

FastJAM: a Fast Joint Alignment Model for Images



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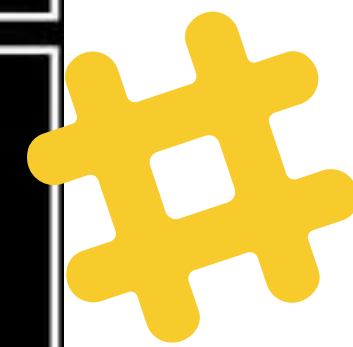
FastJAM's Website

Presented By:

Omri Hirsch

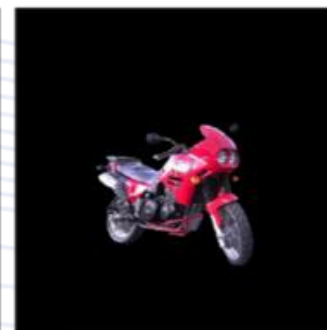
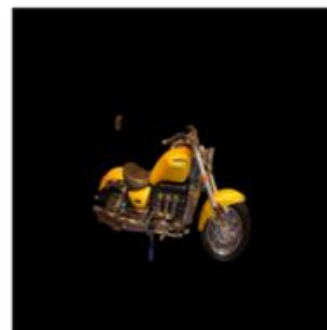
FastJAM was Presented in NeurIPS 2025

• <https://bgu-cs-vil.github.io/FastJAM/>

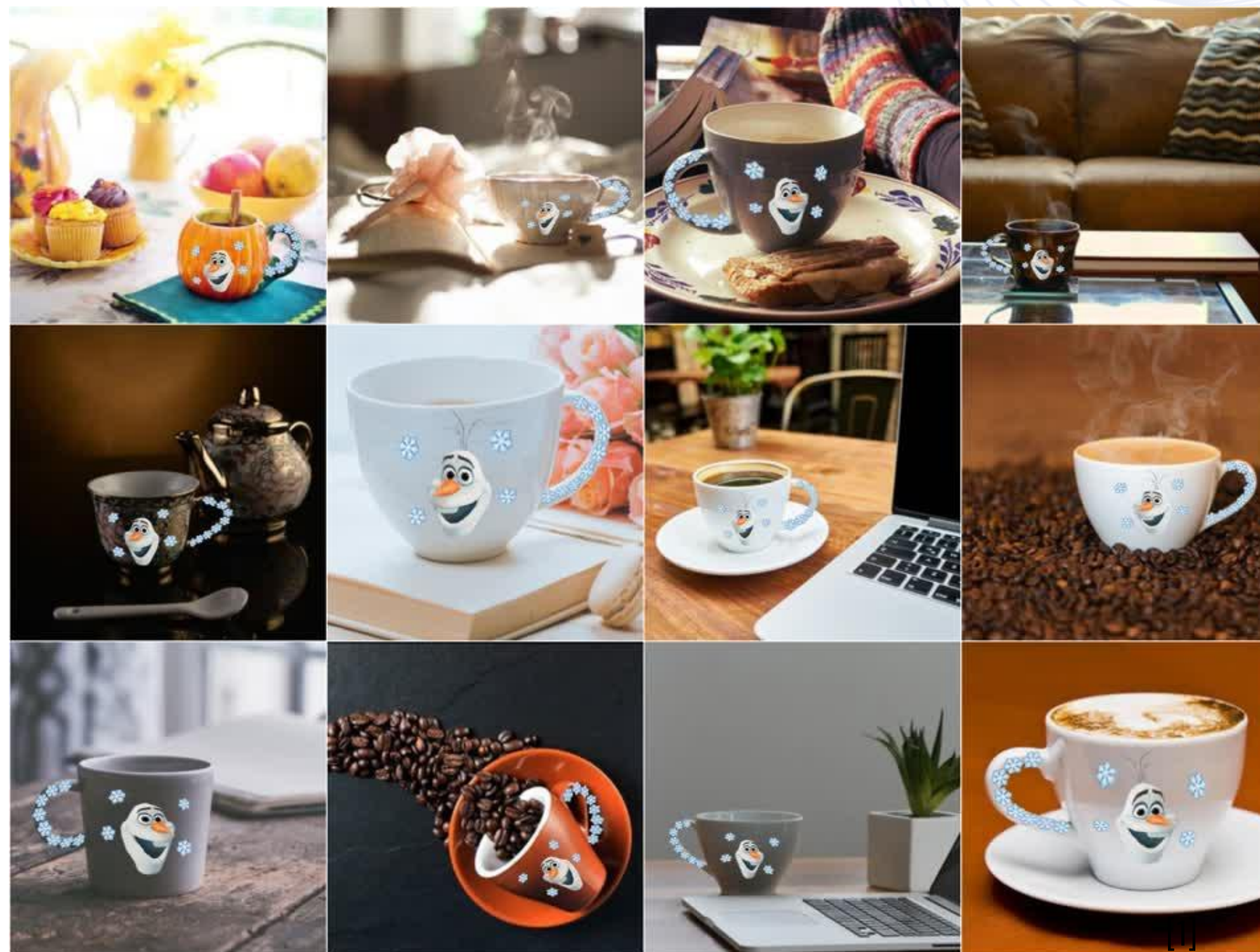


What is Joint Alignment (JA)?

Joint Alignment by FastJAM



Applications - Motivation



[1]

[1] Ofri-Amar et al., CVPR 2023

Applications - Motivation



[1]

[1] Matlab "Image Registration"

Applications - Motivation



[1]

[1] Peebles et al., CVPR 2022

Problem Definition

$$\arg \min_{I_\mu, (T^{\theta_i})_{i=1}^N} \sum_{i=1}^N D(I_\mu, I_i \circ T^{\theta_i})$$

INPUT :

a Set of Images
of the same
category objects



OUTPUT:

Invertible
transformations
for each image

$$(I_i)_{i=1}^N$$

a Set of N images

$$(T^{\theta_i})_{i=1}^N$$

N invertible transformations

$$I_\mu$$

"Atlas"
(i.e. Average Image)

