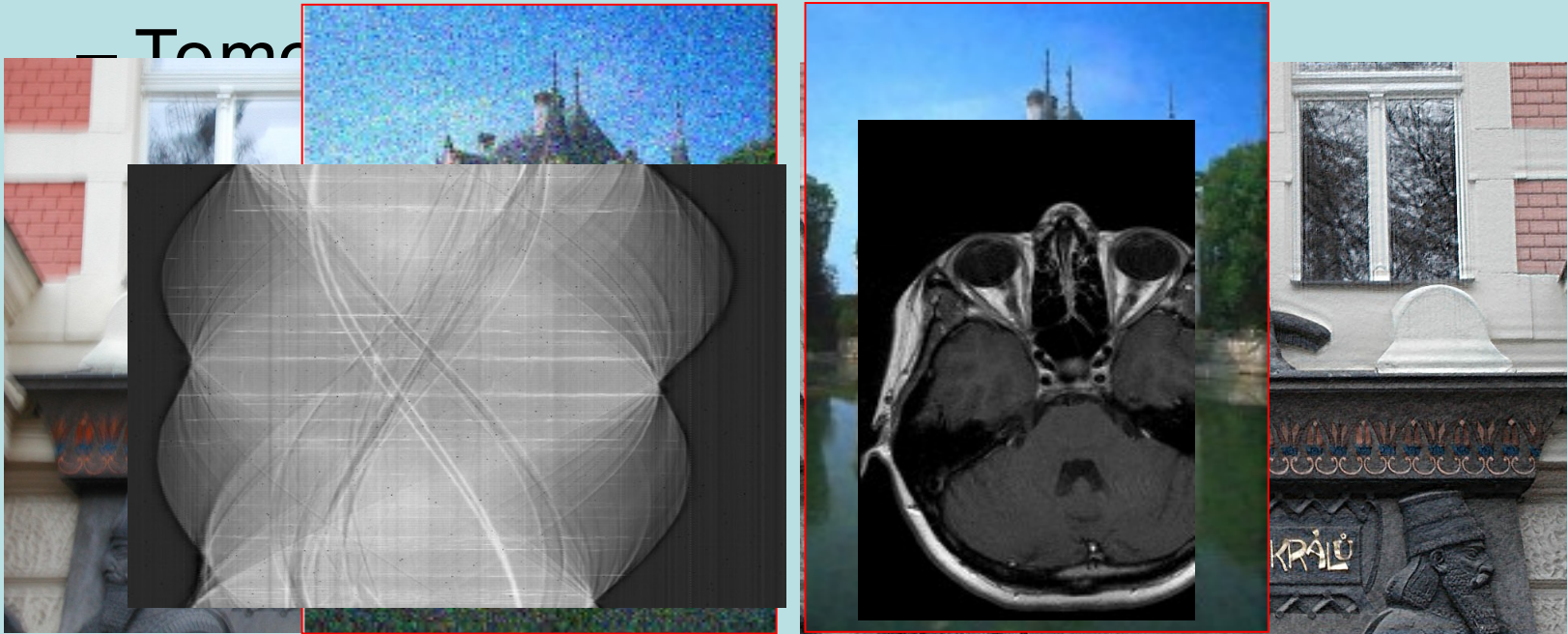
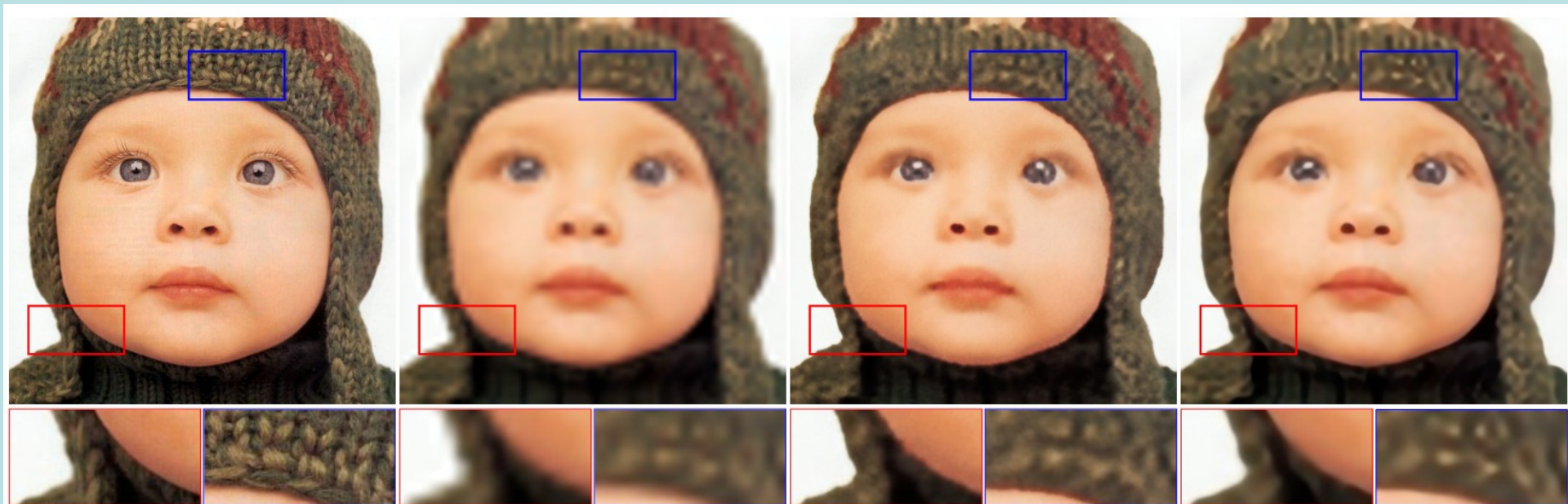

