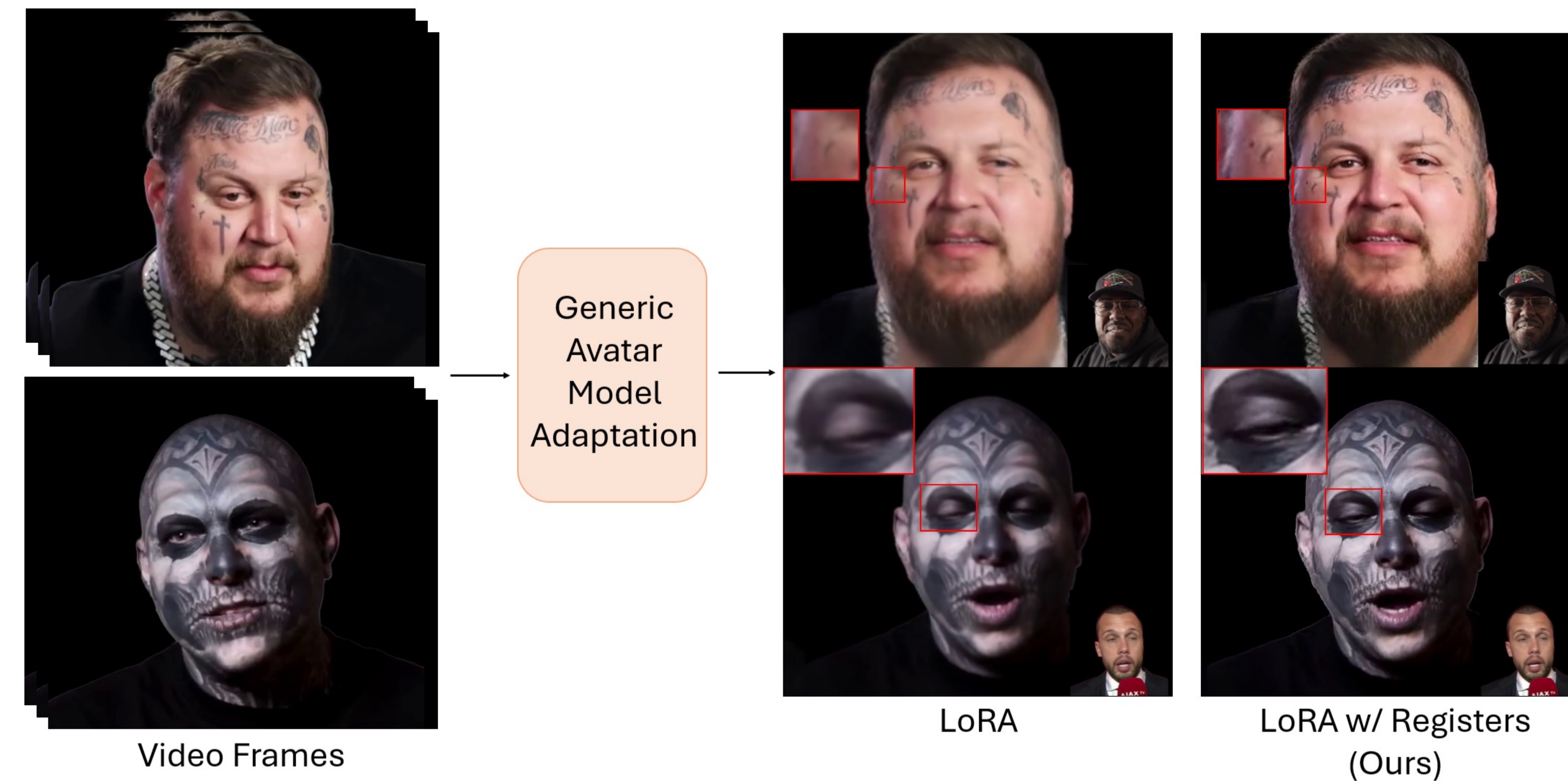
