

# CRISP: Object Pose and Shape Estimation with Test-Time Adaptation

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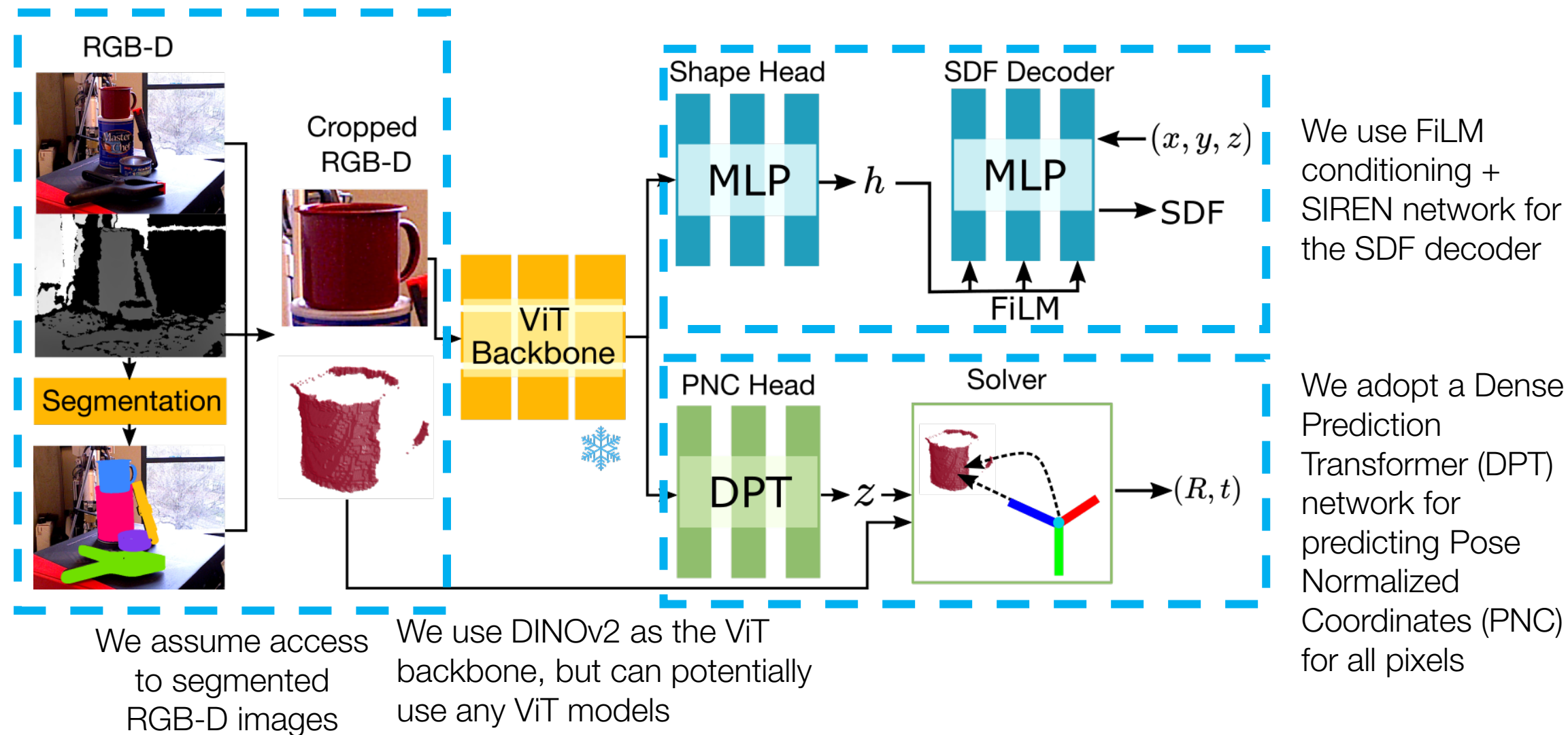
# Problem Statement

How can we design an object pose and shape estimation pipeline that can self-train during test time?