Variational Methods in Image Processing

Motivation

- Image Reconstruction
 - Denoising
 - Deblurring
 - Tomography



Deep Image Prior



GT

LR input

DIP

Trained
SRNet

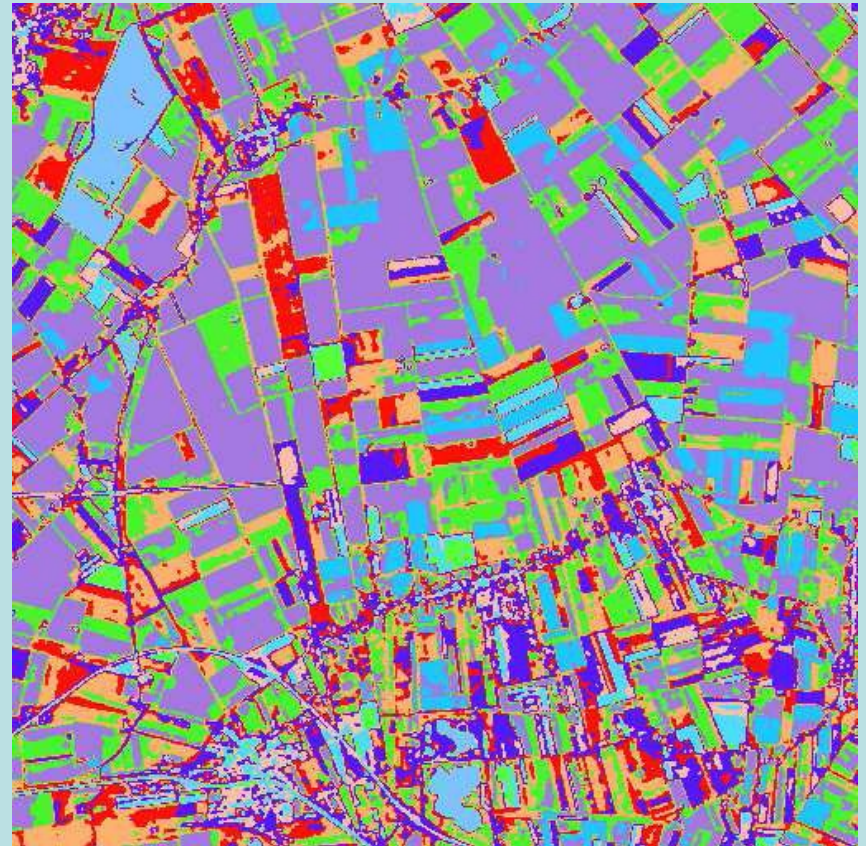
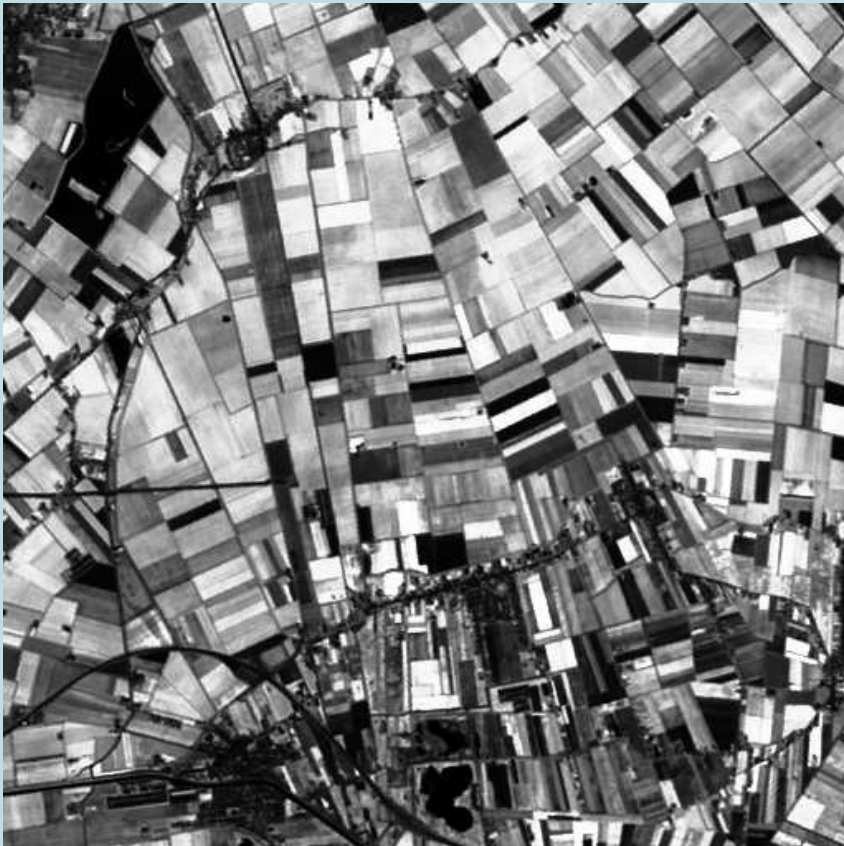
Motivation

