



MIXED PRECISION TRAINING FOR GAUGAN/SPADE

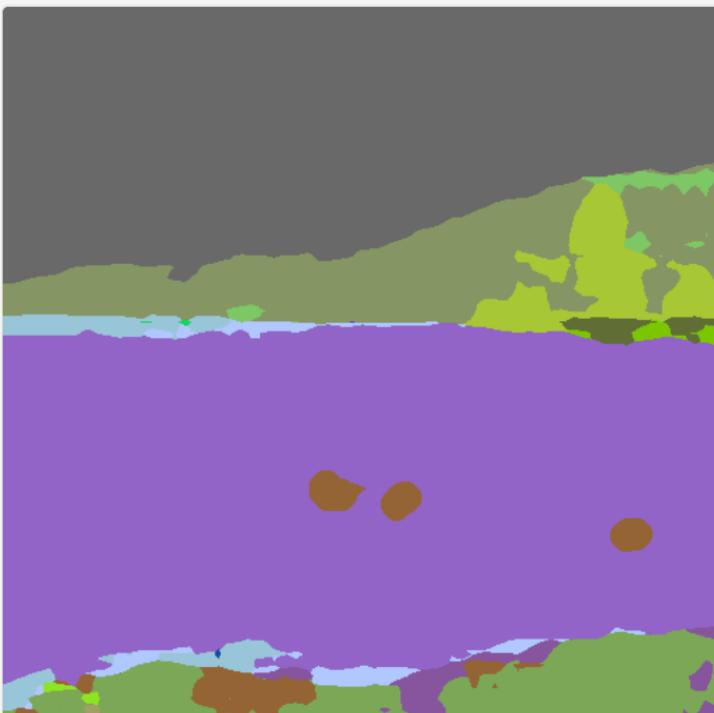
Ming-Yu Liu

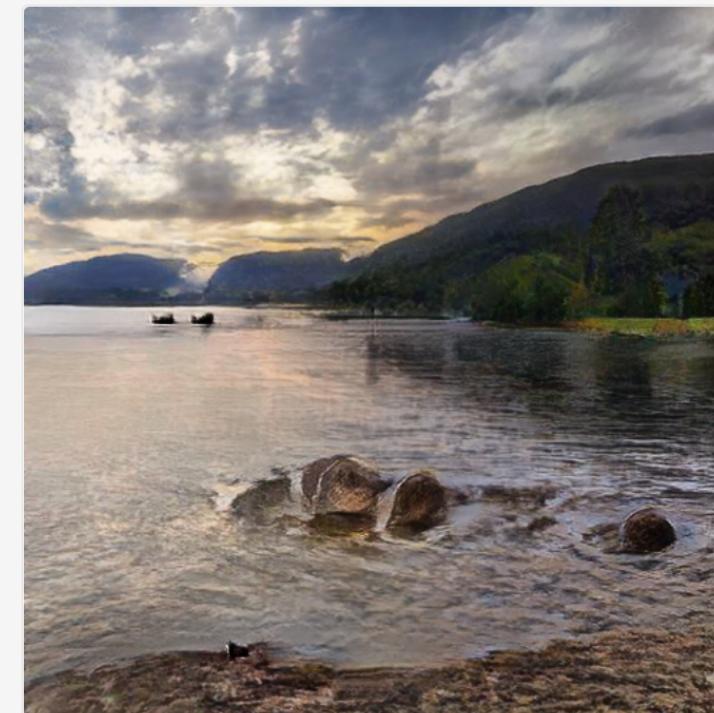
APPLICATION

Fill/brush color: Brush shape: Brush size: 22

NVIDIA GauGAN Beta

- Bush
- Cloud
- Dirt
- Grass
- Gravel
- Hill
- Mountain
- Plant
- River
- Road
- Rock**
- Sand
- Sea
- Sky
- Snow
- Stone
- Tree
- Water