## **Our Contributions**

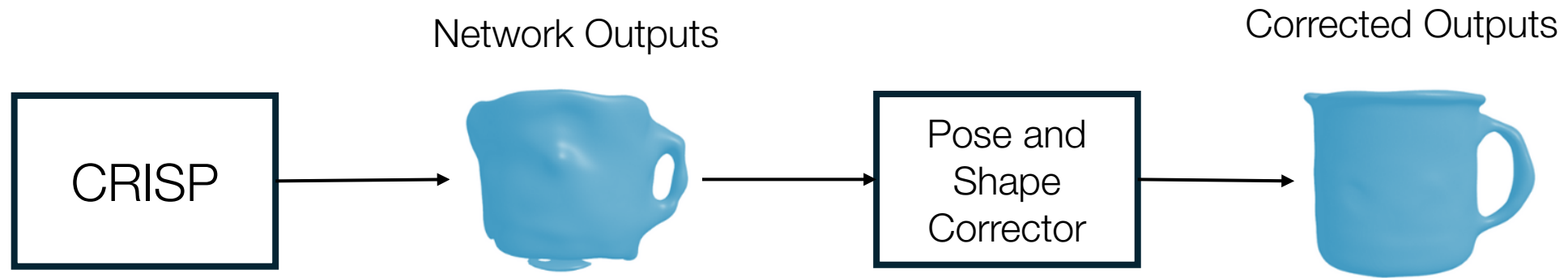
1. We introduce CRISP, an object pose and shape estimation pipeline.
2. We propose an optimization-based pose and shape corrector that can correct estimation errors.
3. We adopt a correct-and-certify approach to self-train CRISP and adapt to new domain in a self-supervised manner.

# CRISP: Pose and Shape Estimation Network



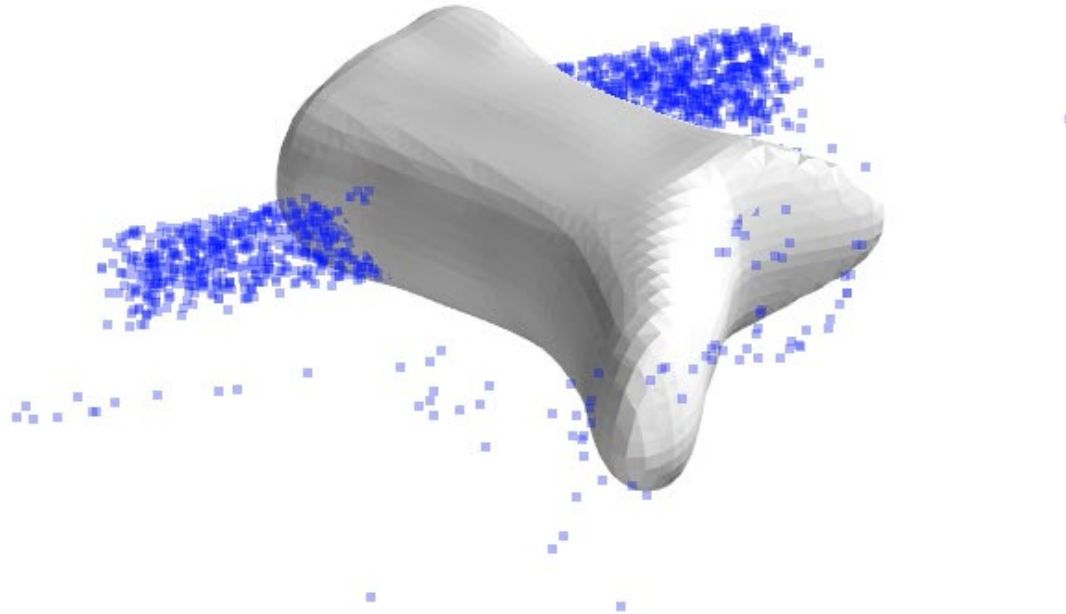
# Pose and Shape Corrector

**Motivation:** Can we partially bridge the domain gap using optimization initialized with the network output, without object CAD models?



