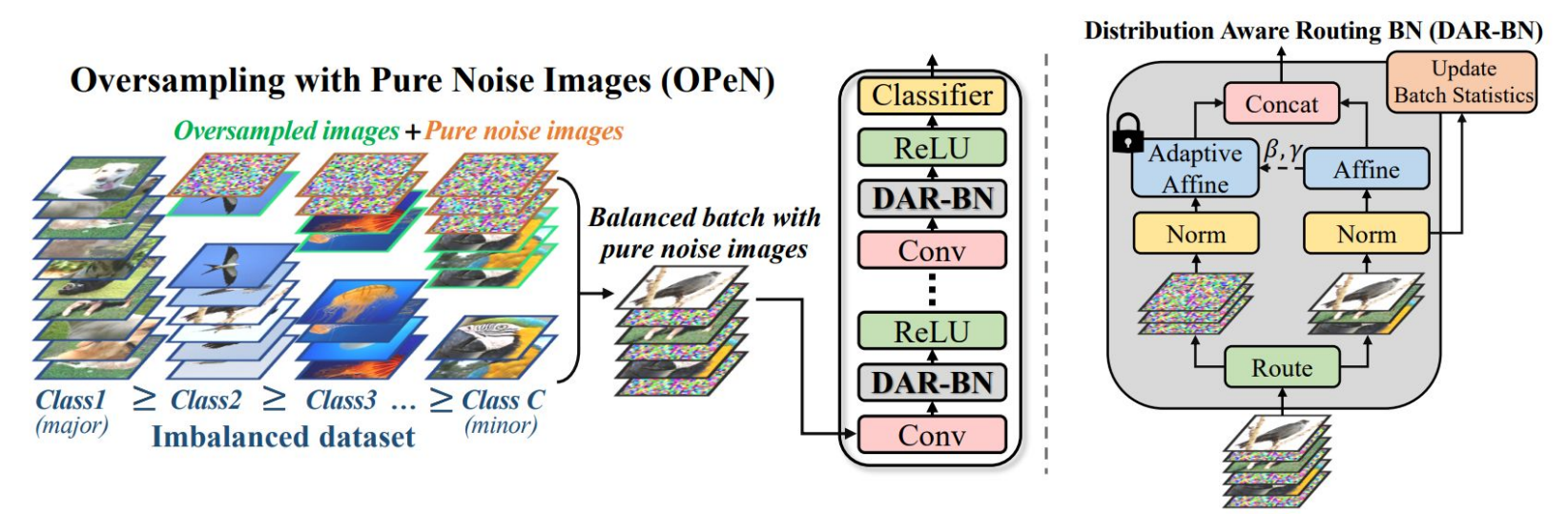
OSeD: Oversampling with Stable Diffusion Improving Imbalanced Image Classification

Alessio Barboni
Giulio Pecile
Francesco Redaelli

Oversampling with Pure Noise (OPeN) - Zada et al., 2021



State-of-the-art results on multiple imbalanced classification benchmarks

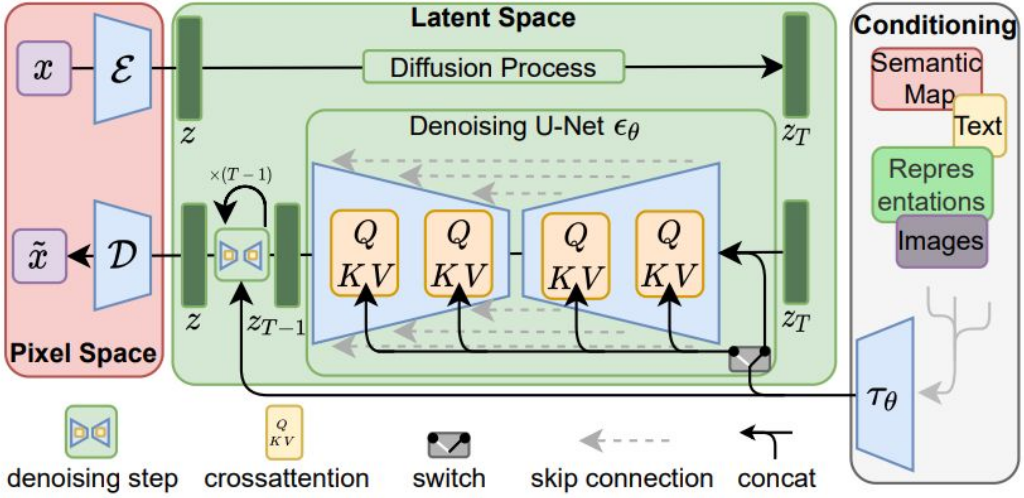
OPeN improvement in generalization on minority classes due to:

- **Regularization effect** on training by adding stochasticity in gradient components *magnitude* and *direction*

- Capability of generating **new random noise training** samples **without being limited** by the **number** and **variety** of **existing samples** in the data

Do we really need random noise?

