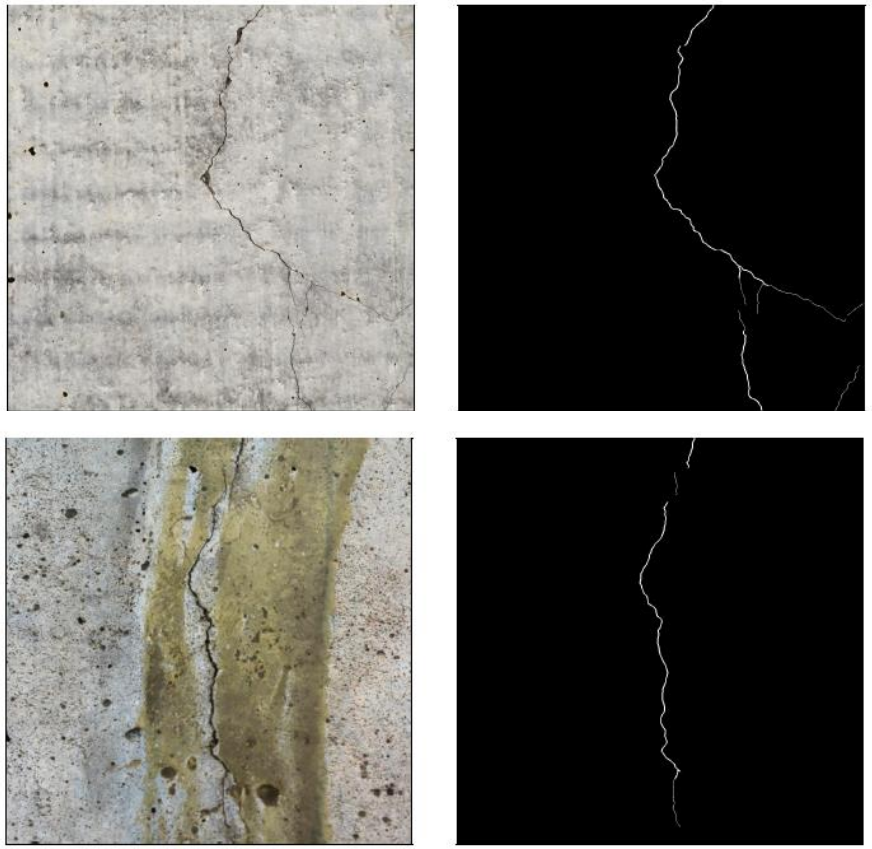
Goal:

- Automated image analysis for crack detection

Input:

- You are responsible for collecting appropriate input data

Input Image | Segmentation Mask



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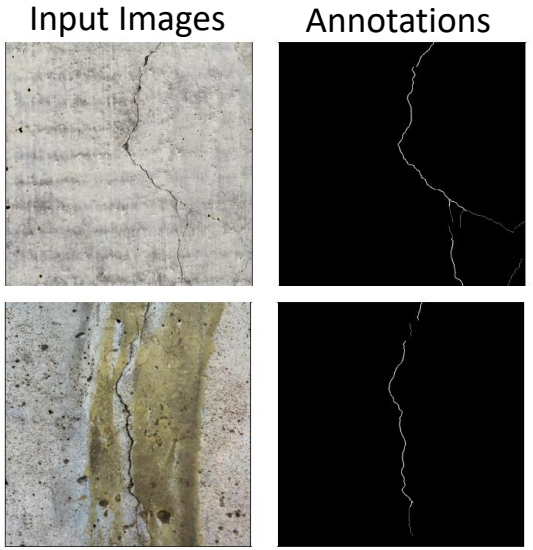
Project Overview

Task A – Data Engineering



a) Data acquisition
   - manually take at least 10 crack images
   - focus on cracks on walls and mind legal restrictions

b) Data annotation
   - keep in mind image resolution
   - use 0 for non-crack and 255 for crack

c) Data split
   - testing data (ca. 20% of all images) should be used once, on the final version of your approach

d) Data augmentation
   - can be used to virtually increase the size of your data set

e) Datasets statistics
   - summarize basic statistical information about your data set in the form of tables/plots

Project Overview

Task B – Crack Segmentation

a) Thresholding

- try to be adaptive towards images of different brightness

b) Morphological filtering

- experiment with different operators
- use for refinement of the results in previous step

c) Connected components analysis

- generate discrete crack candidate regions

d) Feature engineering

- design feature vectors using relevant region properties (you have creative freedom for this task)

e) Classifier training

- use feature vectors defined in previous step as input

Project Overview

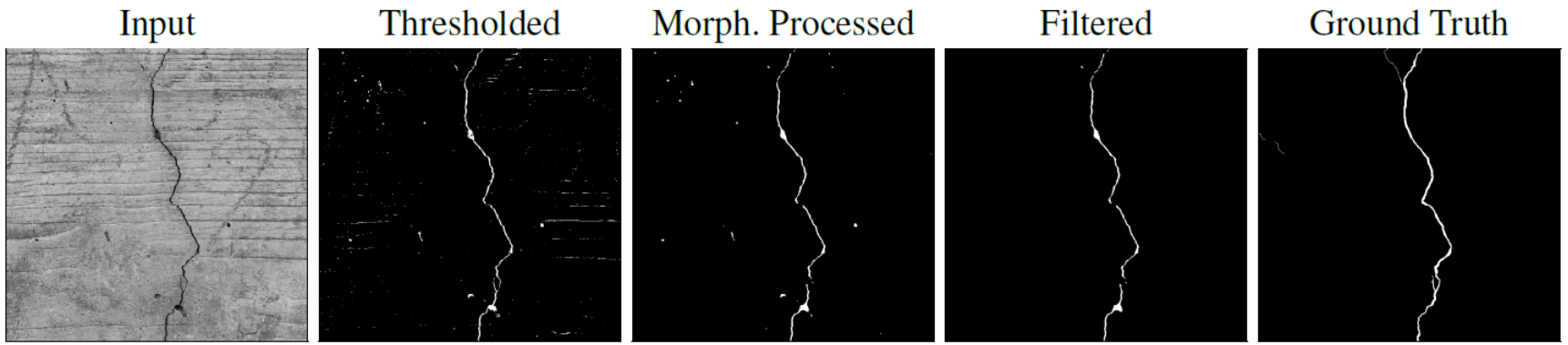
Task C – Crack Analysis

a) Performance assessment via appropriate metric

b) Thinning to the detected crack

c) Crack length estimation

d) Concluding evaluation of the approach



Sample crack detection results at different implementation stages