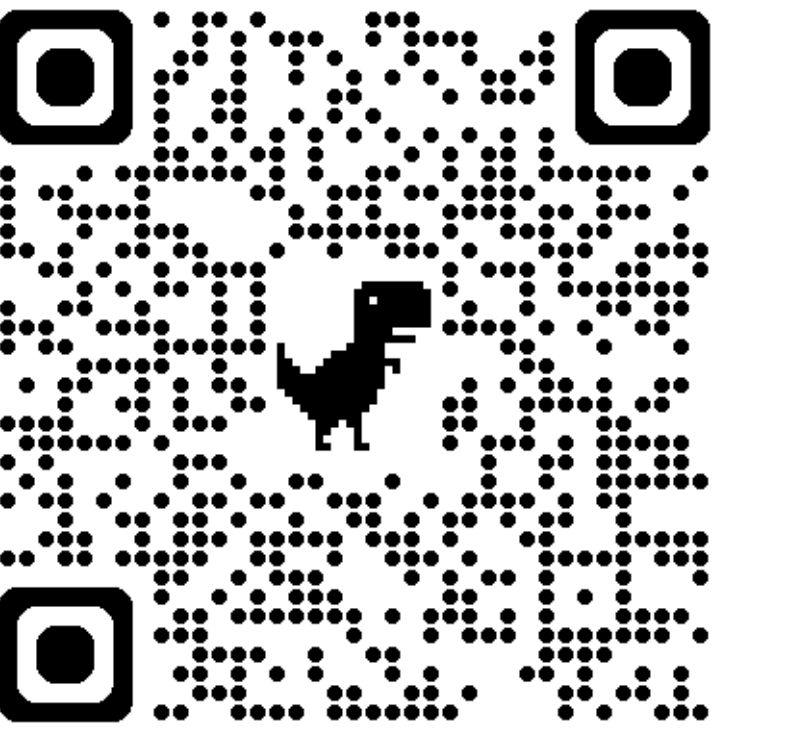


