

Differential Geometric Aspects in Image Processing

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Homework Assignment: November 7, 2019

Please submit your solutions on **November 14, 2019, in the lecture break.**

Remark: Always justify your answer! All steps of the solutions must be complete and consistent. Please do not submit electronically. Only handwritten solutions will be graded.

Problem H1.1 (4 Points)

Prove that curvature motion can also be written as

$$u_t = u_{\xi\xi}$$

where in each point of the image ξ denotes a unit vector tangent to the level line.

Problem H1.2 (4 Points)

- i) Let c be a regular convex simple closed curve. Describe the level sets corresponding to positive values of its signed distance function.
- ii) Describe the set where the signed distance function of the ellipse $\{\frac{x^2}{a} + \frac{y^2}{b} = 1\}$ is differentiable.

Problem H1.3 (4 Points)

Consider the set of matrices S that:

- i) Have in each column one component equal to one and all the others equal to zero.
- ii) Have in each row one component equal to one and all the others equal to zero.

Show that S is a group.