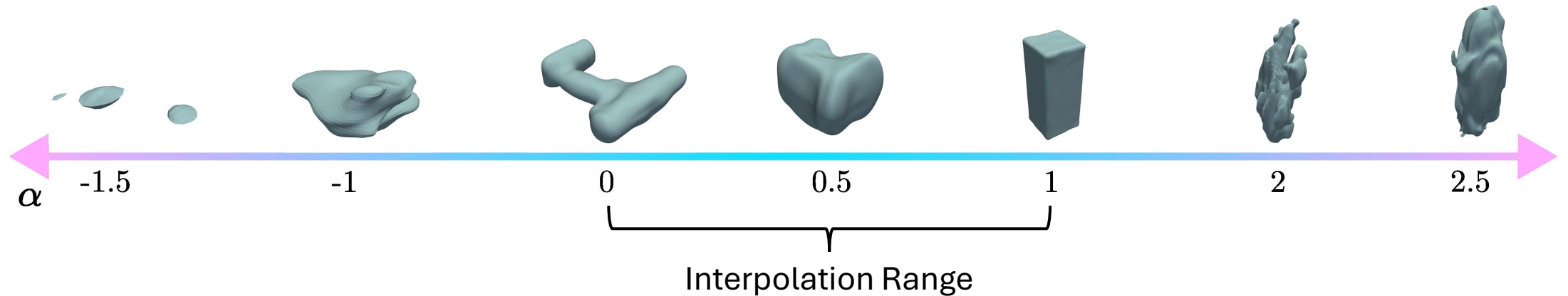
# Pose and Shape Corrector

Gradient descent doesn't work well



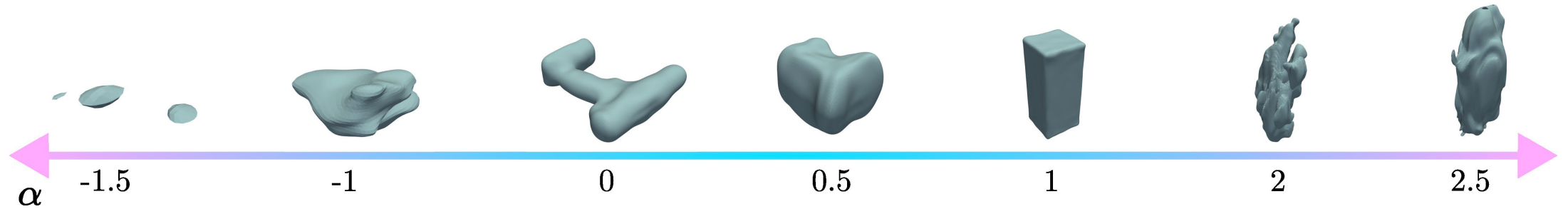
# Pose and Shape Corrector

**Observation:** Interpolation within the simplex of learned latent codes produces much more reasonable shapes.

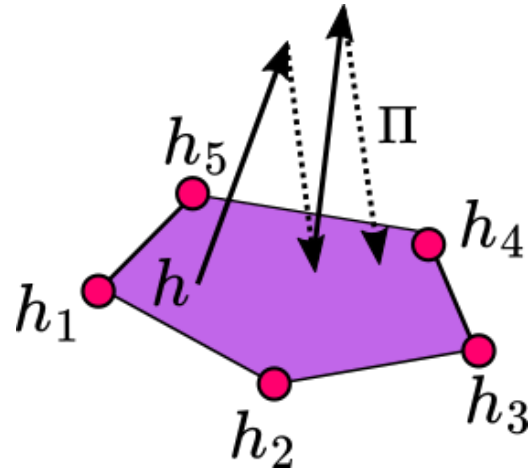


An active shape model for shape latent codes

