

Advanced Out-of-Distribution Detection for Multi-Class Classification

COMPUTER VISION

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Chiara Massari**

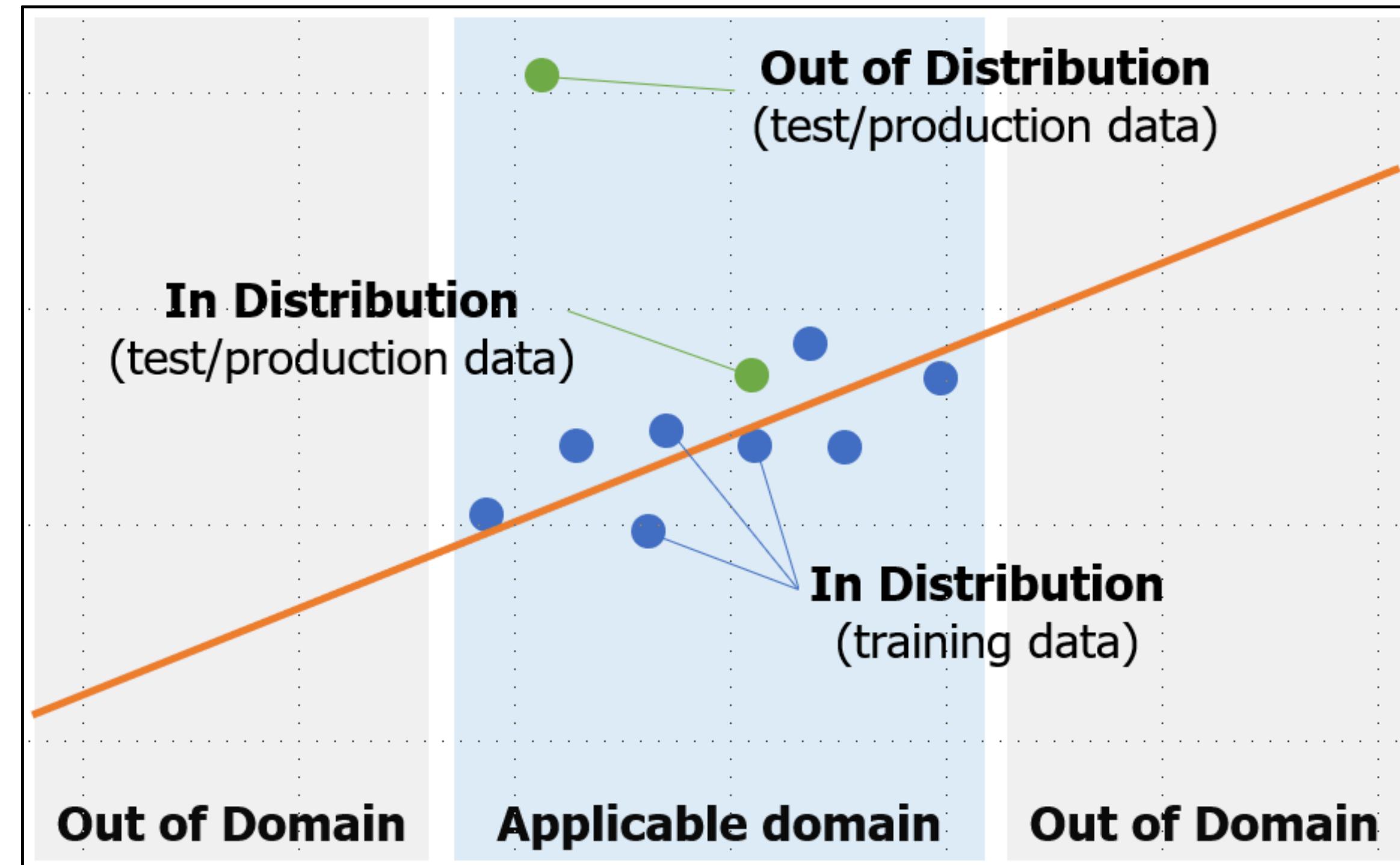
Marta Barroso Infante

Presentation Outline



- Problem statement.
- State of the art.
- Our method.
- Dataset presentation.
- Experimental setup.
- Model evaluation.
- Conclusions.

