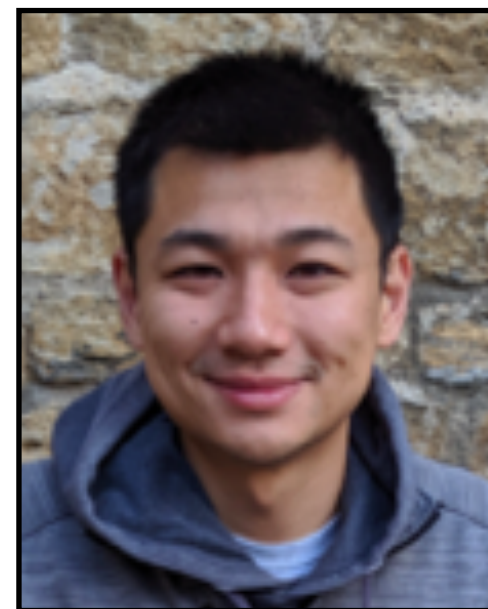
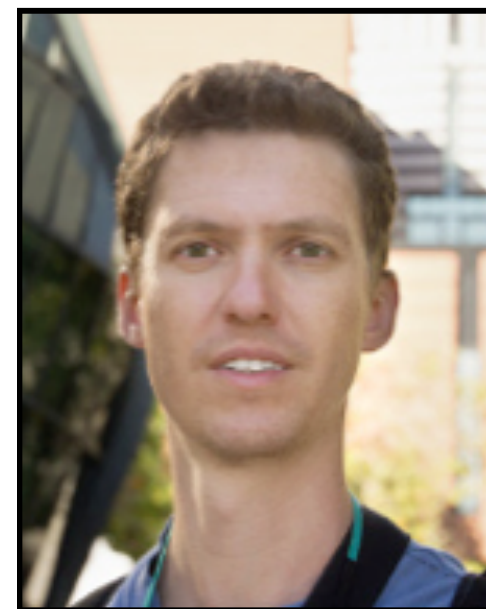
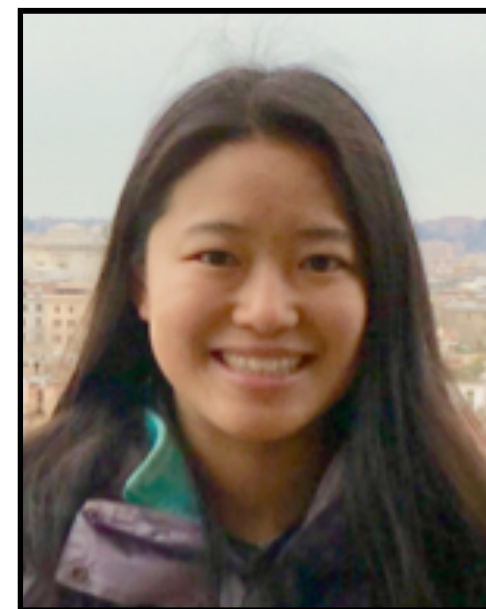


Ensembling with Deep Generative Views

Lucy Chai, Jun-Yan Zhu, Eli Shechtman, Phillip Isola, Richard Zhang



<https://chail.github.io/gan-ensembling/>



Massachusetts
Institute of
Technology



Carnegie
Mellon
University



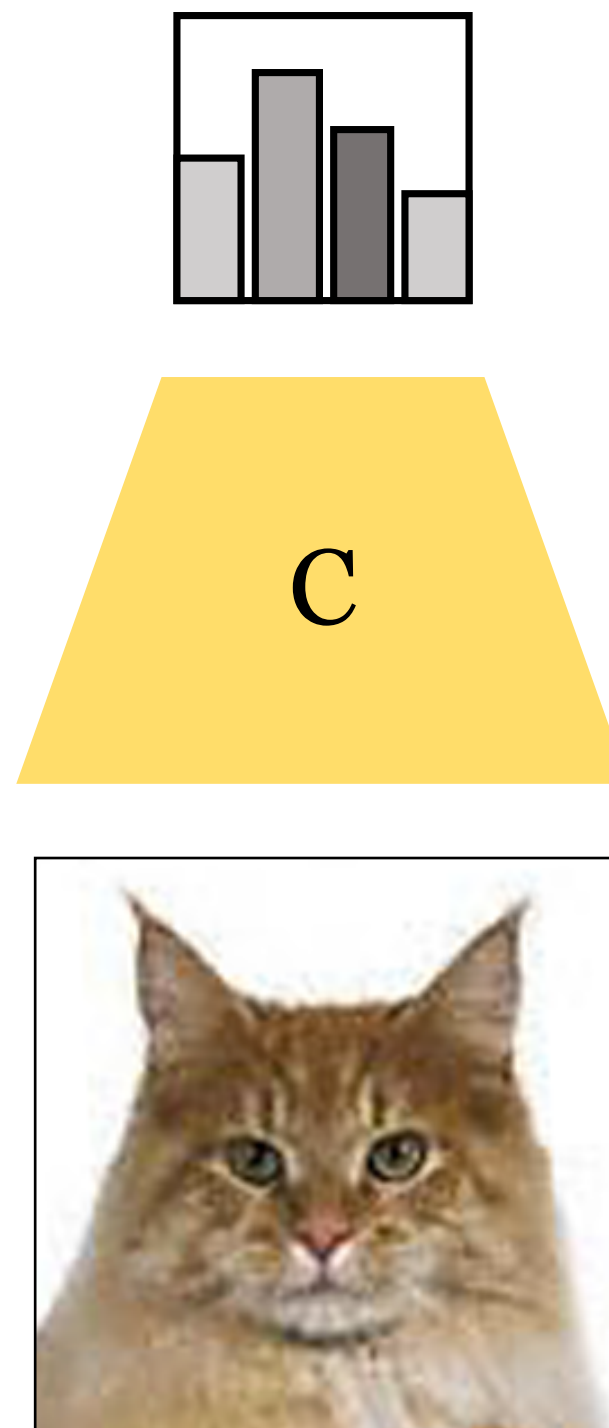
Adobe

GANs continuously approximate real images



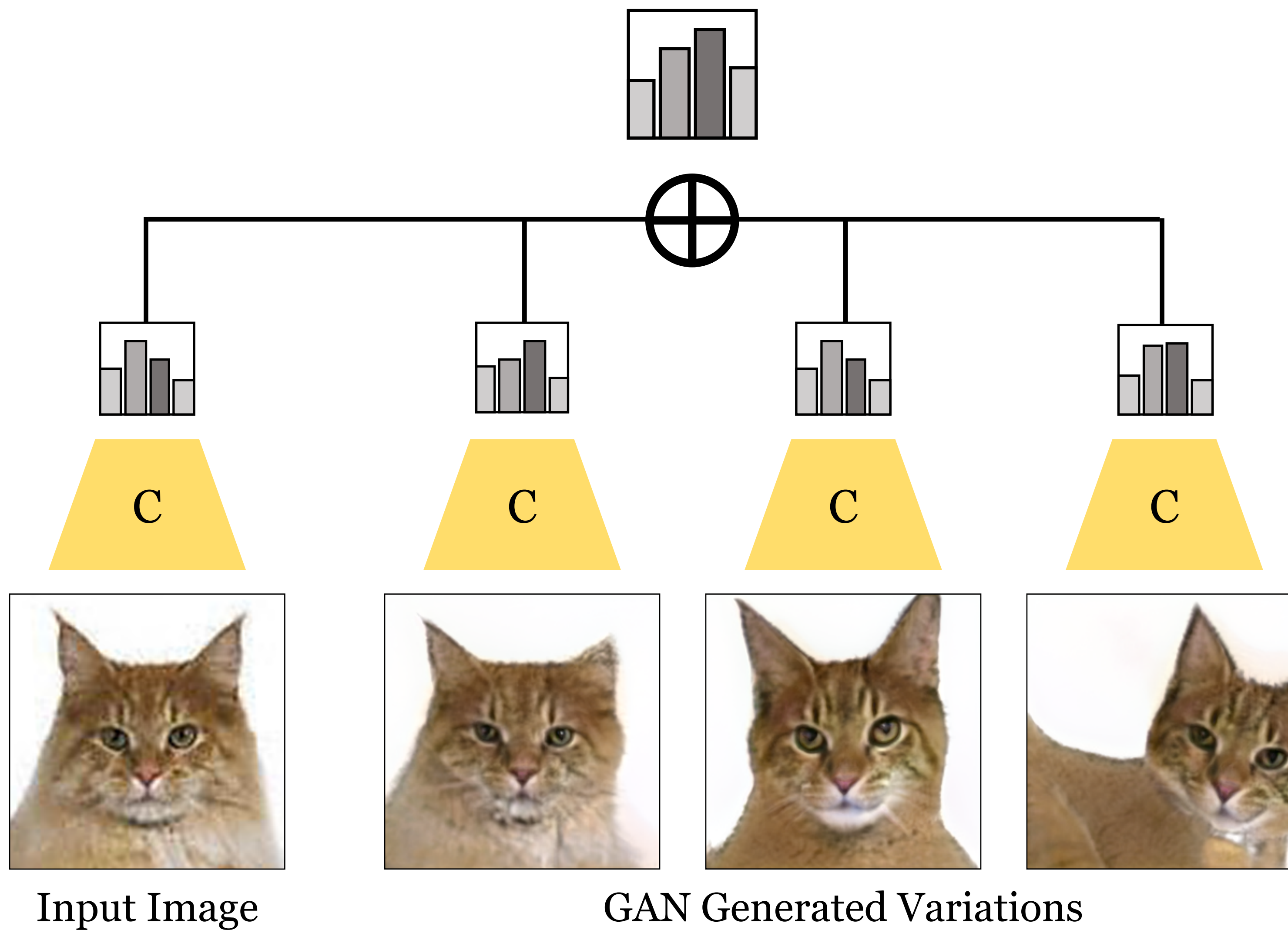
Goodfellow et al. 2014; StyleGAN2. Karras et al. 2020

