

Brain development analysis for the detection of neurological diseases

Program: Ph.D. in Engineering

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Project Description:

Brain development is a key factor in the onset of various neurological diseases, such as epilepsy. The identification of significant relations between developmental components in the brain and certain pathologies could therefore facilitate the detection of these pathologies and lead to novel methods of treatment. Yet, analyzing the development of specific structures in the brain, based on medical imaging data, is a difficult task due to the high scale and complexity of this data.

The objective of this project is to develop new computational methods to 1) identify the main components of brain development related to specific neurological diseases, in order to facilitate the clinical analysis of these diseases, and 2) automatically detect developmental anomalies susceptible to cause a brain disease. To reach this objective, techniques based on Active Shape Models (ASM) will be investigated. Specifically, these techniques will segment a given brain structure in different sequences of 3D MRI data, each sequence corresponding to the brain development of a different patient. Dimensionality reduction methods, such as PCA and LDA, will then be evaluated to extract the main components of development. These components will finally be used to discover and predict relations to neurological diseases.

To validate the results obtained by the proposed methods, this research will be made in collaboration with a team of neuroscientists.

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