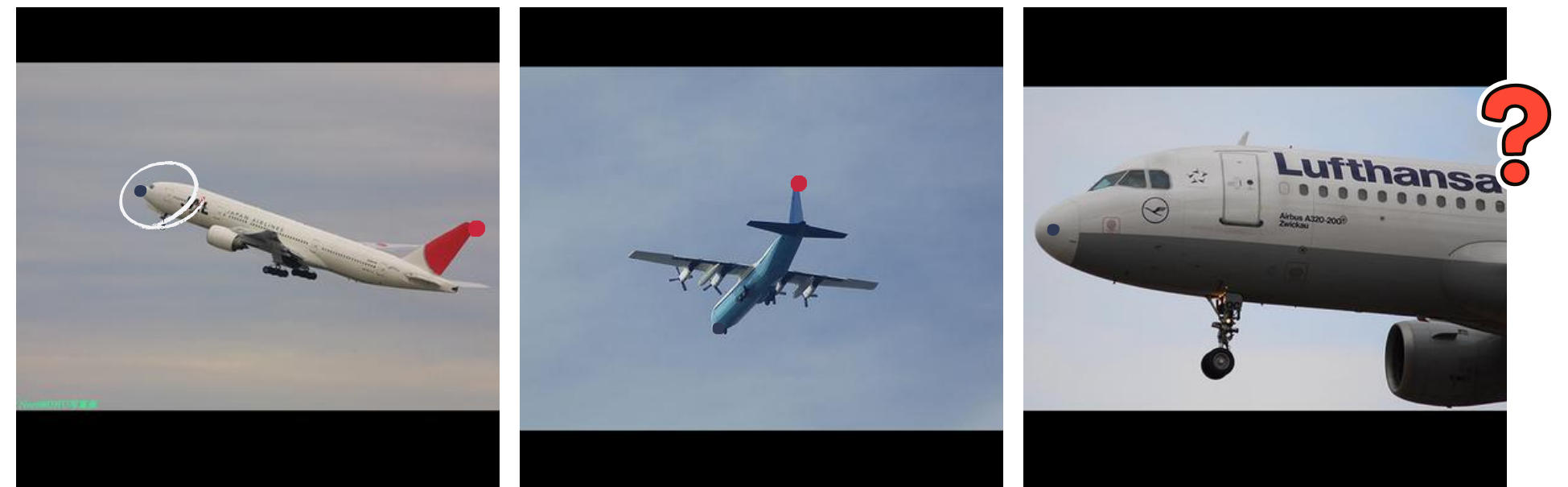
Research Gap

Joint Alignment is crucial for many vision tasks

01 Pairwise = Error Accumulation

02 Inefficiency of Existing Joint Alignment Methods

03 JA based on Dense Feature Losses



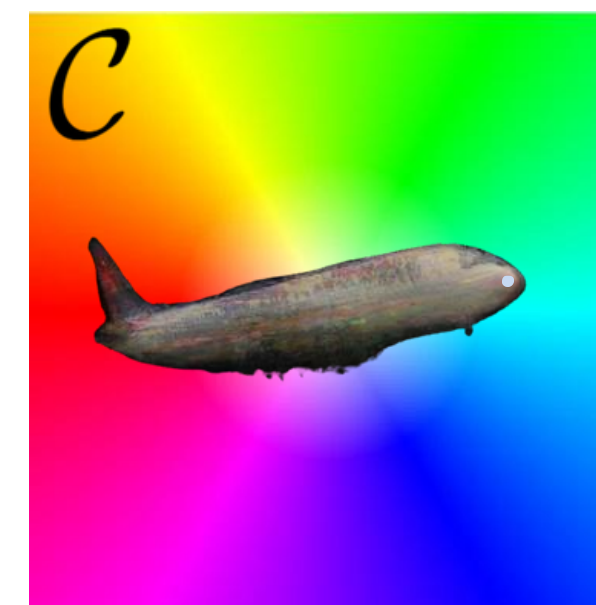
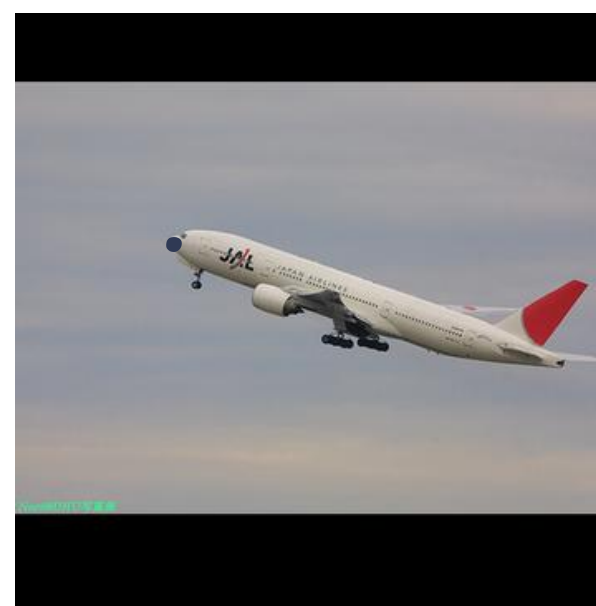
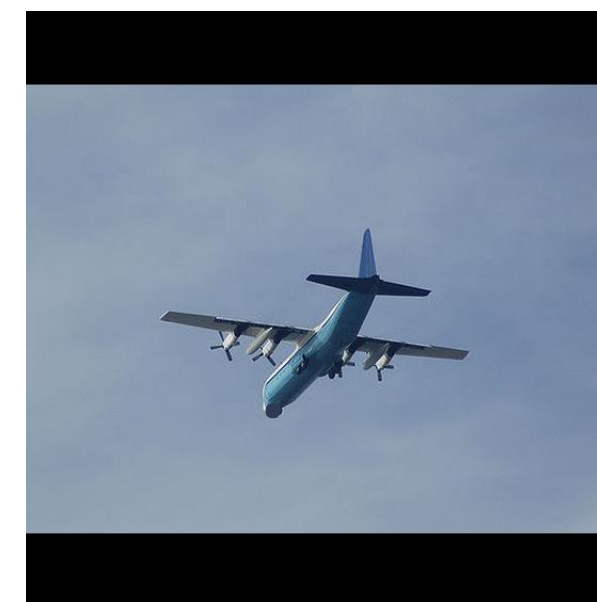
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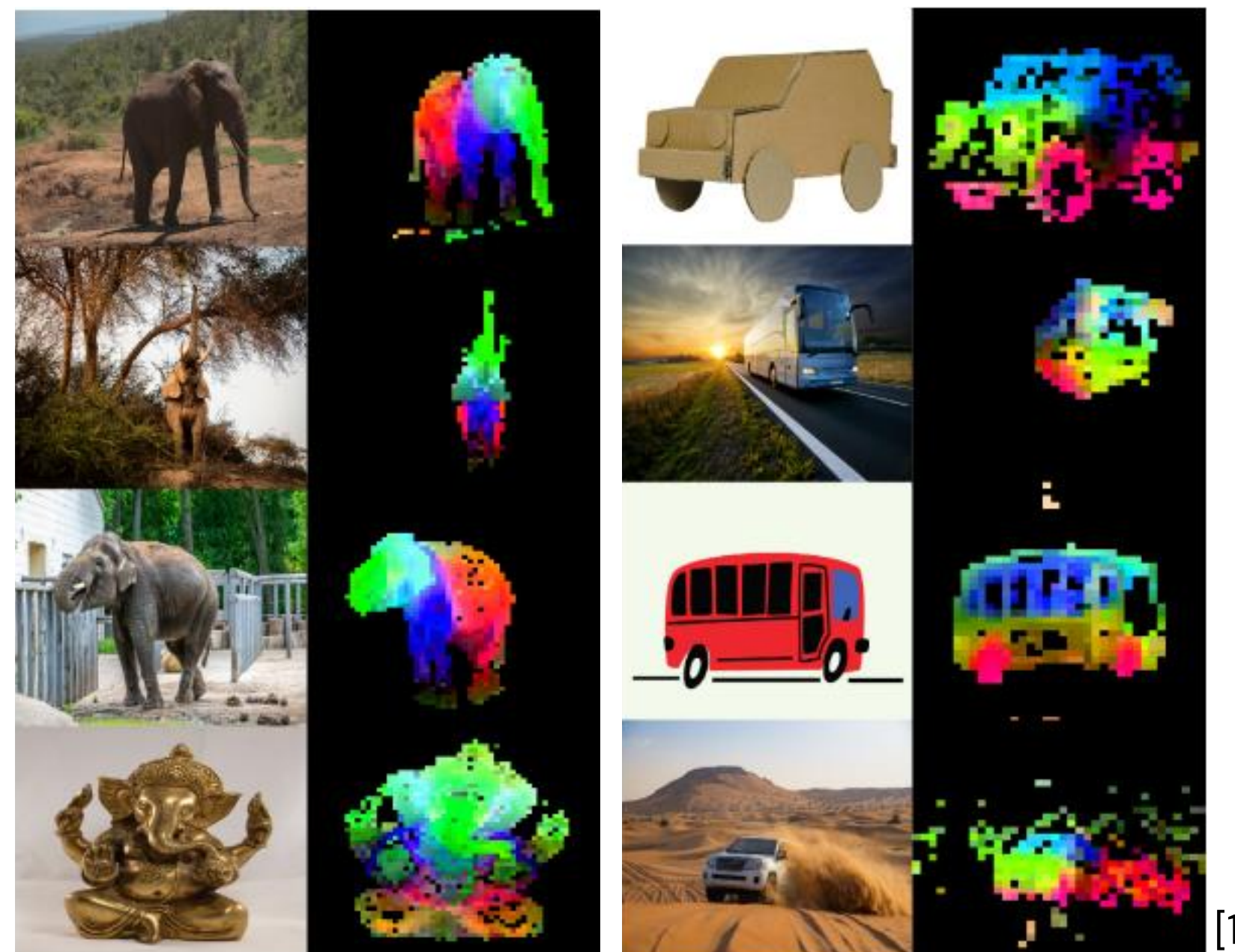
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Joint Alignment is crucial for many vision tasks

