# AE-OT: A New Generative Framework Based on Optimal Transport

Dongsheng An, Yang Guo, Xin Qi, Na Lei, Zhongxuan Luo, Shing-Tung Yau, and Xianfeng Gu
3D Scanning Lab, Computer Science, Stony Brook University

Stony Brook University
Computer Science

Manifold assumption and Distribution transform

Manifold Distribution Hypothesis: a specific class of natural data is concentrated on a low dim manifold in the high dim data space
Distribution Transformation: the generative model computes a transport map from the given continuous distribution to the real data distribution.
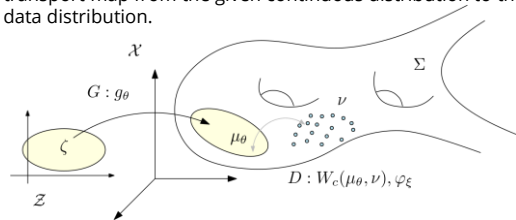

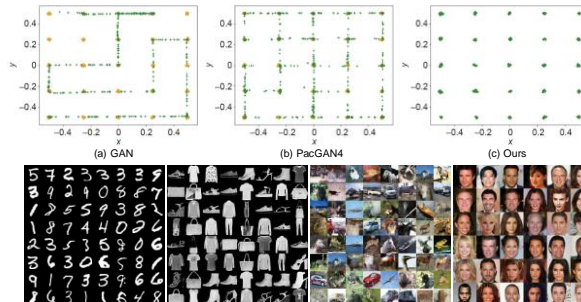## Mode Collapse and Mode Mixture

Mode collapse:; Generate part of the modes for multi-mode dataset
Mode mixture: Generate samples that are mixtures of multi-mode
Explaination: Approximate the intrinsic highly discontinuous probability transform map by continuous DNNs

convex support   (b) concave support: single mode   (c) concave support: multi modes
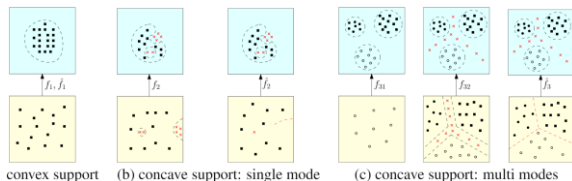
The AE-OT : Conqure Mode Collapse/Mixture
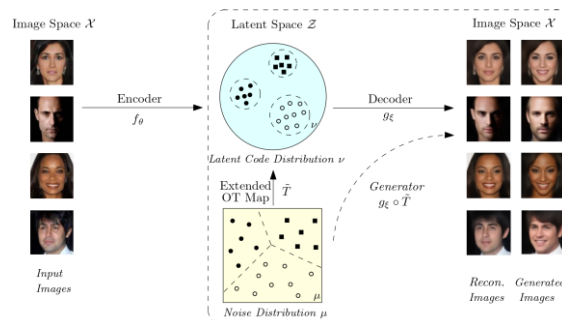
Experimental Results

(a) GAN   (b) PacGAN4   (c) Ours
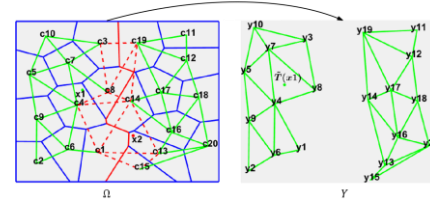

Semi-discrete Optimal transport

We compute the semi-discrete OT map from Uniform distribution to the data distribution $\nu = \frac{1}{n}\sum_{i=1}^{n}\delta(y - y_i)$ by minimizing the following energy

$$E(h) = \int_0^h \sum_{i=1}^n w_i(\eta)\,d\eta_i - \sum_{i=1}^n h_i \nu_i$$

Reference

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[2] Na Lei, Dongsheng An, Yang Guo, Kehua Su, Shixia Liu, Zhongxuan Luo, Shing-Tung Yau, Xianfeng Gu. A geometric understanding of deep learning. Engineering, 2020.
[3] Dongsheng An, Yang Guo, Na Lei, Zhongxuan Luo, Shing-Tung Yau, and Xianfeng Gu. AE-OT: a new generative model based on extended semi-discrete optimal transport. ICLR 2020.
[4] Dongsheng An, Yang Guo, Min Zhang, Xin Qi, Na Lei, Xianfang Gu. AE-OT-GAN: Training GANs from data specific latent distribution. ECCV 2020.