

Brain Surface Parameterization by Conformal Self-Organizing Map.

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Abstract

This paper presents the implementation of parameterizing a brain surface using the conformal spherical self-organizing map (CSSM)[1]. It starts with a regular mesh on a sphere and gradually shapes the regular mesh to match its object's surface by using the CSSM. It can drape a uniform mesh on an object with a high degree of conformality. It defines a conformal mapping from a sphere to the brain's cortical surface.

Numerous methods have been proposed to compute a conformal mapping from the brain's cortical surface to a sphere. In this paper, a self-adaptive learning method is presented to find a conformal and uniform parameterization for brain surface. The conformal spherical self-organizing map (CSSM) can mimic a given manifold by continuously and selectively tuning to the input point patterns.

In general, CSSM is capable of learning the given manifold without unmatched patterns. However, the brain surface is crumpled with many sulci. Direct implementation of CSSM on brain surface will lead to unmatched features. Therefore, an additional step of smoothing the brain surface has been taken before the CSSM learning steps. After the CSSM learns the smoothed manifold, it is directly mapped backwards to the original mesh. Then CSSM continues to learn the brain surface until all patterns are matched.

References

- [1] Cheng-Yuan Liou and Yen-Ting Kuo (2005) Conformal self-organizing map for a genus-zero manifold. The Visual Computer 21(5):340-353

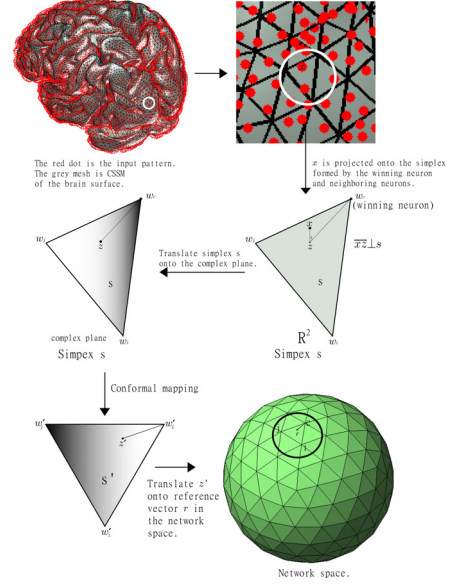


Figure 1: The CSSM conformal learning procedure.

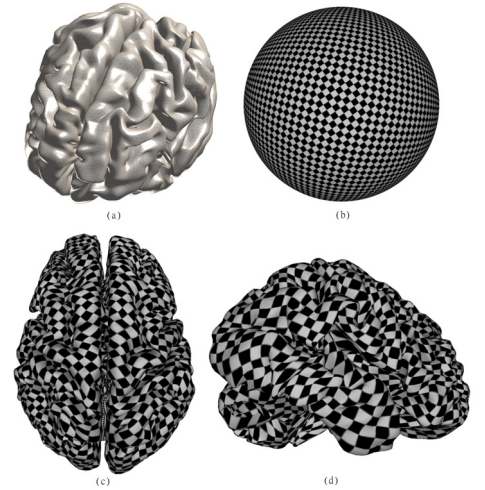


Figure 2: CSSM result of learning a grey matter surface. (a) The CSSM result (b) Texture mapping on sphere which is projected by stereoprojection. (c) Top view of texture mapped brain. (d) Right view of texture mapped brain.

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