01 Pairwise = Error Accumulation

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[1] Oquab et al., TMLR 2024

Challenges

 Unsupervised: 01

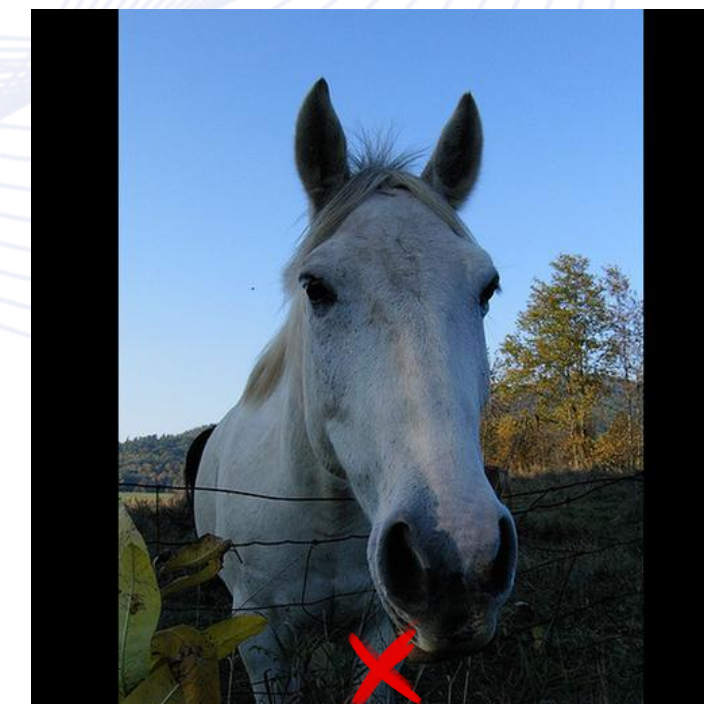
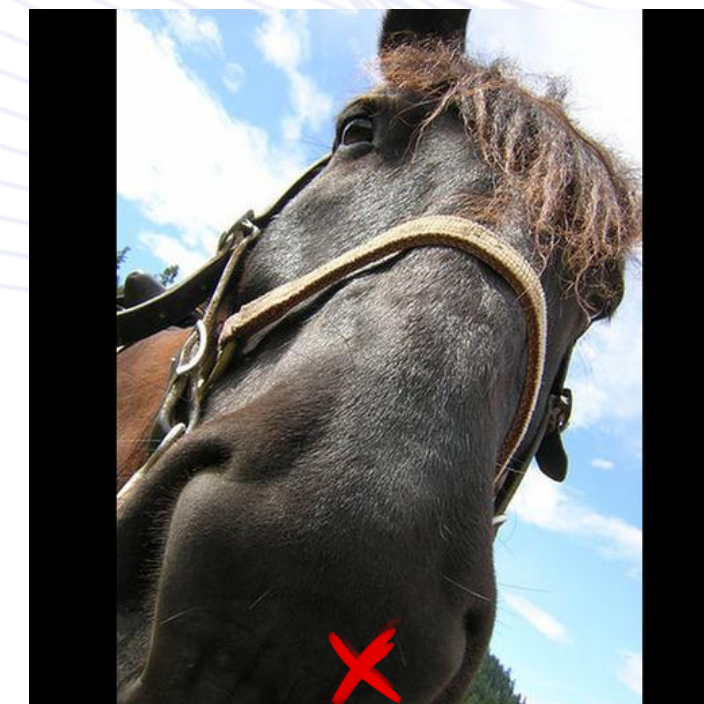
No "Known" Reference

 Regularization: 02

Due to #1, Usually Previous
Methods Require Regularization

 Cross Instance: 03

Cross Instance JA is Even
More Difficult



Challenges

Unsupervised: 01

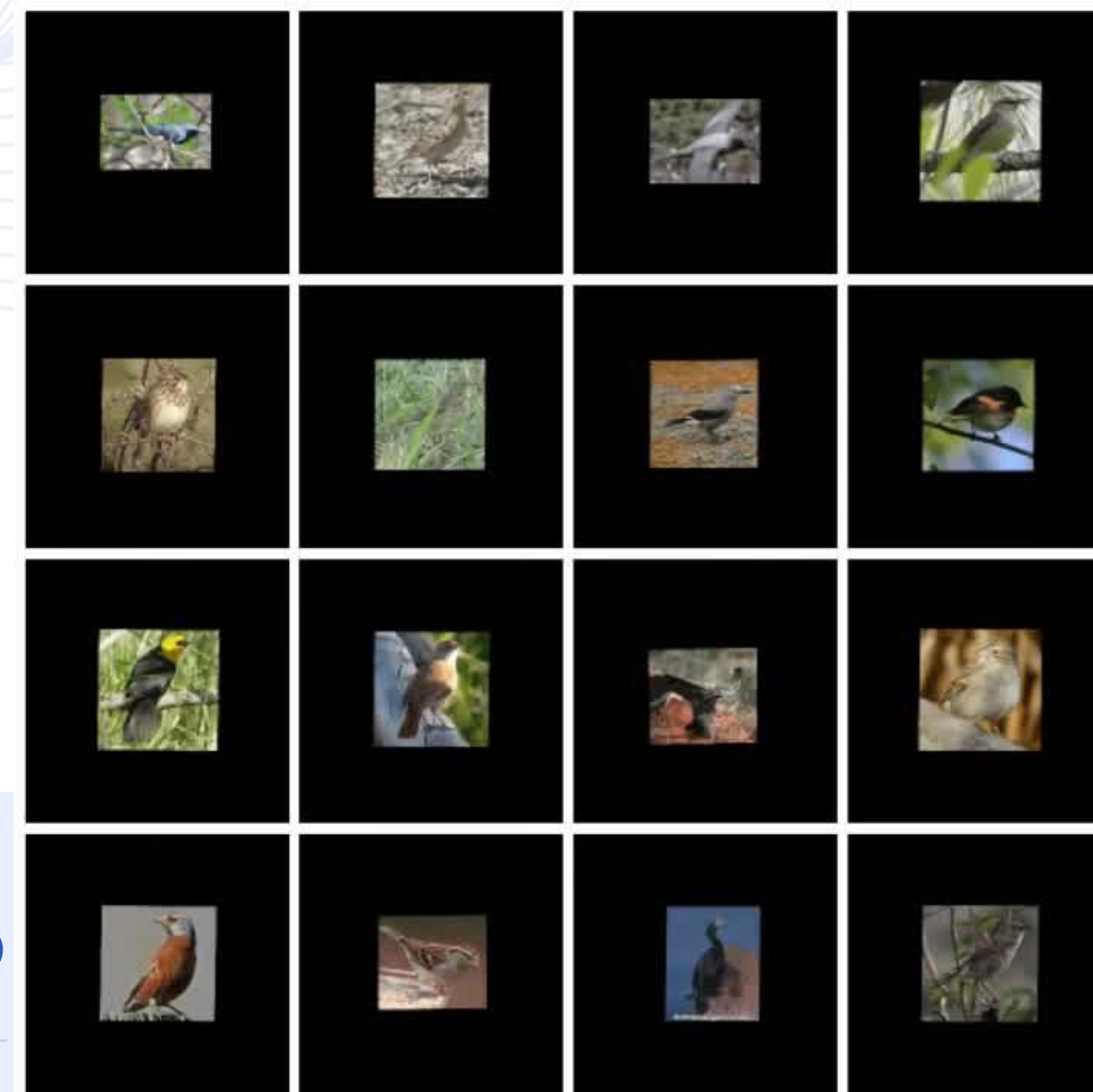
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[1]

