



# FouRA: Fourier low-Rank Adaptation

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# Agenda

Introduction/Motivation

Proposed Approach

Interpretations and Analysis

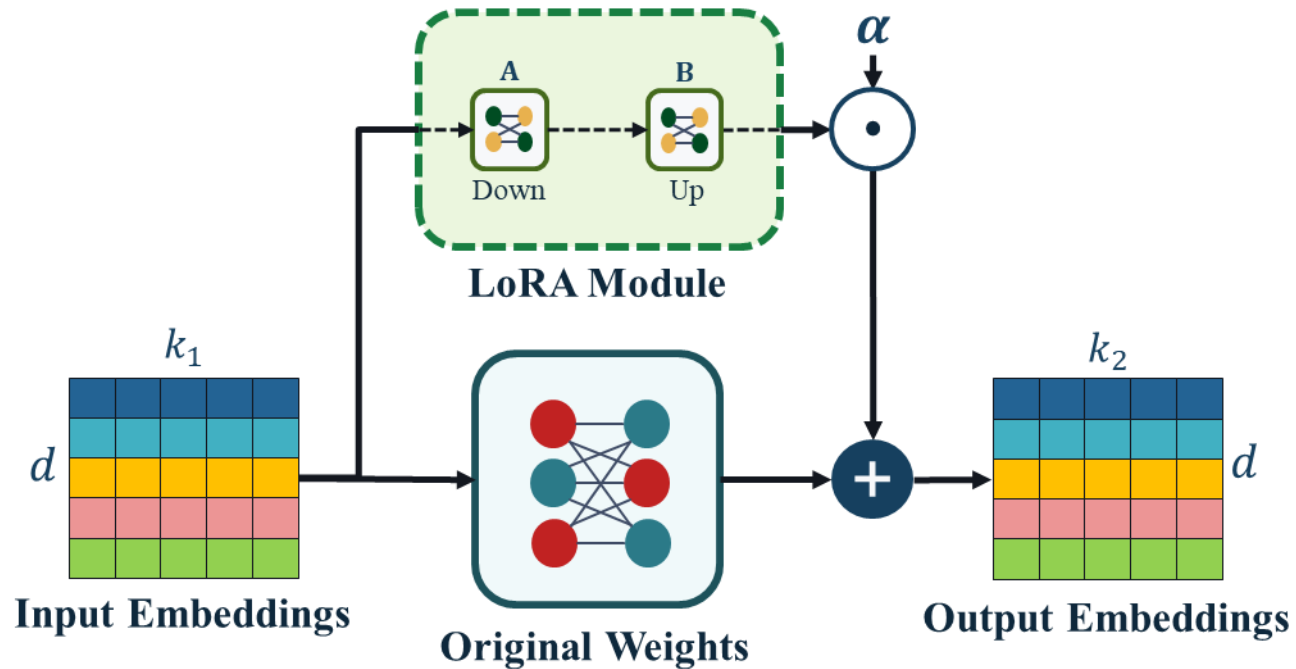
Results

Conclusion

# Introduction/Motivation



# Low Rank Adaptation



## LoRA

- Parameter-efficient fine-tuning
- Parallel branch to network weights
- Transform to a low-rank subspace

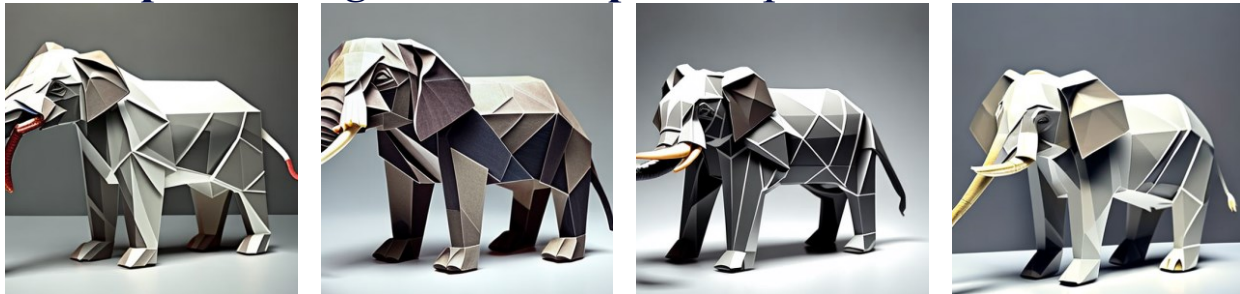
# Low Rank Adaptation: Distribution Collapse

LoRA faces distribution collapse or data-copying artifacts.