Ensembling GAN views for Classification

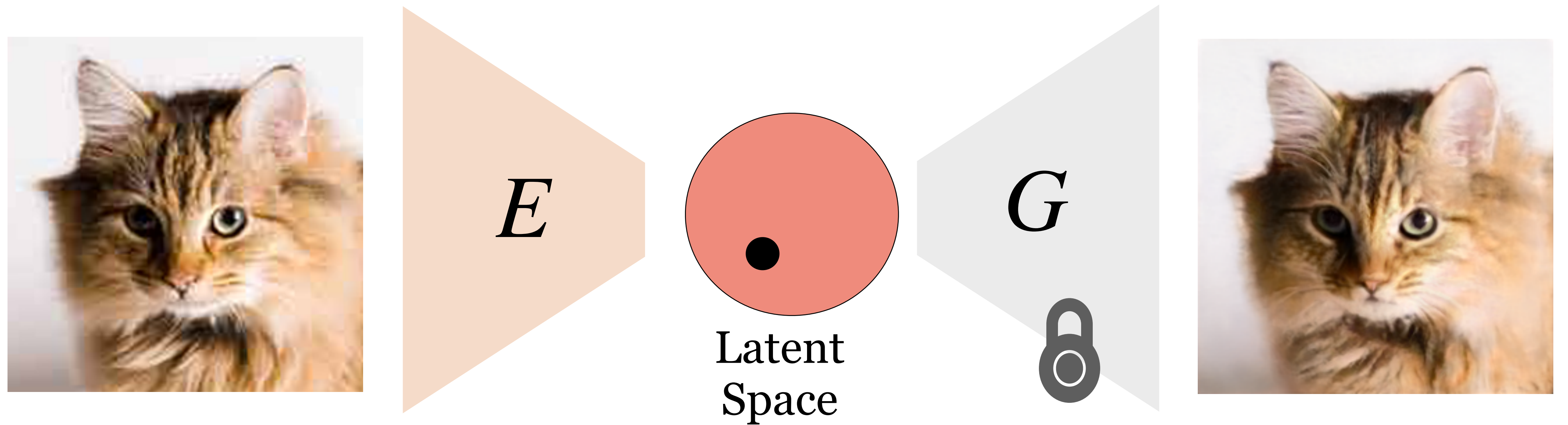


Input Image

Ensembling GAN views for Classification



Projecting images into GAN latent space

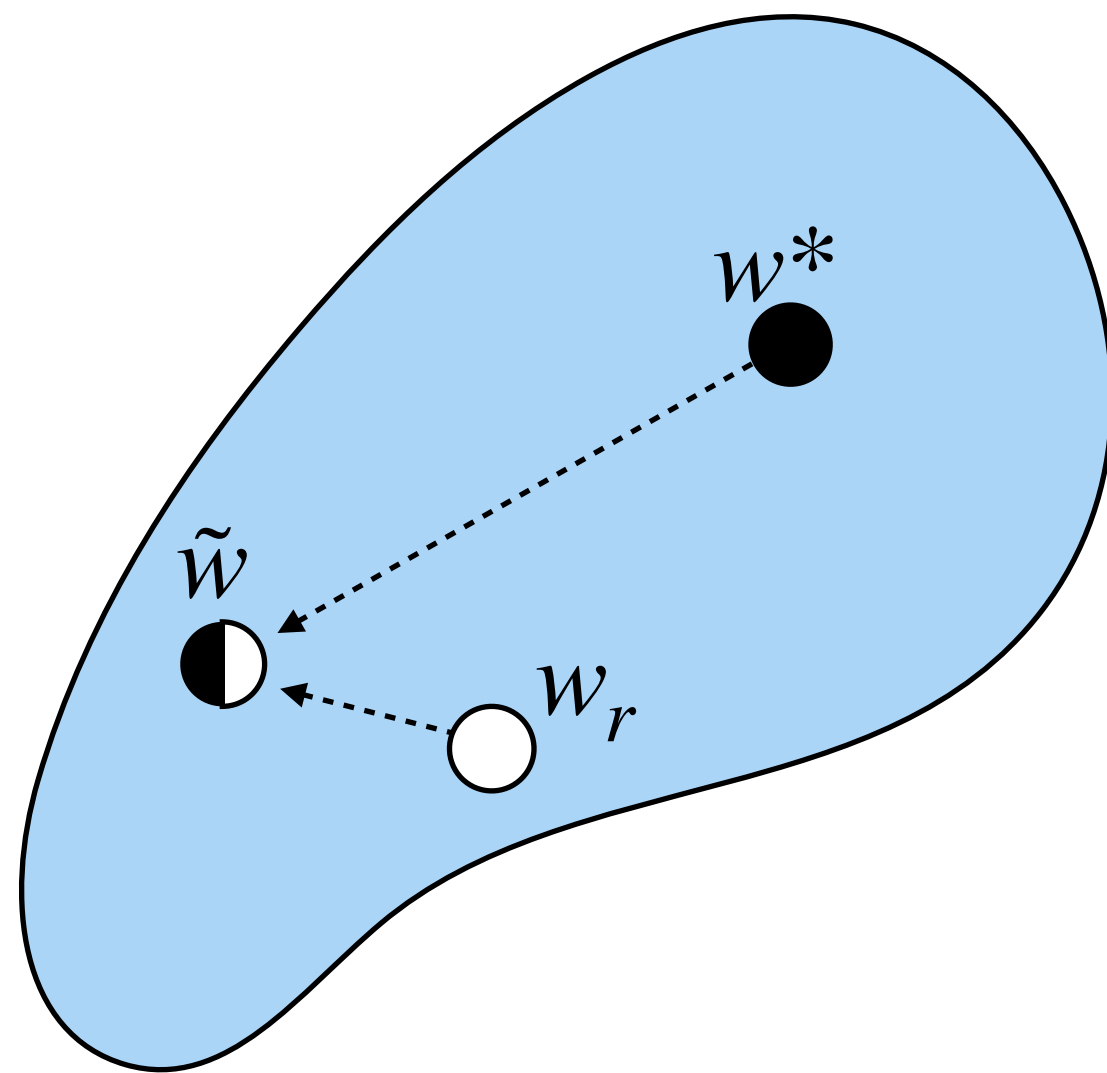


$$w^* = \arg \min_w L_{\text{img}}(x, G(w)) + \lambda L_{\text{latent}}(w, E(x))$$

