Superficial Gaussian Mixture Reduction

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Abstract: Many information fusion tasks involve the processing of Gaussian mixtures with simple underlying shape, but many components. This paper addresses the problem of reducing the number of components, allowing for faster density processing. The proposed approach is based on identifying components irrelevant for the overall density's shape by means of the curvature of the density's surface. The key idea is to minimize an upper bound of the curvature while maintaining a low global reduction error by optimizing the weights of the original Gaussian mixture only. The mixture is reduced by assigning zero weights to reducible components. The main advantages are an alleviation of the model selection problem, as the number of components is chosen by the algorithm automatically, the derivation of simple curvature-based penalty terms, and an easy, efficient implementation. A series of experiments shows the approach to provide a good trade-off between quality and sparsity.