**a. Adapter: “BlueFire”, Prompt: “Fantastical Forest Witch”**



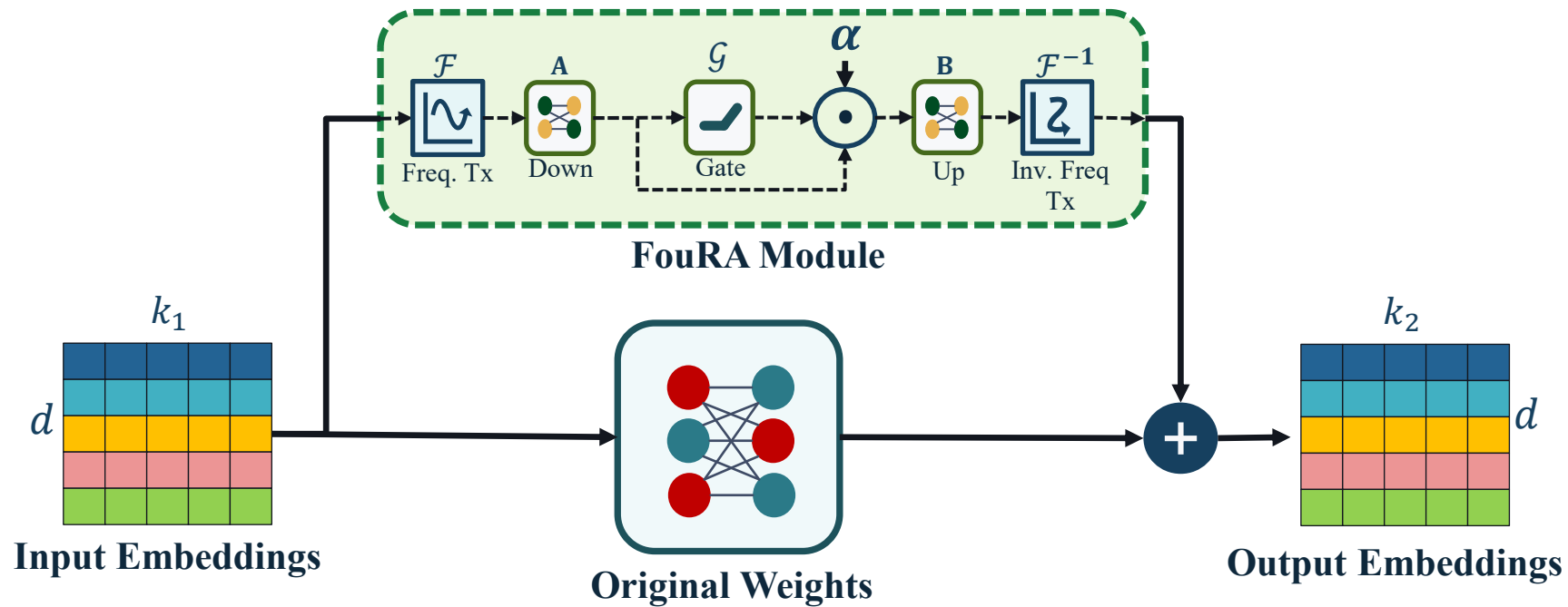
**b. Adapter: “Origami”, Prompt: “Elephant”**