Types of Perturbations in Latent Code

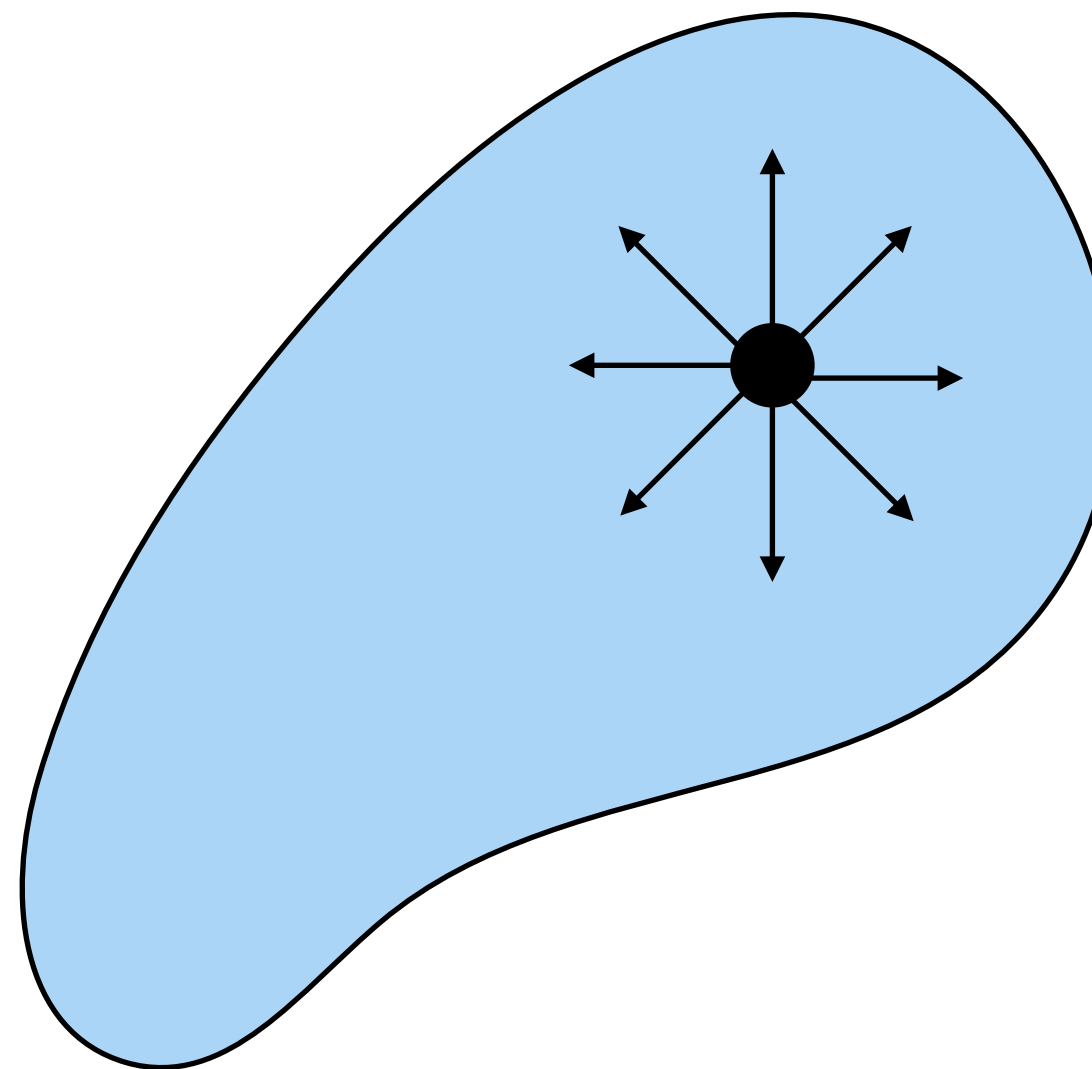
Style-mixing

$$\tilde{w} = \text{mix}(w^*, w_r)$$



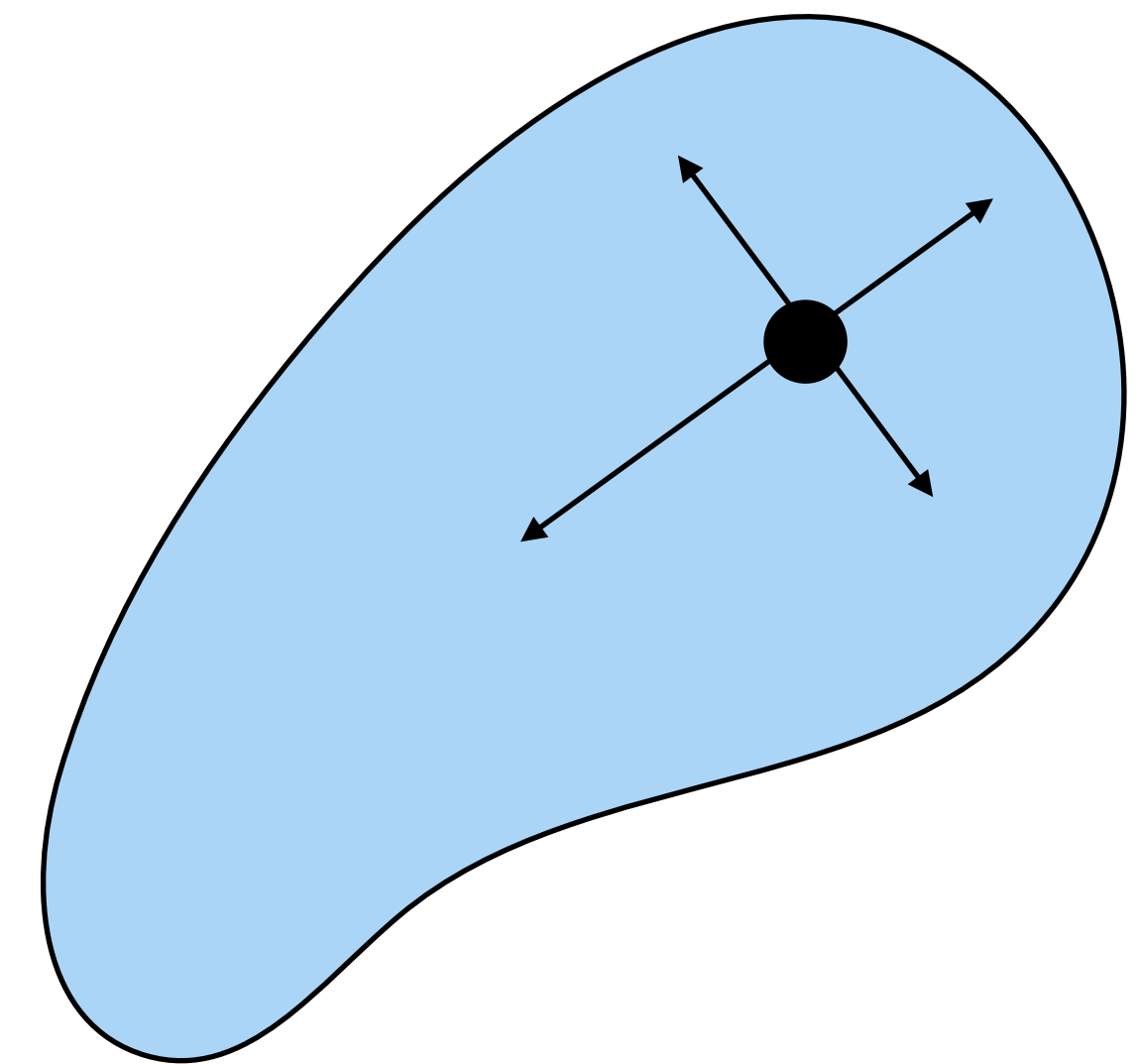
Isotropic

$$\tilde{w} \sim \mathcal{N}(w^*, \sigma I)$$



PCA Directions

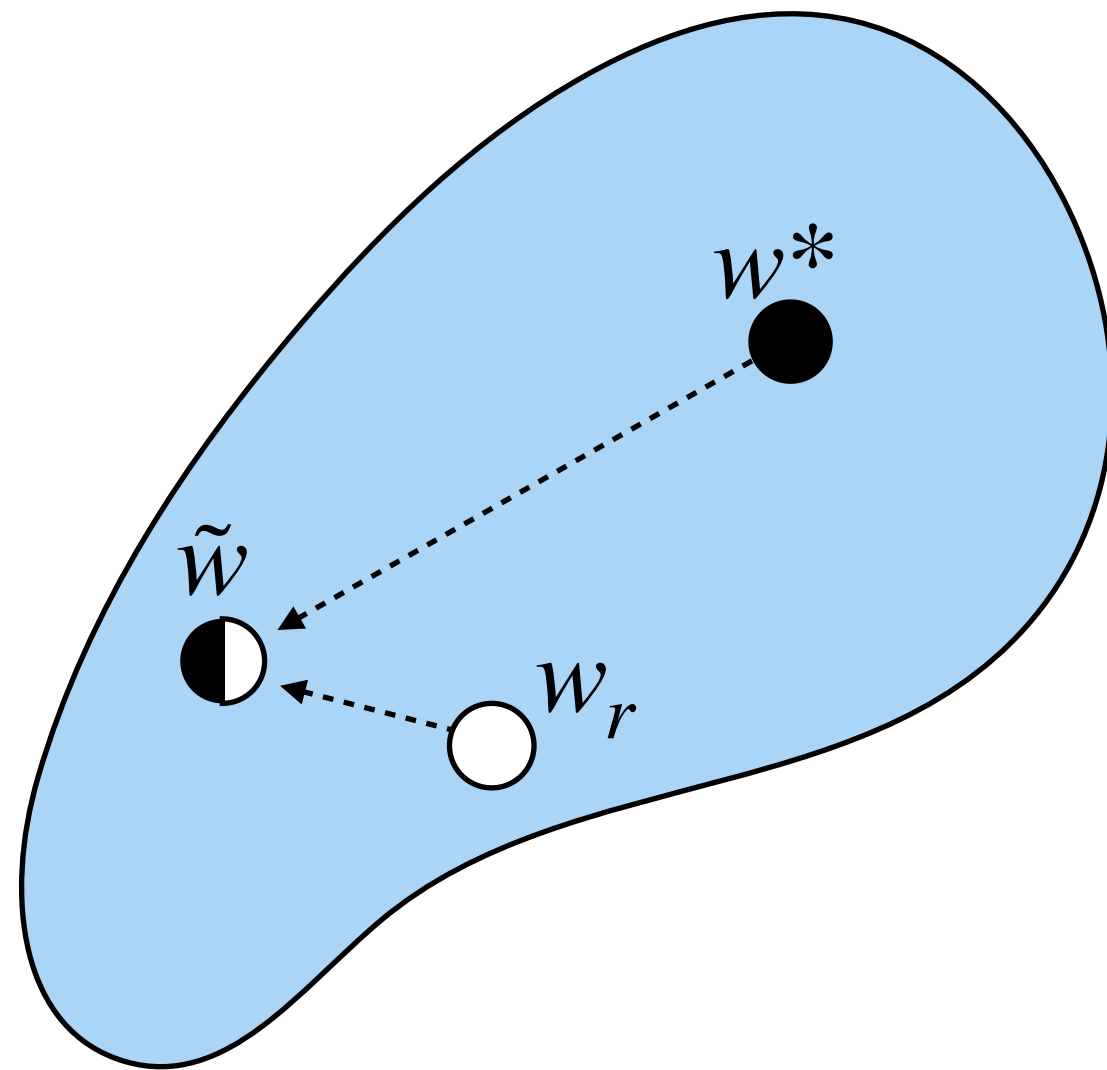
$$\tilde{w} = w^* + \beta \tilde{v}_d$$



Types of Perturbations in Latent Code

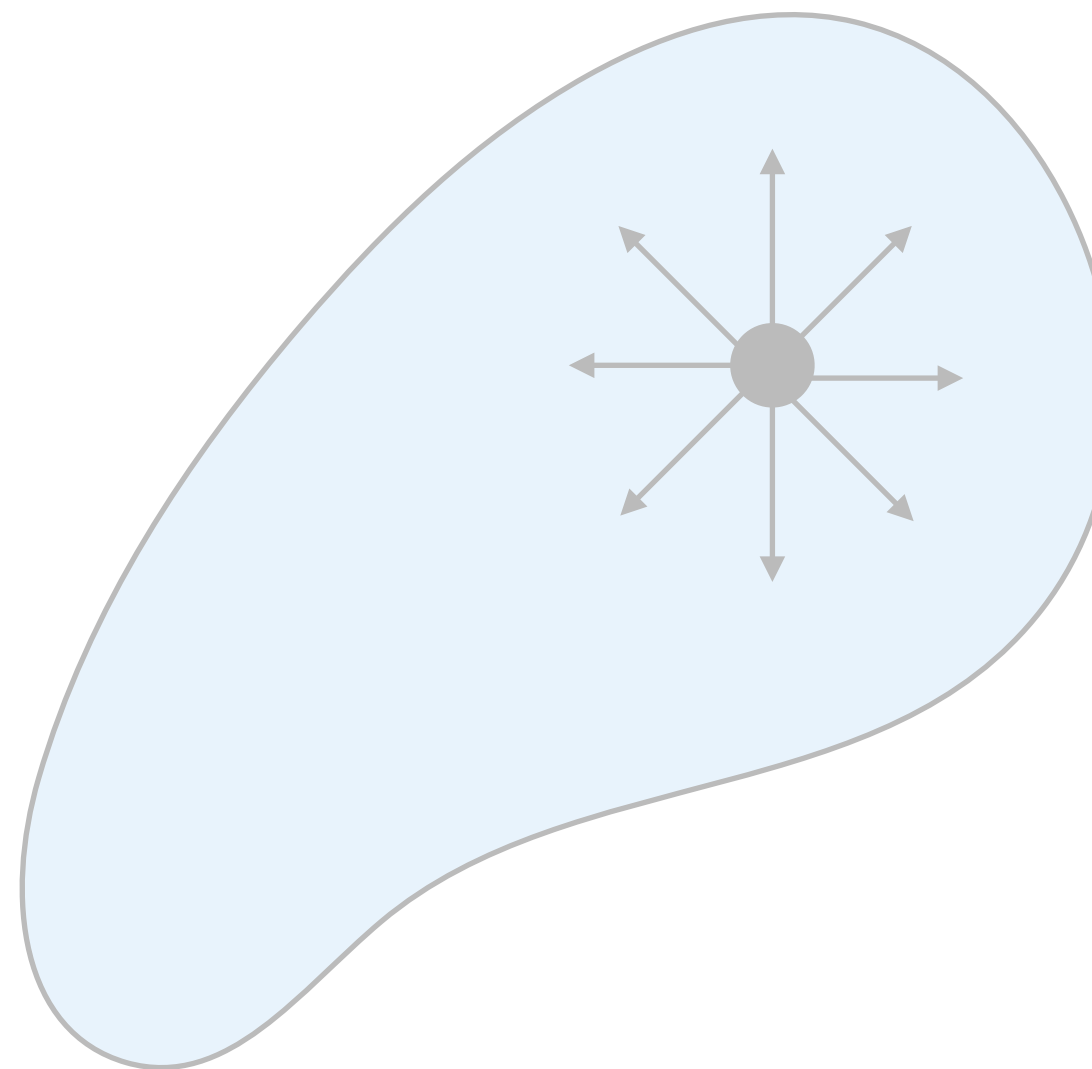
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$$\tilde{w} = \text{mix}(w^*, w_r)$$