Problem Statement

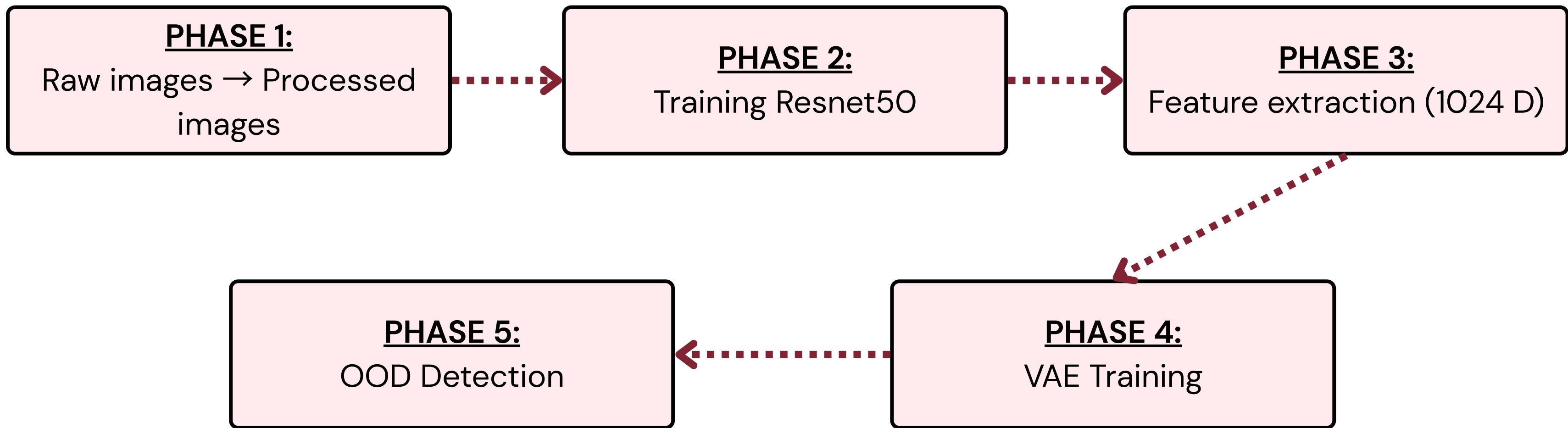


State of the Art



- Energy-Based OOD Detection (Liu et al., 2020)
- Gradient-Regularized OOD Detection (Sharifi et al., 2024)
- CORES: Convolutional Response-based Score (Tang et al., 2024)