[1] Barei et al., ECCV 2024

Challenges

Unsupervised: **01**

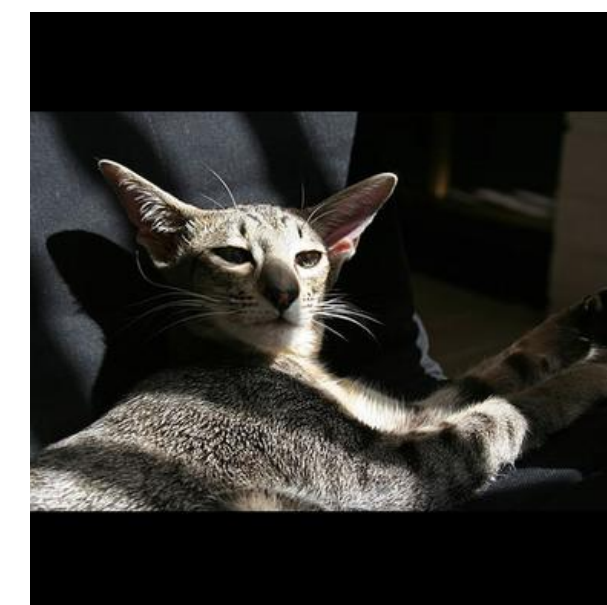
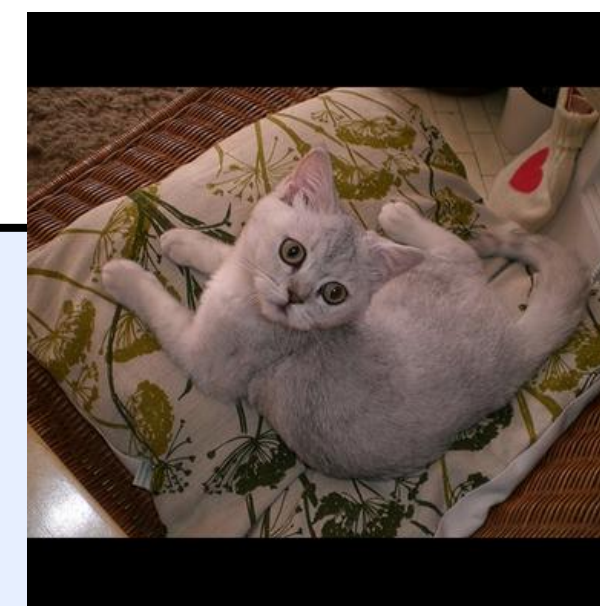
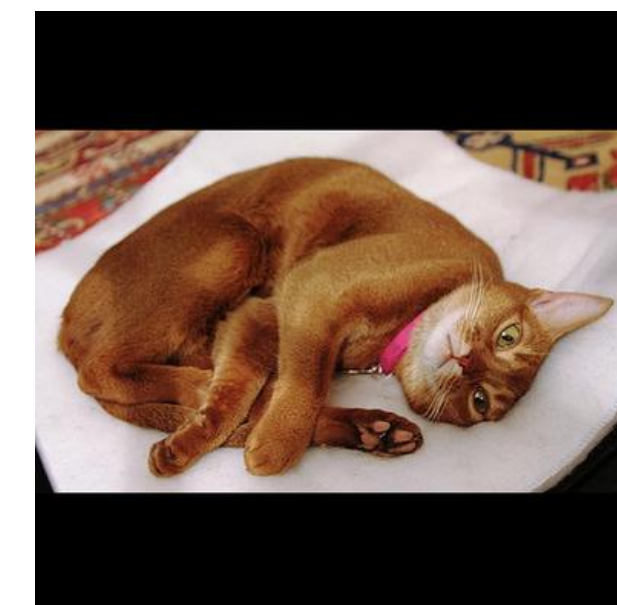
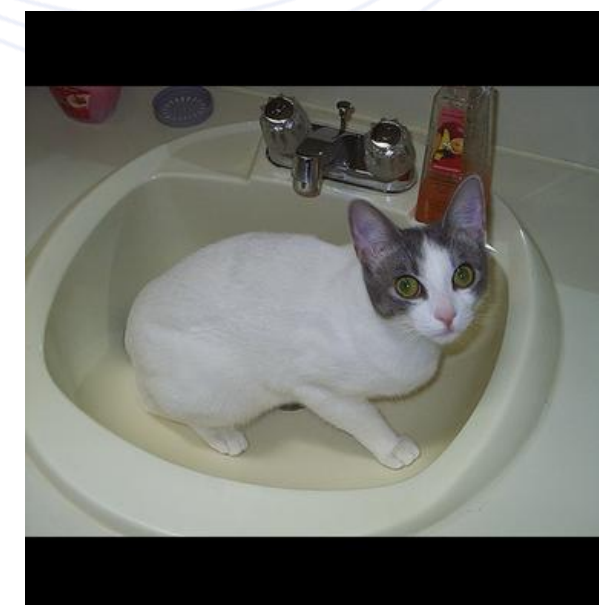
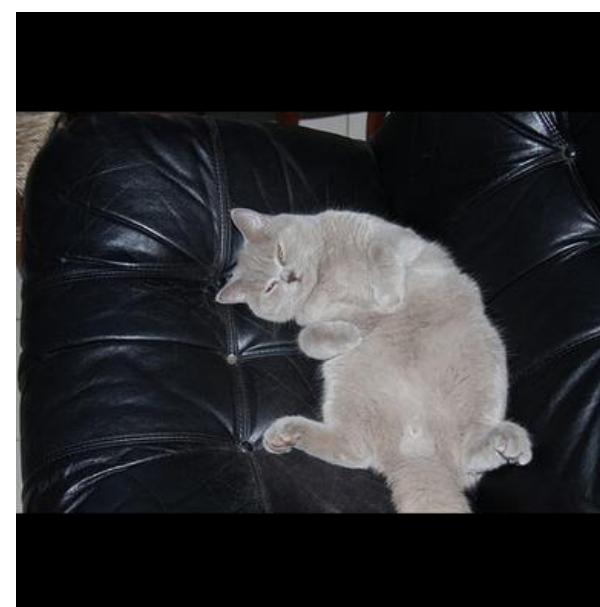
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Regularization: **02**

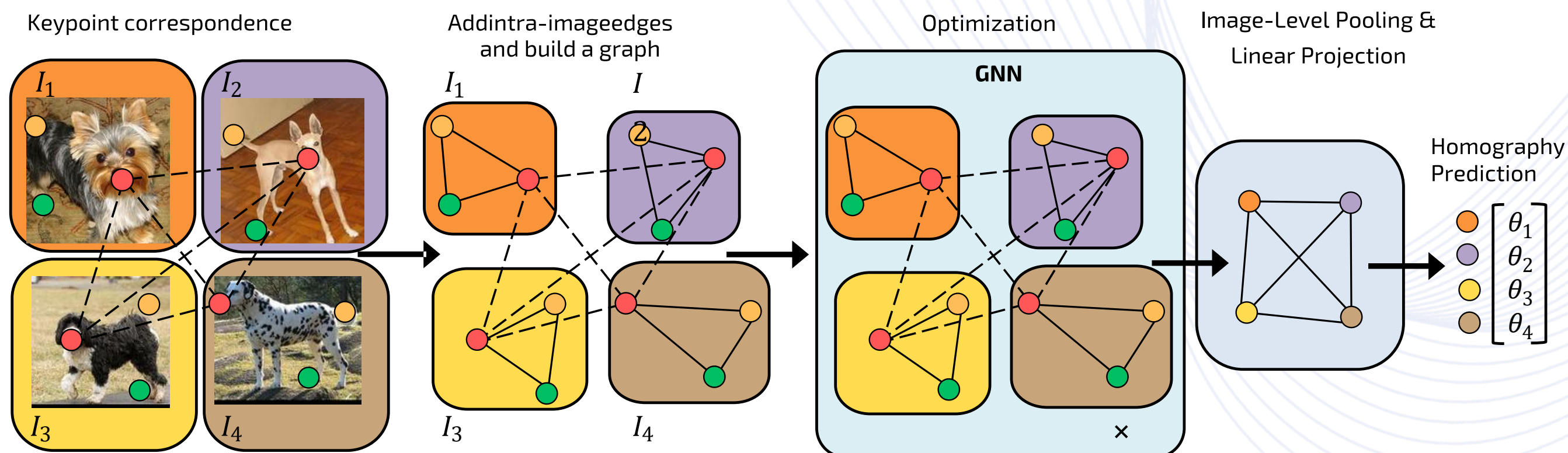
Due to #1, Usually Previous
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Cross Instance: **03**

