

120min, 120 points

1. Optic Flow (54 Pkt.)

- a. Definition of an optic flow problem
- b. What is the basic assumption to match pixels? Give the equation and its linearized version.
- c. Due to the aperture problem, we can only calculate one flow component. What is it called, what is the equation and in which direction does it point?
- d. What does Horn and Schunck assume to overcome the aperture problem?
- e. Why does this make sense?
- f. Does Horn and Schunck optimize the flow locally or globally?
- g. Give the energy functional for Horn-and-Schunck.
- h. Give the general Euler-Lagrange equations and Neumann boundary conditions
- i. Give a invariant assumption for grey values with global additive illumination changes
- j. Give an invariant assumption for grey values with global multiplicative illumination changes
- k. Give an invariant assumption for color images with local multiplicative changes
- l. Explain one morphological invariant
- m. Give the Image-driven isotropic smoothness term. Explain the idea. Are the Euler-Lagrange equations linear (Justify why)
- n. Give the Flow-driven isotropic smoothness term. Explain the idea Are the Euler-Lagrange equations linear (Justify why)
- o. For the two advanced smoothness terms, appropriate functions were introduced. How are these functions related?
- p. Name a method to solve large equations system.
- q. ?
- r. How can non-linear equation systems be solved iteratively?

2. Stereo Flow (31 Pkt.)

- a. Give the degrees of freedom of the intrinsic matrix and explain them. Is the matrix invertible?
- b. What is the inverted matrix for the Extrinsic matrix ?
- c. Give the dimensions and rank of the fundamental matrix. How many degrees of freedom? Why does it have these degrees of freedom?
- d. Give the formula for the Fundamental matrix. Which component makes it not invertible?
- e. Give a method to estimate a fundamental matrix.
- f. Give the epipolar constraint and explain its components?
- g. What is the geometric meaning of the epipolar constraint?
- h. Assume two intrinsic matrices to be given. How does the fundamental matrix change if the resolution of both images is doubled?
- i. ?

3. Medical Image Registration (22 Pkt.)

- a. Why do we not use grey value constancy assumption in MIR?
- b. Mutual information: Give the definition/formula
- c. Mutual information is a distance measure: What kind of measure? (KL divergence) and between which distributions (explain them)
- d. What do we want for the mutual information? High or low? Explain why?

- e. Curvate-based smoothness term: Give the formula and explain the main idea
- f. Give the second order Euler-Lagrange Equations generally

4. PIV (13 Pkt.)

- a. State definition of div and curl, Explain what they mean
- b. Give the smoothness term for first order div-curl regularization
- c. Draw a flow field that has no curl, but div
- d. Draw a flow field that has no div, but curl
- e. First order div-curl is too restrictive. Which more relaxed method was discussed?
Write down the corresponding smoothness term.
- f. What does the Navier-Stokes prior predict? Div or curl?

No questions about brox et al., Zimmer et al, Lucas/Kanade, Bigün et al, Multigrid, Block matching, Occlusion handling, Scene Flow, Sub-pixel refinement, Motion/structure tensor, dichromatic reflection model, Explicit schemes

Almost no calculations, focus on naming/explaining methods/concepts