# Proposed Approach: FouRA



# FouRA: Fourier Low-Rank Adaptation



## FouRA Module

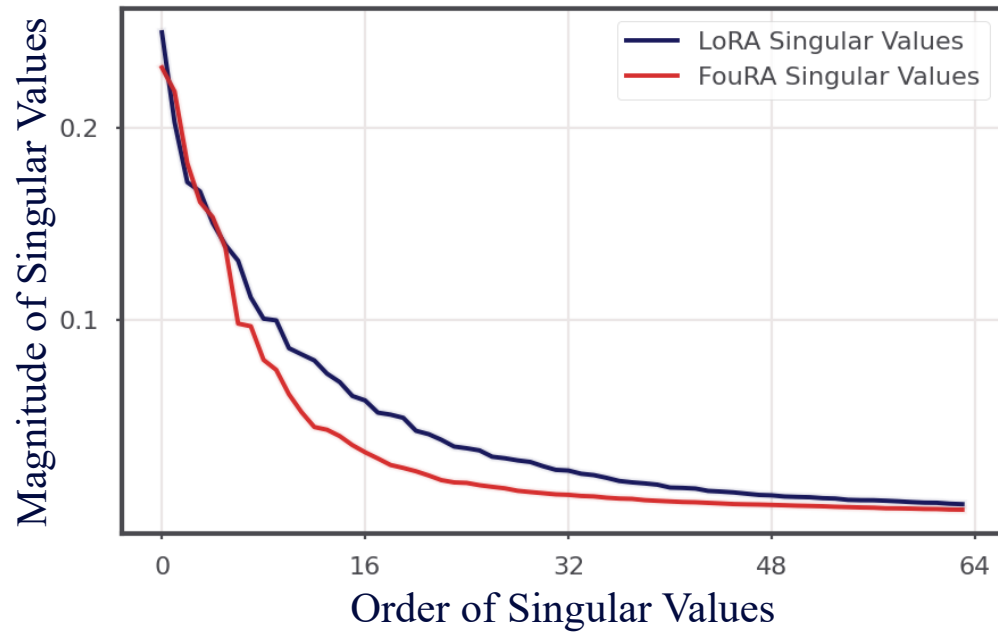
- Frequency Transform
- Inference Adaptive Gating