Cross Instance JA is Even
More Difficult



FastJAM Architecture



INPUT:
Keypoint
Correspondence
Graph



OUTPUT:
Homographies
For Each Image

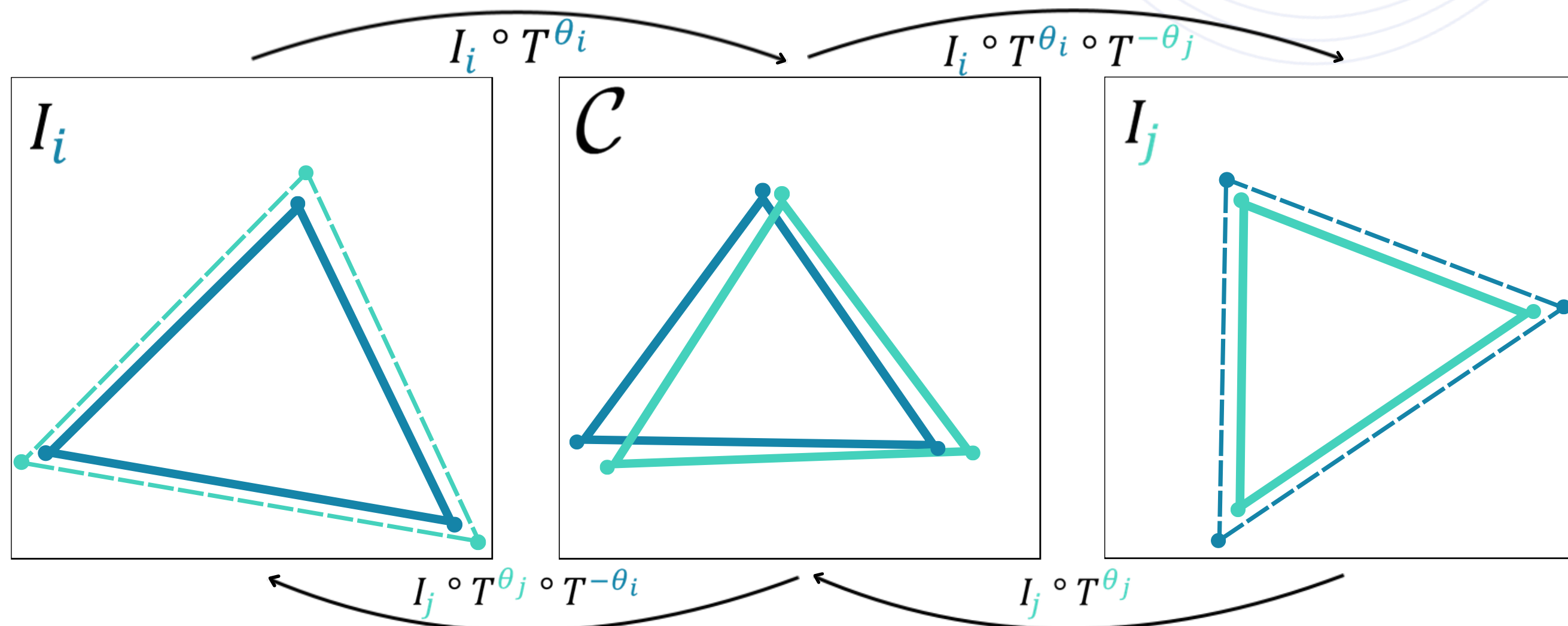
Legend:

— Intra-image edge

- - - Inter-image edge

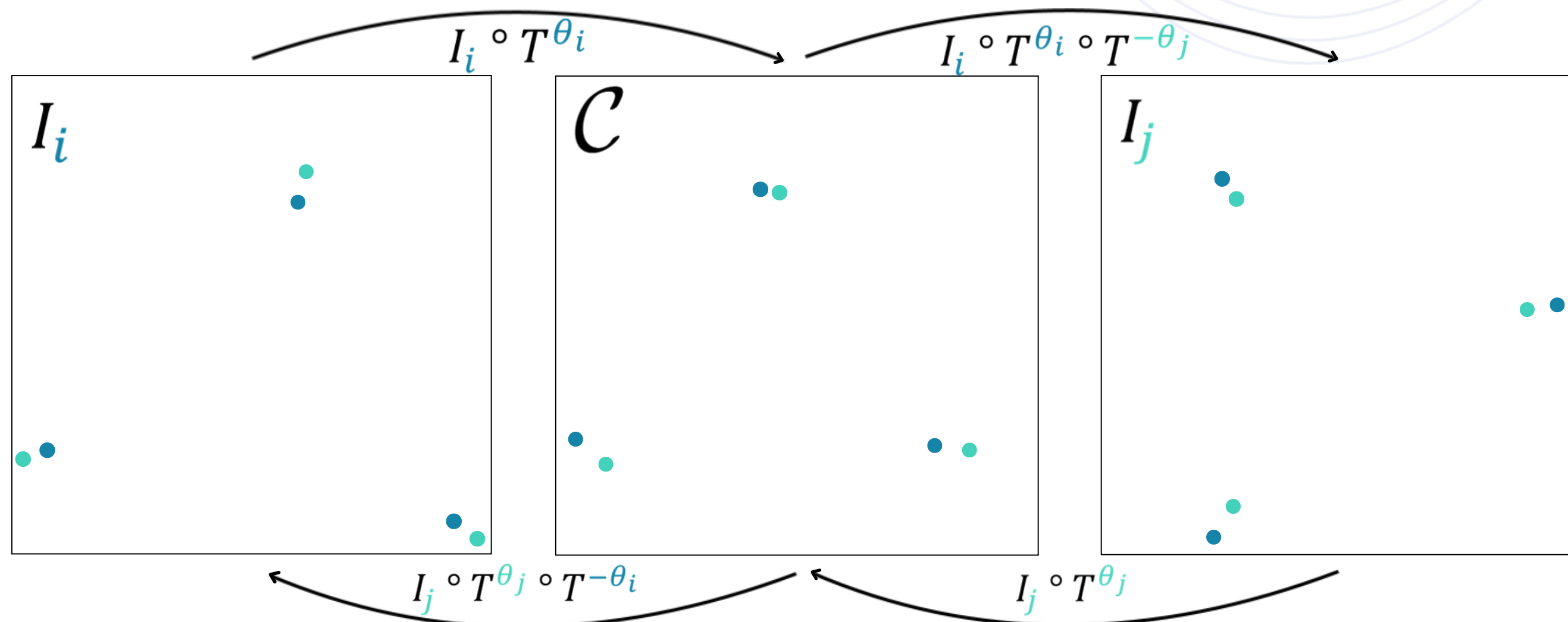
● ● ● Corresponding Keypoints Between Images