Our Method



Dataset Presentation



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FOOD-101

In-Distribution Dataset



SVHN

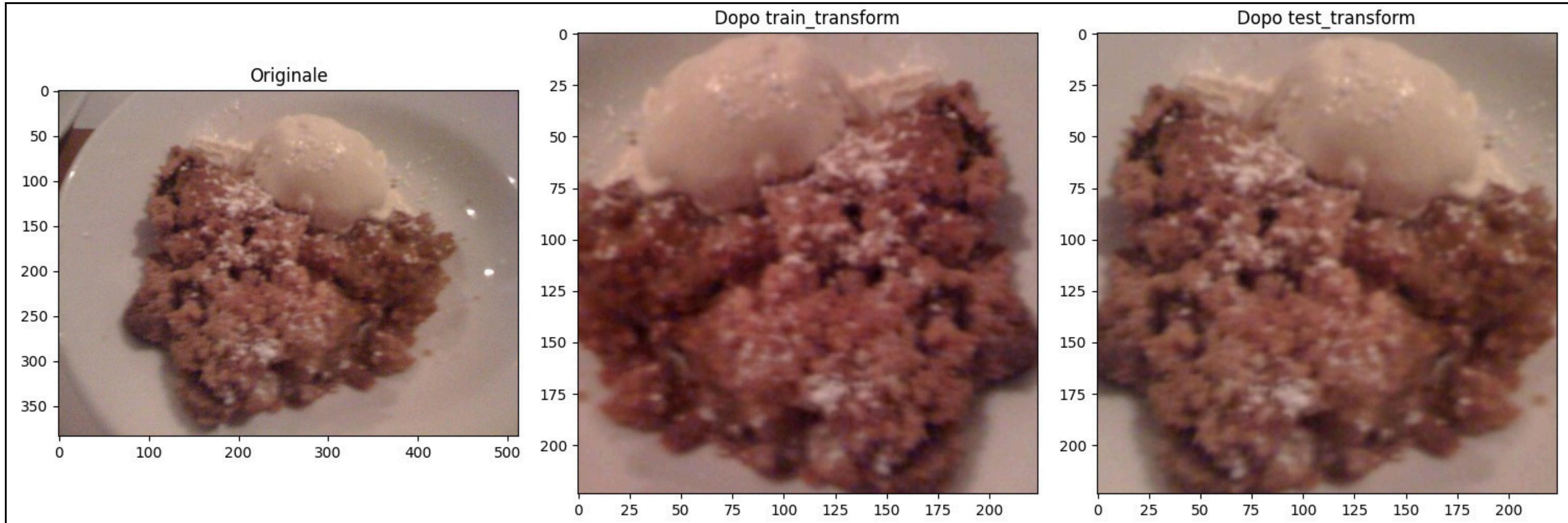
Out-of-Distribution Dataset



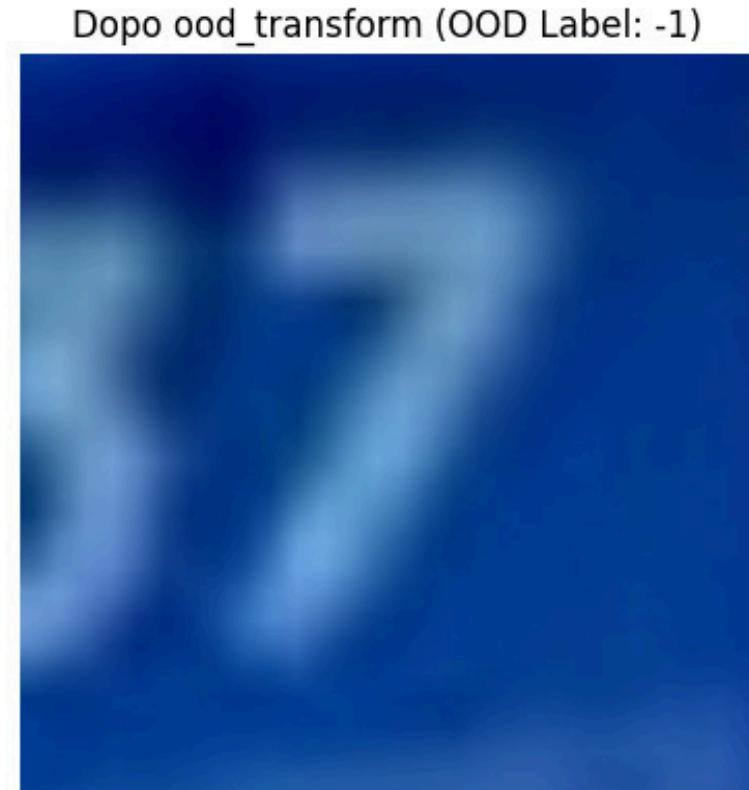
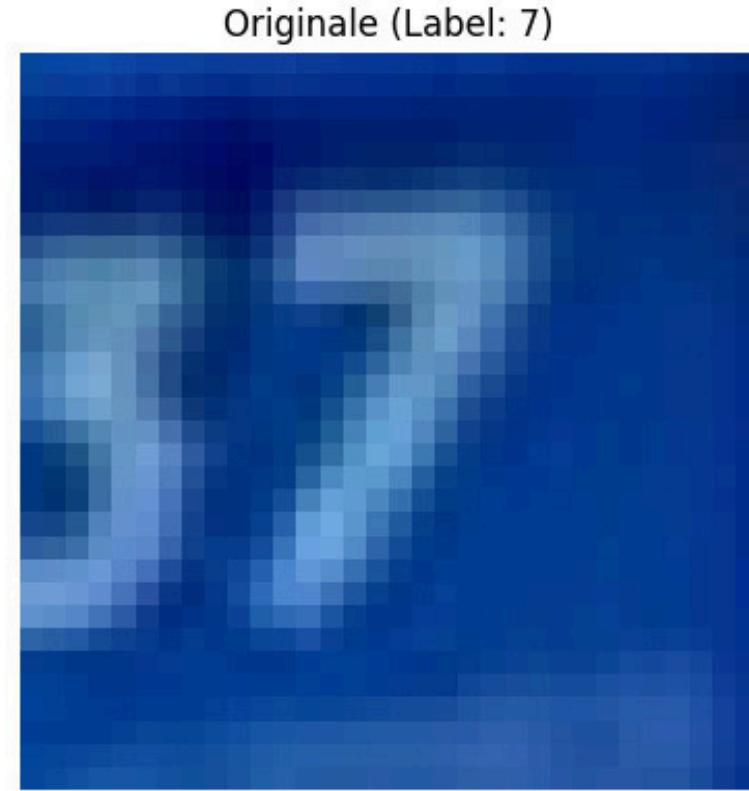
