Discrete Image Reconstruction from Uncertain and Insufficient Data

Members: Péter Balázs [1]
Mihály Gara [2]
Norbert Hantos [3]
Kálmán Palágyi [4]
Zoltán Ozsvár [5]

Founded by: TÁMOP-4.2.2/08/1/2008-0008 program of the Hungarian National Development Agency [6]
OTKA PD100950 grant of the Hungarian Scientific Research Fund [7]
TÁMOP 4.2.4.A/2-11-1-2012-0001 program of the European Union and the State of Hungary co-financed by the European Social Fund ('National Excellence Program')

Partners: Vision Lab of the University of Antwerp [8], Belgium (Joost Batenburg [9])

Related projects:
- Image Processing on Projections and Its Applications for Image Reconstruction [10]

Lifetime from: 2009
Lifetime to: 2013

Short description: The goal of the project is to develop efficient image reconstruction methods to gain visual information from incorrect, noisy, uncertain projections. We also investigate how structural or geometrical prior information can facilitate an improve the reconstruction if the number of projections is insufficient to get a unique and exact reconstruction.

Description:
The goal of the project is to develop efficient image acquisition methods to gain visual information from incorrect, noisy, and uncertain projections. Such projections typically arise in sensor-network applications. Projection signals can be detected in various forms (X-ray, gamma-ray, radar, ultrasound, electric or electromagnetic sensors, etc.). Due to the large variety in the number, modality and position of the detectors, there is no general method to obtain an accurate reconstruction in each application. In the past years it turned out, that discrete tomography can guarantee reconstructions of good quality even when the classical reconstruction methods are hardly applicable due to the small number of possibly noisy projections. Our aim is to investigate the theoretical background of reconstruction problems where projections are noisy, and/or their direction is not known precisely. We study uniqueness and stability questions. We also investigate how structural or geometrical prior information can facilitate an improve the reconstruction if the number of projections is insufficient to get a unique and exact reconstruction. We design and implement discrete tomographic reconstruction methods for different applications and analyse the performance of those algorithms from the viewpoint of speed, accuracy, and noise-sensitivity, both theoretically and numerically.
Binary image reconstruction from two projections and skeletal information [16], Hantos, Norbert [15], Balázs Péter [13], and Palágyi Kálmán [17], Combinatorial Image Analysis, Nov 2012, Number 7655, Berlin; Heidelberg; New York; London; Paris; Tokyo, p.263 - 273, (2012)
The reconstruction of polyominoes from horizontal and vertical projections and morphological skeleton is NP-complete [20], Hantos, Norbert [15], and Balázs Péter [13], FUNDAMENTA INFORMATICAE, 2013, Volume 125, Issue 3-4, p.343 - 359, (2013)
A uniqueness result for reconstructing hv-convex polyominoes from horizontal and vertical projections and morphological skeleton [22], Hantos, Norbert [15], and Balázs Péter [13], Proceedings of International Symposium on Image and Signal Processing and Analysis (ISPA), Sep 2013, Trieste, p.788 - 793, (2013)
Reconstruction and Enumeration of hv-Convex Polyominoes with Given Horizontal Projection [23], Hantos, Norbert [15], and Balázs Péter [13], Progress in Pattern Recognition, Image Analysis, Computer Vision, and Applications (CIARP), Nov 2013, Number 8258, Heidelberg; London; New York, p.100 - 107, (2013)

Kategória: Tomography - Discrete Tomography
Discrete Image Reconstruction from Uncertain and Insufficient Data
Published on Informatikai Intézet (http://www.inf.u-szeged.hu)