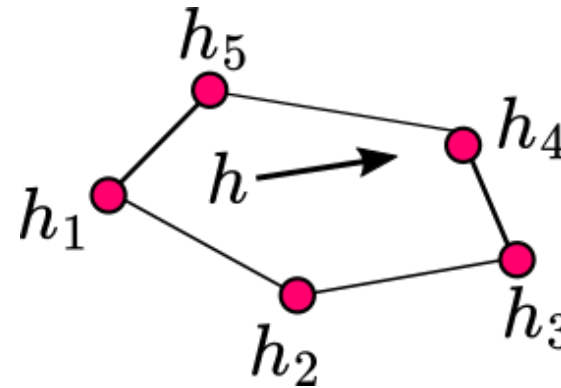
**Observation:** Interpolation within the simplex of learned latent codes produces much more reasonable shapes.



We develop two correctors that exploit this observation.

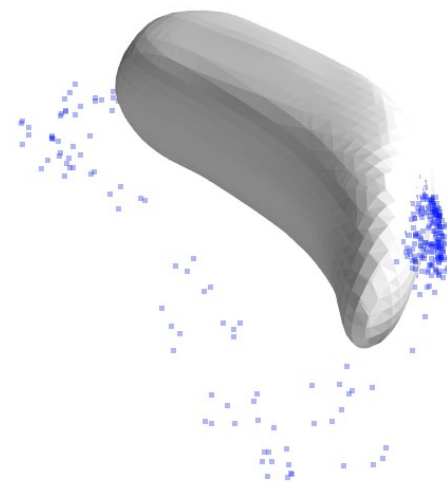
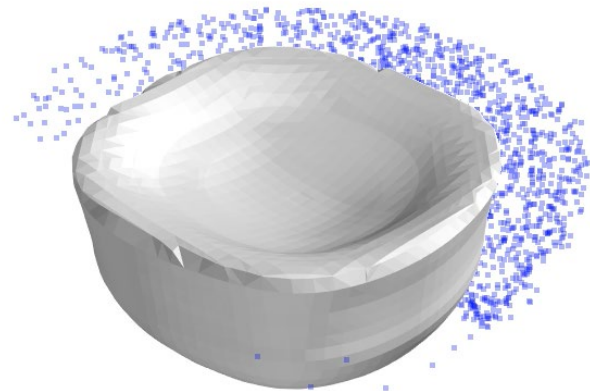
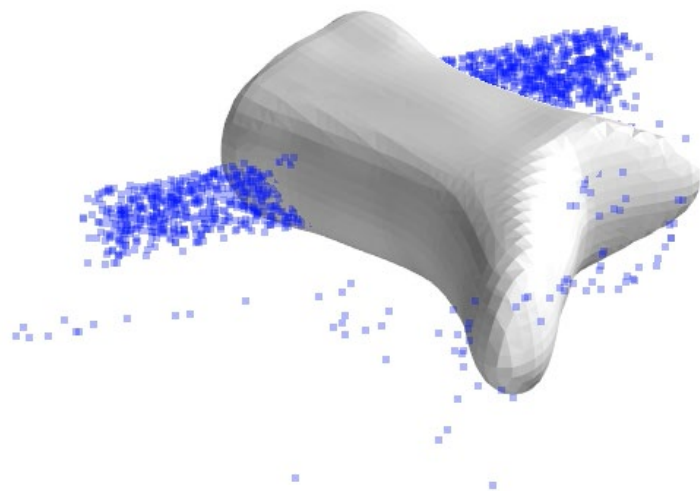


