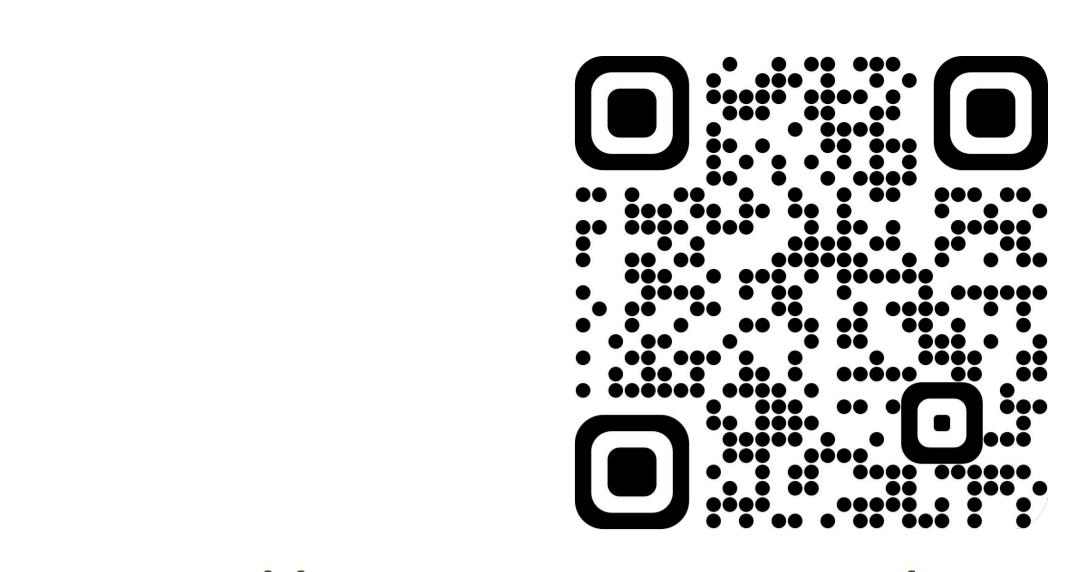




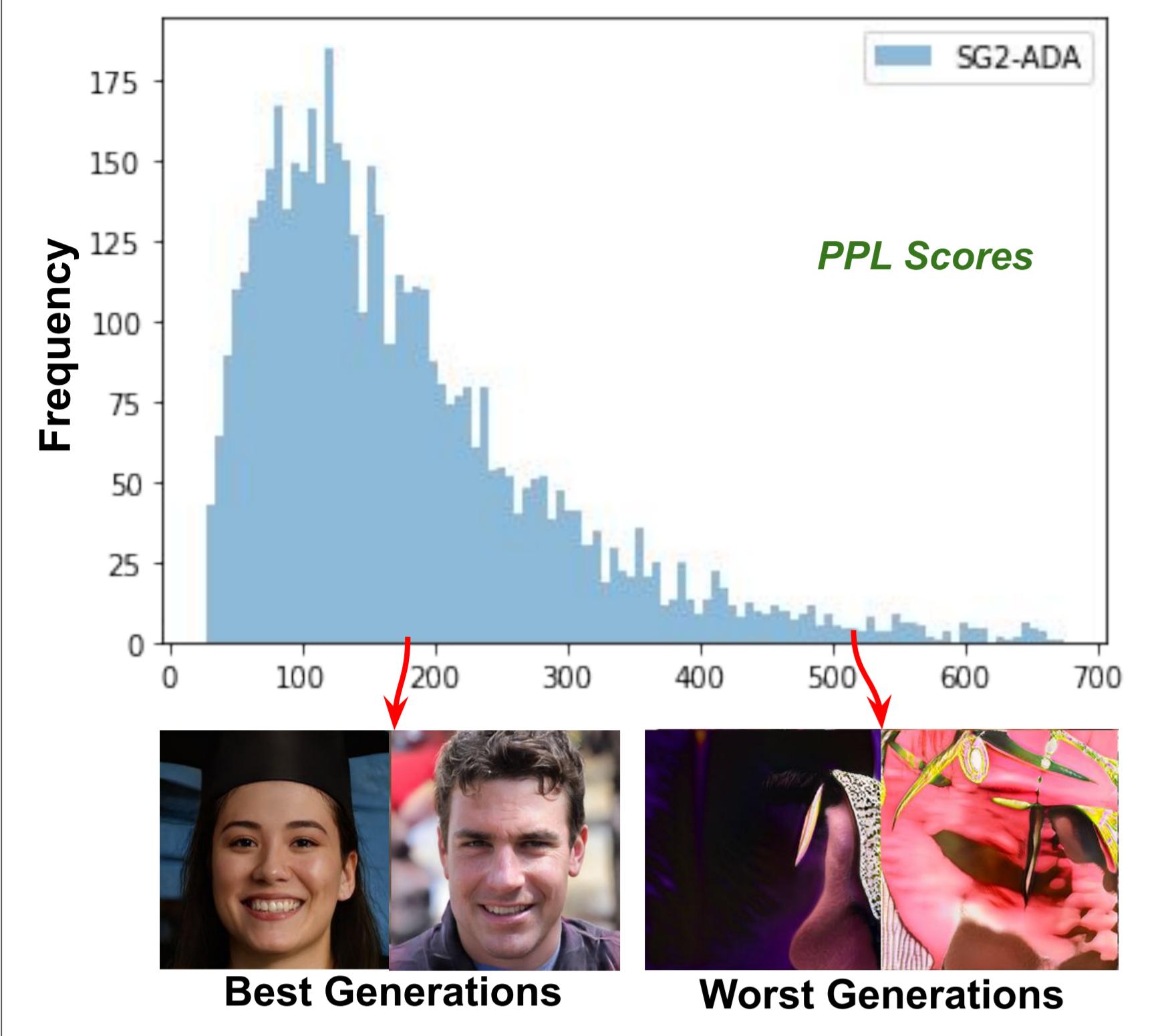
# Hierarchical Semantic Regularization of Latent Spaces in StyleGANs

