Movement estimation with DCC in Fan Beam ROI tomography

Rolf Clackdoyle <rolf.clackdoyle@imag.fr>
Laurent Desbat <laurent.desbat@imag.fr>
TIMC-IMAG,
UMR 5525
Pav. Taillefer, Medical Faculty
38700 La Tronche

This MSc thesis is part of the ANR project DROITE. A PhD is forseen.

Context: In xray tomography, line integrals of patient attenuation are measured in a CT scan. From these data, the patient attenuation function must be reconstructed. It is assumed that the patient is completely still during the data acquisition. In case of patient movement, the reconstructed CT image suffers from artifacts.

Xray projections from various angles of the same patient are not independent: Data Consistency Conditions (DCC) must be fulfilled by the projections. In case of the Radon transform, the DCC (or range conditions) can be expressed though *n*th order moments of the projections. It has been shown that the DCC can be used to estimate some external parameters such has calibration parameters, attenuation factors or even movement parameters.

Objectives: To apply new fanbeam DCC to estimate an unknown translation of the patient during a short time interval of the scan. For a known arc of the fanbeam fullscan, the patient moved with constant unknown velocity. The problem of determining the movement using fanbeam DCC will be addressed in this thesis. Fanbeam DCC for a segment of a circular trajectory will be used, as well as new fanbeam DCC which will be developed in this project. Computer simulations will be used to verify the method.

Bibliography:

[1] R.Clackdoyle. 2013. "Necessary and Sufficient Consistency Conditions for Fanbeam Projections along a Line" *IEEE Trans. Nucl. Sci*. 60, 1560-1569.

[2] R.Clackdoyle, L.Desbat. 2015. "Data consistency conditions for truncated fanbeam and parallel projections." *Med. Phys.* 42, 831- 845.

[3] R. Clackdoyle, M. Defrise, L. Desbat, J. Nuyts. 2015. "Consistency of Fanbeam Projections Along an Arc of a Circle." *The 13th International Meeting on Fully Three-Dimensional Image Reconstruction in Radiology and Nuclear Medicine, Newport, RI, May 31-June 4, 2015*. Pages: 253-256.