Block Coordinate Descent  
(BCD) Corrector

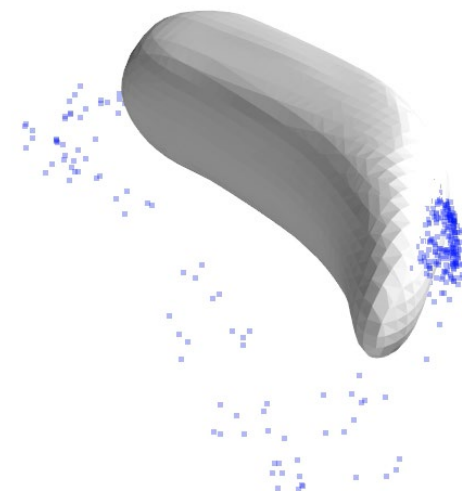
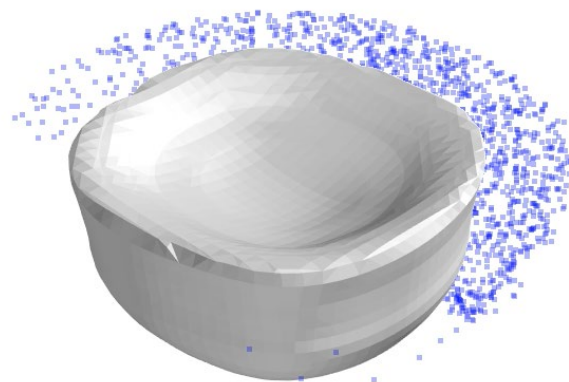
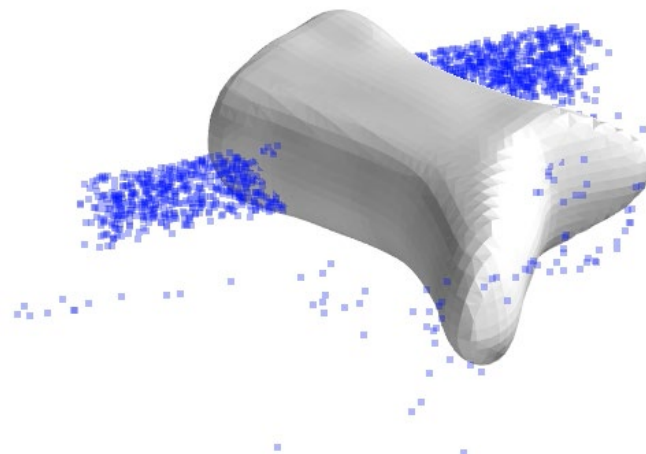