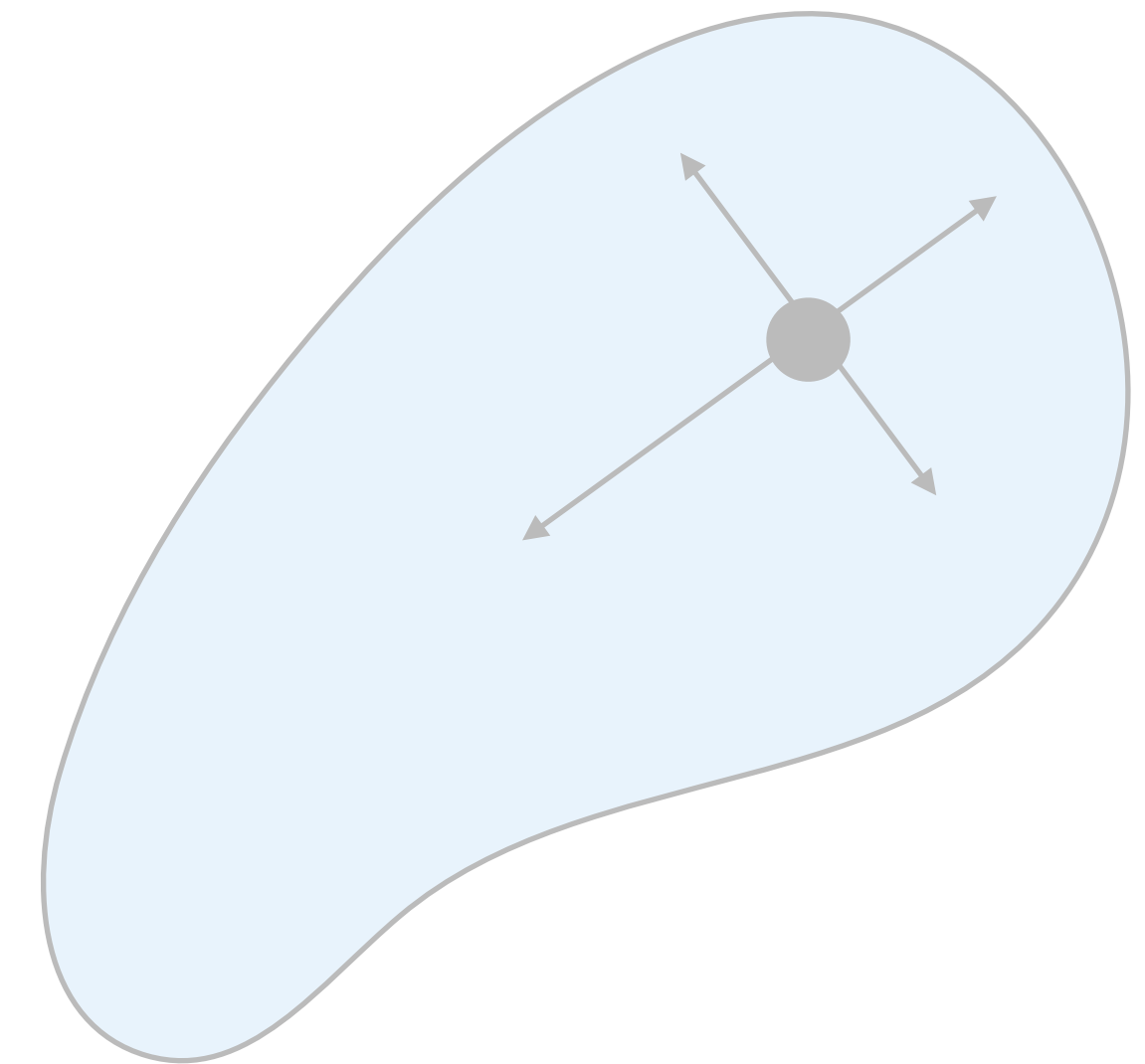
Isotropic

$$\tilde{w} \sim \mathcal{N}(w^*, \sigma I)$$



PCA Directions

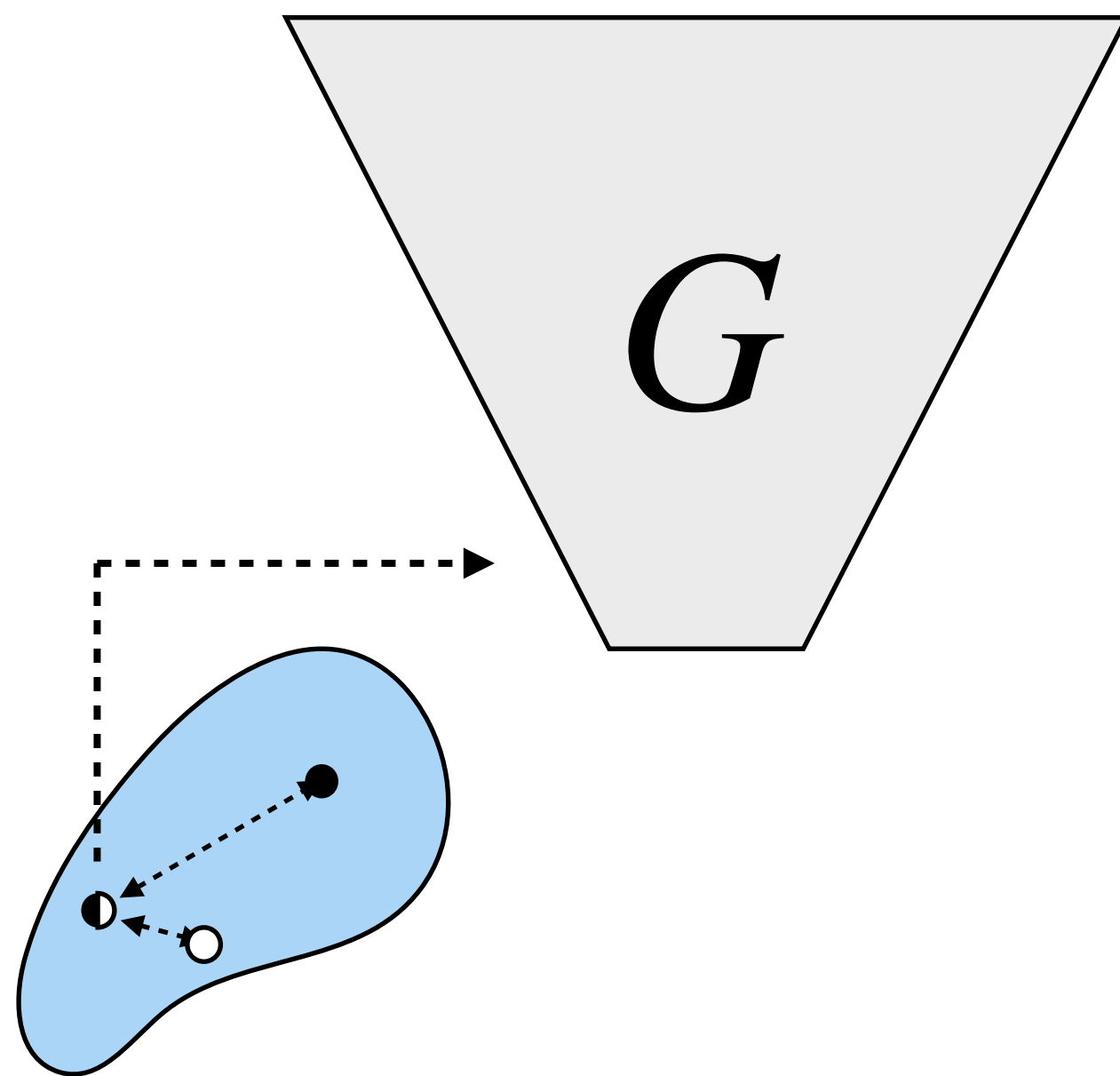
$$\tilde{w} = w^* + \beta \tilde{v}_d$$



Types of Perturbations in Latent Code

Style-mixing

$$\tilde{w} = \text{mix}(w^*, w_r)$$



Reconstruction



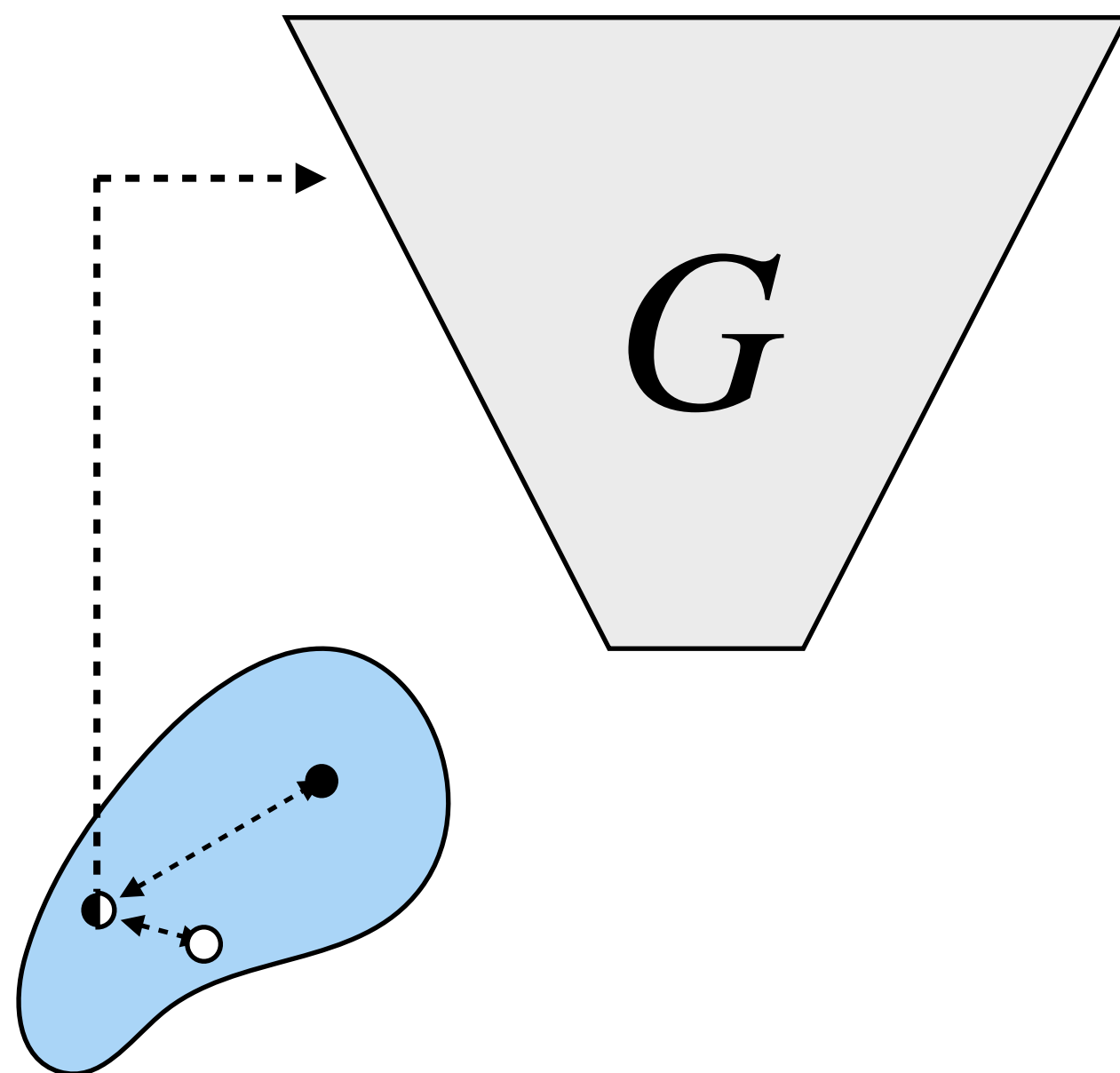
Coarse Layers



Types of Perturbations in Latent Code