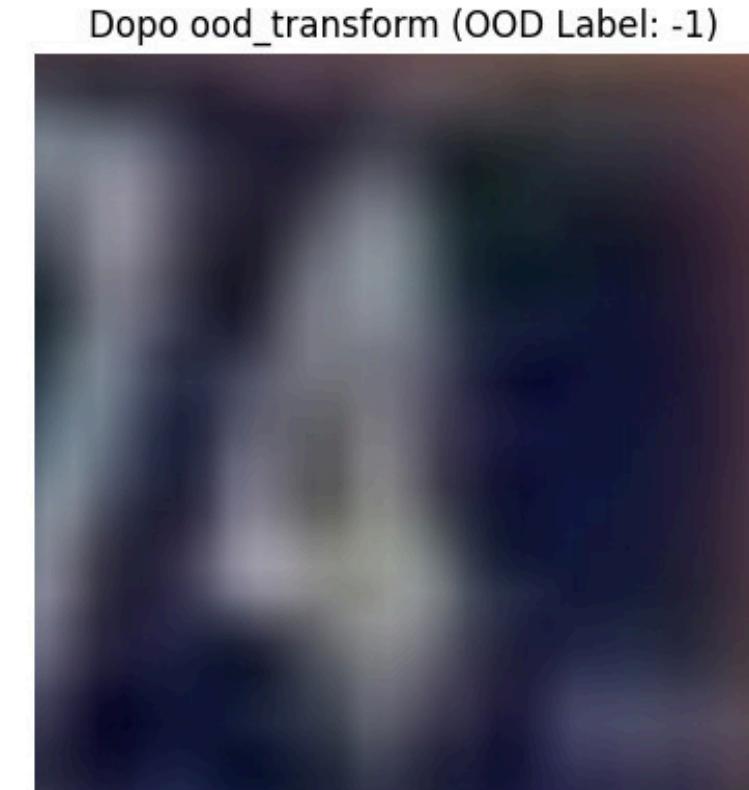
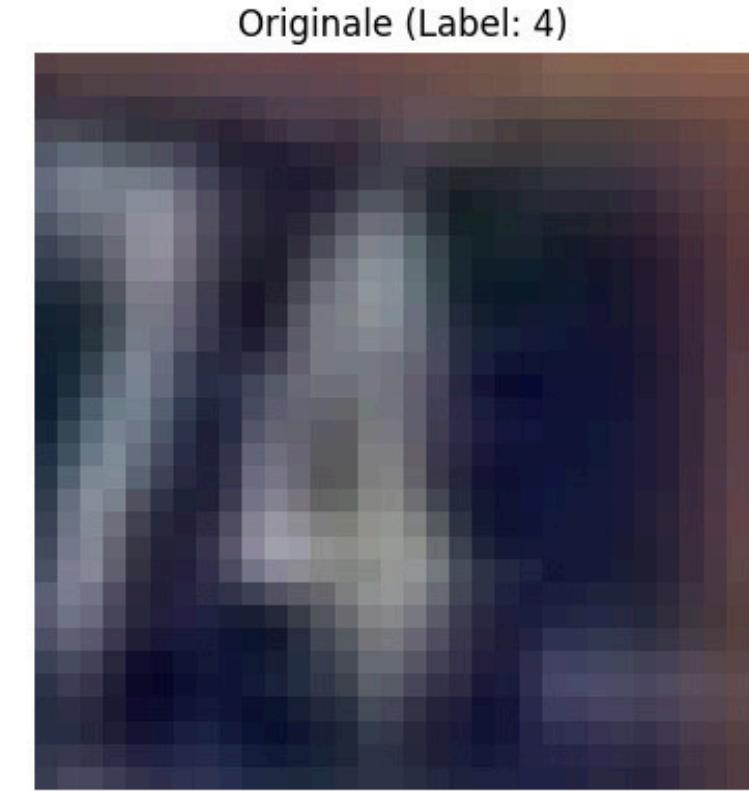
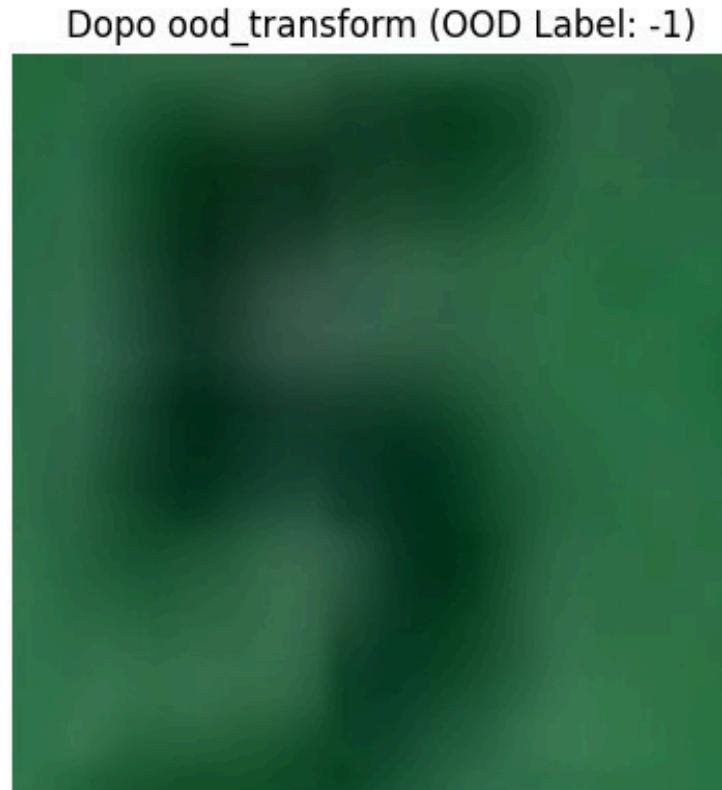
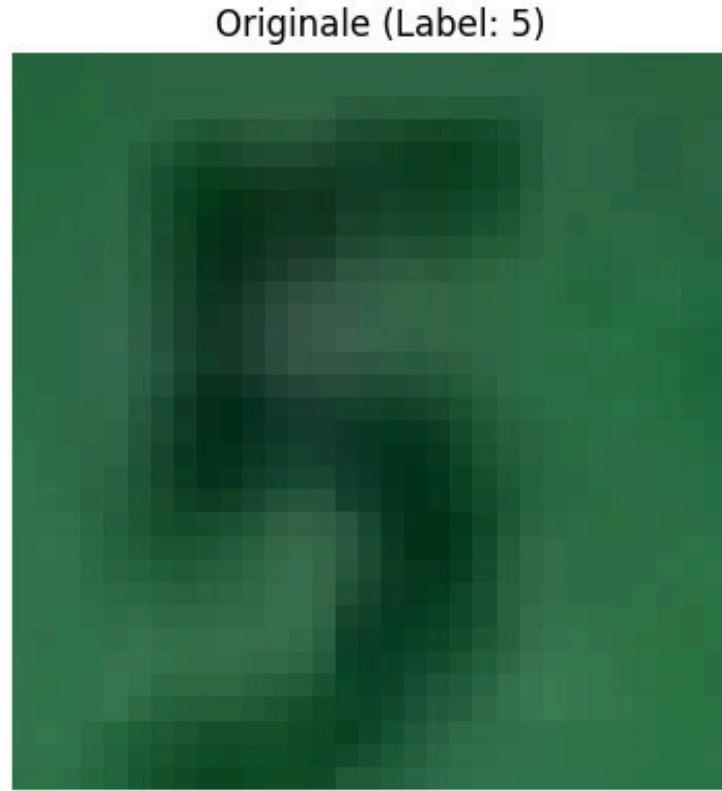