Least-squares  
(LSQ) Corrector

**Gradient  
Descent**

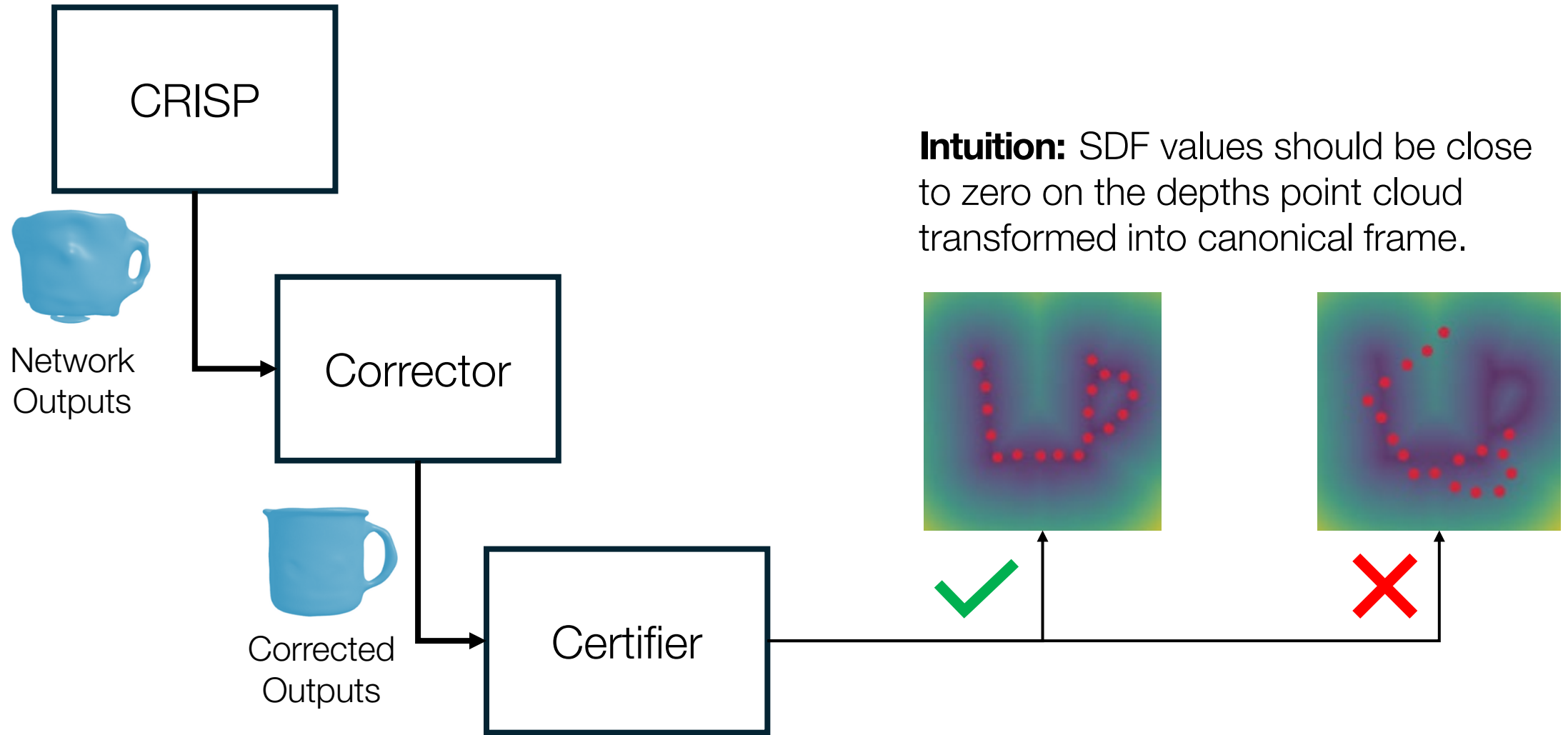


**Ours  
(BCD)**

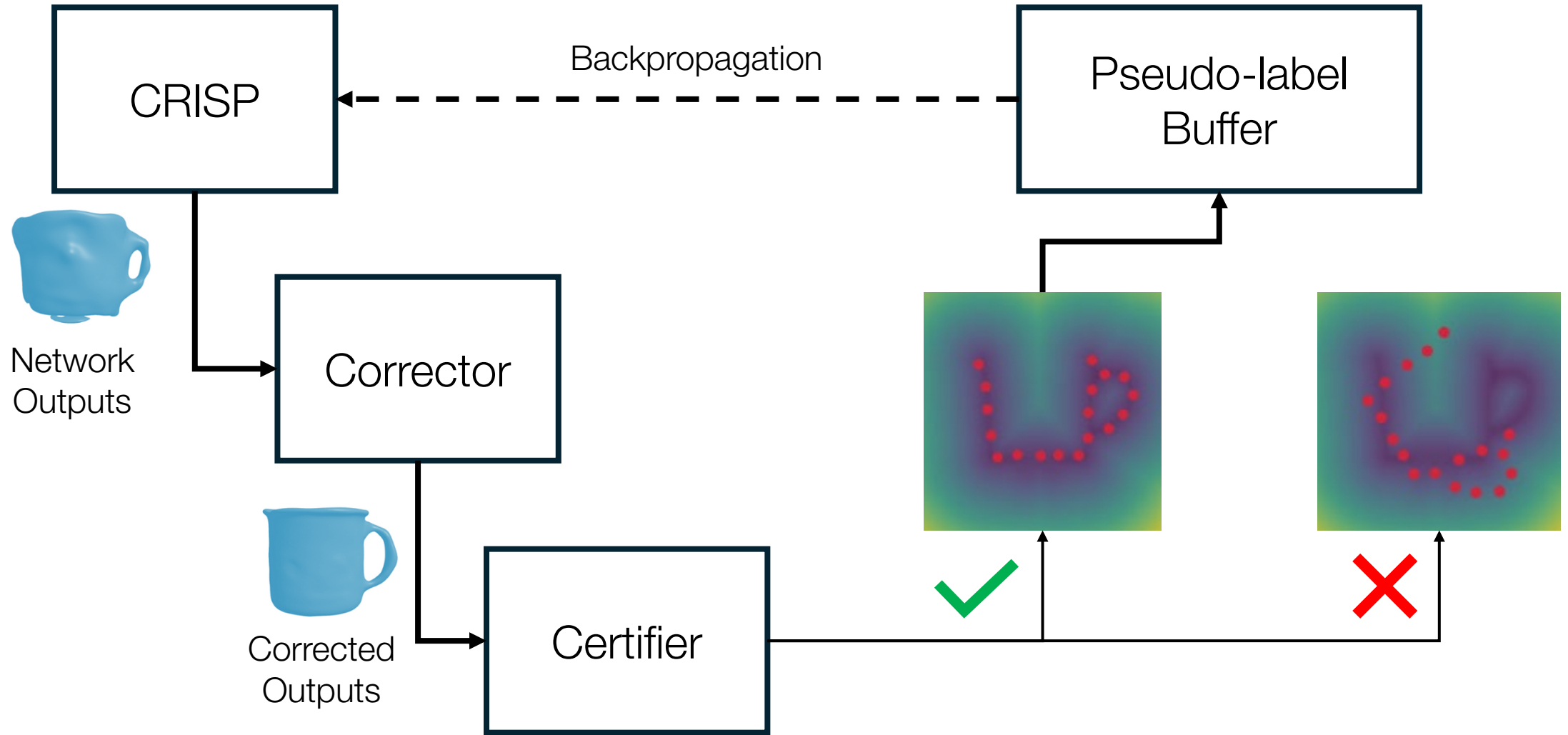




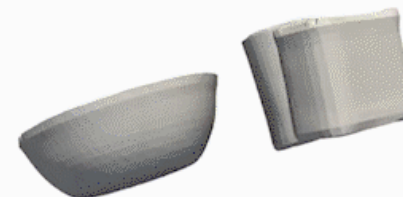
