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PARAMETRIC IMAGING OF GLUCOSE METABOLISM IN BIOLOGICAL TISSUES

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Parametric imaging is a compartmental approach that processes nuclear imaging data to estimate the spatial distribution of the kinetic parameters governing tracer flow. This talk will review models and methods for compartmental analysis concerning metabolisms of diverse complexity [1, 2, 3]. Applications will consider [^{18} F]-fluorodeoxyglucose positron emission tomography data and discuss uniqueness issues for different models. The talk will focus on a specific imaging method [4], which starts from the reconstructed PET images of tracer concentration and applies image processing algorithms for noise reduction and image segmentation. The optimization procedure solves pixel-wise the non-linear inverse problem of determining the kinetic parameters from dynamic concentration data through a regularized Gauss - Newton iterative algorithm. The reliability of the method is validated against both synthetic data and experimental measurements acquired from murine models.

References

[1] Garbarino S, Caviglia G, Brignone M, Massollo M, Sambuceti G and Piana M. (2013). *Estimate of FDG excretion by means of compartmental analysis and Ant Colony Optimization*, Computational and Mathematical Methods in Medicine, 793, 142

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[2] Garbarino S, Caviglia G, Sambuceti G, Benvenuto F and Piana M. (2014). *A novel description of FDG excretion in the renal system: application to metformin-treated models*, Physics in Medicine and Biology, 59, 2469.

[3] Garbarino S, Vivaldi V, Delbary F, Caviglia G, Piana M, Marini C, Capitanio S, Calamia I, Buschiazzo A and Sambuceti G. (2015). *A new compartmental method for the analysis of liver FDG kinetics in small animal models*, European Journal of Nuclear Medicine and Molecular Imaging Research, 5, 35.

[4] Scussolini M, Garbarino S, Sambuceti G, Caviglia G, and Piana M. (2017). *A physiology based parametric imaging method for FDGPET data*, Inverse problems, 33, 12, 125010.

 ISBN: 978-989-98750-4-3