- Image Segmentation



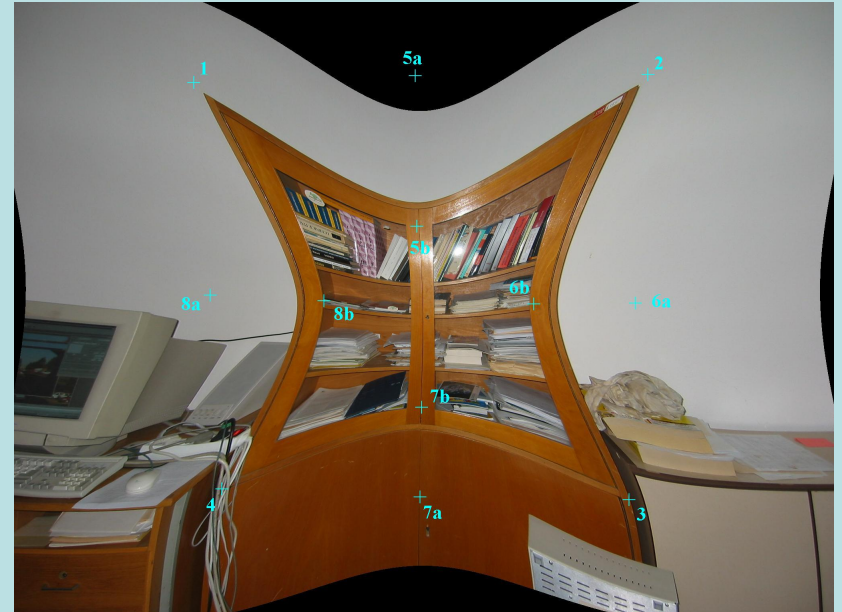
Motivation

- Image Classification



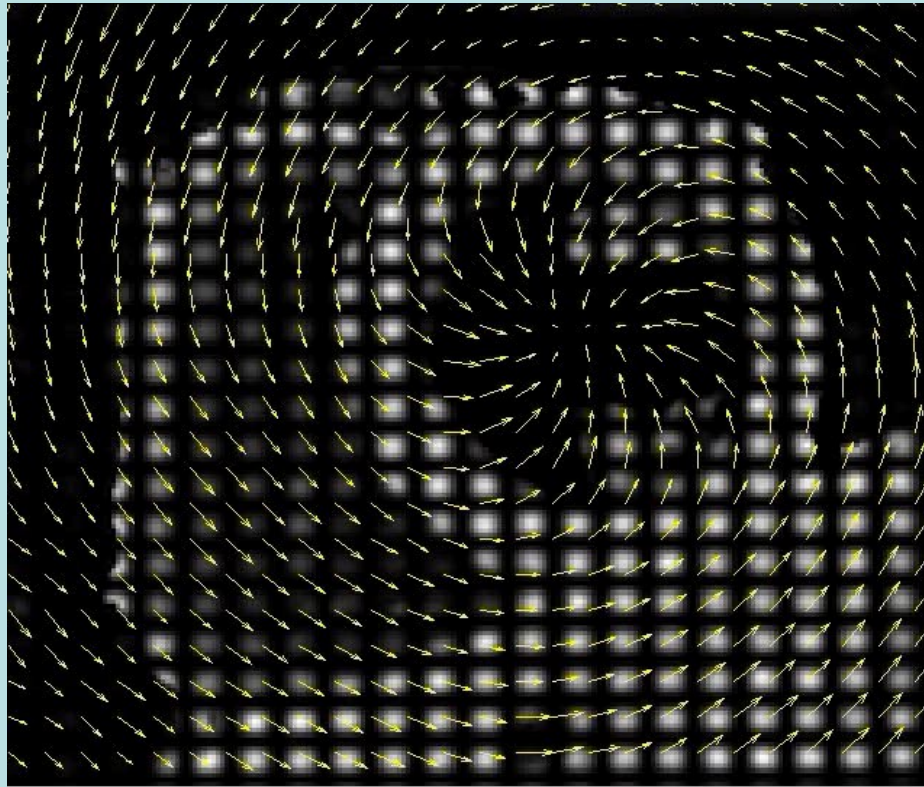
Motivation

- Image Registration
 - Thin Plate Spline



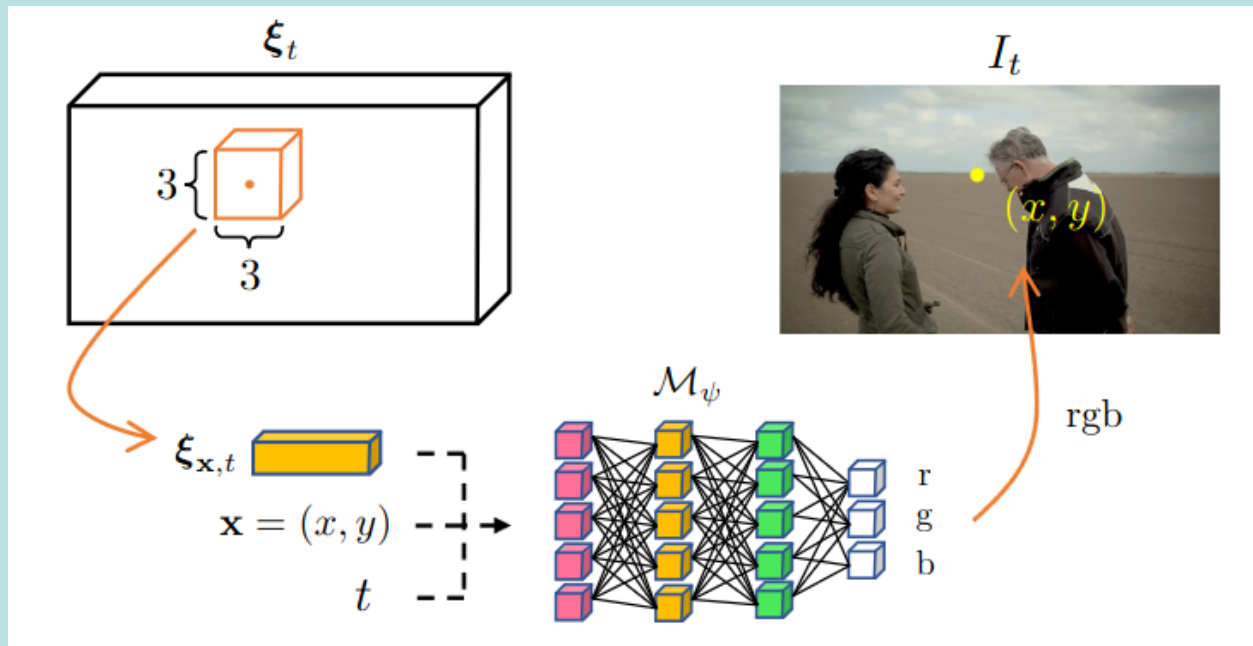
Motivation

- Motion Estimation
 - Optical flow



CURE

- Video Neural Field
