# Application of Ricci flow to 3D image processing for Alzheimer's disease diagnosis

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**Abstract:** Ricci flow parameterization enables the conformal mapping of surfaces, such as brain cortical surfaces, to canonical spaces like spheres, Euclidean planes, or hyperbolic planes.
We applied Ricci flow to brain surface indexing for Alzheimer's disease diagnosis using novel covariance-based descriptors derived from Ricci energy optimization. These descriptors, embedded in the nonlinear manifold of symmetric positive-definite matrices, were classified using Gaussian radial basis functions. Additionally, Ricci flow was used to calculate conformal factors and mean curvature, with Shannon entropy applied for local surface encoding.
In a separate study, Euclidean Ricci flow mapped surfaces onto spheres. Experiments on nearly 200 3D MRI brain models from the ADNI dataset demonstrated that our methods achieved over 90% classification accuracy between Alzheimer's patients and cognitively normal subjects, particularly in the hippocampal region.