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Geometric Approach to Detecting Volumetric Changes in Medical Images

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Abstract

We present a new quantitative method for detecting changes in 3D medical images. The dissimilarity between shapes is quantified as a measure of the effort it takes to deform one 3D region into another. Our main tool is an assessment of conformal and isometric distortions of mappings between volumes. Unlike most existing techniques for shape comparison, our algorithm operates both on triangular and tetrahedral meshes, and therefore can be applied both for closed simply connected surfaces, as well as for volumetric domains homeomorphic to a ball, with geometrically complicated boundaries. Furthermore we extend our main geometric distortion measure to higher dimensions, in a manner that allows for the dealing with spatial data at the maximal, as well as at all the lower dimensions.

Keywords: Change detection, 3D medical images, quasiconformal mapping, distortion measures

2010 MSC: 68U15, 30C65

1. Introduction

Voxel-based morphometry (VBM) is one of the most popular methods for detecting brain differences between two or more groups of subjects [1]. This fully automated method makes it possible for researchers with various expertise to perform reproducible

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