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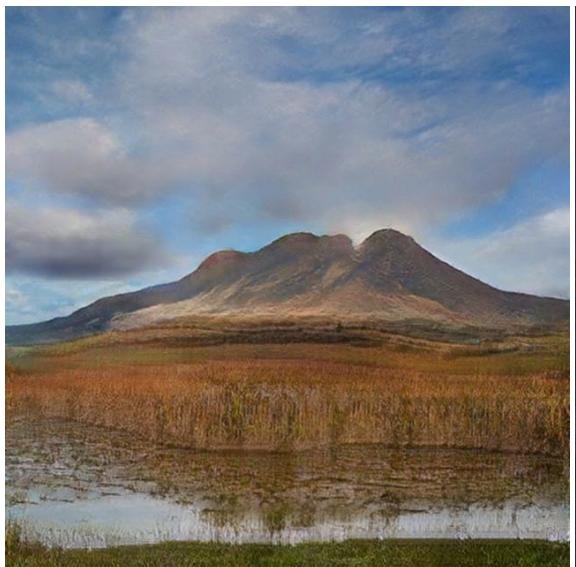
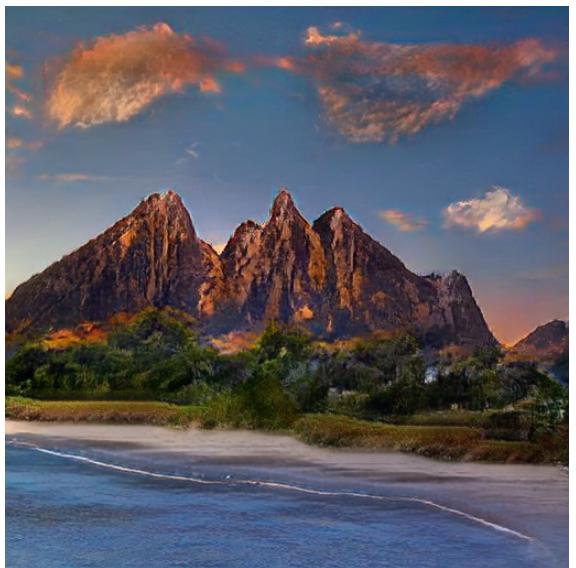