Stable Diffusion - Robin et al., 2021



Robin et al., 2021, High-Resolution Image Synthesis with Latent Diffusion Models, CVPR

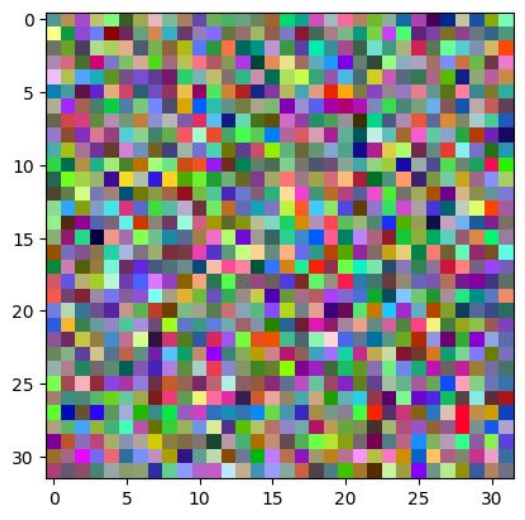
Diffusion model: *image formation process into a sequential application of denoising autoencoders*

Input: *textual prompt*

OSeD - Oversampling with Stable Diffusion

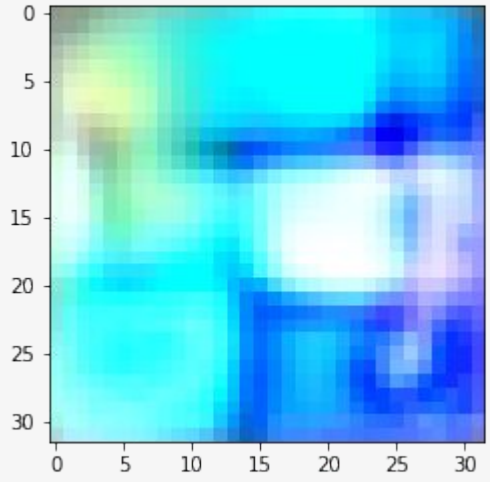
OPeN

sample_noise(image_size, mean, std)

