The geometry of the generalized gamma manifold with an application in medical imaging

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The fisher information metric provides parameterized probability densities with a Riemannian manifold structure, yielding the so-called information geometry. The information geometry of the gamma manifold associated to the family of gamma distribution has been well studied [1]. However, only a few results are known for the generalized gamma family, that adds an extra shape parameter, making it a non-natural exponential family. As a consequence, the fisher metric is no longer a Hessian one, and the computation of the Christoffel symbols and the sectional curvature become more intricate. An alternative approach based on gamma manifold embeddings will be introduced, yielding both a computationally efficient algorithm and a geometric insight. Within this frame, approximate geodesics can be obtained, using a two-step move.
The presentation will also introduce an application in medical imaging that is the classification of Alzheimer's disease population [2]. In the medical field, over the past two decades, a growing number of quantitative image analysis techniques have been developed, including histogram analysis, which is widely used to quantify the diffuse pathological changes of some neurological diseases. This method present several drawbacks. Indeed, all the information included in the histogram is not used and the histogram is an overly simplistic estimate of a probability distribution. Thus, in this study we present how using information geometry and the generalized gamma manifold improved the performance of the classification of Alzheimer's disease population.

Références

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