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<https://sites.google.com/view/hsr-eccv22>

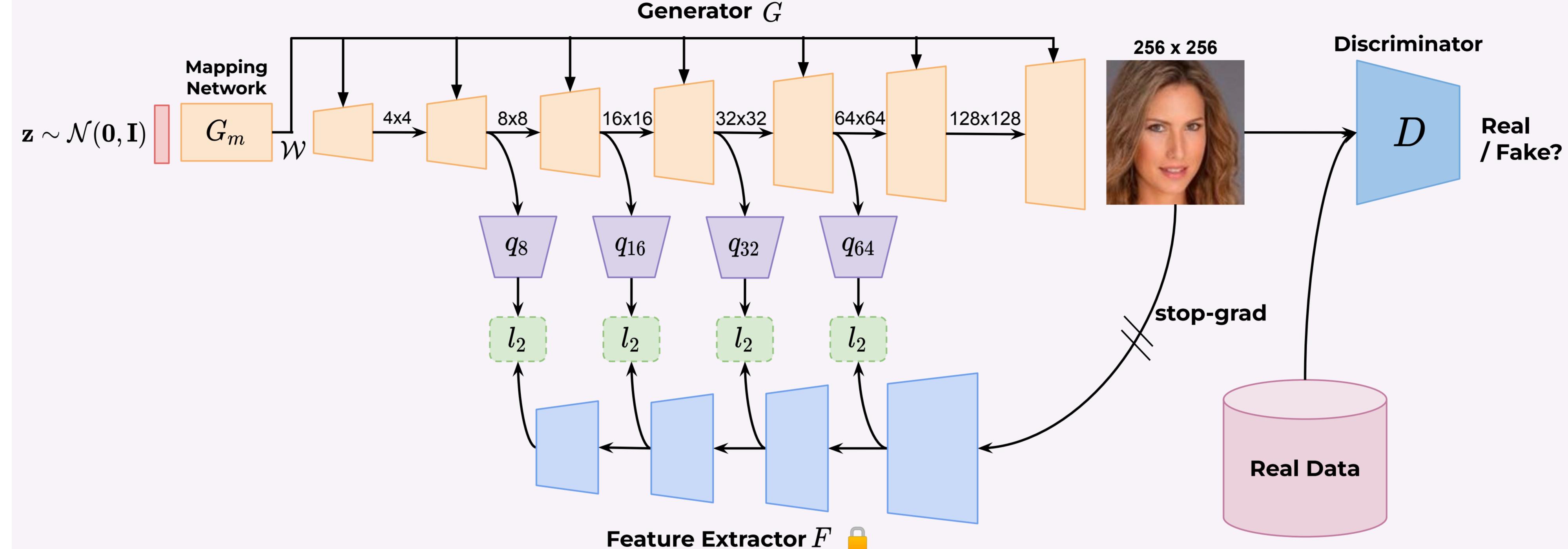
## Introduction



## Motivation

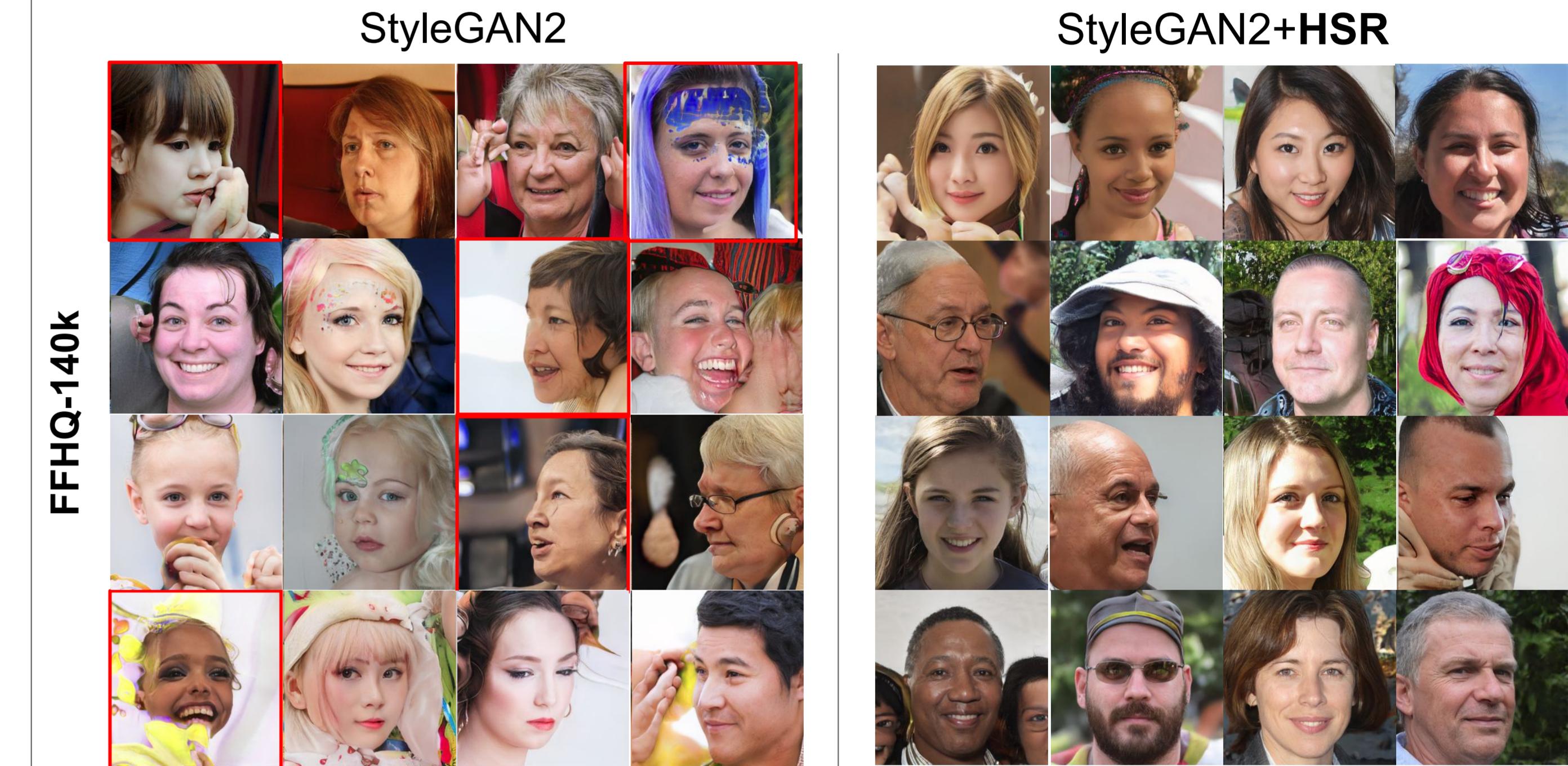
- We aim to alleviate the problem **unnatural image generation** by StyleGANs
- A **naturalness prior** is introduced using **pretrained feature extractor**.
- Analyzed the impact on **smoothness of latent space** and **editing capabilities** of StyleGANs