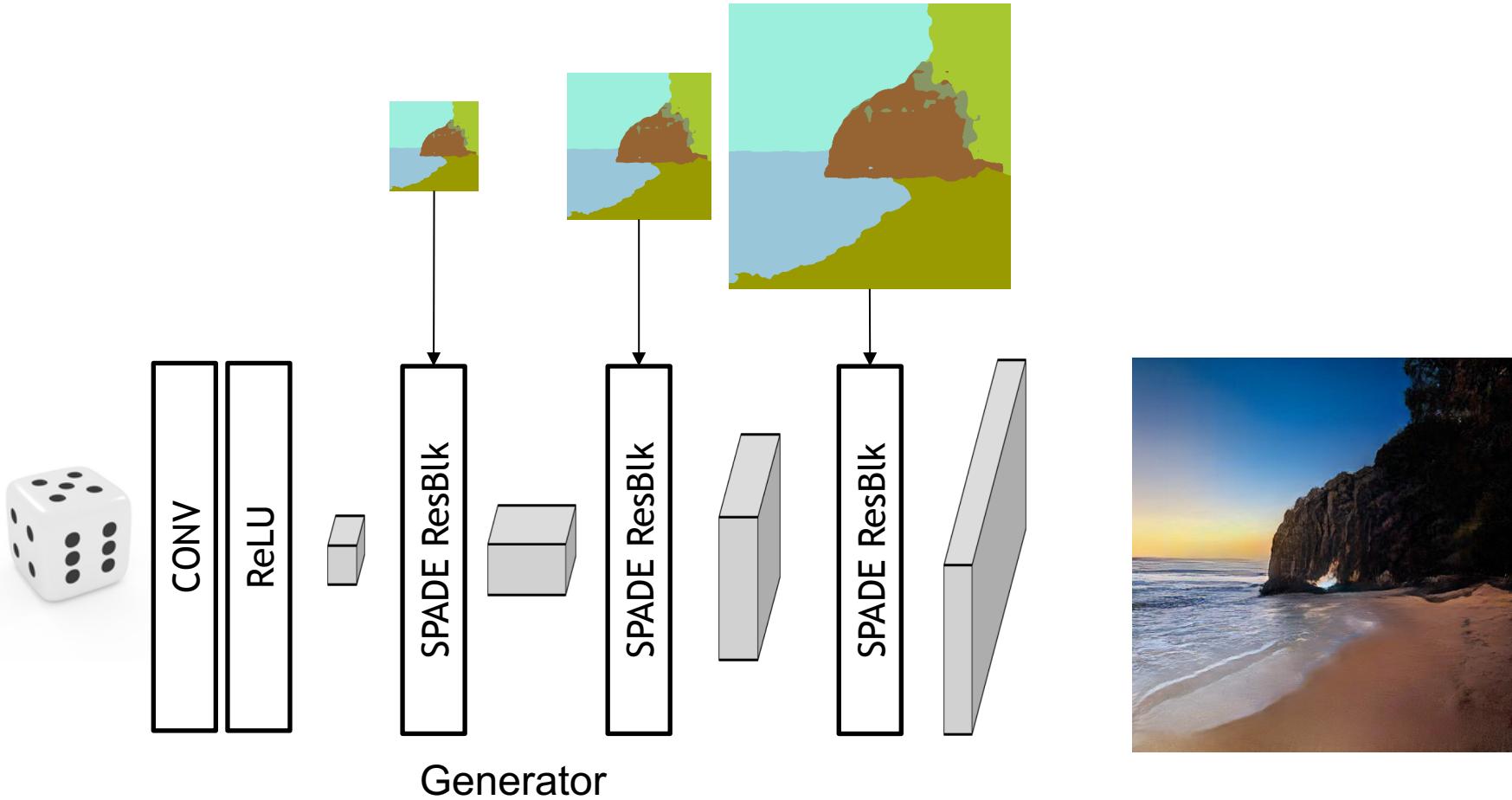




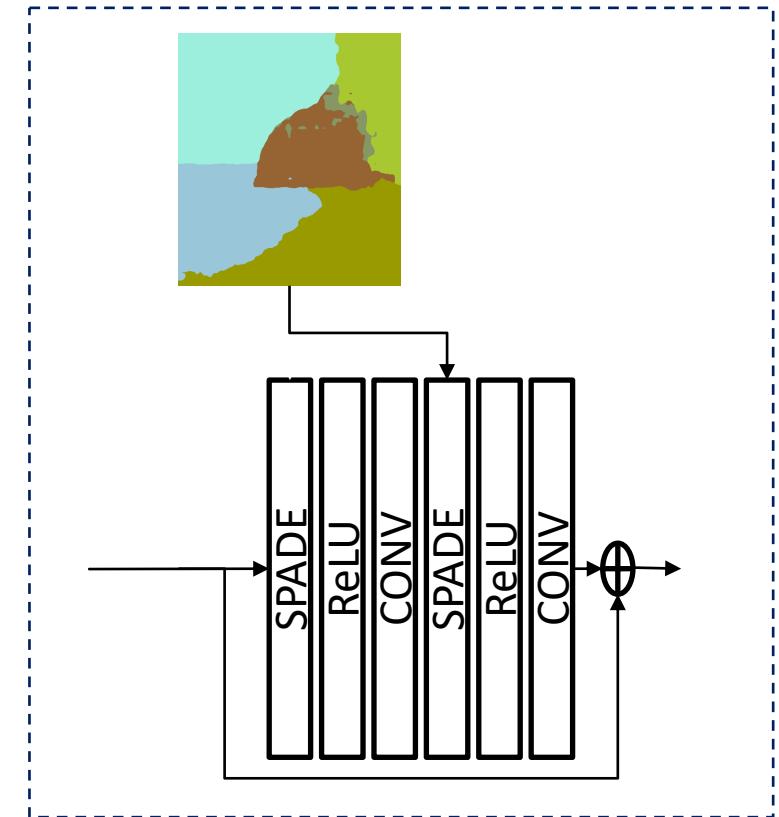
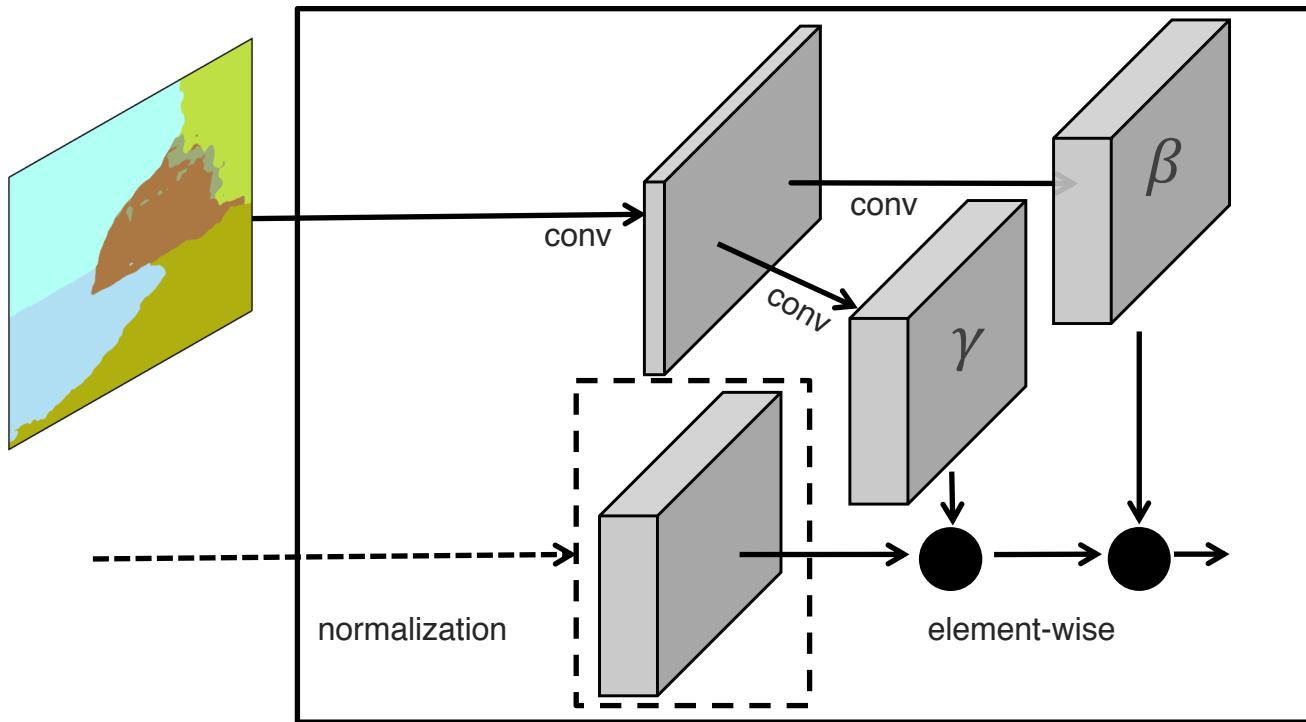




MODEL DETAILS



MODEL DETAILS



SPADE ResBlk

CHANGES REQUIRED

```
from apex import amp
```

```
[netE, netG, netD], [optE, optG, optD] = \  
    amp.initialize([netE, netG, netD], [optE, optG, optD],  
                  opt_level=cfg.amp, num_losses=2)
```

```
with amp.scale_loss(loss_g, [self.optG, self.optE],  
                     loss_id=0) as scaled_loss:  
    scaled_loss.backward()
```

```
with amp.scale_loss(loss_d, self.optD, loss_id=1) as scaled_loss:  
    scaled_loss.backward()
```