Style-mixing

$$\tilde{w} = \text{mix}(w^*, w_r)$$



Reconstruction



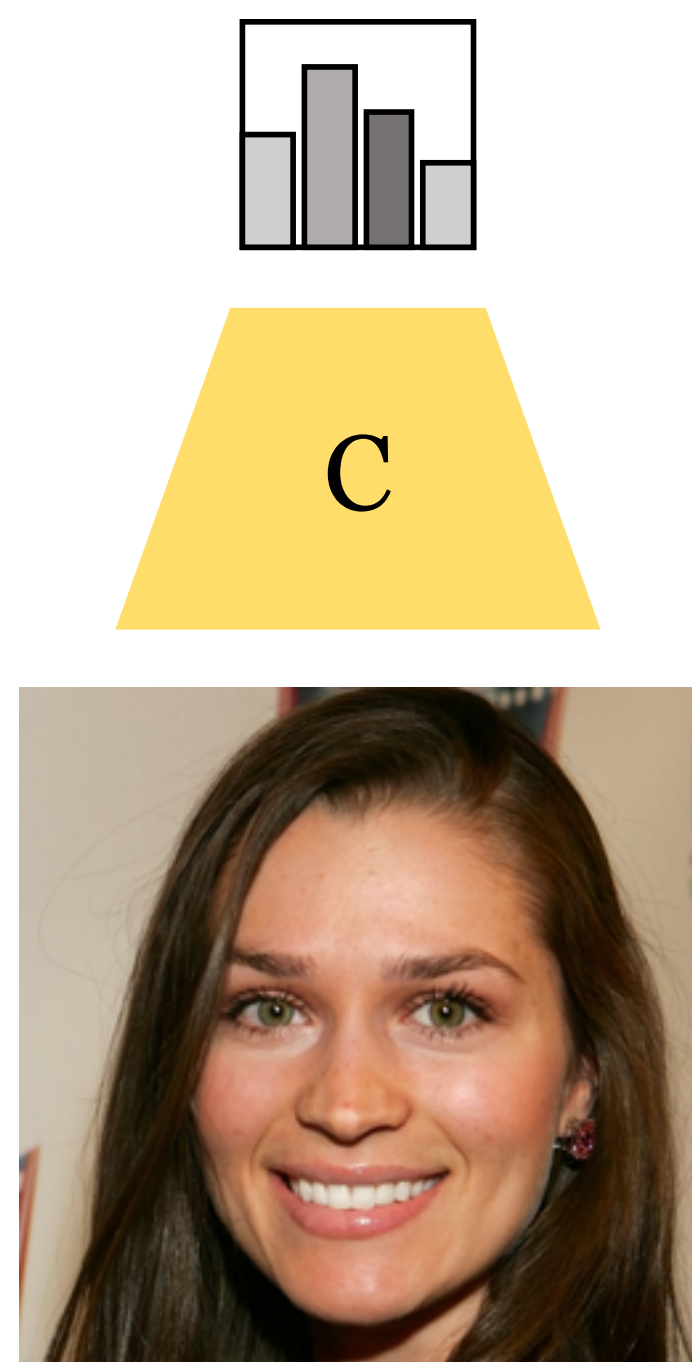
Coarse Layers



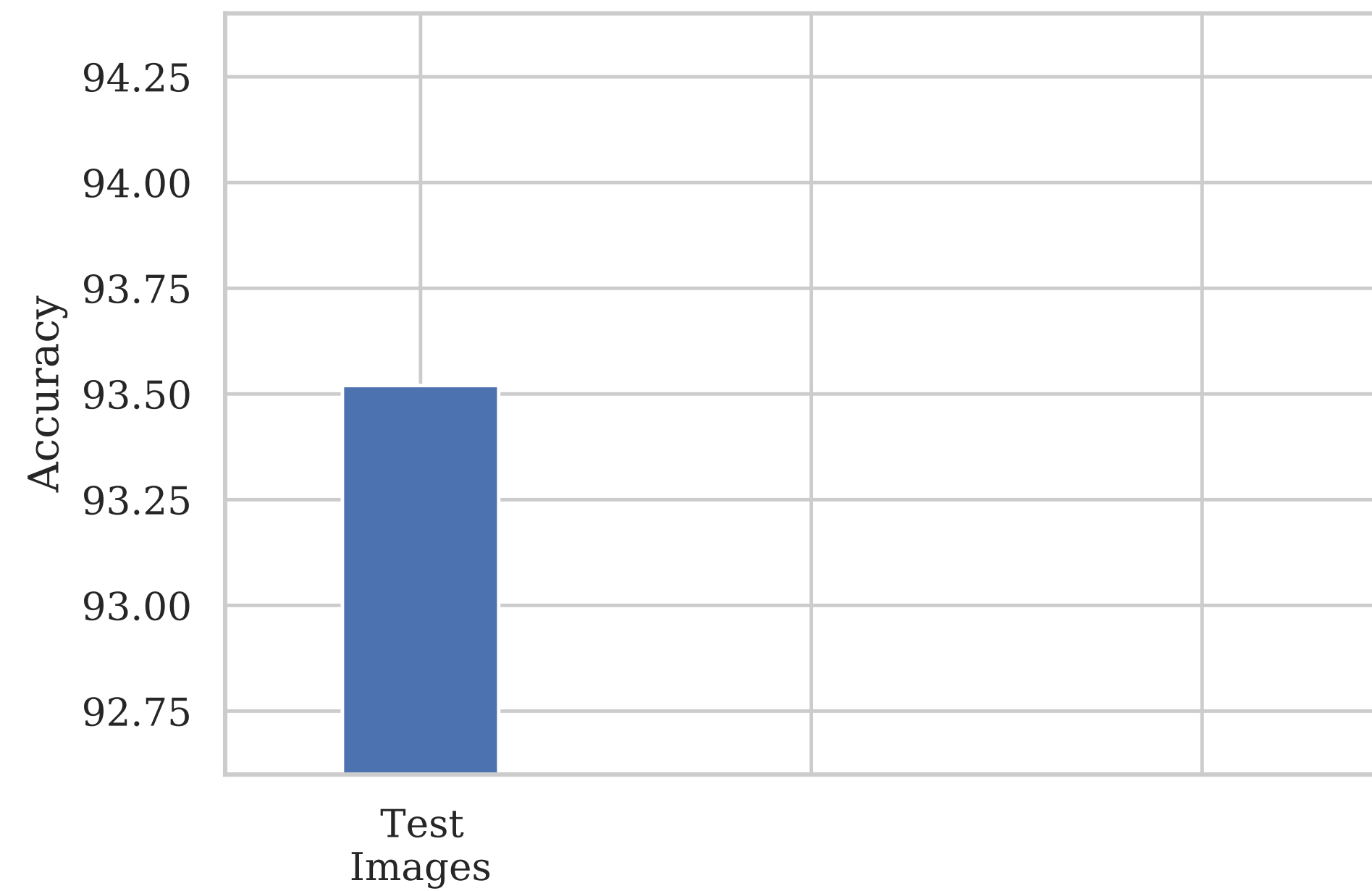
Fine Layers



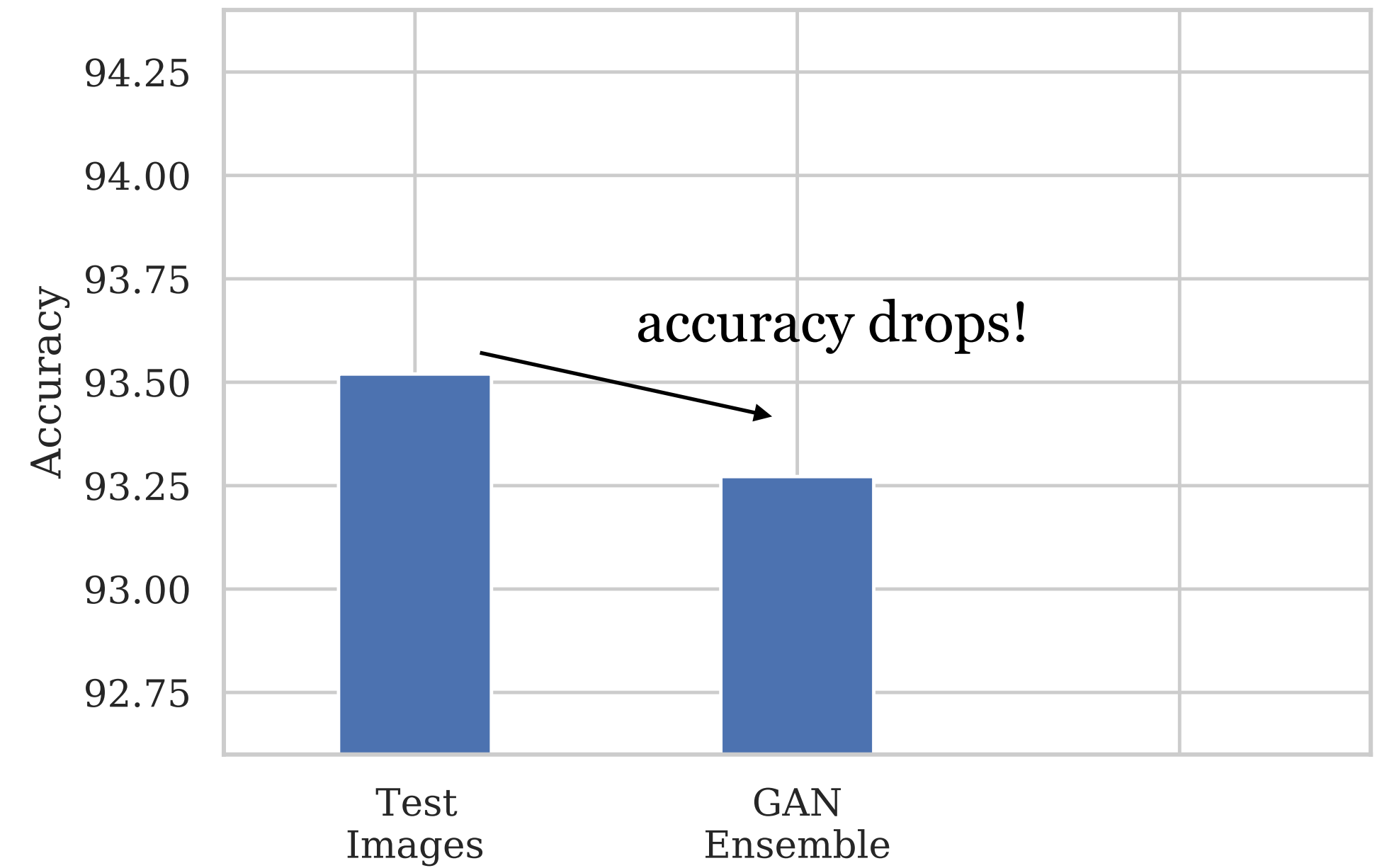
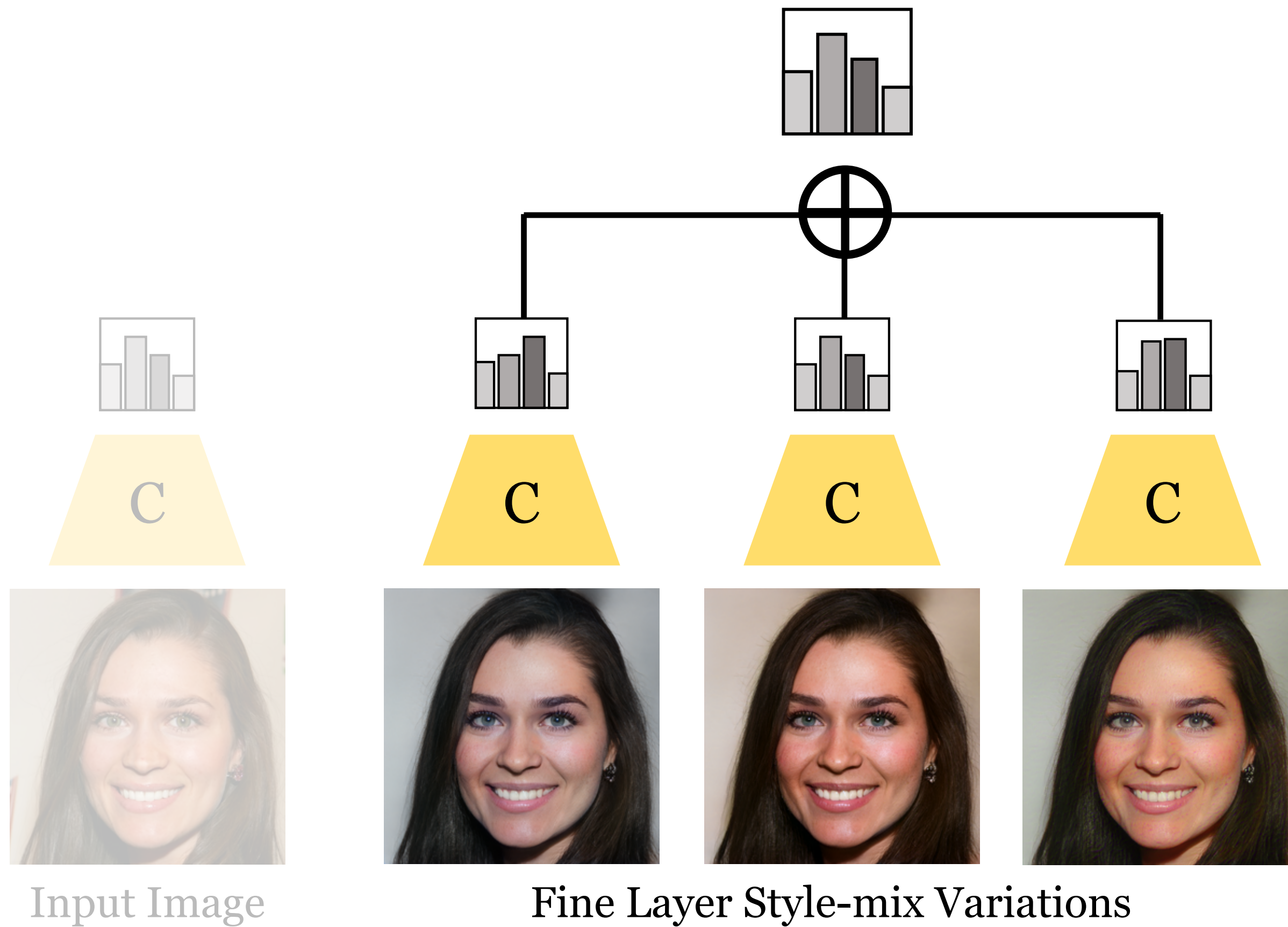
Investigating Ensemble Weight



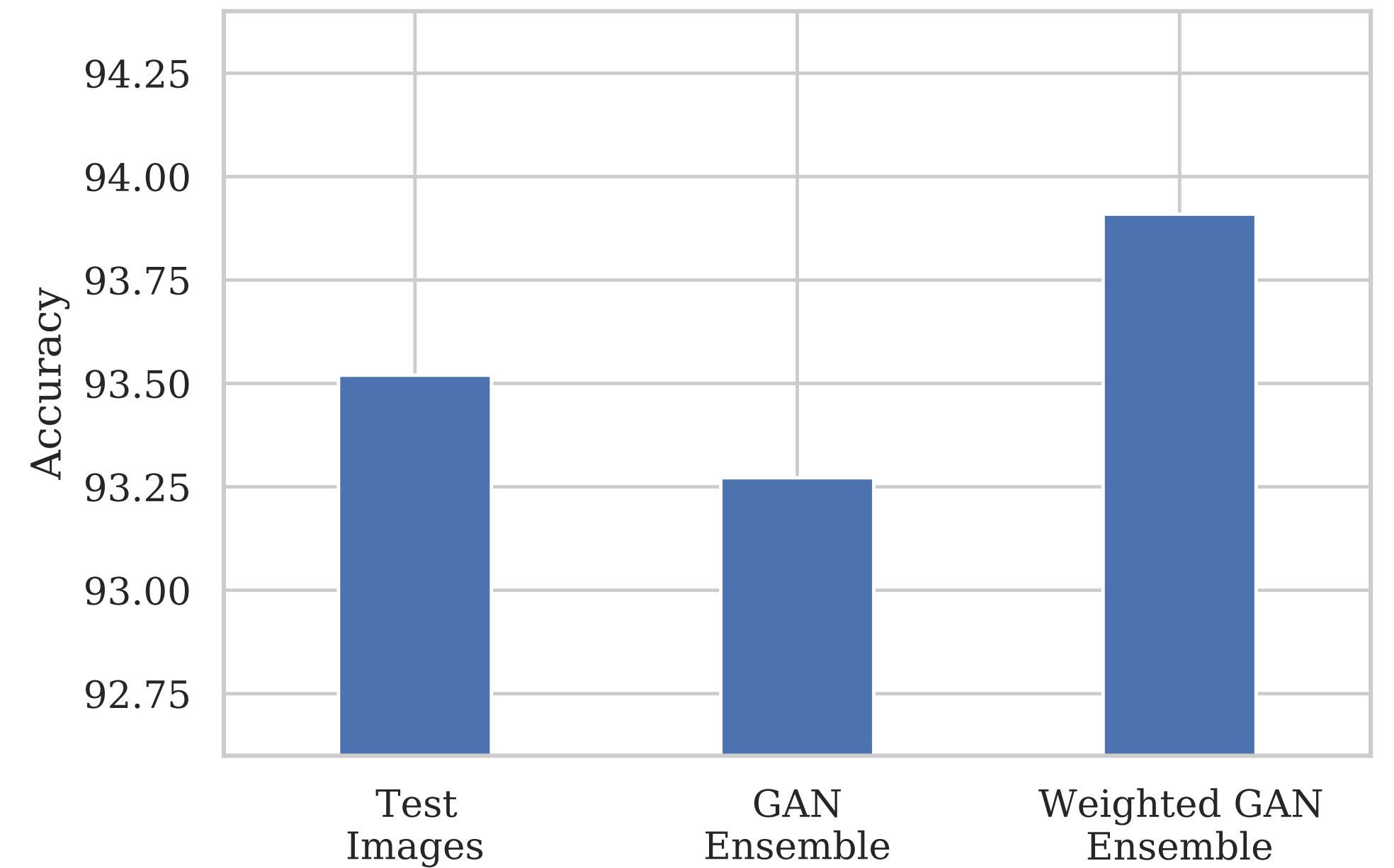
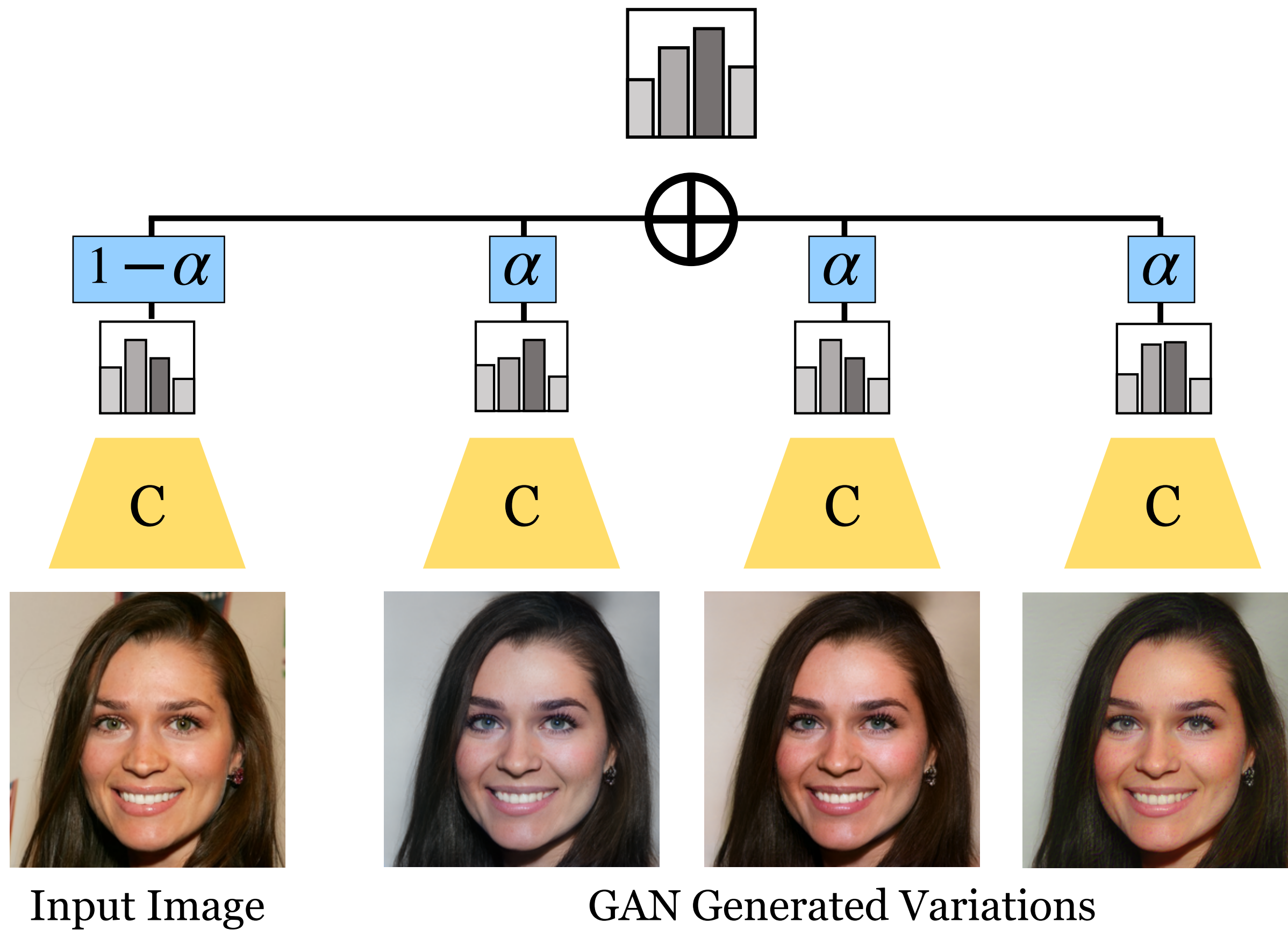
Input Image



