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Classification Based on Longitudinal Shape Pairs

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Classifying medically imaged objects, e.g., into diseased and normal classes, has been one of the important goals in medical imaging. In particular we consider the problem of classification when imaging dataset is longitudinal; patients are scanned at two distinct time points. This is motivated by findings in neuroscience that brain developmental trajectories of abnormals are hypothesized to be different from those of healthy individuals.

However challenges arise from not only that object representation of one particular time point lives on complex curved manifold but also that we takes correlation of pairs of object representations for the two time points into account during classification. In this talk we propose a novel classification method that uses skeletal representation to capture rich non-Euclidean geometric object properties of objects of interest. Our statistical method combines distance weighted discrimination (DWD) with a carefully chosen Euclideanization which takes full advantage of the geometry of the manifold on which these non-Euclidean geometric object properties (GOPs) live. Our method is evaluated via the task of classifying 3D hippocampi between schizophrenics and healthy controls.