THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

Master's Thesis Presentation

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"The SphericalTNBBeta Distribution and its Applications to Variational Autoencoders"

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Abstract

Deep generative models typically employ an isotropic Gaussian prior due to its mathematical tractability, as well as it being the maximum entropy distribution on Rd up to mean and covariance constraints. In low dimensions, isotropic Gaussian samples concentrate about the origin while in high dimensions, they concentrate about a hyperspherical shell. Recent work has investigated hyperspherical embeddings using the uniform distribution as a prior. In the context of variational autoencoders (VAEs) [Kingma and Welling, 2022], the von Mises-Fisher (vMF) and power-spherical distributions have been investigated as candidates for posterior approximation. This work provides an overview of existing hyperspherical posteriors and introduces the SphericalTNBBeta distribution which admits greater expressivity. We show that equipping a VAE with this posterior results in performance that at least matches the S-VAE [Davidson et al., 2022] and the power-spherical VAE [Cao and Aziz, 2020], and results in stronger representations of featureless graphs.

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