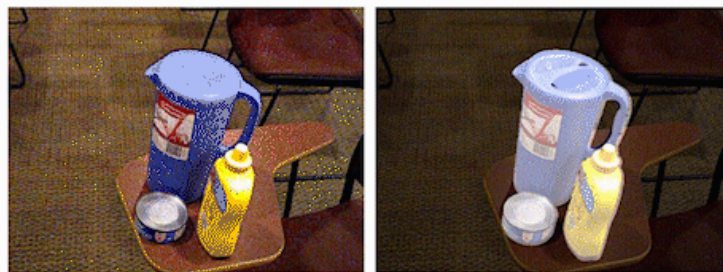
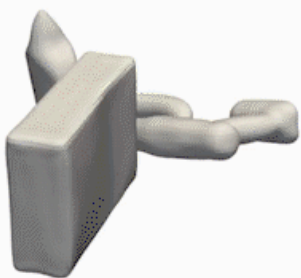
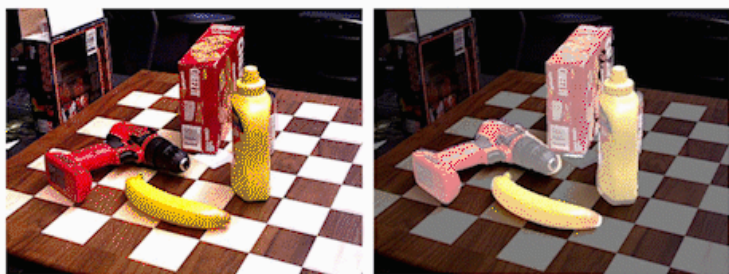
# Self-training for Test-time Adaptation



