Intermediate Layer Optimization (ILO)

- Fine-grained image reconstructions are obtained through iterative optimization over the layers of the generator.
- The algorithm runs in rounds, where in each round the previous layer is discarded and optimize over this newly defined generator.
- By removing layers one at a time, we introduce flexibility in the generation of images that more easily match the observed image.
- We switch to the next layer when the loss function flattens, which can be done in an unsupervised manner.
- The algorithm consists of the following steps:
  1. Given a deep generator $G = (g_n \circ g_{n-1} \cdots \circ g_2 \circ g_1)(z_1)$ we run gradient descent to find the latent vector $z_1$.
  2. We then discard the previous layer and optimize over the generator defined as: $(g_n \circ g_{n-1} \cdots \circ g_2)(z_2)$ while initializing $z_2 = g_1(z_1)$.
  3. This process repeats until the MSE loss becomes very small.

Experiment Setup

- Experiments are performed using the StyleGAN2 generator.
- We utilize a ramped-down learning scheduler with an initial learning rate of 0.1.
- The regularization term $R(z)$ is defined as the geodesic loss of all 18 latent vectors.
- In each instantiation of a generator in any round of the ILO algorithm, we optimize over all the latent vectors and the next 5 noises.

Super-resolution

- We show the effect of different loss functions and compare our results to PULSE.
- We notice that ILO leads to less biased reconstructions since it expands the expressive range of the generators by optimizing intermediate layers.