## Key Idea



## Results

### Qualitative Comparison



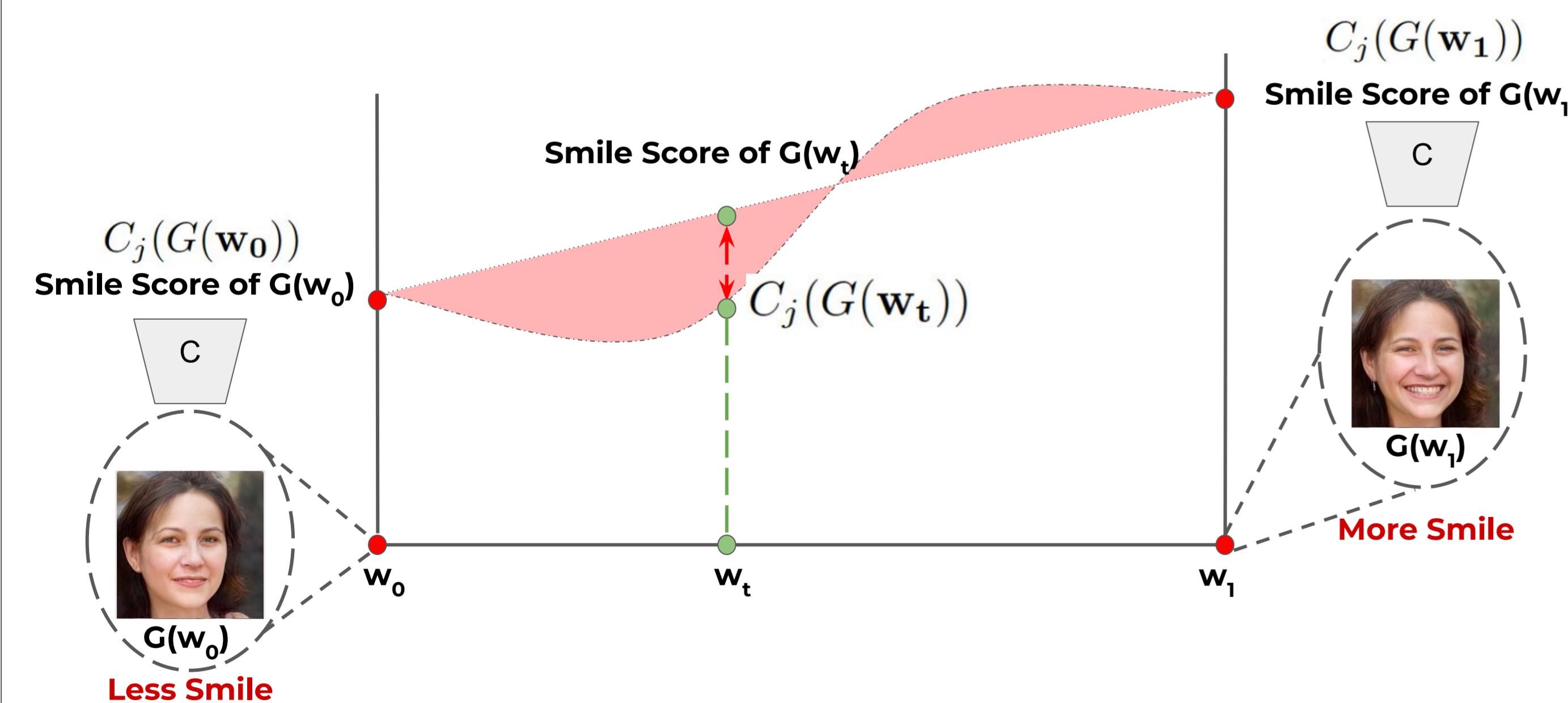
### Quantitative Comparison

	FFHQ-140k	FID↓	Precision↑	Recall↑	PPL↓
StyleGAN2	3.92	<b>0.68</b>	0.45	175.09	
+ HSR	<b>3.74</b>	<b>0.68</b>	<b>0.48</b>	<b>144.59</b>	
LSUN-Church					
StyleGAN2	4.08	<b>0.60</b>	0.34	916.15	
+ HSR	<b>3.82</b>	<b>0.60</b>	<b>0.41</b>	<b>678.55</b>	

### Interplay between PLR and HSR

PLR	HSR	FID↓	PPL↓
X	X	57.97	75.63
✓	X	53.28	59.27
X	✓	52.98	58.60
✓	✓	<b>51.58</b>	<b>48.02</b>

## Attribute Linearity Score



Attribute Linearity Score measures the deviation of the attribute score over images produced by the latent space between  $w_0$  and  $w_1$ .

	Gender	Smile	Age	Hair	Bangs	Beard	Mean
SG2-ADA	1.38	1.48	1.18	1.96	1.95	1.60	1.59
+ HSR	<b>1.12</b>	<b>0.99</b>	<b>1.15</b>	<b>1.87</b>	<b>1.62</b>	<b>1.16</b>	<b>1.32</b>



## Conclusion

- Self-Supervised networks exhibit strong natural priors, that can improve quality of generated images.
- We show the relationship between naturalness of images and smoothness of the latent space.
- We propose Attribute Linearity Score (ALS) to measure the linearity of the latent space wrt common facial attributes.