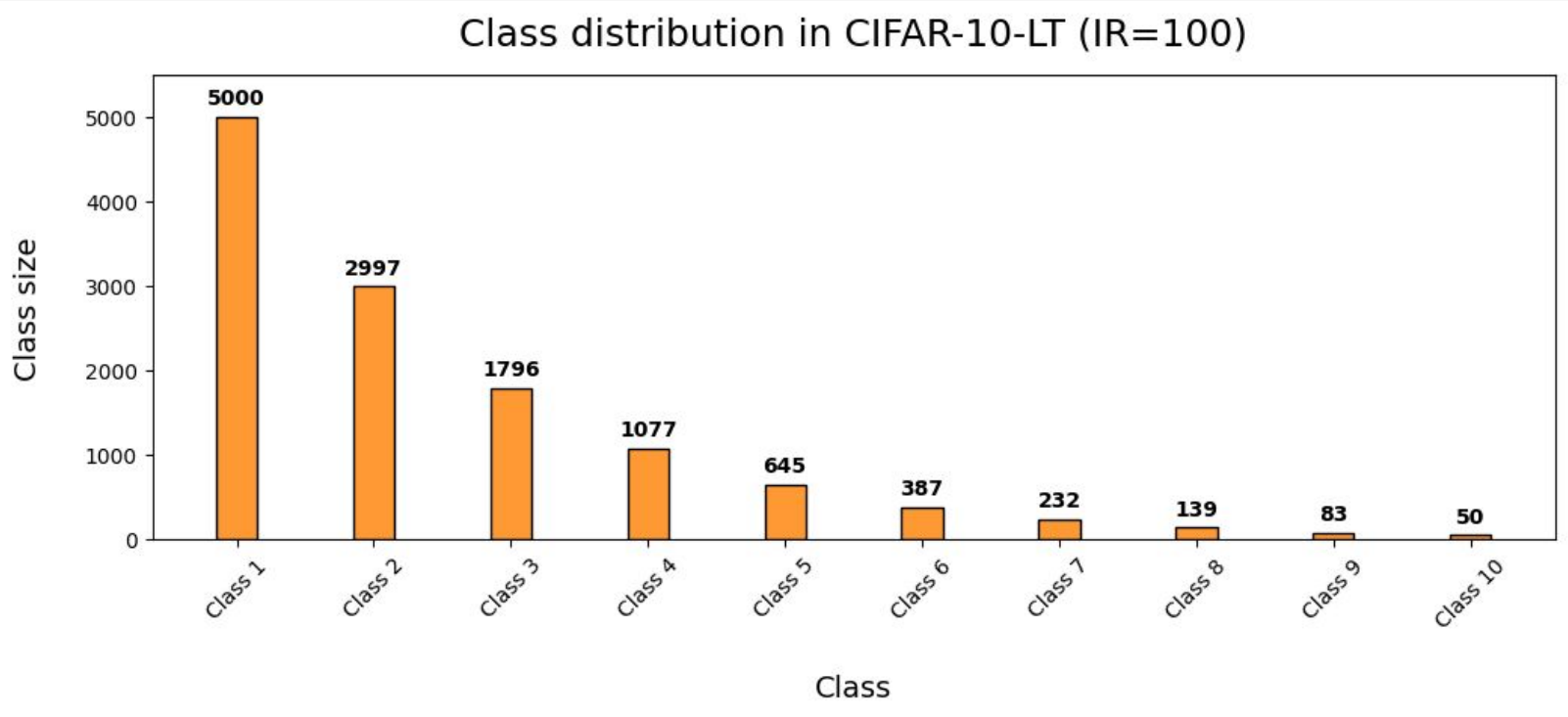


OSeD

StableDiffusion(image_label)