# Interpretations and Analysis





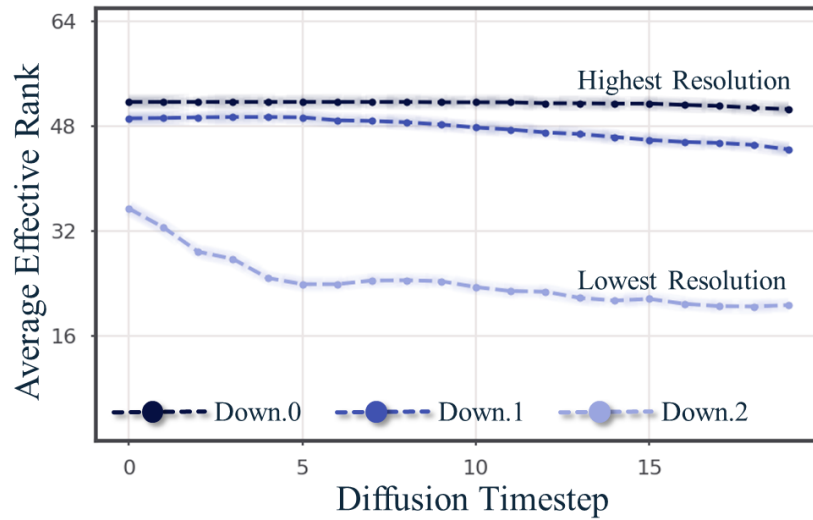
# Compactness in the **Fourier** domain



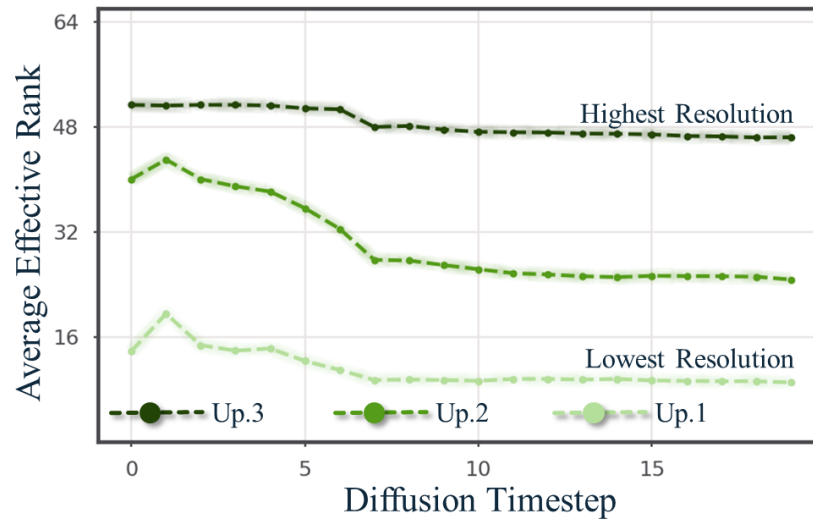
## Singular Value Spread

- Compactness
- Decorrelation

# Average Effective Rank



**a) FouRA UNet Downsampling Blocks**



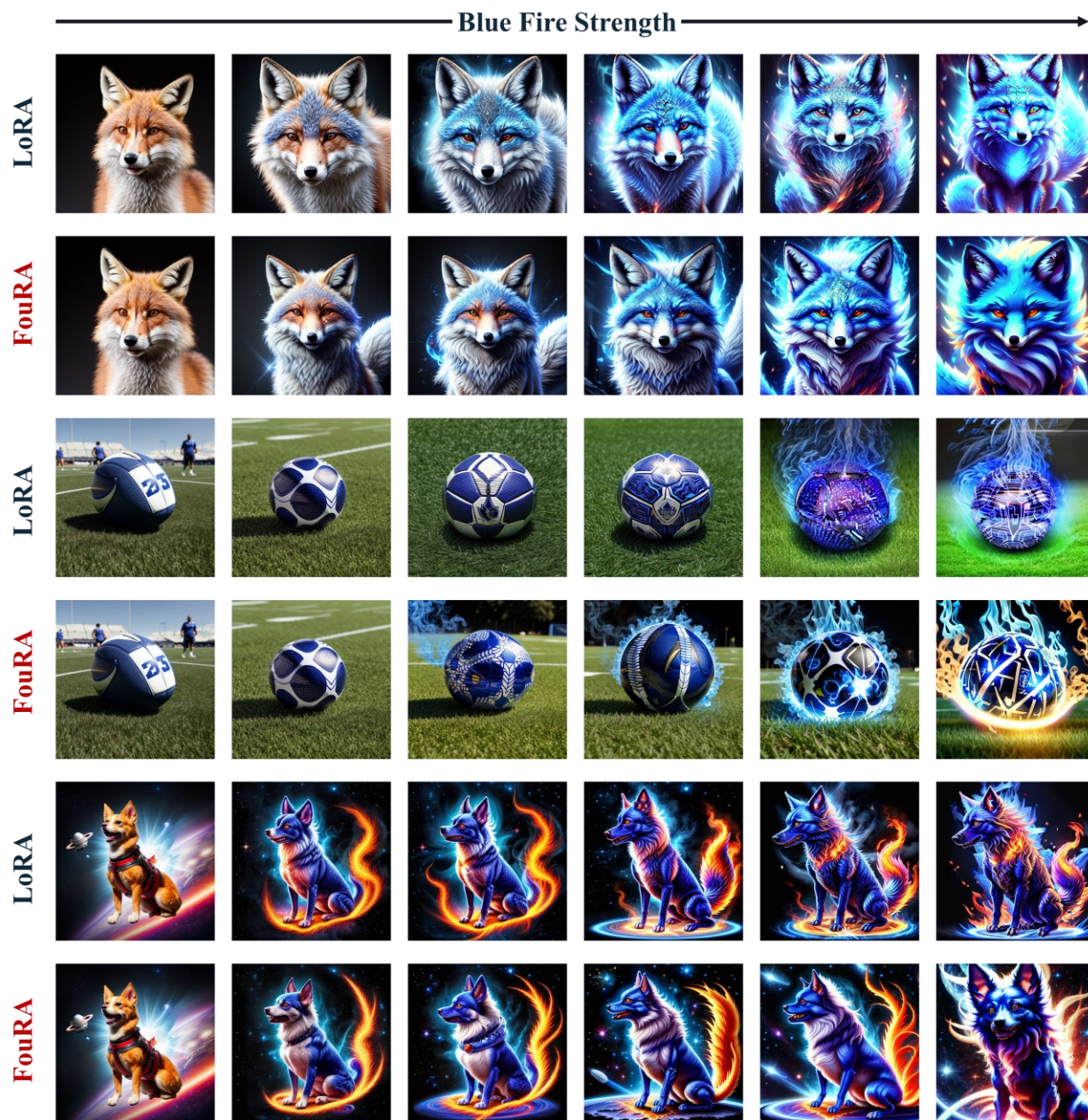
**b) FouRA UNet Upsampling Blocks**

- Average Effective Rank increases as resolution increases
- Average Effective Rank reduces as diffusion timestep increases

# Results



# FouRA for Text-to-Image stylization



## Text-to-Image stylization

- Base model: SD1.5
- Adapter: Blue Fire
- Prompts (top to bottom):  
Fox, Football, Dog in space.