# Low-Rank Head Avatar Personalization with Registers

Sai Tanmay Reddy Chakkerla<sup>1</sup>, Aggelina Chatziagapi<sup>1</sup>, Md Moniruzzaman<sup>2</sup>, Chen-Ping Yu<sup>2</sup>, Yi-Hsuan Tsai<sup>2</sup>, Dimitris Samaras<sup>1</sup>

<sup>1</sup> Stony Brook University  
<sup>2</sup> atmanity

NEURAL INFORMATION  
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## Avatar Personalization

Generic facial animation models:

- miss **subtle, high-frequency details** on face.
- with LoRA **struggles** to preserve these identity-specific traits.

We introduce a **Register Module** that:

- Improves** LoRA to reproduce fine, identity-specific facial details.
- Maintains** the original inference speed.

## Register Module

### Integration

- Introduce Register Module into pretrained network.
- Add LoRA weights to branches.

### Adaptation

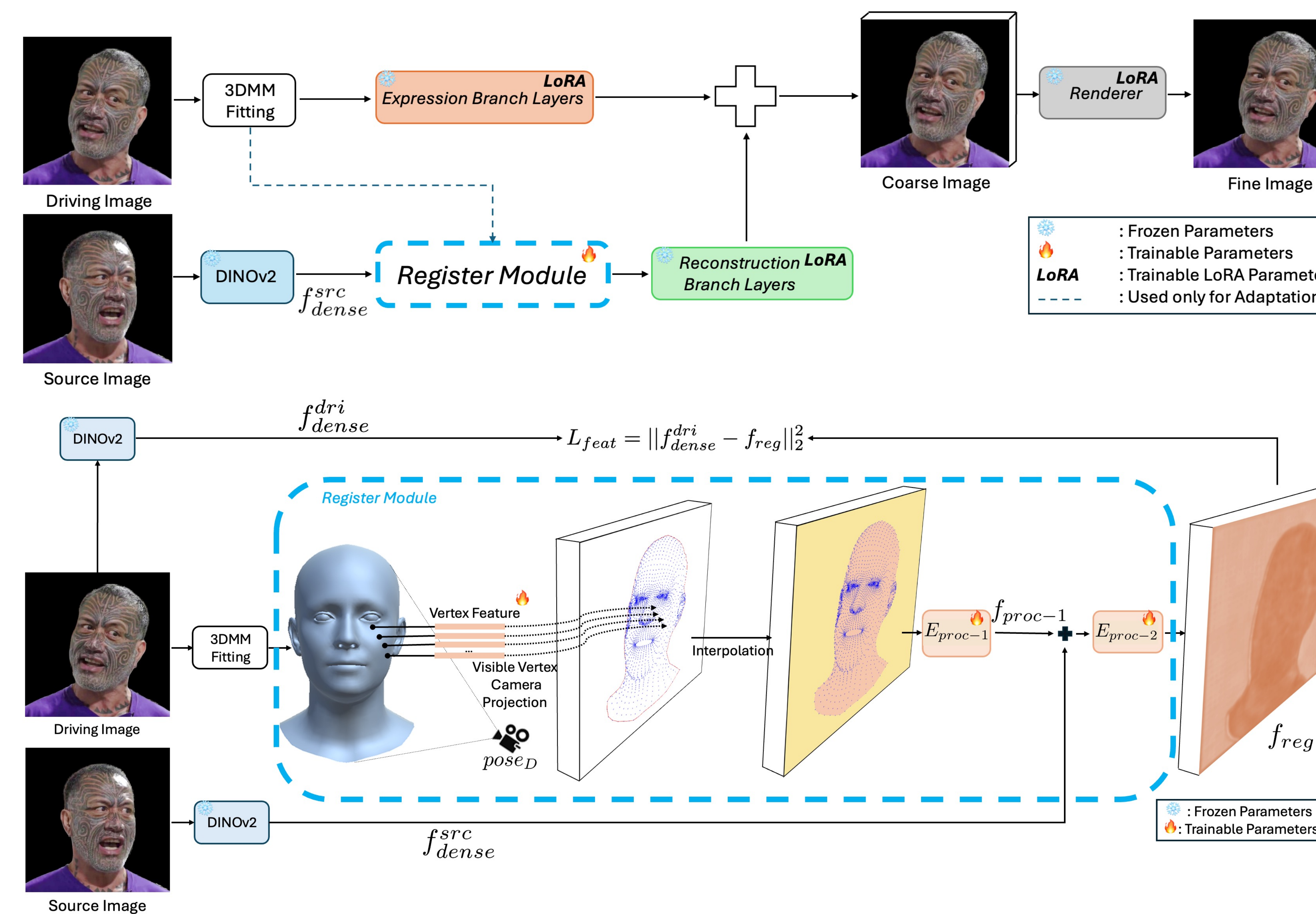
- Takes **dense DINO feats** from the source image and **3DMM params** from the driving image.
- Learns to **highlight** important regions in the DINO features.
- Provides **stronger learning signals** → enables LoRA to reproduce fine, high-frequency facial details.

