Image Analysis I questions for ERASMUS Students 2025/26

1. Thresholding, determining the threshold level, indexing. (WLN, CLE, E)
2. Edge detection: Gradient methods, zero crossing methods. (WLN, E)
3. Canny edge detector (general idea only). (OL, E)
4. The Hough transform. (WLN)
5. Detecting corners. (WLN)
6. Mathematical morphology (WLN)
7. Basic steps of a manually constructed image analysis pipeline (object recognition)
8. Computing attributes/features for object recognition (e.g. moments, features derived from the curvature of boundary etc.). (OL, CLE will be enough)
9. HoG features. (CLE)
10. Tools for object recognition: classifiers with a discriminant function, etalons. (OL, CLE)
11. K-means classifiers. (CLE)
12. HoG + sliding window + SVM approach. (DNN_N)
13. Neural cell, activation function (DNN_N, CLE, E).
14. Shallow neural networks, fully connected layers, loss function, back-propagation learning (DNN_N, CLE, E).
15. Convolution and its meaning in image processing and analysis (DNN_N, E)
16. General ideas and components of deep neural networks, e.g. convolution, pooling, softmax, dropouts. (DNN_N)
17. The idea of inception module from GoogleNet, the idea of ResNet
18. The networks without sliding window: R-CNN and similar, YOLO (basic ideas only). (DNN_N)
19. The networks with time (recurrent, LSTM, self attention, basic ideas only). (DNN_N)
20. The self-attention networks and vision transformers (main ideas only)
21. GAN networks (main principle and purpose) (GANs, OL)
22. General idea of diffusion networks (the idea only) (DiffN)
23. The camera model, homogeneous coordinates, and projective transform. (OL, E)
24. Reconstructing the scene from two or more images. (OL, E)
25. Analysing the images changing in time: Optical flow, Kalman filtering. (OL, E)

WLN: http://mrl.cs.vsb.cz//people/sojka/erasmus_ano_I.pdf
DNN_N: http://mrl.cs.vsb.cz//people/sojka/cnns.pdf
CLE: Materials you used in our computer lab.
OL: The problem was explained during the lecture (maybe, you did your own notes).
E: Elsewhere (problem is well known and many materials/tutorials can be found in internet).
GANs: http://mrl.cs.vsb.cz//people/sojka/gans.pdf
DiffN: https://mrl.cs.vsb.cz//people/sojka/diffusion.pdf

You will select three questions from the list above randomly. Then we can start the discussion immediately. Alternatively, depending on the situation, you may have a short time to summarise your ideas (i.e., to think about what you want to speak about during the discussion). Then we will discuss the questions.

From the computer lab, you can obtain up to 40 points, and up to 60 points from the examination. Without finishing the lab, you cannot be examined (the exam on May 13 is the only exception).

The possible terms of the examination will be seen in our university system (Edison). You should enroll to the term you prefer. The first term will be next Wednesday May 13, 2026, 14:45 AM in the time and in the room of the usual lecture, i.e. the lecture will not take place, the exam will be instead of it.