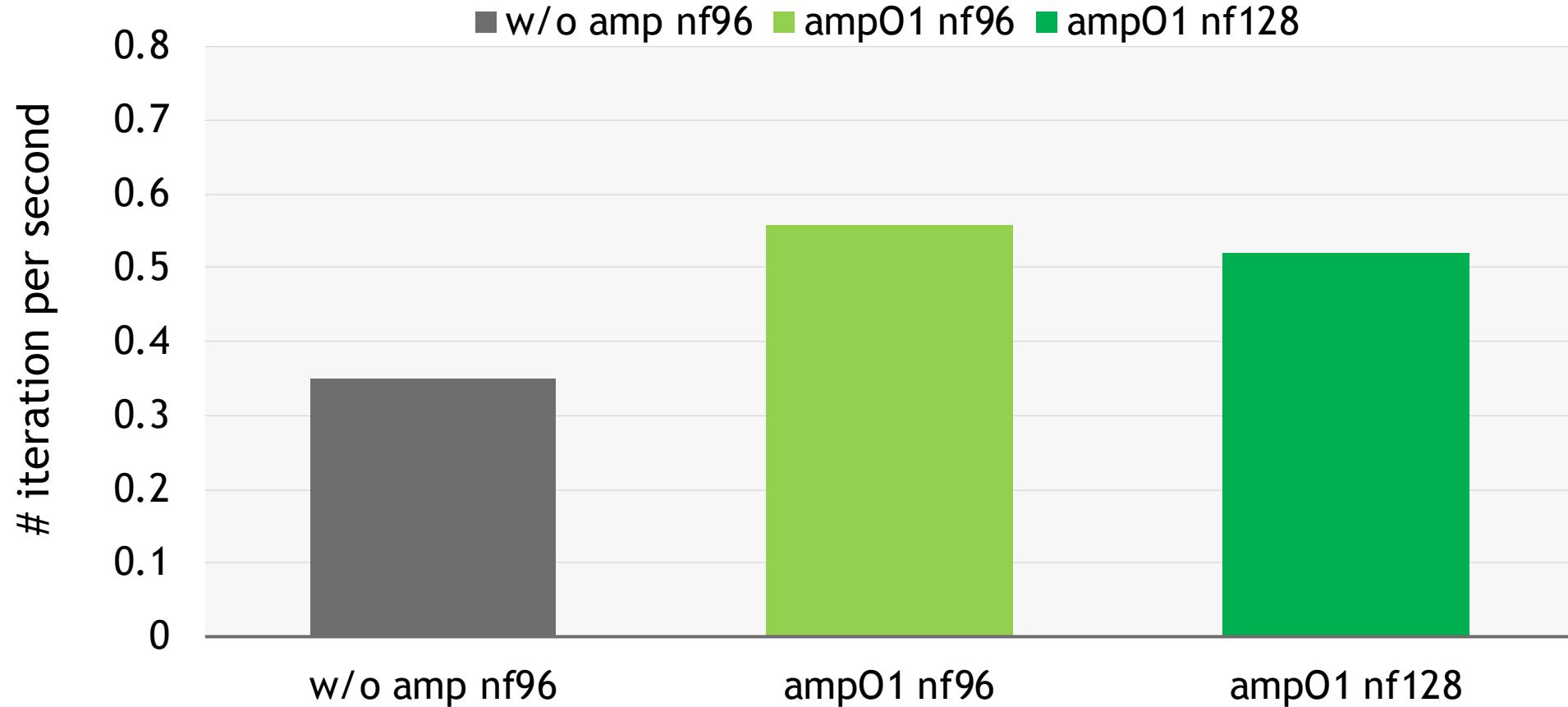
Machine: DGX1 8 V100 32GB

Batch Size: 32 image per batch

Output image resolution: 512x512

TRAINING TIME REDUCTION

1.58x training time reduction per iteration

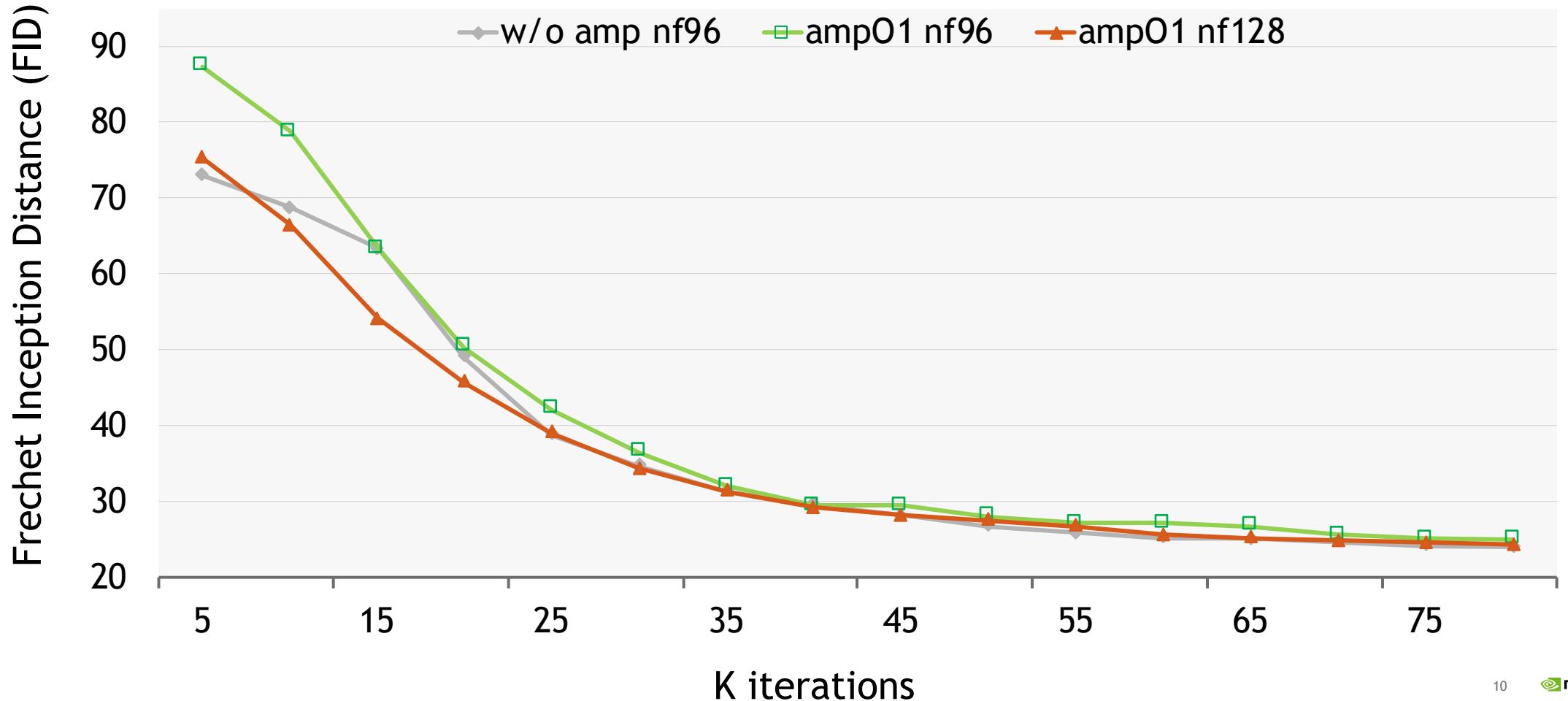


EVALUATION CRITERIA

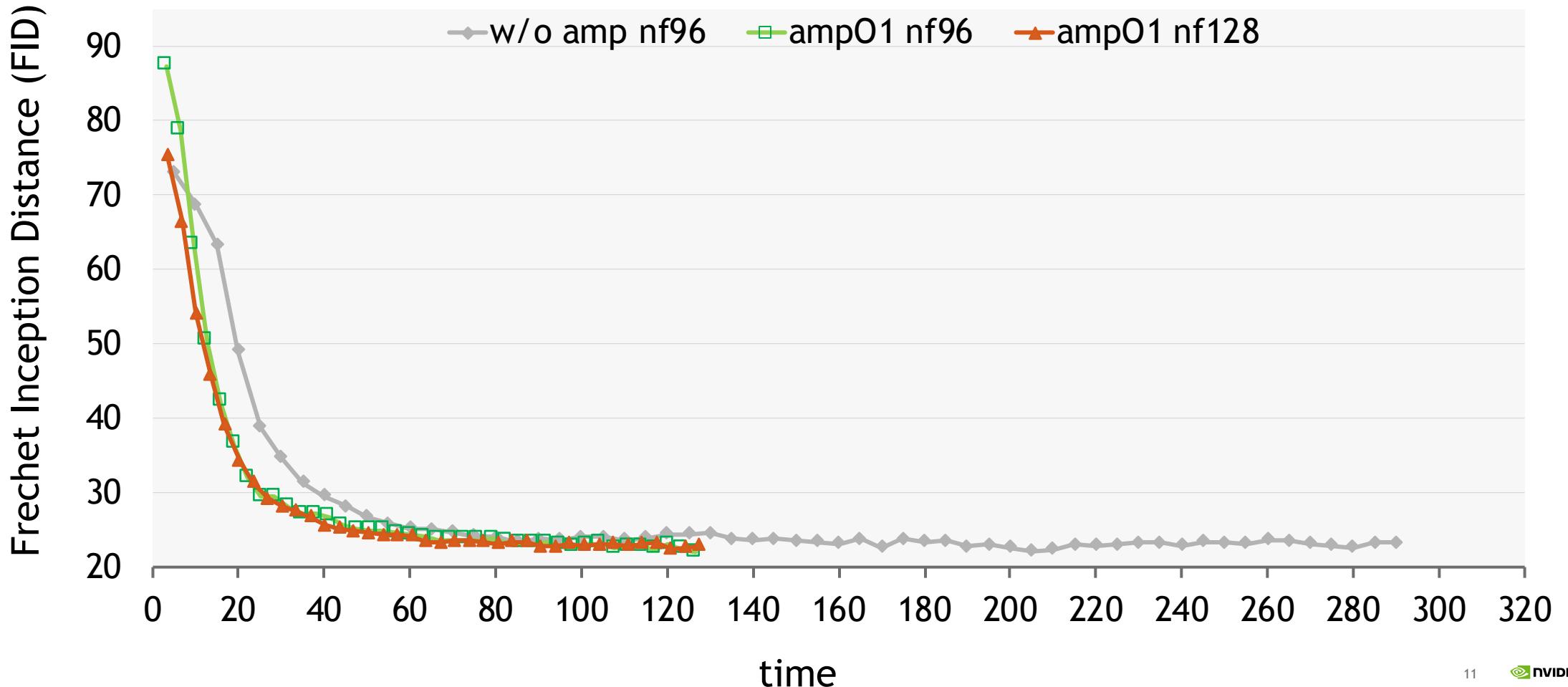
Frechet Inception Distance

$$\text{FID} = \|\mu_r - \mu_g\|^2 + \text{Tr}(\Sigma_r + \Sigma_g - 2(\Sigma_r \Sigma_g)^{1/2}),$$

EFFECT ON ACCURACY



ACCURACY OVER TIME



CONFIGURATION VS SPEEDUP

ampO1 (including data loading)	Output image resolution		
	256x256	512x512	1024x1024
BS=8	1.19	1.24	2.90
BS=16	1.27	2.07	
BS=32	1.61	2.17	
BS=64	1.59		

Removing the data pipeline costs can make AMP 3.3x faster than FP32 (10-20% perf improvement).

CONCLUSION

Mixed precision training is useful for GauGAN/SPADE training.

1. Drop-in replacement when utilizing NVIDIA APEX AMP library. Only need to change 4 lines of code.
2. For the same model and batch size, we can get 1.6x speed up. With an optimized data flow,
3. Utilizing mixed precision training allows us training a bigger generative model, which is the key toward better visual quality.
4. AMP helps usually when model capacity is large or batch size is large.



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