Any-resolution Training for High-resolution Image Synthesis

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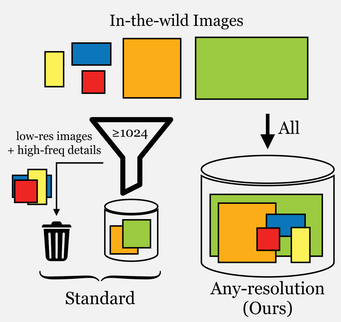
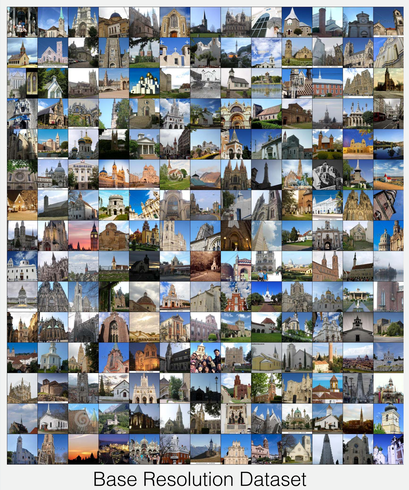
https://chail.github.io/anyres-gan

Any-resolution Datasets



- Unconditional synthesis wastes learnable pixels
- How can we use images at native resolution?
- Train on **multi-resolution** data for **high-resolution** generation

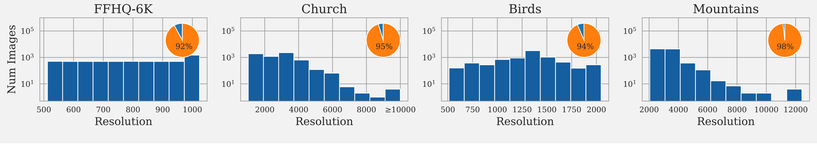
Dataset Collection



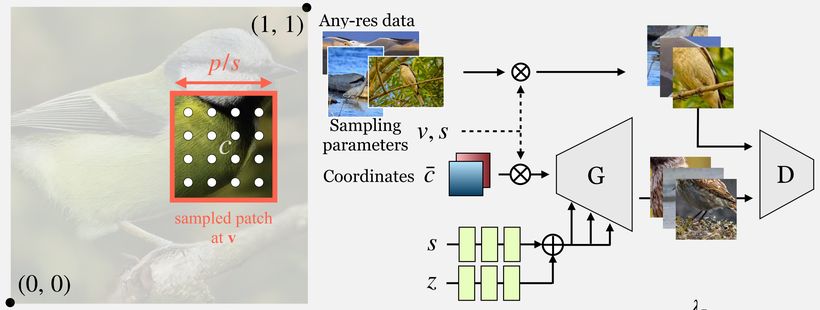
Base Resolution Dataset
LSUN [Yu 2015]

High Resolution Dataset
Collected from Flickr

- Use standard base resolution dataset to learn structure (~95%)
- Add few thousand images at larger, varied resolutions to learn texture (~5%)



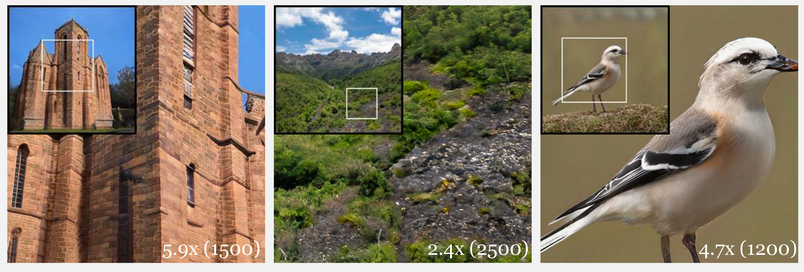
Training Any-res GAN



$$G^* = \arg\min_G \max_D \mathbb{E}_{z,\{x,s,\mathbf{v}\}\sim\mathcal{D}} \underbrace{V(D, G(z, c_{\mathbf{v},s}, x))}_{\text{non-saturating GAN loss}} + \underbrace{\lambda_{teacher}\mathscr{L}_{teacher}(G, G_{fixed}, z)}_{\text{teacher reconstruction}} - \underbrace{\frac{\lambda_{R_1}}{2}R_1(D, x)}_{\text{R1 regularization}}$$

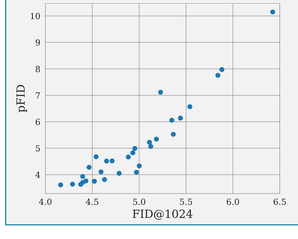
- Images parametrized as continuous surfaces: coordinate grid c controlled by scale s, center v, and patch size p
- Transform generator coordinates using sampled patch parameters
- Teacher loss encourages similarity between patch and smaller global image

Arbitrary Scale Synthesis with Continuous Images



- Sampling the coordinates generates image patches at arbitrary scales

New Patch-FID evaluation



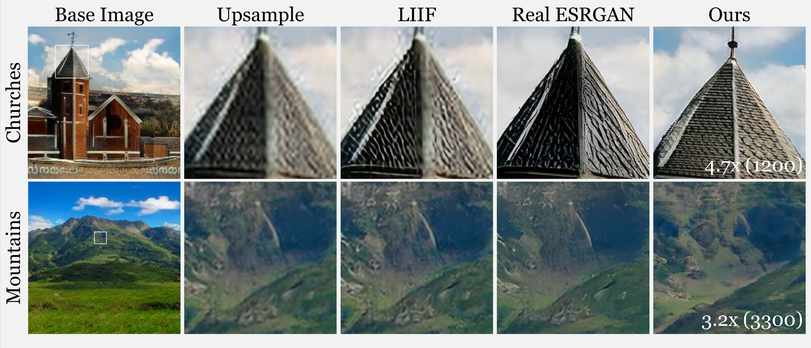
- Measure similarity between real/fake patches, focusing on texture
- Correlated with standard FID on ground truth FFHQ

	FFHQ6K	Church	Birds	Mountain
LIIF	22.93	83.88	30.19	23.10
Real-ESRGAN	16.92	23.04	16.10	19.05
Any-res GAN (Ours)	2.96	9.89	6.52	7.99

Large Image Generation

- Seamless generation of large images despite training with patches

Comparison to Super-Resolution



- Super-resolution methods can amplify artifacts or over-smooth the result
- Any-res GAN tolerates distortions, can mitigate artifacts in base image