### Inference

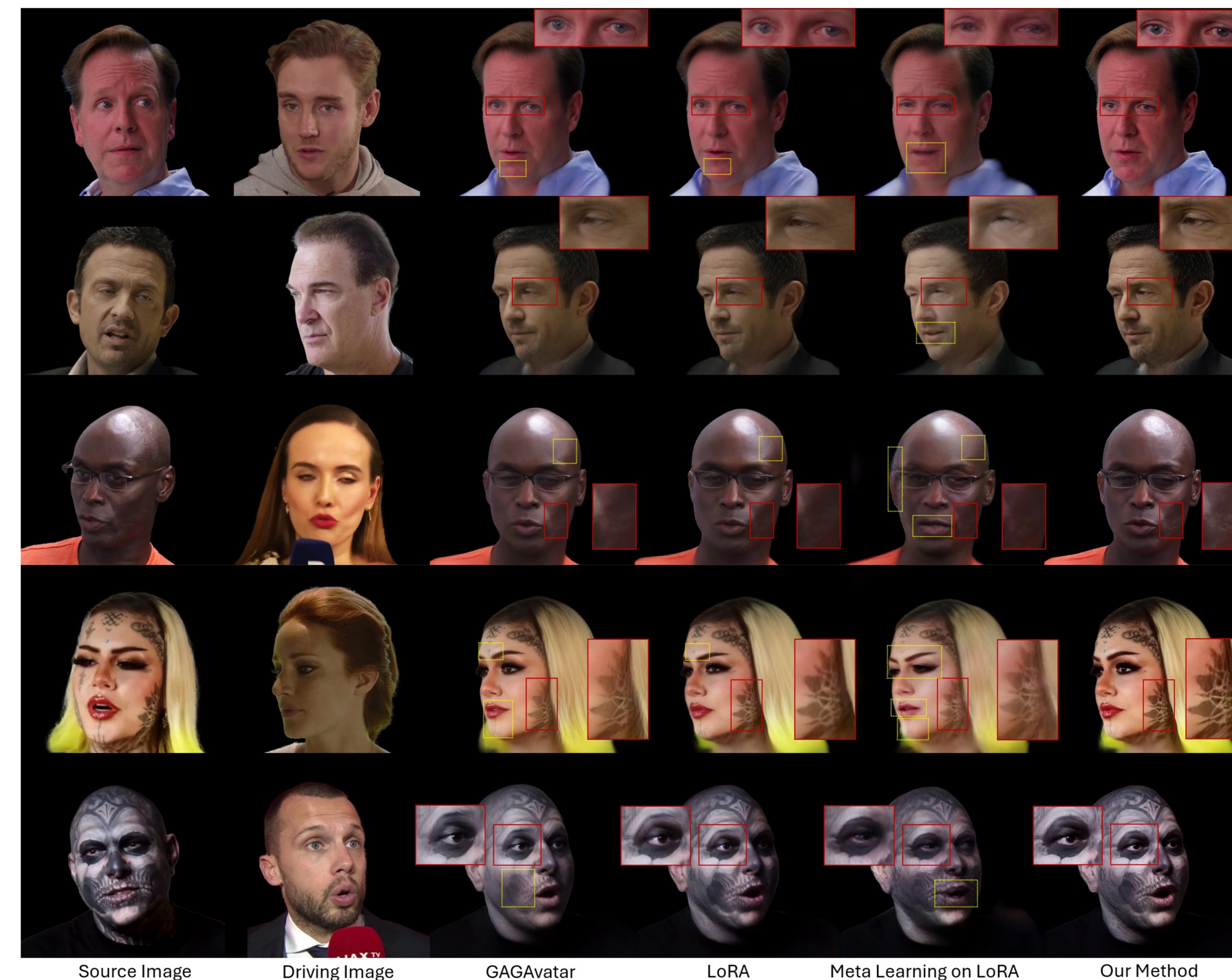
- Register Module is used only during adaptation.
  - LoRA weights get merged.
- ⇒ no **additional runtime cost or latency** at inference.

### Inside Register Module

- Rig **learnable embeddings** to 3DMM vertices.
- Project** visible vertex emb. to camera plane using **camera pose** ( $pose_D$ ).
- Interpolate** features in face mask; fill background features.
- Process map and add **source image's DINOv2 features**  $f_{dense}^{src}$ .



## Results



We compare state-of-the-art methods for adaptation (LoRA and Meta-Learning). Results shown from VFHQ Test set in rows 1, 2, and 3, and RareFace50 in rows 4 and 5.