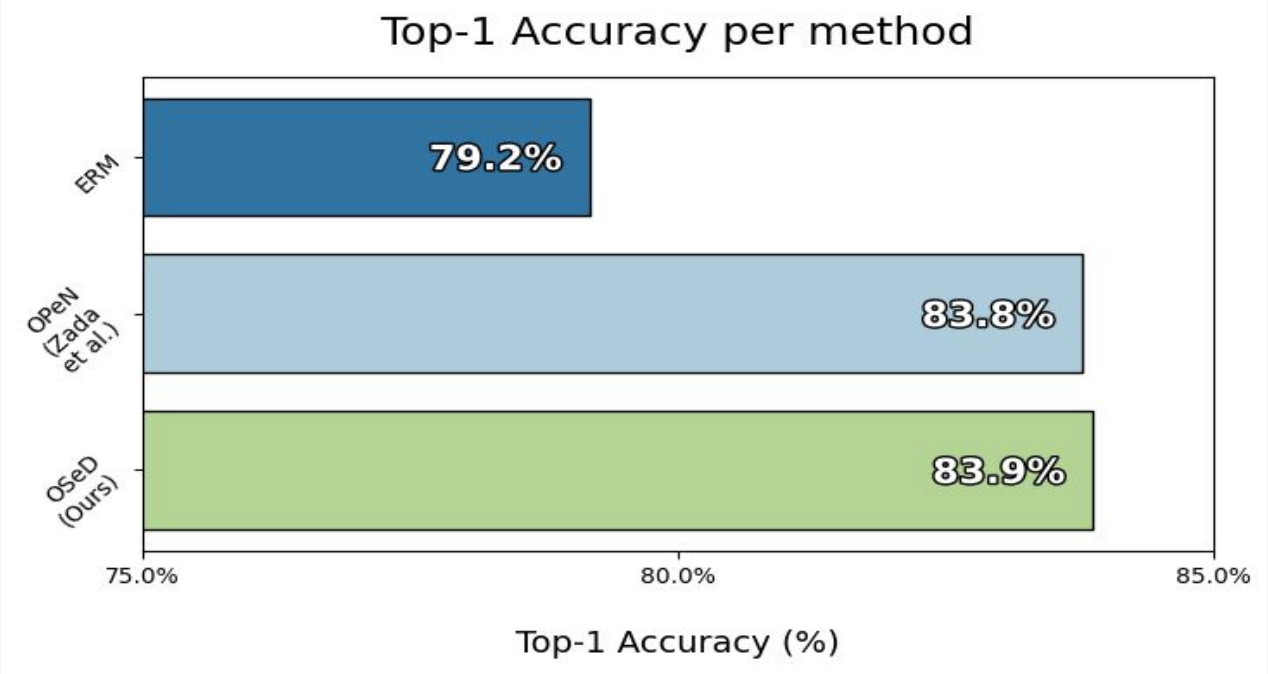


CIFAR-10-LT - Imbalance Ratio = 100

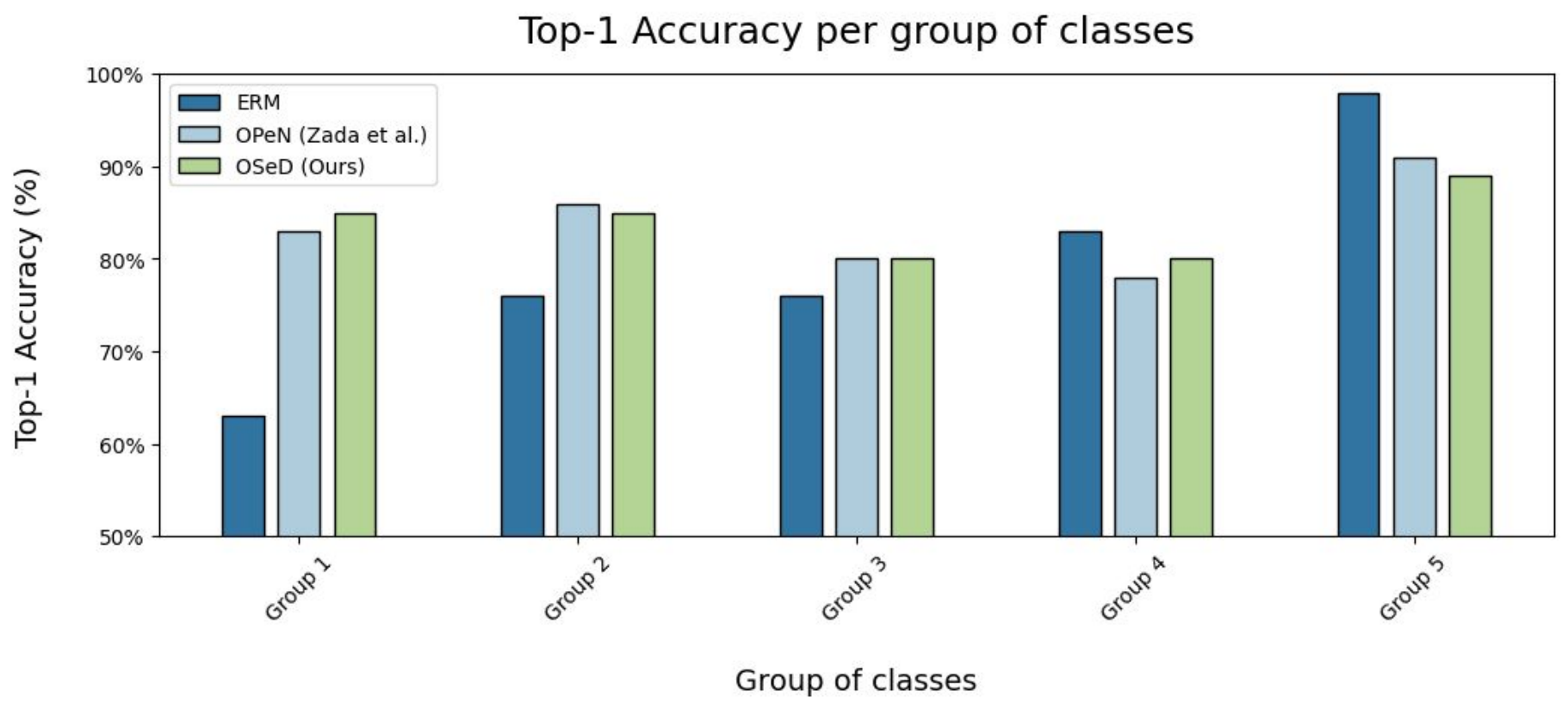


Architecture: WideResNet-28-10 (Baseline ERM + Deferred OPeN / OSeD)

OSeD in numbers…



OSeD in numbers…



… and beyond numbers!