Postdoc fellowship

Exponential Data Consistency Conditions for Patient Motion Detection and Correction in SPECT

https://www.creatis.insa-lyon.fr/site7/en/node/47177

Context

The ANR project SPECT-Motion-eDCC is a collaborative project between CREATIS, TIMC, OHI and LUMEN. Single photon emission computed tomography (SPECT) is a technique for imaging the 3D distribution of a radioactive tracer that has been administered to a patient to track certain biological functions. The long acquisition times (10-40 minutes) of SPECT make them prone to patient motion which decreases image quality. Exponential data consistency conditions (eDCC) are mathematical equations [1] that should be verified by the input data of SPECT reconstruction algorithms. Inconsistencies might be used to correct input data, e.g., to improve correction of the attenuation [2].

Objective

The goal of this postdoc fellowship is to implement motion correction in SPECT reconstruction using eDCC-based motion estimation. The investigations will start with Monte Carlo simulations of clinical SPECT scanners with a parallel collimator as those available at the LUMEN. Application to real data and pinhole SPECT will be investigated subsequently.

Tasks

- Select patient data from which SPECT acquisitions will be simulated,
- Simulate SPECT projections with patient motion using GATE,
- Implement motion correction in SPECT reconstruction with RTK

Required skills

- **Education**: PhD in applied mathematics, computer sciences or medical physics.
- **Scientific interests**: applied mathematics, computer sciences (medical image processing), medical physics.
- **Programming skills**: Python, C++ (ITK, RTK).
- **Languages**: command of English required, French optional.

Practical information

- **Supervision**: Simon Rit
- **Location**: Mainly at the Centre Léon Bérard, Lyon, France.
- **Period**: 1 year, starting as soon as possible.
- **Salary (net)**: depending on experience, starting 2100 euros/month.
- Send CV and a brief statement of interest on https://bit.ly/3uhilhW.

References

[1] V. Aguilar, L. Ehrenpreis, and P. Kuchment. Range conditions for the exponential Radon transform. *Journal d'Analyse Mathématique*, 68(1):1–13, 1996.

[2] R.G. Wells and R. Clackdoyle. Feasibility of attenuation map alignment in pinhole cardiac SPECT using exponential data consistency conditions. *Med Phys*, 48(9):4955–4965, 2021.