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International Summer Course "Image Processing by Variational Methods" Cottbus, 09.07.2007 – 13.07.2007

I. Images

- 1. Human vision
- 2. Computer vision
- 3. Mathematical models of images
- 4. Remarks about function spaces
 - A) Sobolev spaces
 - B) The space of functions of bounded variation

II. Basic problems of image processing in variational formulation

- 1. Image restoration / image smoothing
 - A) Problem formulation
 - B) Classification of regularization terms
- 2. Image restoration & edge detection
- 3. Image deblurring
- 4. Image inpainting
- 5. Image registration / image matching $% \left({{{\rm{D}}_{{\rm{B}}}} \right)$
- 6. Optical flow
 - A) Problem formulation
 - B) Applications
 - C) Variational formulation
 - D) Classification of regularization terms
 - E) Edge detection within the optical flow
- 7. Shape from Shading
 - A) The Horn equation
 - B) Variational formulation involving higher partial derivatives of X

III. Multidimensional calculus of variations: image restoration as model problem

- 1. Existence of global minimizers
 - A) Image restoration with quadratic regularization
 - B) The generalized Weierstrass theorem
 - C) Image restoration with convex regularization for greyscale images
 - D) Quasiconvex functions
 - E) Image restoration with quasiconvex or convex regularization for color images
 - F) Image restoration with TV regularization for greyscale images
- 2. Tichonov regularization
 - A) Ill-posed operator equations and variational problems
 - B) The regularization parameter μ in the image restoration problem
- 3. Remarks about numerical methods for image restoration
 - A) Quadratic regularization in the Hilbert space $W^{1,2}(\Omega)$
 - B) Convex, nonquadratic regularization in the reflexive Banach space $W^{1,p}(\Omega)$
 - C) TV regularization and duality