

Convex optimisation with applications to image processing

Part III, Michaelmas 2013

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■ Cambridge Image Analysis



Layout

- Course format
 - graduate level - Part III, CCA, ...
 - M/W/F 12-1pm, MR14
 - 24 lectures
 - 3-4 example sheets
 - examinable (May/June 2014)
- CIA courses this year:
 - T. Valkonen – Measure and Image, 11-12, MR14
 - C. Schönlieb – Variational and PDE Methods, Lent

Image Processing



Goal:

*Extract “useful” information
from the data that we have...*

*...by using what we know
about the problem.*

The problem



original



noisy input



output?

Denoising



Denoising L2-TV



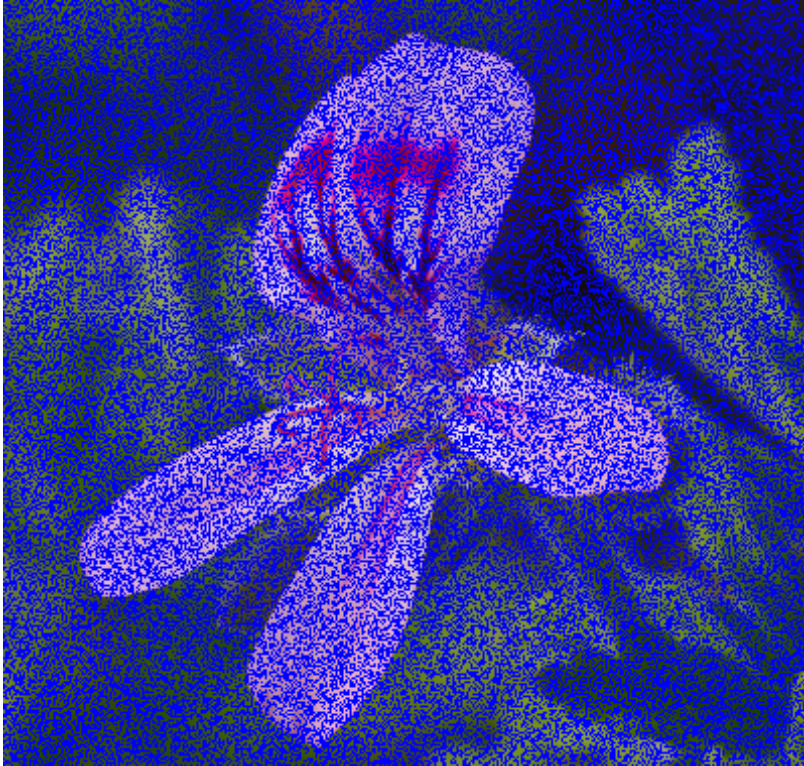
Denoising L1-TV



Inpainting



Inpainting



Segmentation



Course outline

1. *Convex Analysis*

- existence
- subdifferentials, optimality, certificates
- conjugacy, duality

2. *Solvers*

- first-order
- interior-point
- min-cut/max-flow

3. *Applications*

- convex models, TV, SVM
- combinatorial problems, relaxation, segmentation
- convex approximations, lifting
- sparsity, compressed sensing

Literature

- Boyd/Vandenberghe: *Convex Optimization*
- Rockafellar/Wets: *Variational Analysis*
- Ben-Tal/Nemirovski: *Lectures on Modern Convex Optimization*
- Paragios/Chen/Faugeras: *Handbook of Mathematical Models in Computer Vision*

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