EPSTEIN INSTITUTE SEMINAR ▪ ISE 651

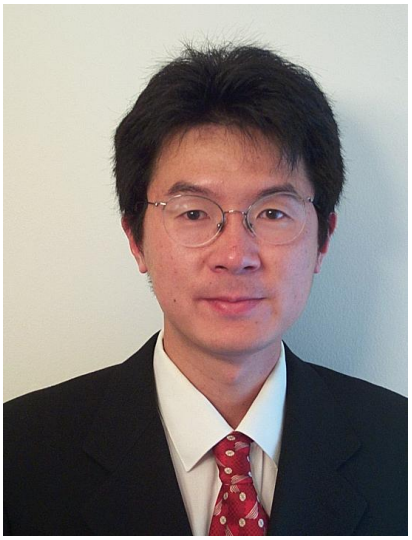
Geometric View of Optimal Transportation and Generative Adversarial Networks (GANs)

ABSTRACT - This work introduces an optimal transportation (OT) view of Generative Adversarial Networks (GANs). Natural data sets have intrinsic patterns, which can be summarized as the manifold distribution principle: the distribution of a class of data is close to a low dimensional manifold. GANs mainly accomplish two tasks: manifold learning and probability distribution transformation. The latter can be carried out using classical optimal transportation method.

From OT point of view, the generator computes the optimal transportation map, the discriminator computes the Wasserstein distance between the generated distribution and the real data distribution, both of them can be reduced to a convex geometric optimization process. Furthermore, OT theory discovers the intrinsic collaborative, instead of competitive, relation between the generator and the discriminator, and the fundamental reason for mode collapse.

Furthermore, we propose a novel generative model, which uses an autoencoder for manifold learning and OT map for distribution transformation. The AE-OT model improves the theoretic rigor and transparency, also computational stability and efficiency, especially it eliminates the mode collapse.

Experimental results validate our hypothesis, and demonstrates the advantages of our proposed model.



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SPEAKER BIO - Dr. David Gu got his B.S. from Tsinghua University, MS and PhD from Harvard University in 2003, supervised by a Fields medalist, Prof. Shing-Tung Yau. Dr. Gu currently is an Associate Professor in the Computer Science Department at Stony Brook University, affiliated with the Center of Mathematical Sciences and Applications, Harvard University. Dr. Gu got NSF CAREER award in 2005, Morningside Gold Medal for Applied Mathematics in 2013. Prof. Yau and Dr. Gu, together with collaborators, founded an merging interdisciplinary field: Computational Conformal Geometry, which combines Modern Geometry and Computer Science, and applied for a broad range of engineering fields, such as Computer Graphics, Computer Vision, Geometric Modeling, Networking, Medical Imaging and CAD/CAE. Dr. Gu has about 300 publications, several books, including "Computational Conformal Geometry", "Ricci Flow for Shape Analysis and Surface Registration" and so on. His patent on virtual colonoscopy has been licensed to Simens and GE, and broadly applied in clinics worldwide.

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