Inverse Compositional Loss



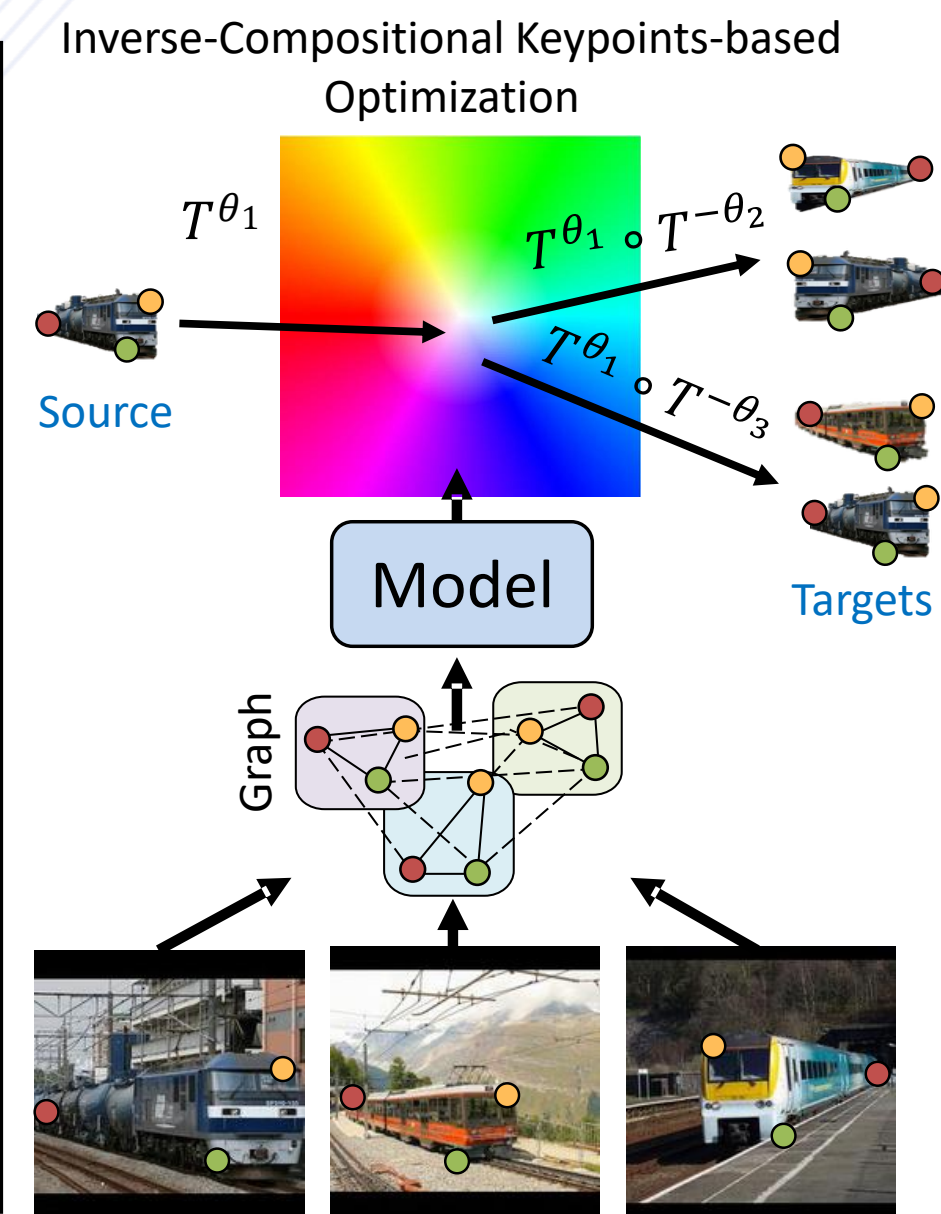
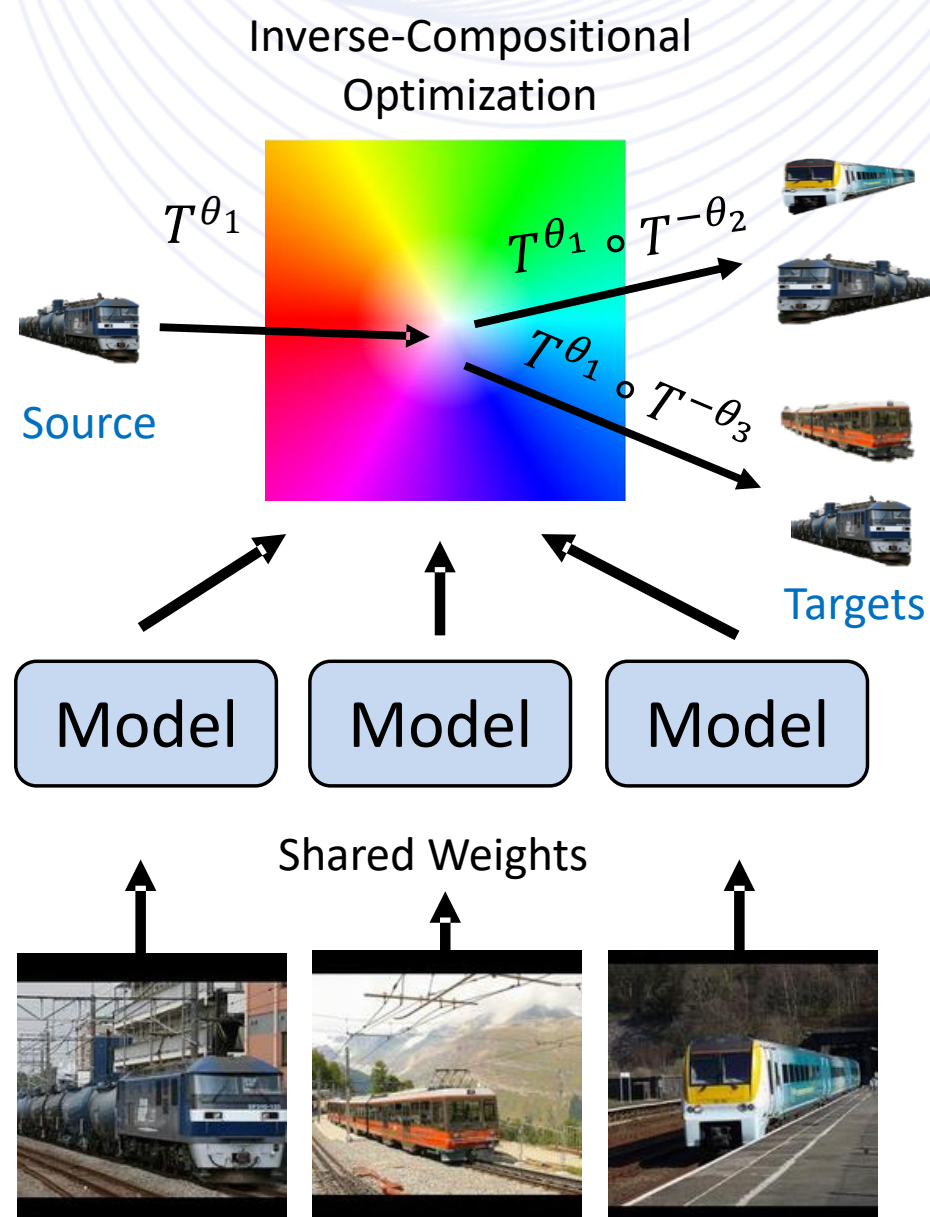
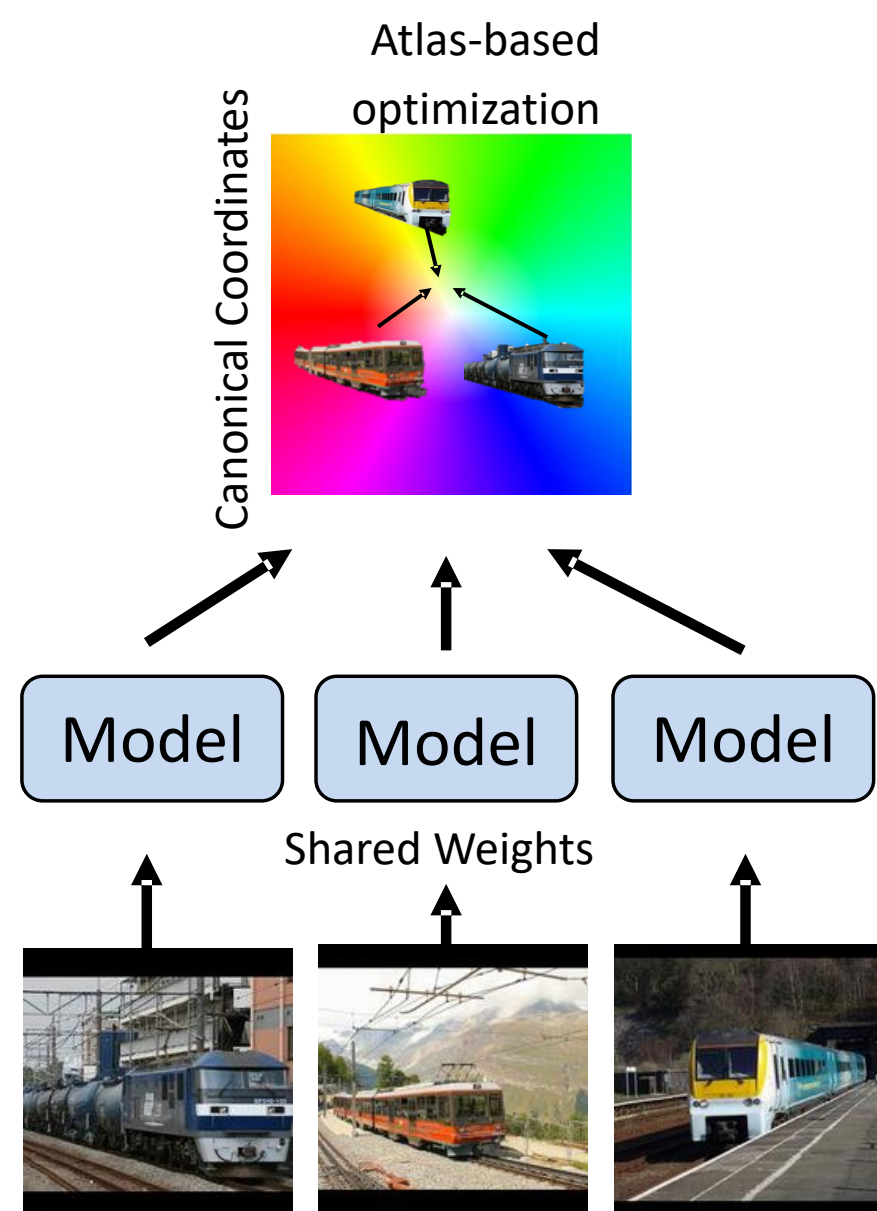
$$I_j \approx I_i \circ T^{\theta_i} \circ T^{-\theta_j} \Leftrightarrow I_j \circ T^{\theta_j} \approx I_i \circ T^{\theta_i}$$

KP - Inverse Compositional Loss



$$I_j \approx I_i \circ T^{\theta_i} \circ T^{-\theta_j} \Leftrightarrow I_j \circ T^{\theta_j} \approx I_i \circ T^{\theta_i}$$