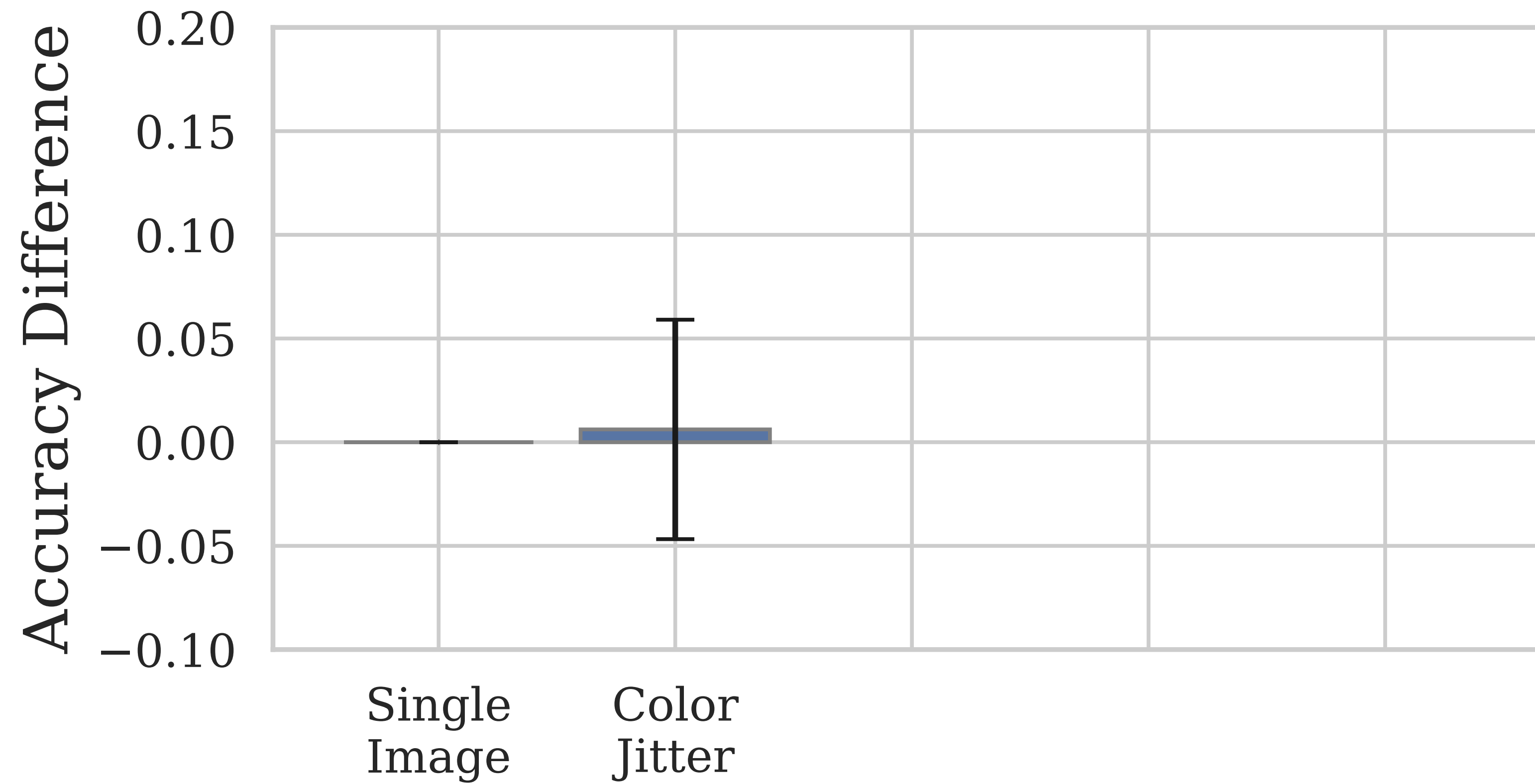
Investigating Ensemble Weight



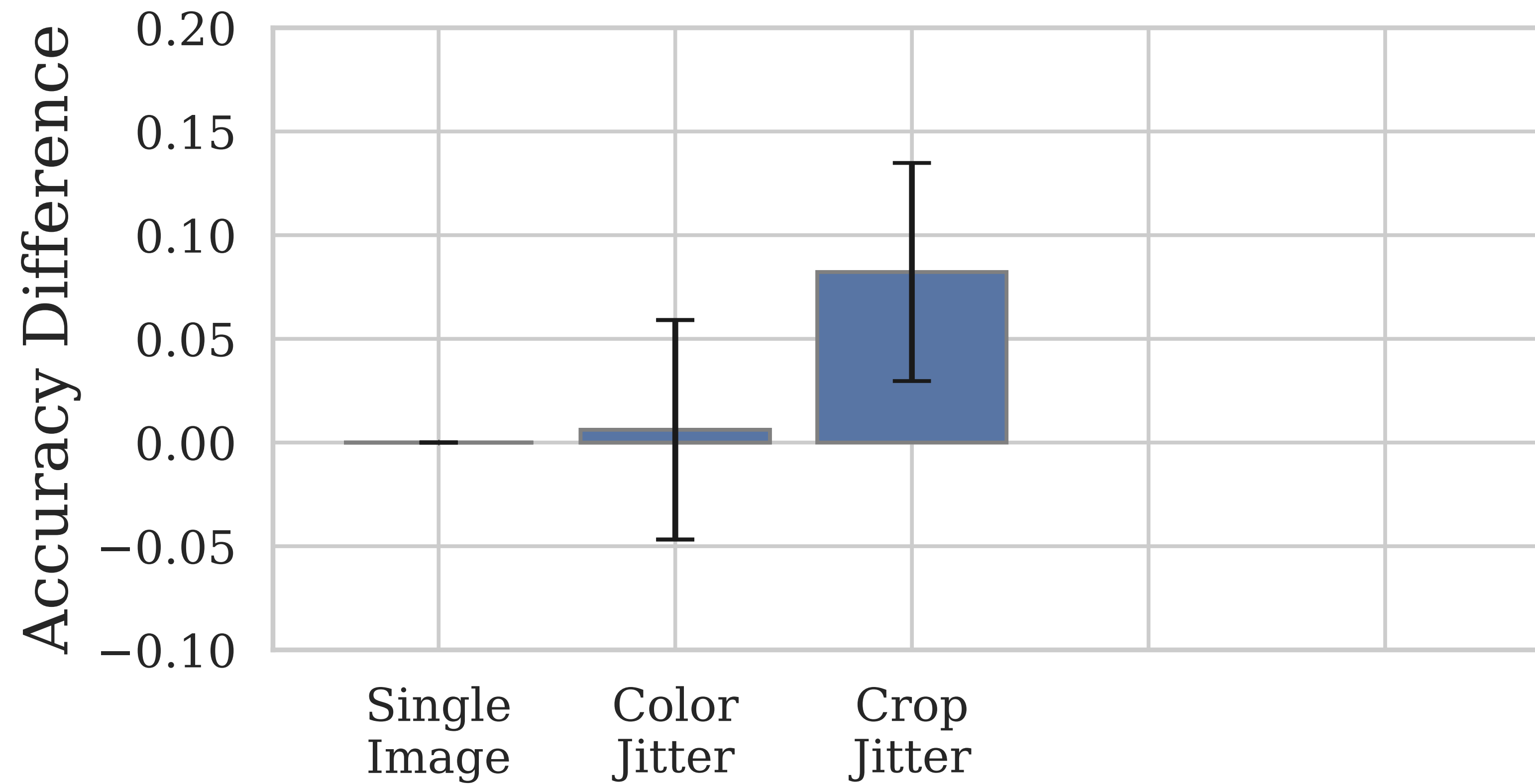
Investigating Ensemble Weight



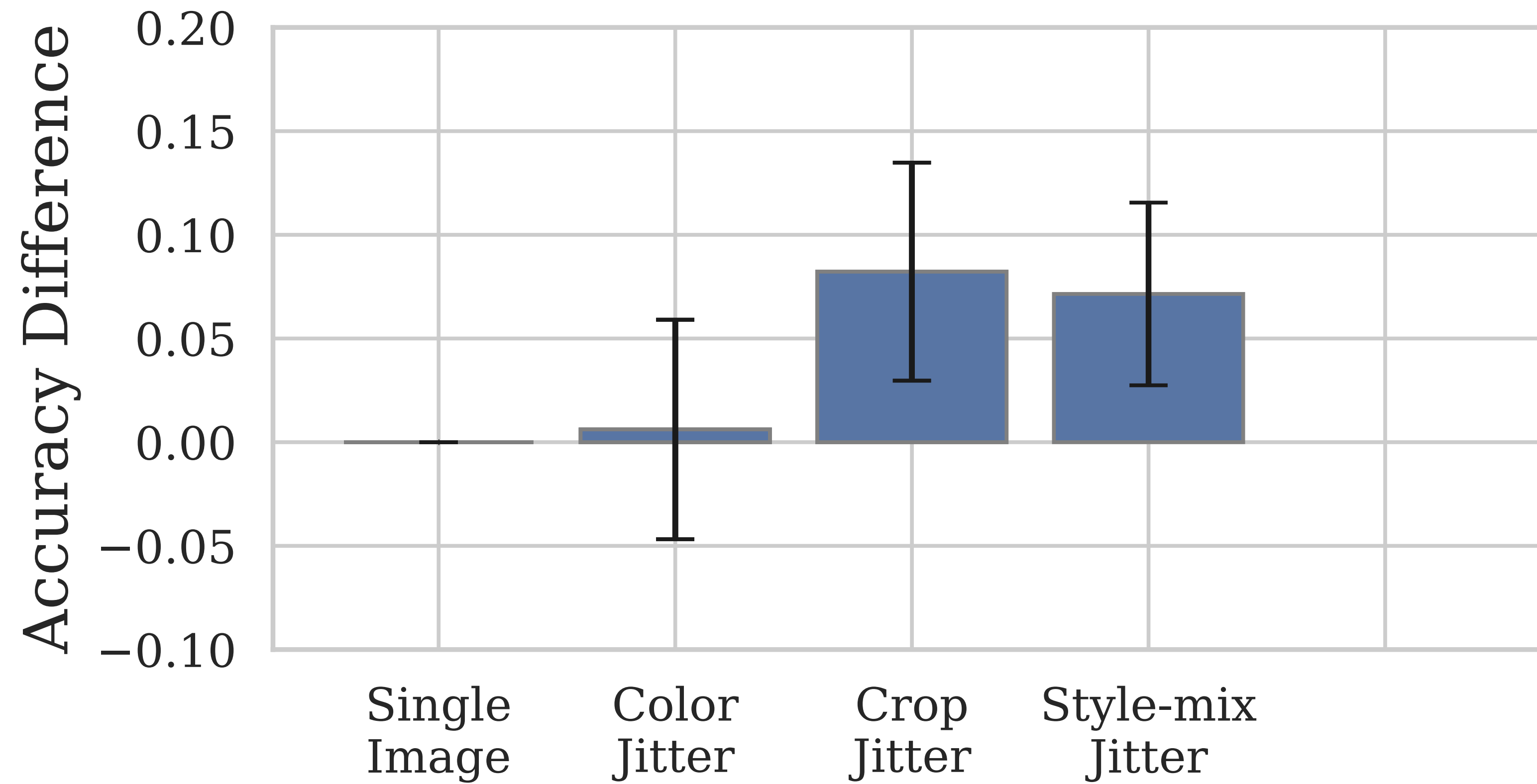
Combining GAN and Traditional Ensembling



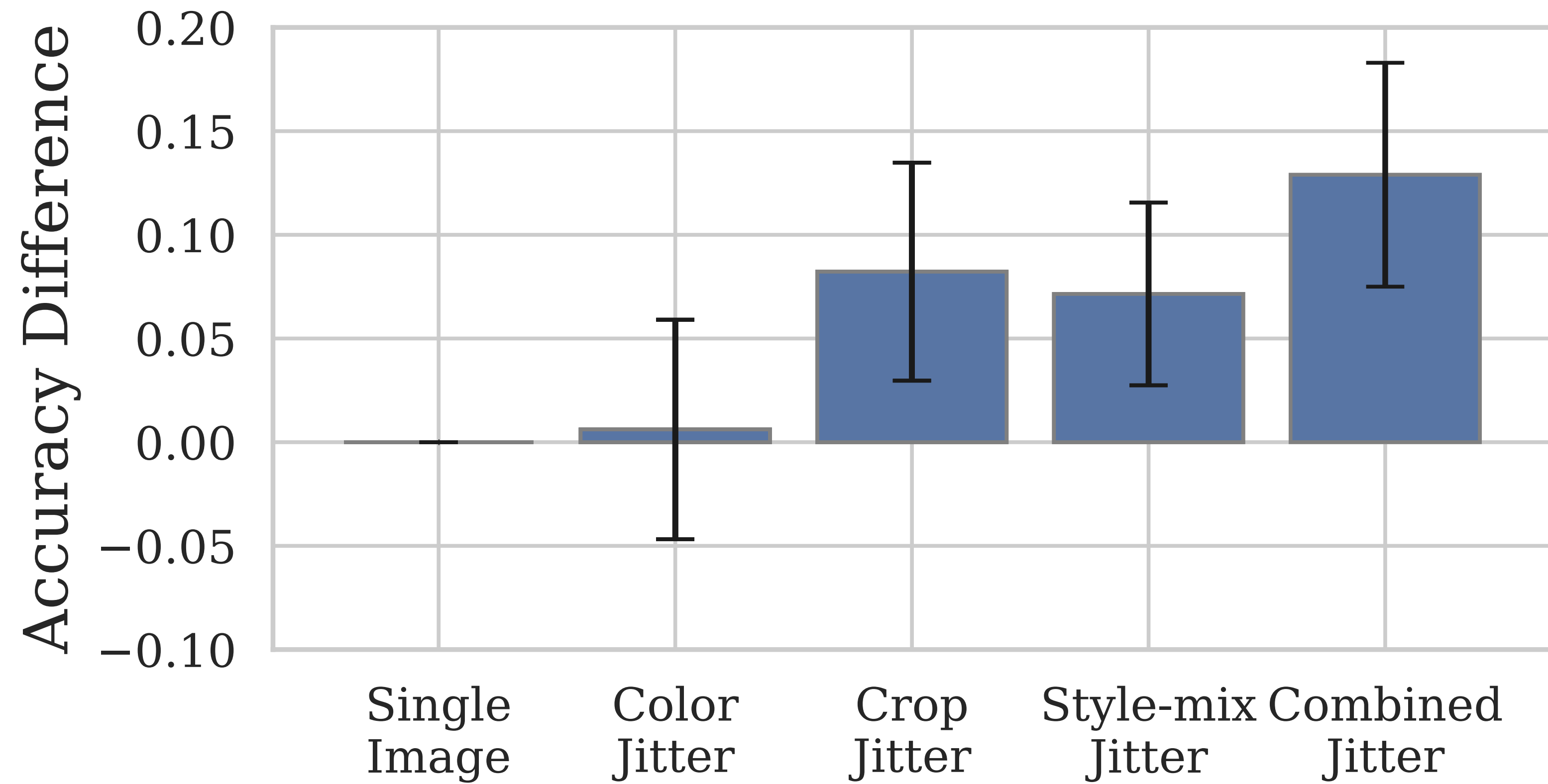
Combining GAN and Traditional Ensembling



