Brain Surface Conformal Parameterization with Holomorphic Flow Method and Its Application to HIV/AIDS

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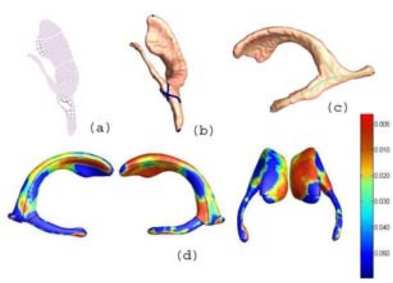
Introduction: We propose a method that computes surface conformal parametrization with holomorphic flow segmentation method. Surface morphometry was studied by calcuating the middle axis representation.

Methods: The introduced conformal parameterization method can work on the high genus and branching surfaces. By finding the canonical holomorphic 1-form, ventricle surfaces are parameterized by their intrinsic geometry structure thus they can seperated into the consisent parts. We can then canonically partition surface into patches and compute its conformal grids. The parameterization results are consistent and the subdivided surfaces can be matched to each other. This algorithm can match complex (possibly branching) topology surfaces.

Results: The lateral ventricles, a fluid-filled structure deep in the brain, is of great interest in the study of psychiatric illnesses. These structures are often enlarged in disease and can provide sensitive measures of disease progression. Our algorithm can conformally map a lateral ventricle surface to three patches and get a uniform parameterization on some areas that otherwise are difficult for usual parameterization methods to capture.

We further compute middle axis and tensor based morphometry to study the surface enlargement. By permutation test, we collected surfaces areas where the surface enlargement is significant.

Conclusions: We introduce holomorphic flow segmentation algorithm to study brain ventricle surface morphometry and apply it to HIV/AIDS. The algorithm successfully detects the significant changing areas.



Category: Modeling and Analysis
Sub-Category: Flattening, segmentation