

VAEs

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Outline



Problem and Goal

- **Problem:** no consistent perceptual-metric comparison
- **Goal:** to evaluate reconstruction and visualization across 3 then-popular VAE-based architectures and also use newer perceptual metrics

VAE architecture

- Mention original paper

β -VAE and VQ-VAE

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Dataset and Implementation

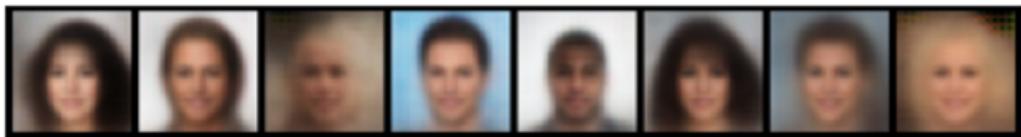
- CelebA dataset (10,000 images)
- Training of VAE, β -VAE, VQ-VAE and VAEGAN, implementations via Pythae
- [Project repository](#)
- HF model?..
- Wandb for training stats?

Visual evaluation - reconstruction

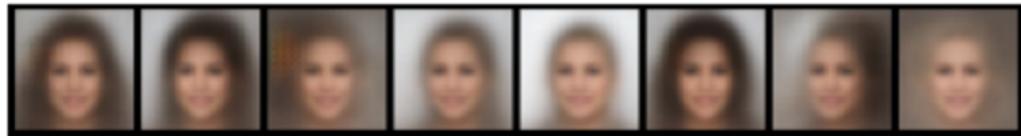
Orig



$\beta=1.0$



$\beta=8.0$



- β results in worse reconstruction.

Visual evaluation - reconstruction

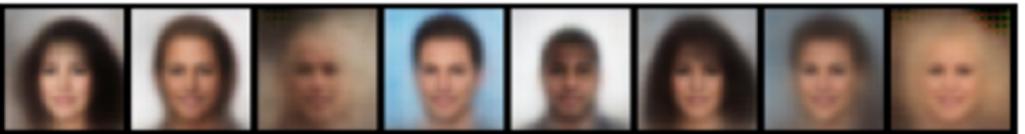
Orig



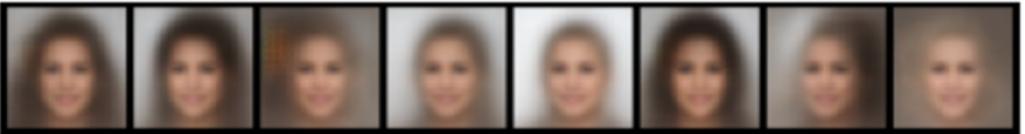
$\beta=0.5$



$\beta=1.0$

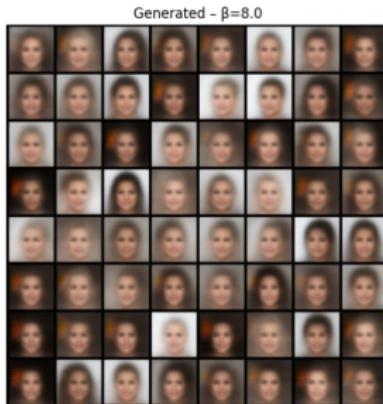
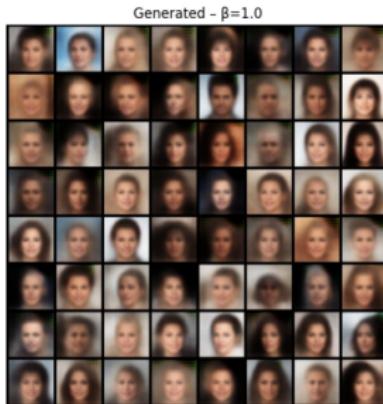
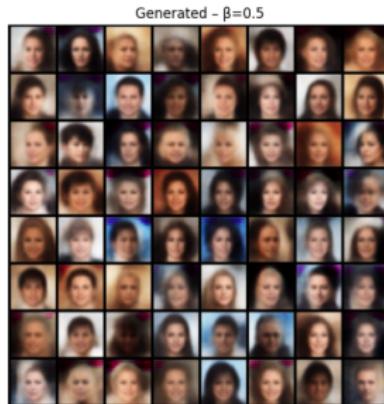


$\beta=8.0$



- β results in worse reconstruction.

Visual evaluation - generation



- β results in worse generation.

Numerical evaluation

β	BCE	MSE	KL	ELBO	LPIPS	SSIM	GMSD
0.5	23.214	0.015	45.934	46.181	0.289	0.643	0.163
1	32.491	0.021	14.912	47.402	0.318	0.565	0.190
4	50.755	0.033	1.090	55.115	0.380	0.477	0.224
VQ-VAE	0	0	0	0	0	0	0
VAEGAN	0	0	0	0	0	0	0

Table: Reconstruction metrics for different β values.

β	BCE	MSE	KL	ELBO	LPIPS	SSIM	GMSD
0.5	8.764	0.006	39.163	28.345	0.093	0.870	0.109
1	9.131	0.006	12.443	21.574	0.090	0.835	0.121
4	12.050	0.008	0.945	15.831	0.073	0.841	0.124
VQ-VAE	0	0	0	0	0	0	0
VAEGAN	0	0	0	0	0	0	0

Table: Generation metrics for different β values.

Discussion - effects of β

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Discussion - VQ-VAE effects

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Summary

- Short recap of the results.