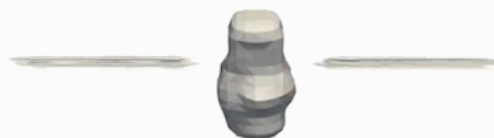
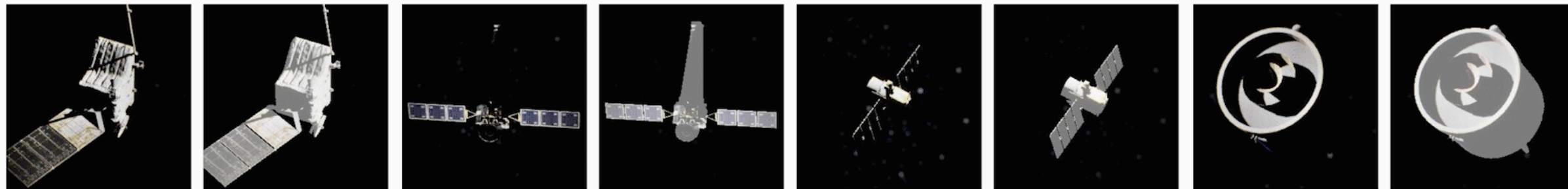
# Self-training for Test-time Adaptation



# Experimental Results

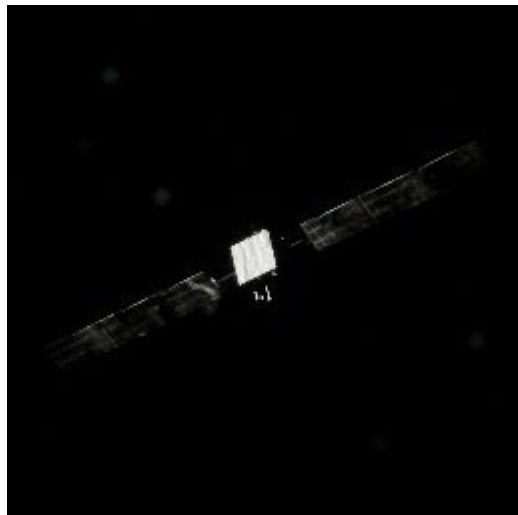


# Experimental Results

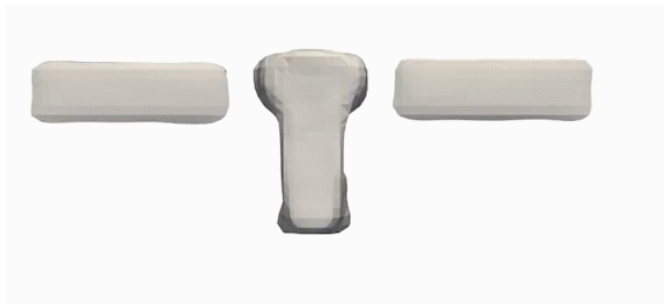


# Adaptation to Unseen Objects

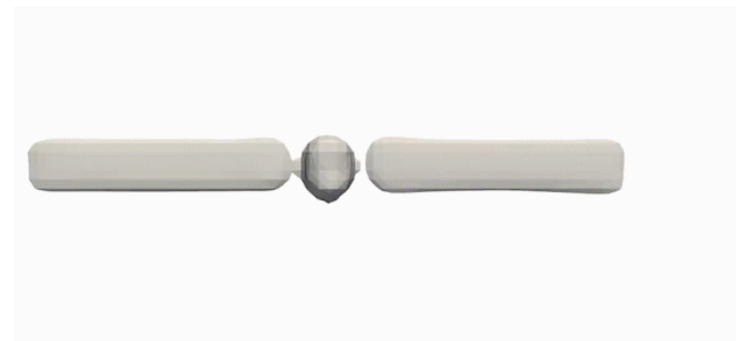
Test Image



Network Output:  
Reconstructed Model  
Before Self-training



Reconstructed Model  
After Self-training



Similar Satellite  
in the Train Set

# Thank you for your attention!

Paper



Code



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