Experimental Setup

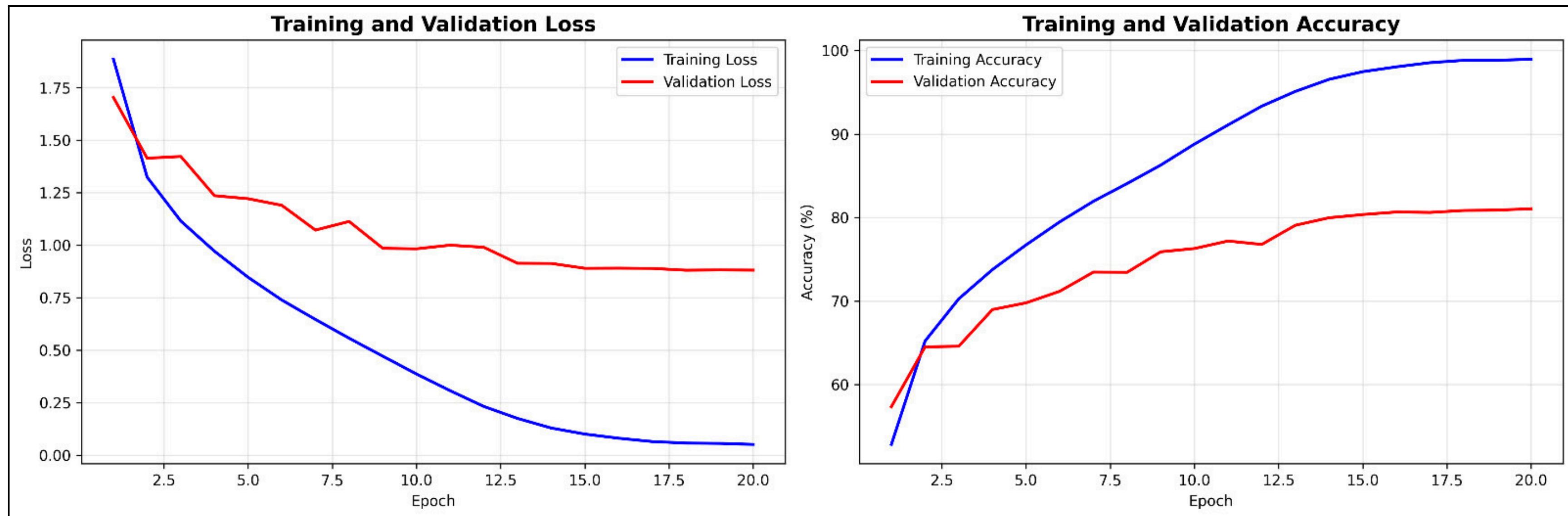
Phase 1: Image Processing