- Video

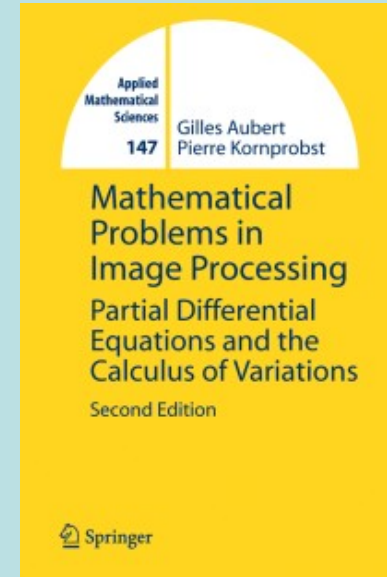


Contents

- Theory of Calculus of Variations
- Application in Image Processing
- P.D.E. (Steepest descent)
- Stochastic approach (MAP)
- Numerical Optimization Methods
- Sparse Representation (wavelets)
- Parameter estimation (EM, Variational Bayes)
- Deep Image Prior, Neural Fields

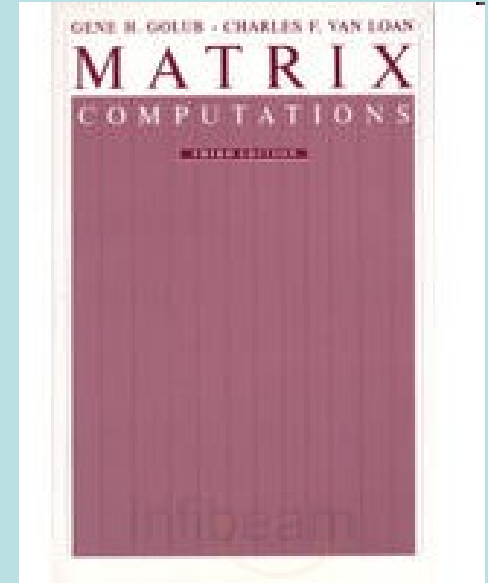
Books to read

- Mathematical problems in image processing
 - G. Aubert and P. Kornprobst
- Springer, 2002



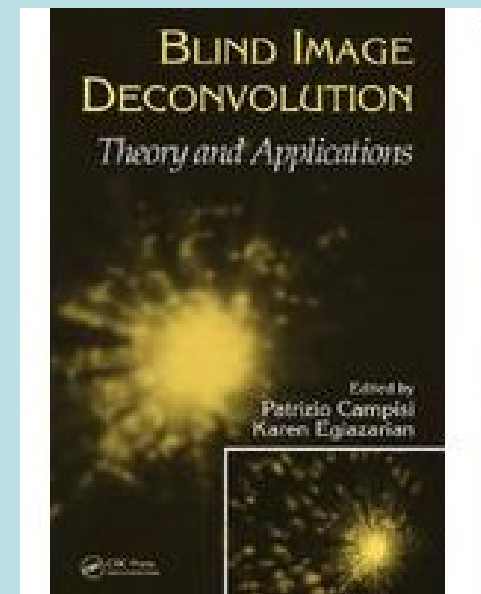
Books to read

- Matrix Computations
 - Gene H. Golub, Charles F. Van Loan
 - Johns Hopkins University Press



