Preterm Or Term Prediction Based On dMRI Metrics
An Introduction to Python-based Bio-Medical Data Analysis

(A 6-week Mini-Project Summary)

Introduction

Preterm infants are born too early compared to full-term-born infants. Brain development from preterm to term is crucial. Diffusion magnetic resonance imaging (MRI) can provide valuable insights into this process. There is already some research on the brain development differences between preterm and term infants' brains at term-equivalent age. But the inverse problems have not been answered clearly: 1) can we know the infant's age based on their brain data? 2) coming soon... This mini-project aims to answer these two questions based on diffusion MRI data.

This mini-project is ideal for those interested in medical image analysis and seeking hands-on experience in Python-based scientific research.

Methods

The project will focus on Python-based medical data analysis on a certain dataset.

The project will involve several stages:

1. Problem definition and Theory preparations: classification and regression (week 1);
2. Introduction to Python-based scientific research and necessary libraries (e.g., numpy, scipy, scikit-learn, matplotlib, etc.) (week 2);
3. Practice on provided example data 1 (classification) (week 3);
4. Practice on provided example data 1 (regression) (week 4);
5. Statistic and visualization (week 5);
6. Finalize the project report and presentation, discussing the study's limitations and possible future directions (week 6).

Dataset: 90 brain data select from dHCP dataset 2.

Tools: Python, Jupyter Notebook, Markdown, Dipy, Nibabel, FSL, ITKSNAP.

Expected results

1. shows the results of age prediction: regression curves, accuracy, weights of components;
2. shows the results of preterm or not prediction: classification curves, accuracy, weights of components;
3. Explain the results and answer the two questions mentioned in the introduction.

Deliverables & Expectations

By the end of the mini-project, interns will 1) gain practical experience in data analysis using Python; 2) Have knowledge of classification and regression; 3) Gain a basic understanding of scientific statistics; 4) Write a well-structured scientific report and deliver an oral presentation.