Combining GAN and Traditional Ensembling



Combining GAN and Traditional Ensembling

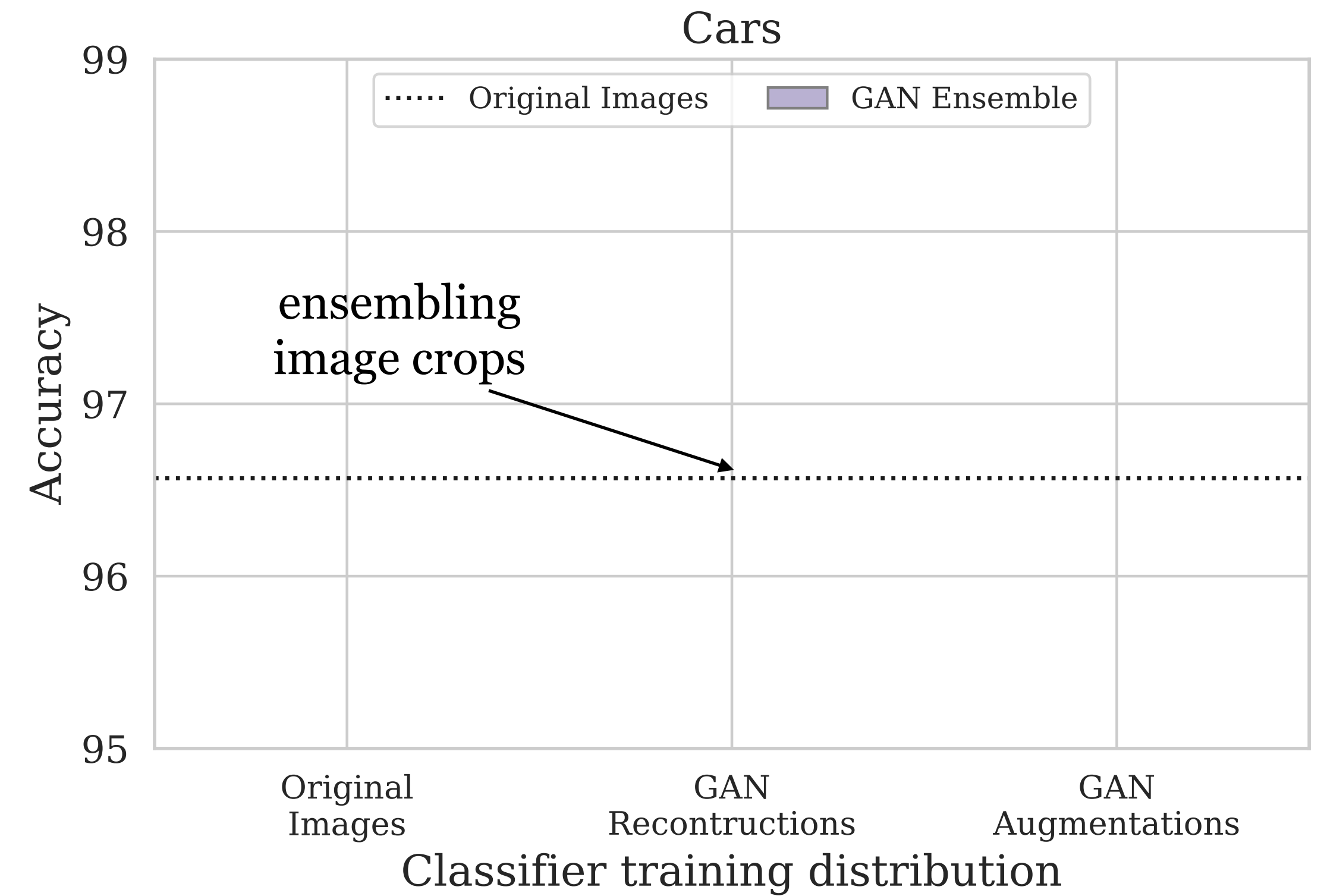


Three-way Cars Domain

Input



Reconstruction



Three-way Cars Domain

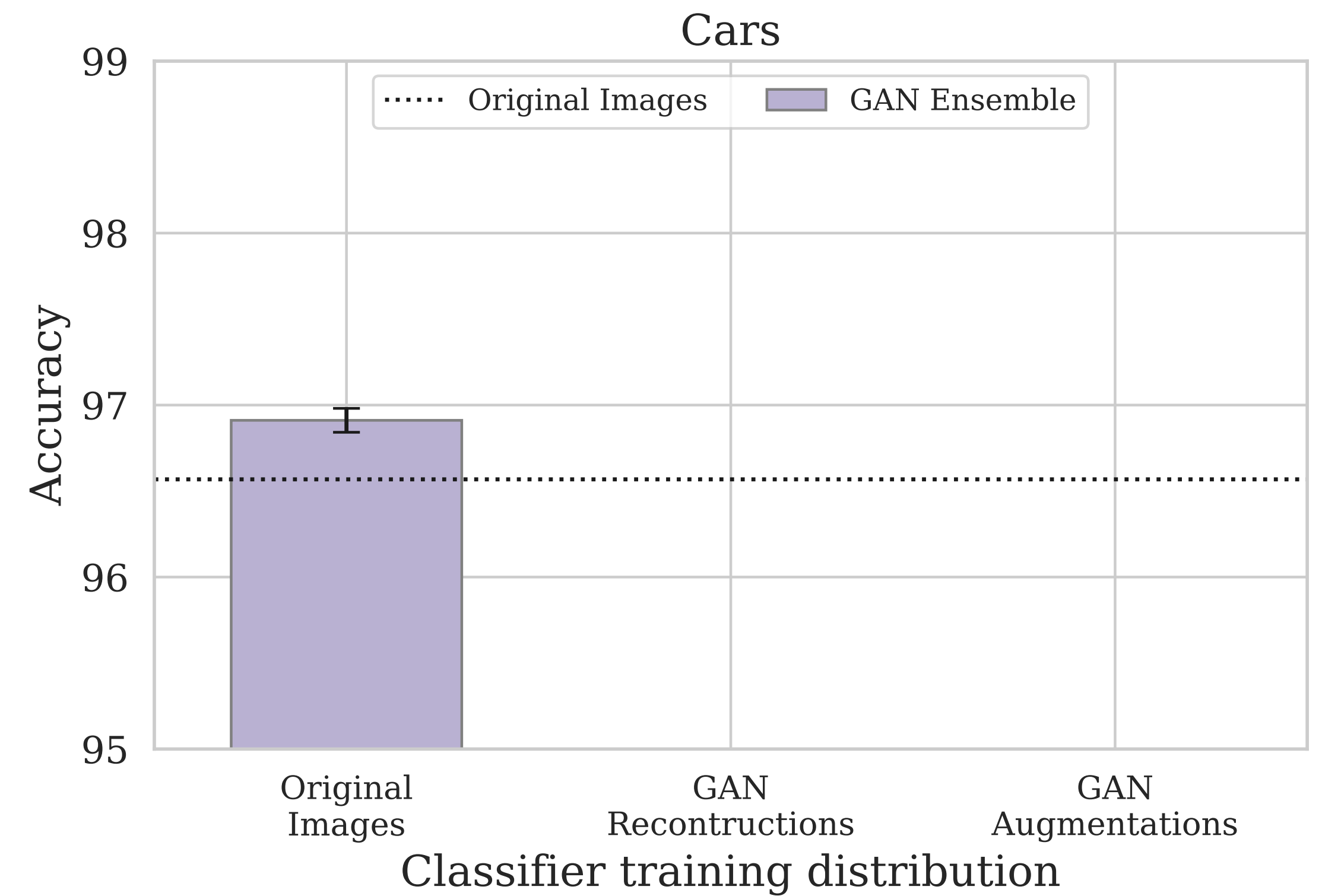
Input



Reconstruction



Style-mix Fine Layers



Three-way Cars Domain

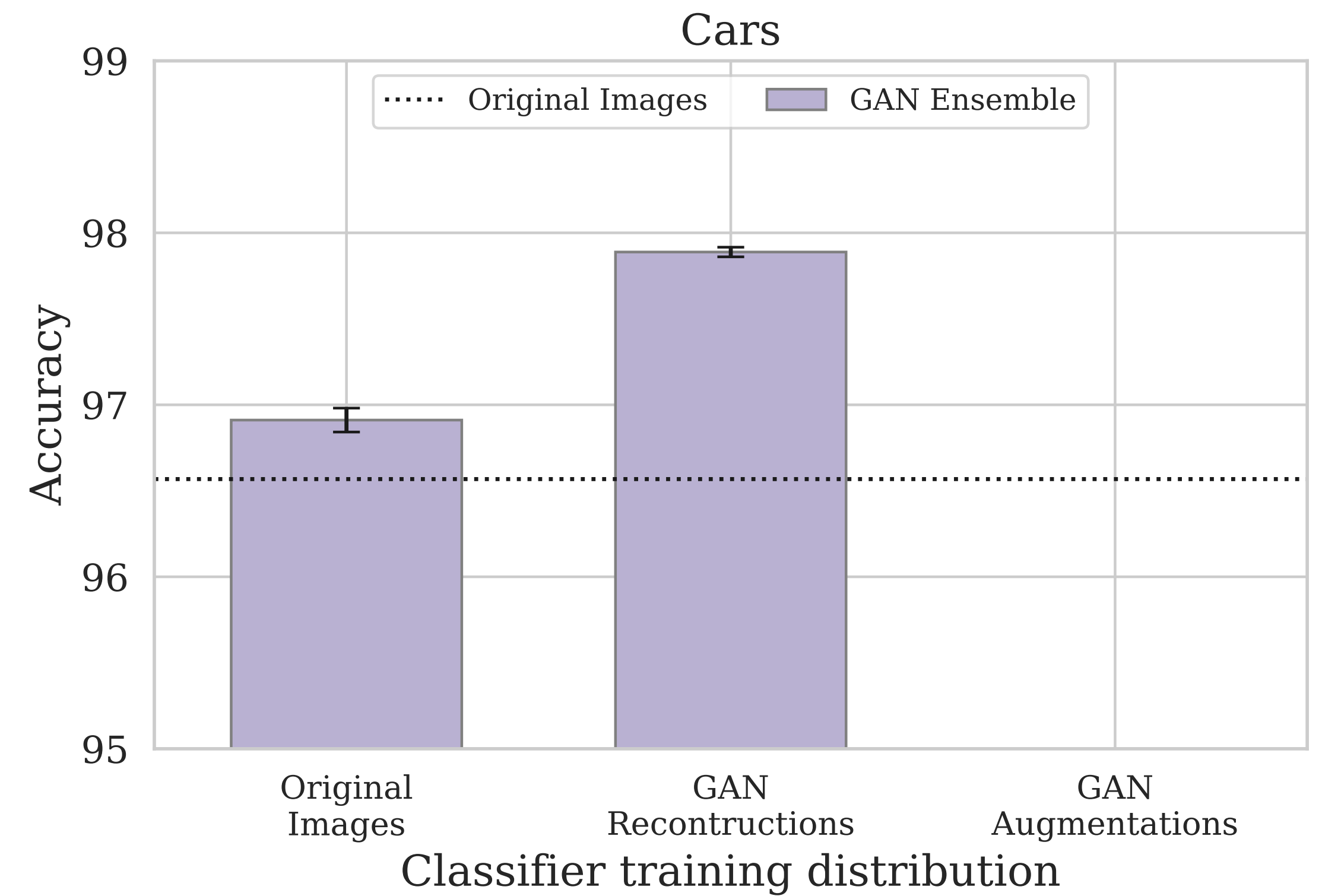
Input



Reconstruction



Style-mix Fine Layers



Three-way Cars Domain

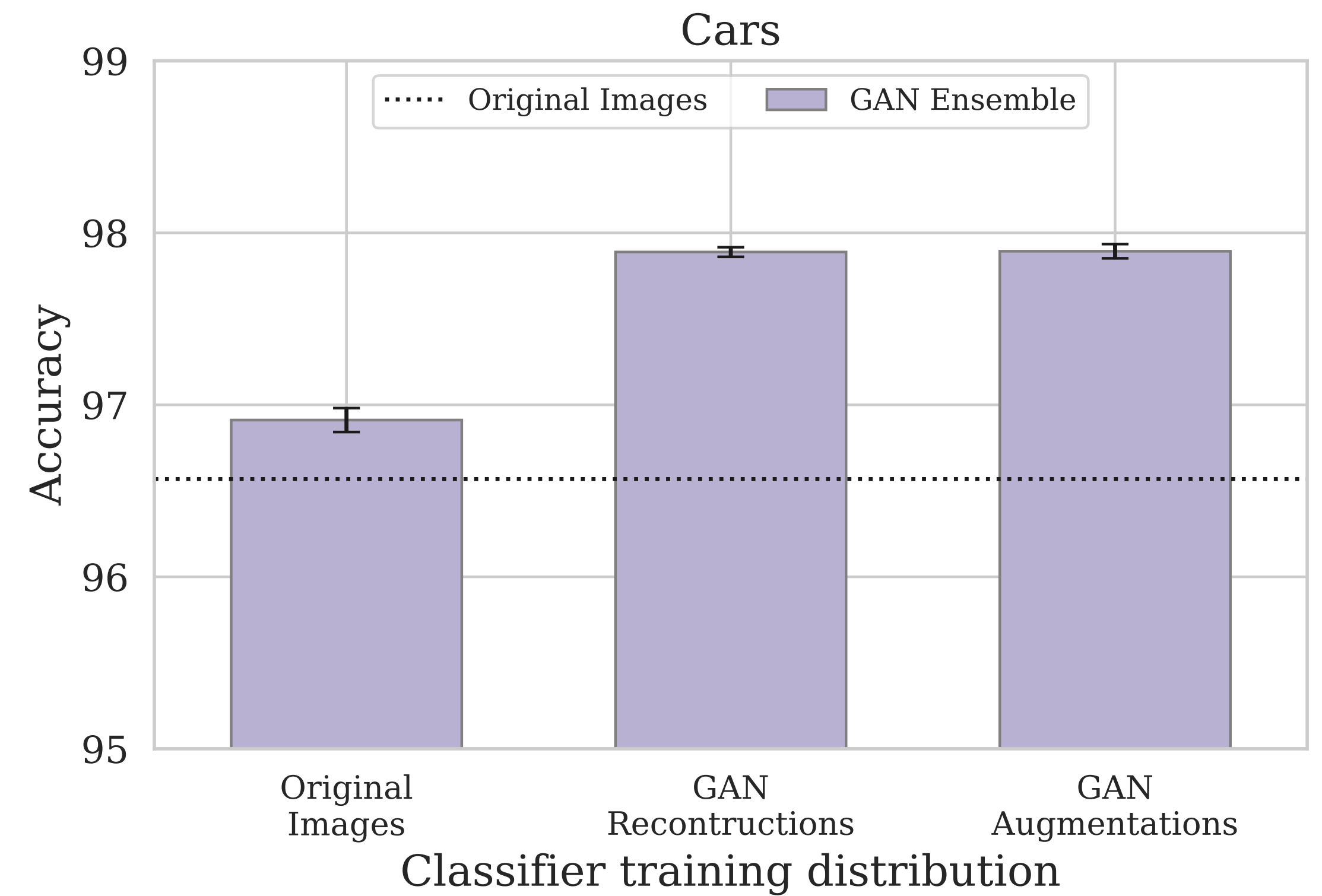
Input



Reconstruction



Style-mix Fine Layers



12-way Cats Domain

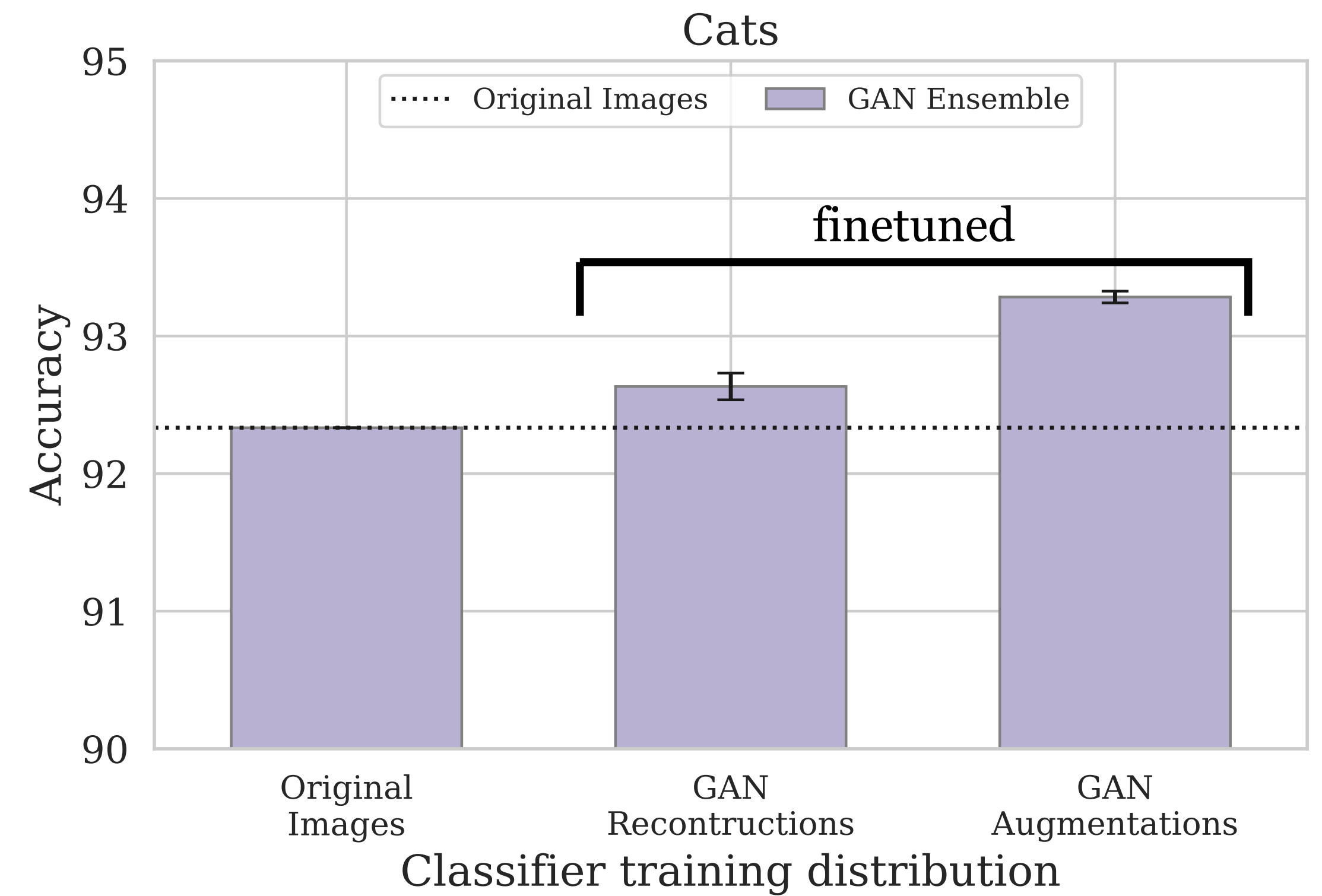
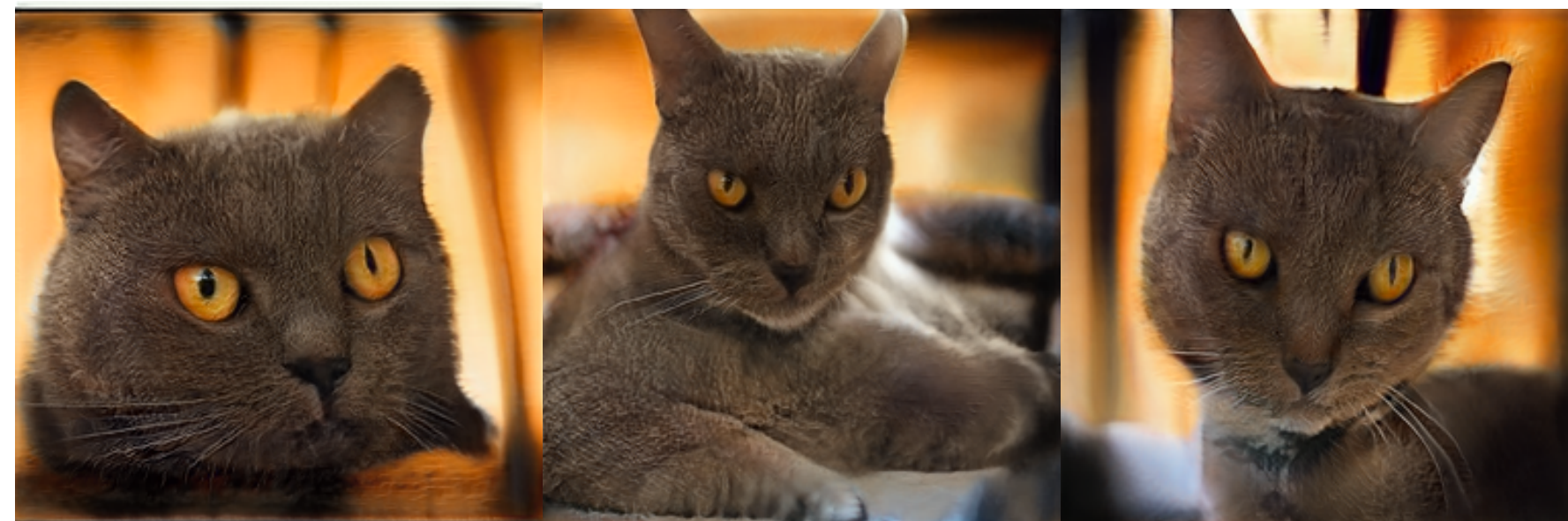
Input



Reconstruction



Style-mix Coarse Layers



Limitations

