Methods for an Automatic Analysis of Motion Tracking Data in PET

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Motivation

• Patient motion reduces the image quality and affects accurate analysis of tracer kinetics in brain PET imaging
• For quantification of motion external motion tracking systems are often used
• Motion thresholds are applied to every motion parameter for identification of “significant” motion and for reduction of required motion correction computations
• However, raw motion parameters (three translations, three rotations) are unsuited for direct assessment of magnitude of 3D motion
  • combinational relation between translations and rotations (and rotation centre)
  • magnitude dependent on the location of ROI
  ➞ Development of objective method for identification of motion significance and generation of a clinical report

Methods

• Use of statistics toolkit ‘R’ for development of automatic motion analysis
• Application of raw motion parameters to virtual sphere with Ø 20 cm (imaginary patient head)
• Distance calculation of grid points on the sphere from their original location (Figure 1)
• Motion exceeding empiric threshold (1-2 mm) of distances are considered „significant“
• Calculation of statistical parameters of motion (e.g. „worst“ point on sphere, distance fluctuation, etc.)
• Automatic generation of report document with summary page and “estimated motion score”

Results

Conclusions

• Unambiguous determination of “significant” motion via application of single threshold
• Reduction of motion compensation computations due to effective filtering of motion data
• Automatic generation of clinical report document with statistical parameters on patient head motion
  ➞ For quality control and easy assessment of the influence of patient motion on the PET data