Current JA Methods

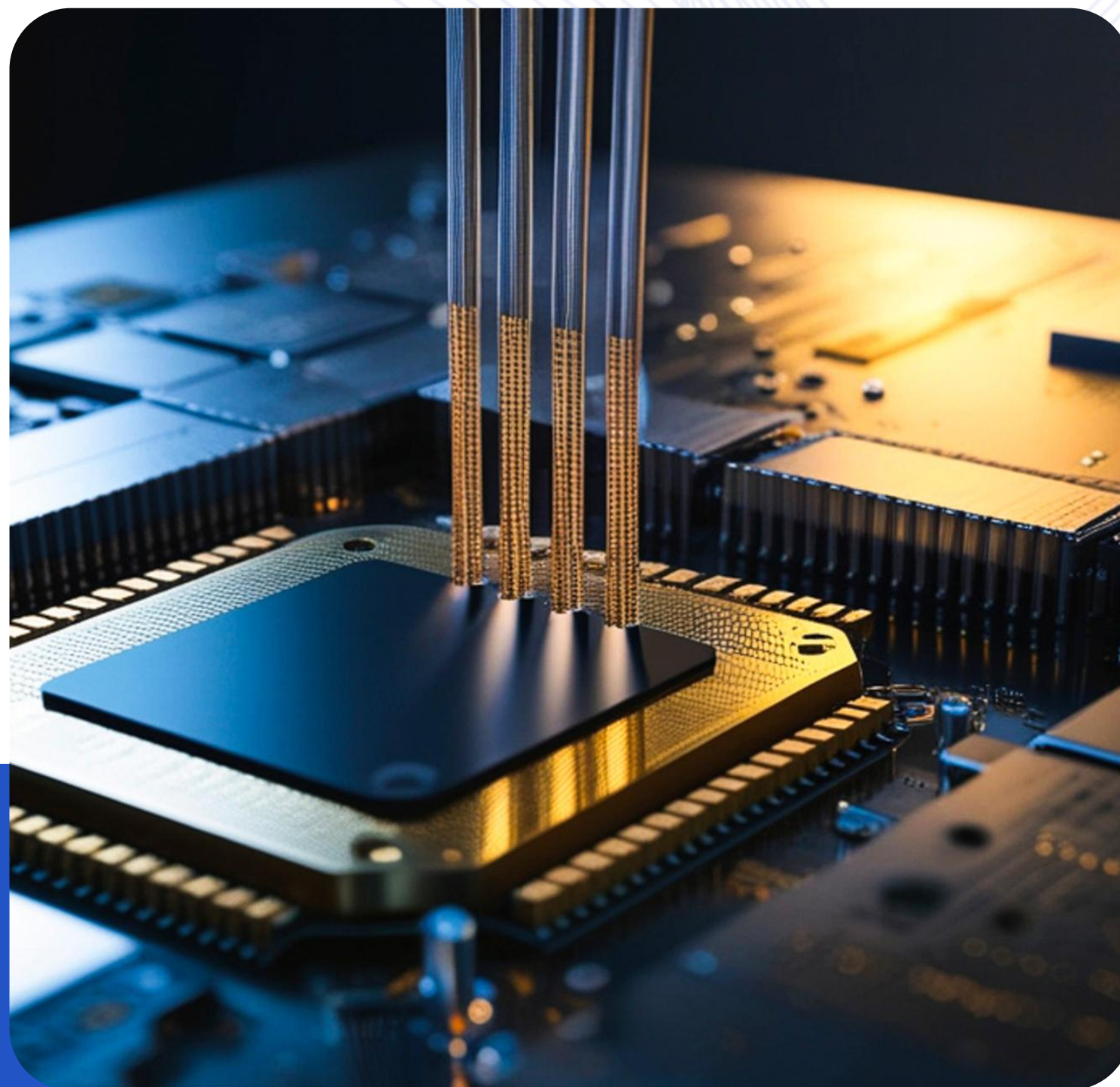


Runtime Comparison

FastJAM runtime is in **Seconds** Compared to Minutes or Hours (hh:mm:ss)

→ Neural Congealing	01:18:30 ± 00:06:18
→ ASIC	01:06:38 ± 00:00:38
→ SpaceJAM	00:06:00 ± 00:00:12
→ FastJAM (Ours)	00:00:49 ± 00:00:04

*For the Full Table Please Check Our Paper



Quantitative Results

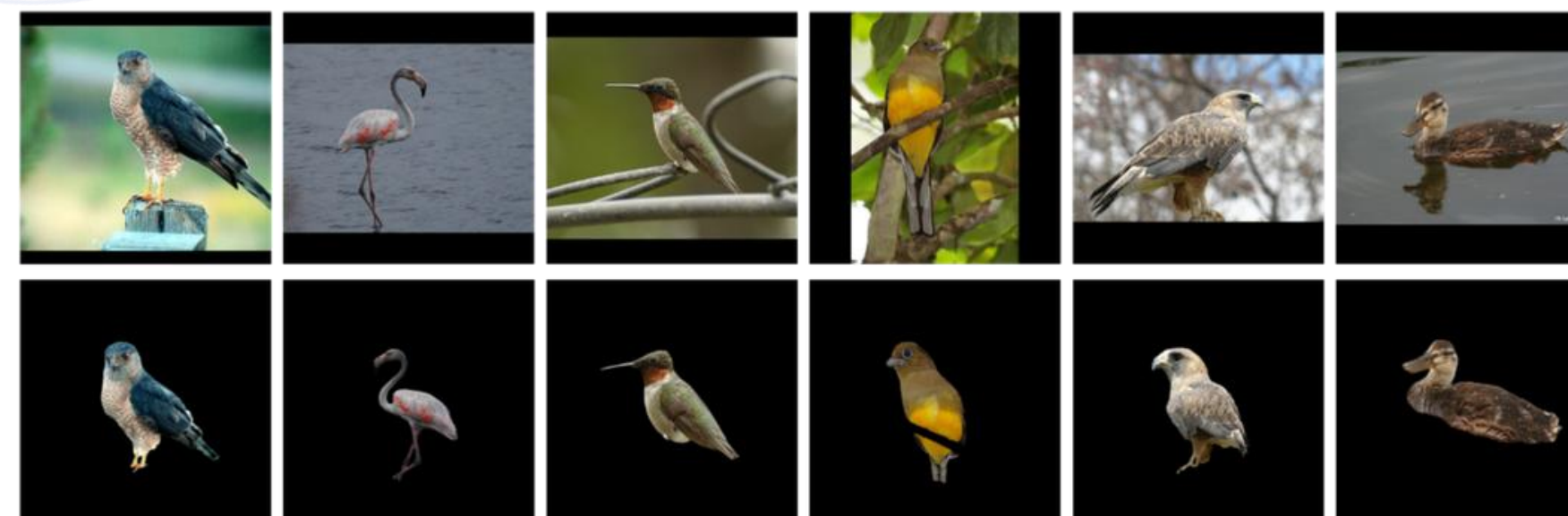
FastJAM gets either **better** or comparable results.