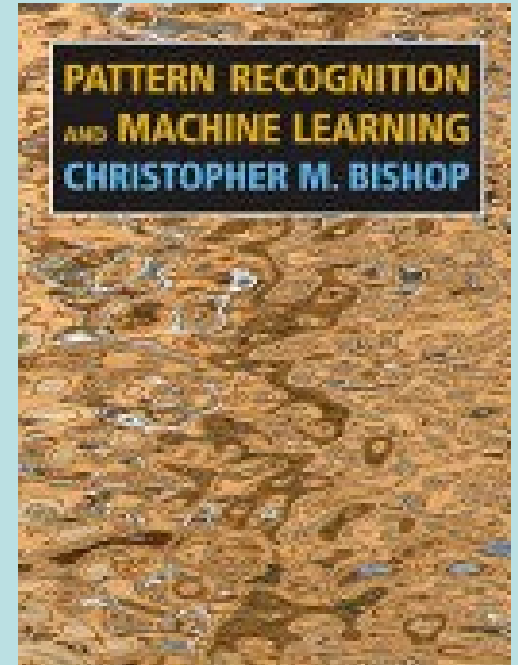
Books to read

- Blind Image Deconvolution
 - Ed. P. Campisi, K. Egiazarian
 - CRC Press, 2008



Books to read

- Pattern Recognition and Machine Learning
 - Christopher M. Bishop
 - Springer, 2006

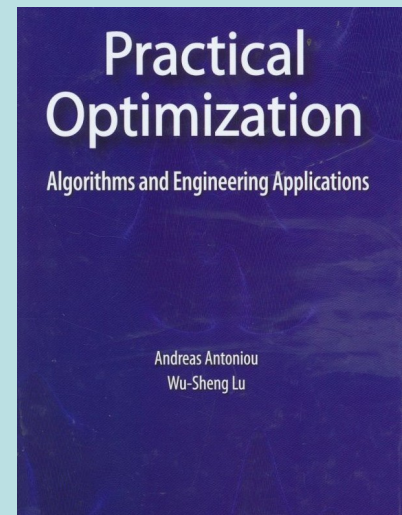
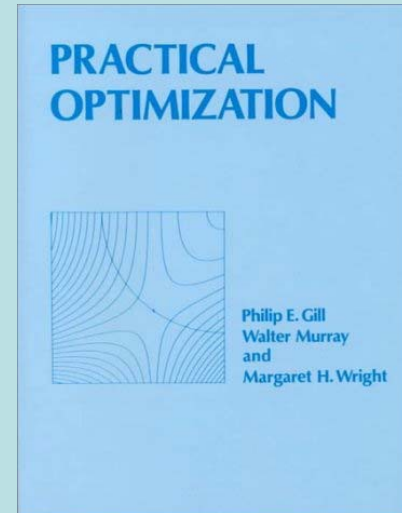


Books to read

- **Practical Optimization**
 - Philip E. Gill, Walter Murray, and Margaret H. Wright
Academic Press, 1981

- **Practical Optimization: Algorithms and Engineering Applications**
 - Andreas Antoniou and Wu-Sheng Lu
2007

Both cover unconstrained and constrained optimization. Very clear and comprehensive.



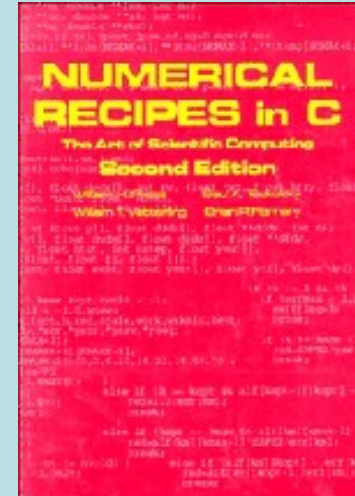
Further reading and web resources

- **Numerical Recipes in C (or C++) : The Art of Scientific Computing**

- William H. Press, Brian P. Flannery, Saul A. Teukolsky, William T. Vetterling
- Good chapter on optimization
- Available online at www.nrbook.com

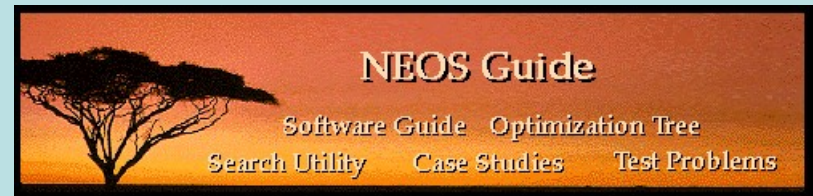
(1992 ed.) for free

(2007 ed.) not free



- **NEOS Guide**

www.neos-guide.org/



- **Lecture's Powerpoint and PDF presentations**

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