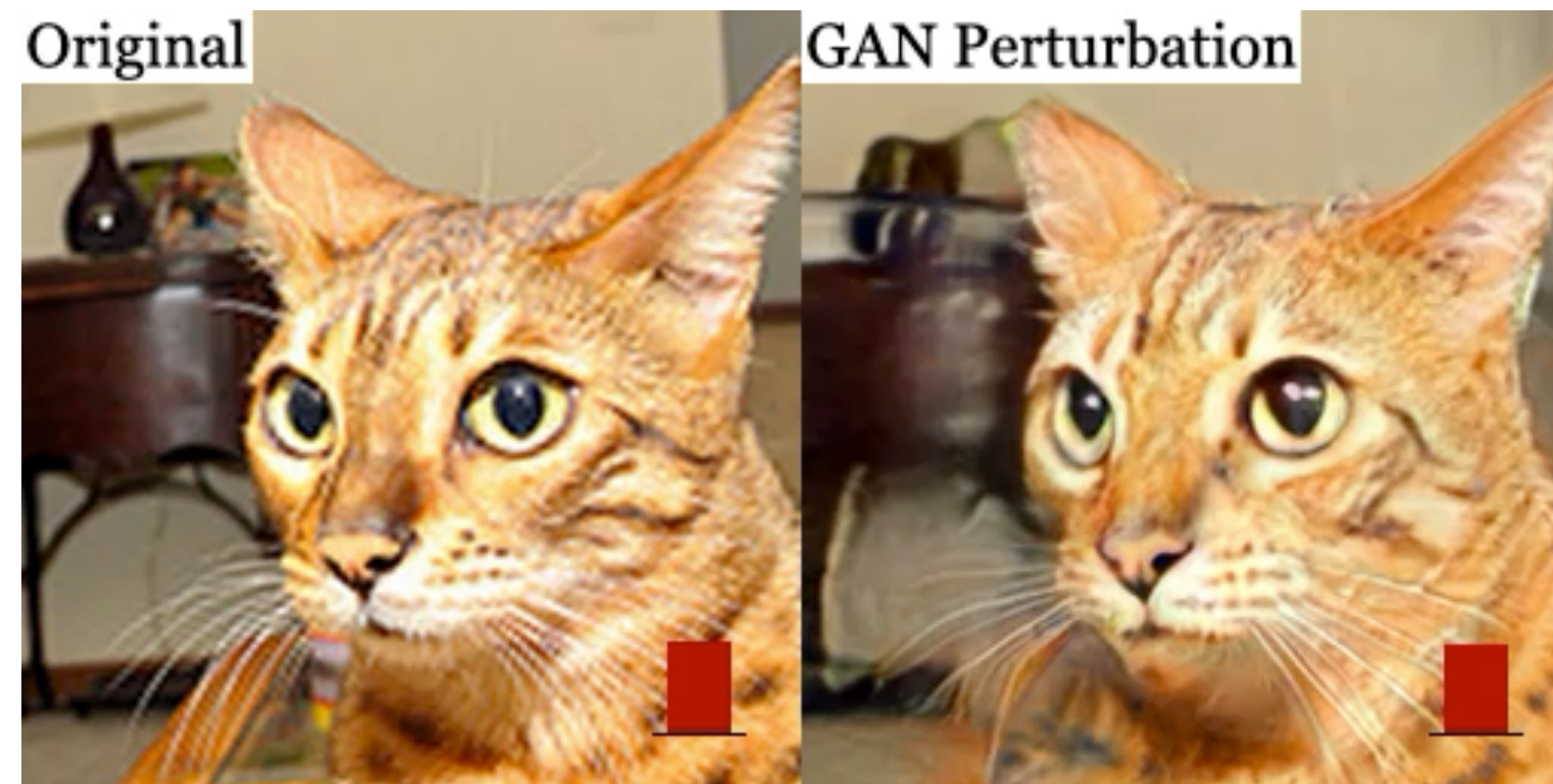
- GAN **reconstruction** capability
- GAN inversion **efficiency**
- Classifier **sensitivities** to GAN output
- Currently limited to simple tasks with small, structured datasets...
- But generation and inversion technology is rapidly improving!

Summary

- StyleGAN as a generator of image variations
- Project image into latent space and perturb
- Requires adjustments to mitigate classifier sensitivity to GAN output

Summary

- StyleGAN as a generator of image variations
- Project image into latent space and perturb
- Requires adjustments to mitigate classifier sensitivity to GAN output



Project Website + Code + Colab:
<https://chail.github.io/gan-ensembling/>