Based on **PCK**

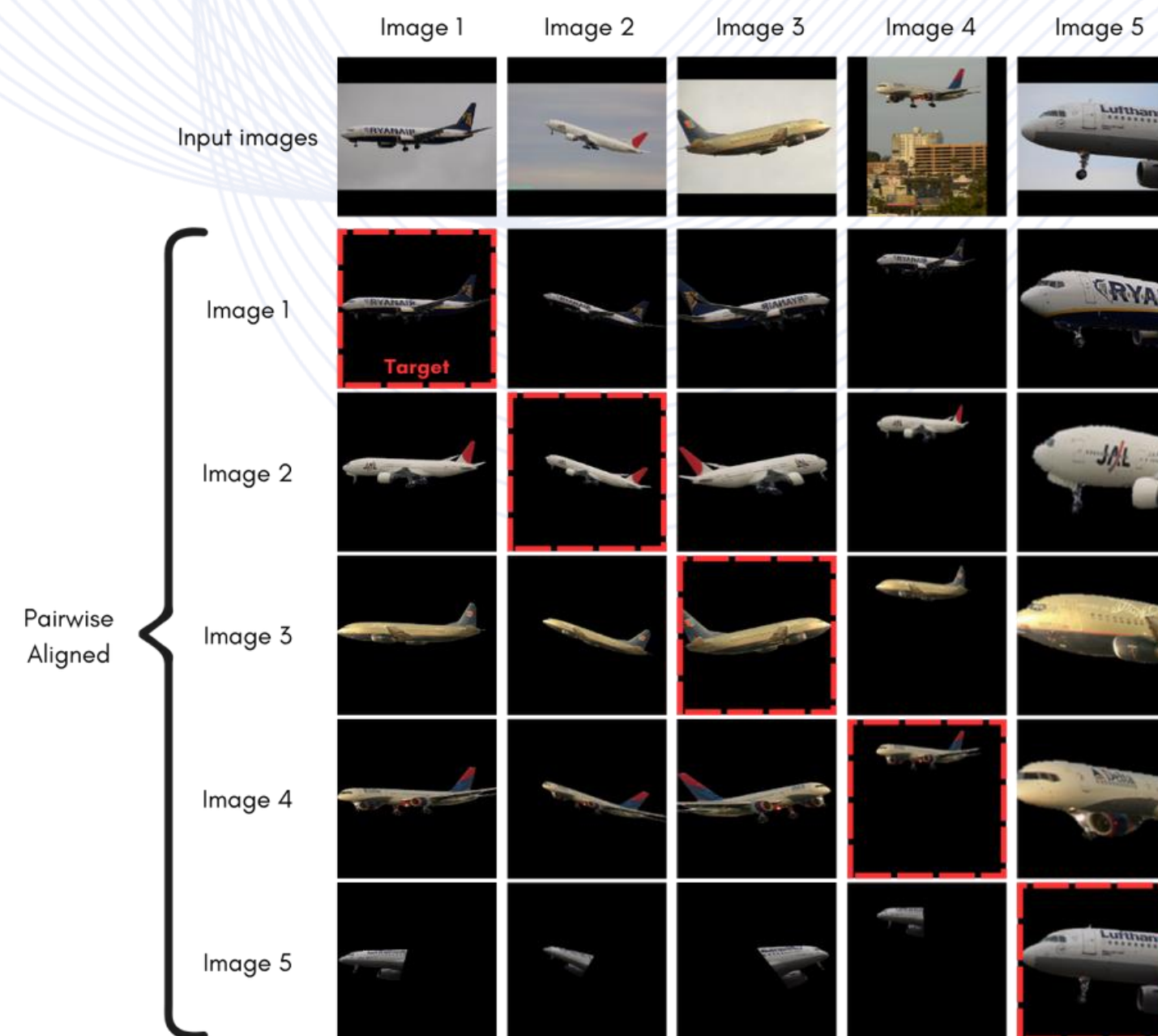
	SPair-71K Avg. All Classes	CUB-200 Subsets
→ Neural Congealing	–	63.6
→ ASIC	37.0	–
→ SpaceJAM	<u>45.7</u>	<u>69.9</u>
→ FastJAM (Ours)	53.4	73.6

*For the Full Table Please Check Our Paper

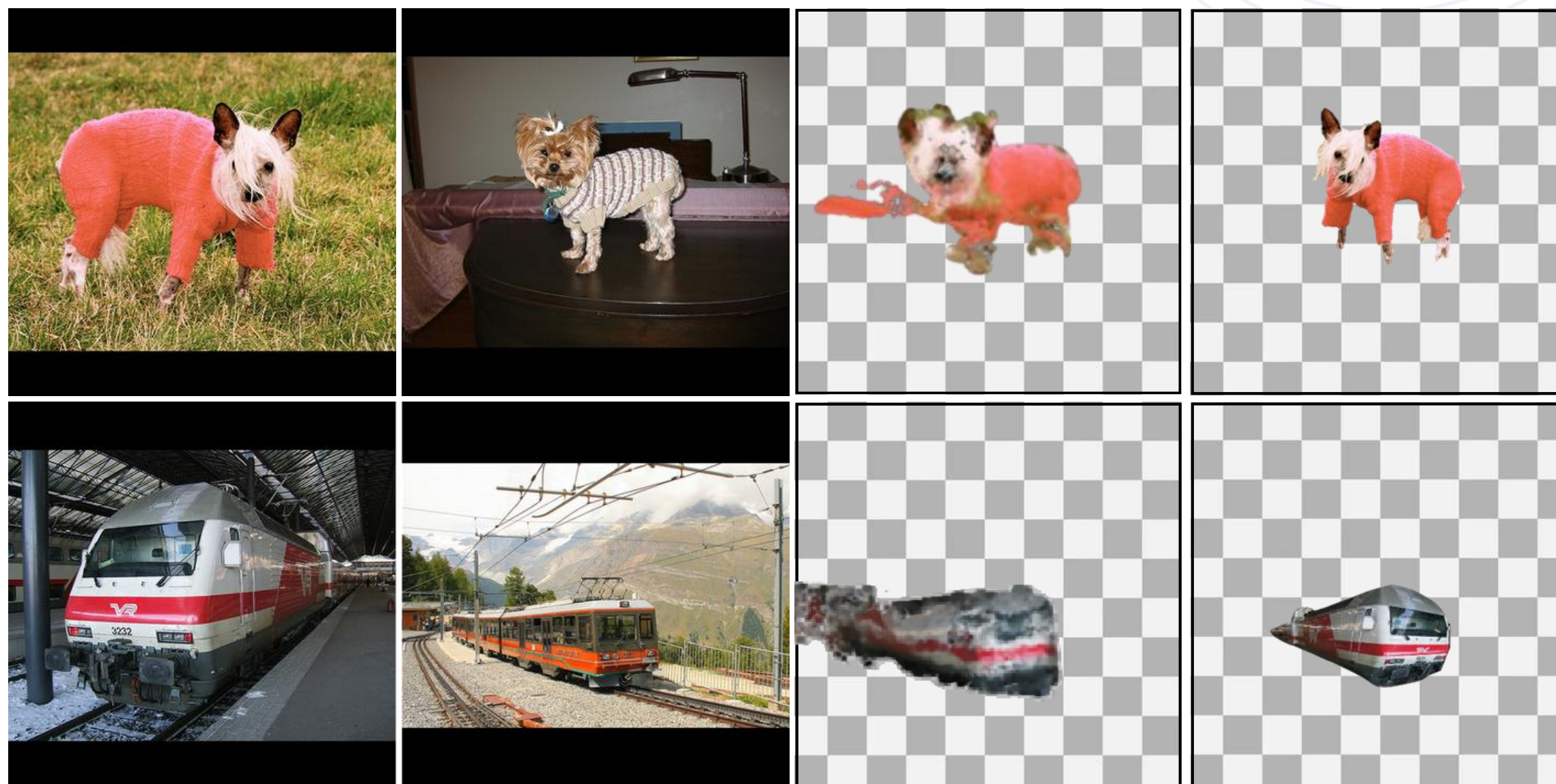
Qualitative Results



Qualitative Results - Pairwise



Qualitative Comparison



Source

Target

ASIC

FastJAM (Ours)

***For More Results
Please Check Our Paper**

Qualitative Comparison

Sheep



SpaceJAM

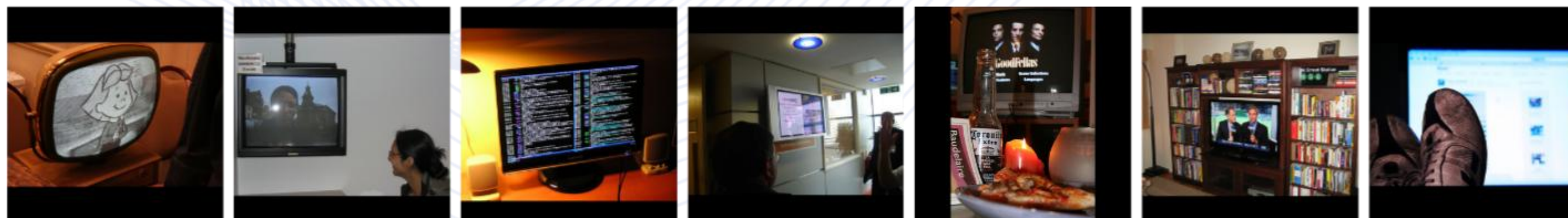


FastJAM (Ours)



Qualitative Comparison

TV



SpaceJAM



FastJAM (Ours)



Thank You.

Thank you for your attention.
I welcome any questions or feedback.

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FastJAM's Website

• <https://bgu-cs-vil.github.io/FastJAM/>