# FouRA for Text-to-Image stylization

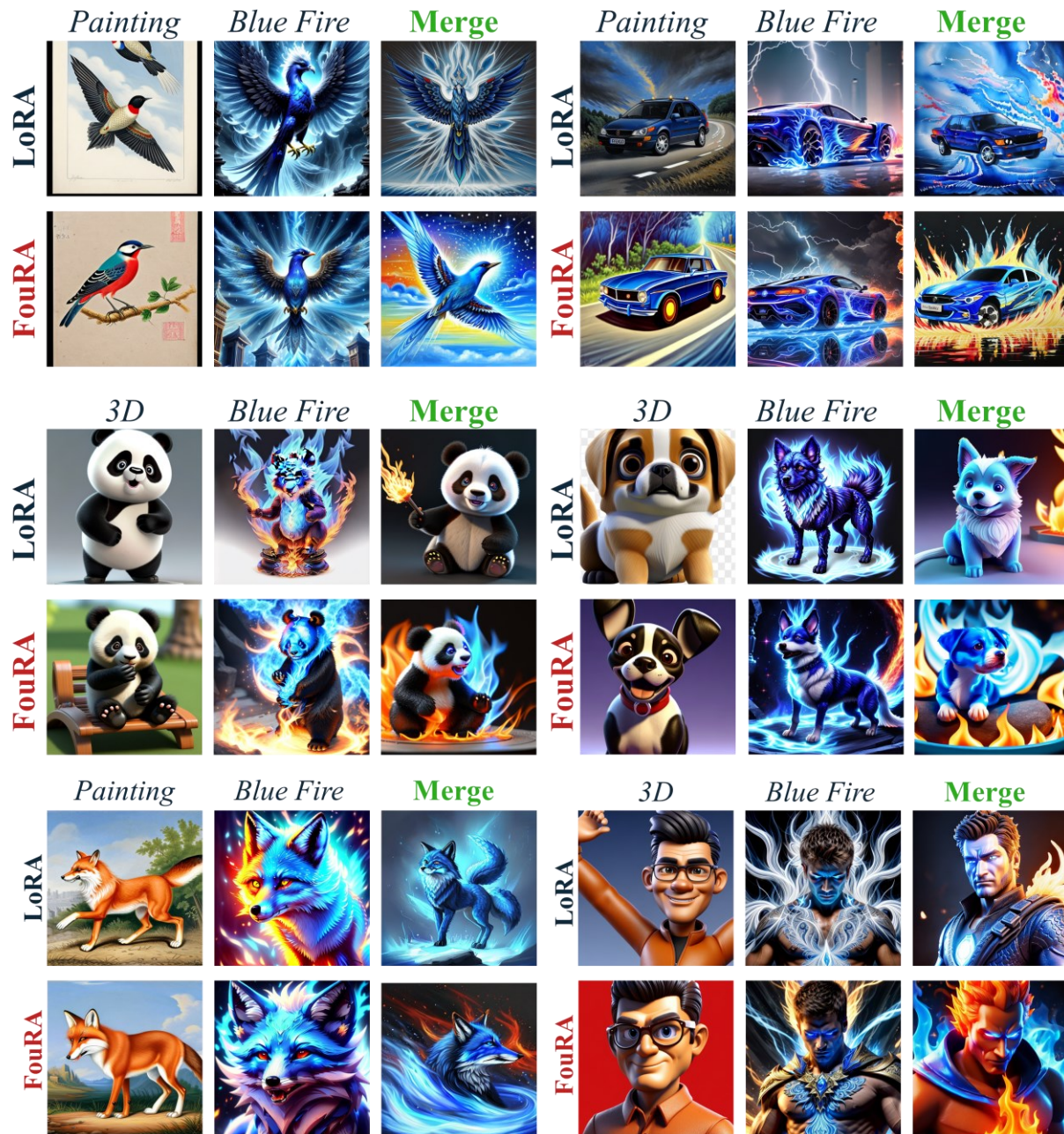
## Text-to-Image stylization

- Base model: SD1.5
- Adapter: **Paintings**
- HPS: For prompt alignment and aesthetic quality
- LPIPS-Diversity: Diversity across 30 seeds

Adapter	Fourier	Frozen Dynamic Mask	Inf-Adaptive Mask	HPS (↑)	LPIPS-Diversity (↑)
LoRA				27.7	37.8
Frozen Mask		✓		28.2	38.9
Inference-Adaptive Mask			✓	28.7	39.7
FouRA (No Mask)	✓			30.0	43.2
FouRA (Frozen Mask)	✓	✓		30.3	44.0
FouRA (Inference-Adaptive Mask)	✓		✓	<b>30.6</b>	<b>44.5</b>



# FouRA for Merging Adapters



## Merging Adapters

- Base model: SD1.5
- Weighted addition of adapter outputs.
- FouRA can effectively merge two styles.

# FouRA with concept sliders

Editing of concepts using  
Concept Slider FouRA

FouRA



FouRA





Conclusion





# Thank you

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