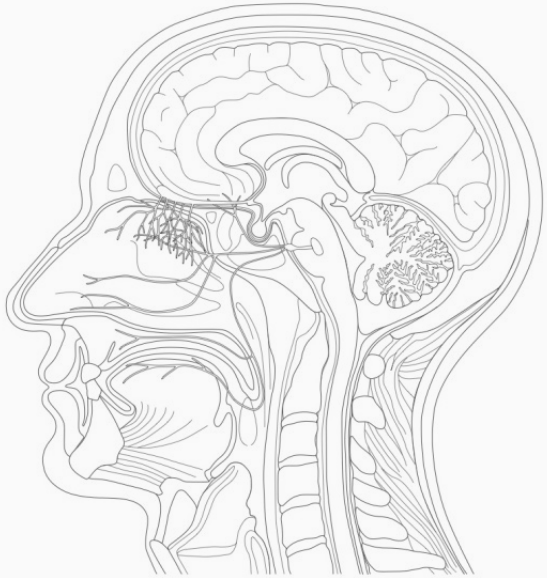
Homework - Academic Year 2022/2023

Investigation the use of radiomics for analysis of DAT SPECT imaging in Parkinson's Disease



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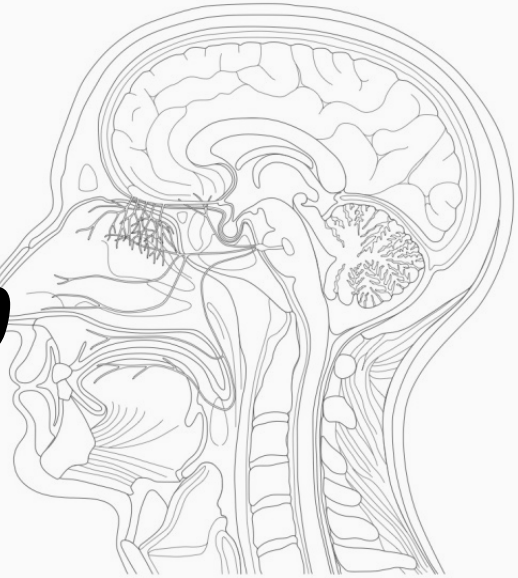
Homework assignment:

Radiomics for DAT SPECT imaging in PD



Rationale in brief: PD, DAT SPECT, Radiomics

- Parkinson's disease (PD) is characterised by the degeneration of the nigrostriatal dopamine nerve.

- Dopamine transporter (DAT) single-photon emission computed tomography (SPECT) is clinically use for diagnosis of PD as biomarker for nigrostriatal dopamine degeneration.

- Generally, the evaluation of DAT-SPECT images is conducted via visual inspection, frequently supported by semi-quantitative indexes. There is the need for quantitative analysis to eliminate subjectivity and experience differences among readers.

- In nuclear medicine, radiomics can quantitatively represent the heterogeneity of radiopharmaceutical uptake, such as a tumour, in a region of interest and it has the potential to provide support for diagnosis but also for predicting patient prognosis and determining treatment effects.

Outline of the homework

- The aim of the homework is **to prepare a technical report which should provide a justified opinion on the use of radiomics analysis for DAT SPECT imaging as biomarker of PD**

- **RESEARCH QUESTIONS:**

  By using the data collected from a PD study, this report should address the following questions:

  PART 1 – GROUP DIFFERENCES
  - Is there any difference between controls and PD in radiomics features (or combined score)?
  - Are the radiomic features or any derived scores associated to PD clinical symptoms severity?

  PART 2 - INDIVIDUAL PREDICTION
  - Are the radiomics features capable to distinguish patients from controls?

Exam questions (what I expect to see in the report)

- **Background**
  - To introduce the **rationale** of applying radiomics to DAT SPECT imaging in PD (see supporting readings)
  - What are the literature evidences for the use of radiomics to DAT SPECT imaging in PD (see supporting readings)
  - State the aim of the study, and based on literature evidences, formulate and motivate study hypotheses

Exam questions (what I expect to see in the report)

- **Material and Methods**

  Dataset

  - Provide a summary of the dataset and the methods used to generated the data (refer to Homework Study Protocol)

  Research methods

  - Provide a description of the methodology used to answer the research questions.
  - Provide an extensive and motivated description of statistical analysis plan, including the metrics used to assess the biomarker performances

Exam questions (what I expect to see in the report)

- **Results**
  - A clear and concise description of the statistical results providing answers to the research questions
  - A sensitivity analysis of the results to covariates, group matching and data quality (e.g. missing data, data miss-balance)

- **Discussion**
  - Direct answers to the research questions
  - An overview of the limitations of the study
  - A list of possible suggestions to improve the study in case someone will repeat it in future

Deliverables

Expected deliverables (i.e. what you have to submit) consist in

- A technical report (pdf file)
- A zip folder with all the code used the process the data and ancillary files (make sure it contains all the information for re-using it)

Marking: PROJECT REPORT MARKING GRID file

Element	Content	Maximum Mark
Abstract	• Summary of the work presented in the report (a summary figure is welcome) • Clarity of writing • Shows awareness of the limitations and significance of the work	10
Background	• Clarity of statement of aims and hypothesis to be tested • Range and appropriateness of background material and/or references • Clarity of writing including presentation and organisation of material • Analysis and summary of background material	15
Materials & Methods	• Correct description of materials and their sources (e.g. study sample etc.) • Clarity of description of methods and appropriate level of detail such that someone else could repeat the experiments or study • Correct statistical planning	15
Results	• Results or data presented in a logical order and containing all the relevant information • Presentation of data including appropriate use of graphs/illustrations such as micro photographs with appropriate figure legends or statistical analysis with correct labelling in each case • Clarity of written description and of experimental work and results • Correct interpretation of findings	30
Discussion	• Quality of conclusions drawn from the data • Comparison with the literature where appropriate, and appropriate referencing • Analysis and insight • Discussion of future work	15
Figures	• Correct presentation • Quality and quantity • Relevance	5
References	• Correct presentation • Quality and quantity • Relevance and recency	5
Code	• Clarity of the code and presentation • Reproducibility	5