## Results

- GAGAvatar and LoRA + GAGAvatar **lose fine details**.
- Meta-Learning on LoRA **introduces artifacts**.
- Our method **preserves fine, identity-specific details** and achieves **better visual quality**.

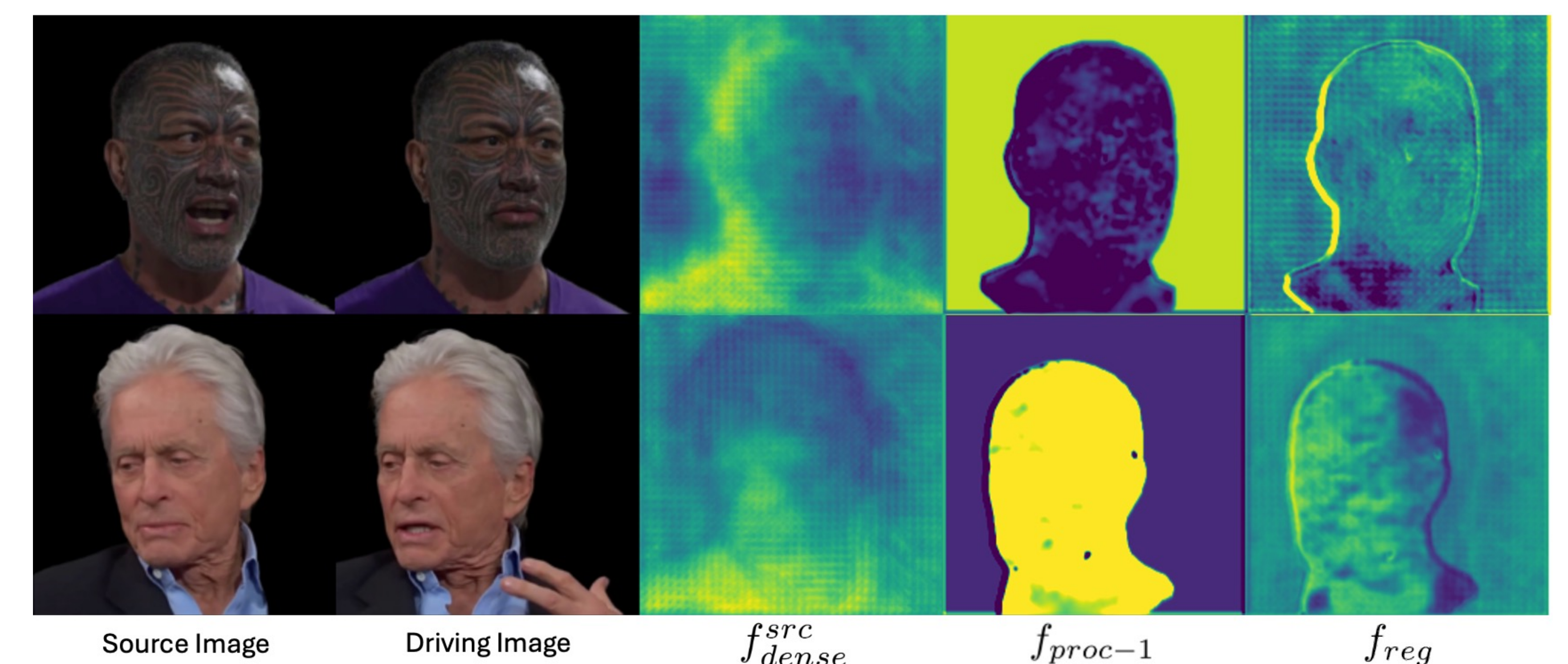
## Visualization of Register Module

We visualize three feature maps using 2<sup>nd</sup> channel-wise PCA comp.:

- source DINOv2 features** ( $f_{dense}^{src}$ )
- intermediate features** ( $f_{proc-1}$ )
- Register Module output** ( $f_{reg}$ )

Observations:

- Face region is **highlighted**
- Background is **dampened**



## References

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