Phase 1: Image Processing



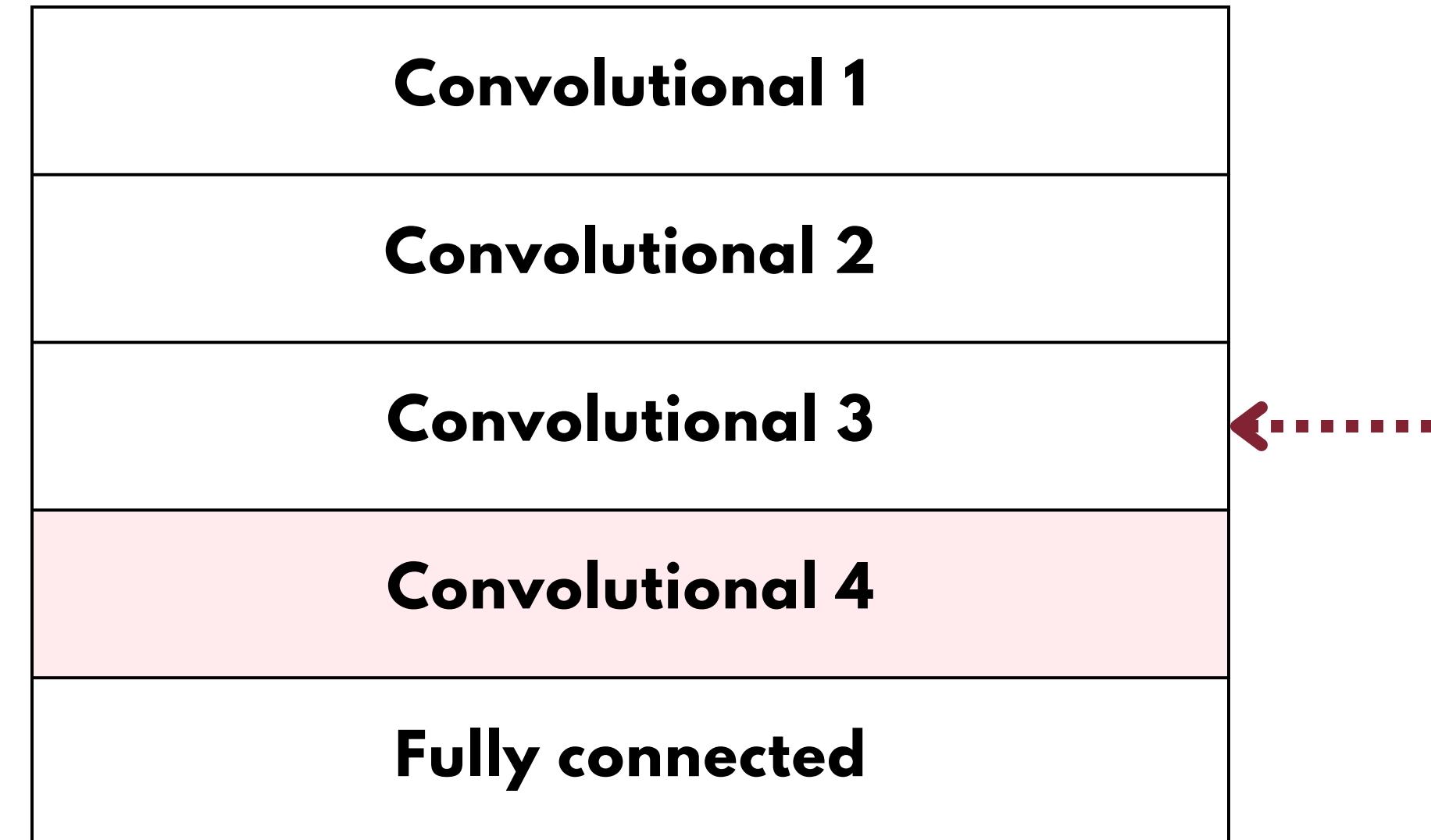
Phase 2: Data Loader and Resnet training



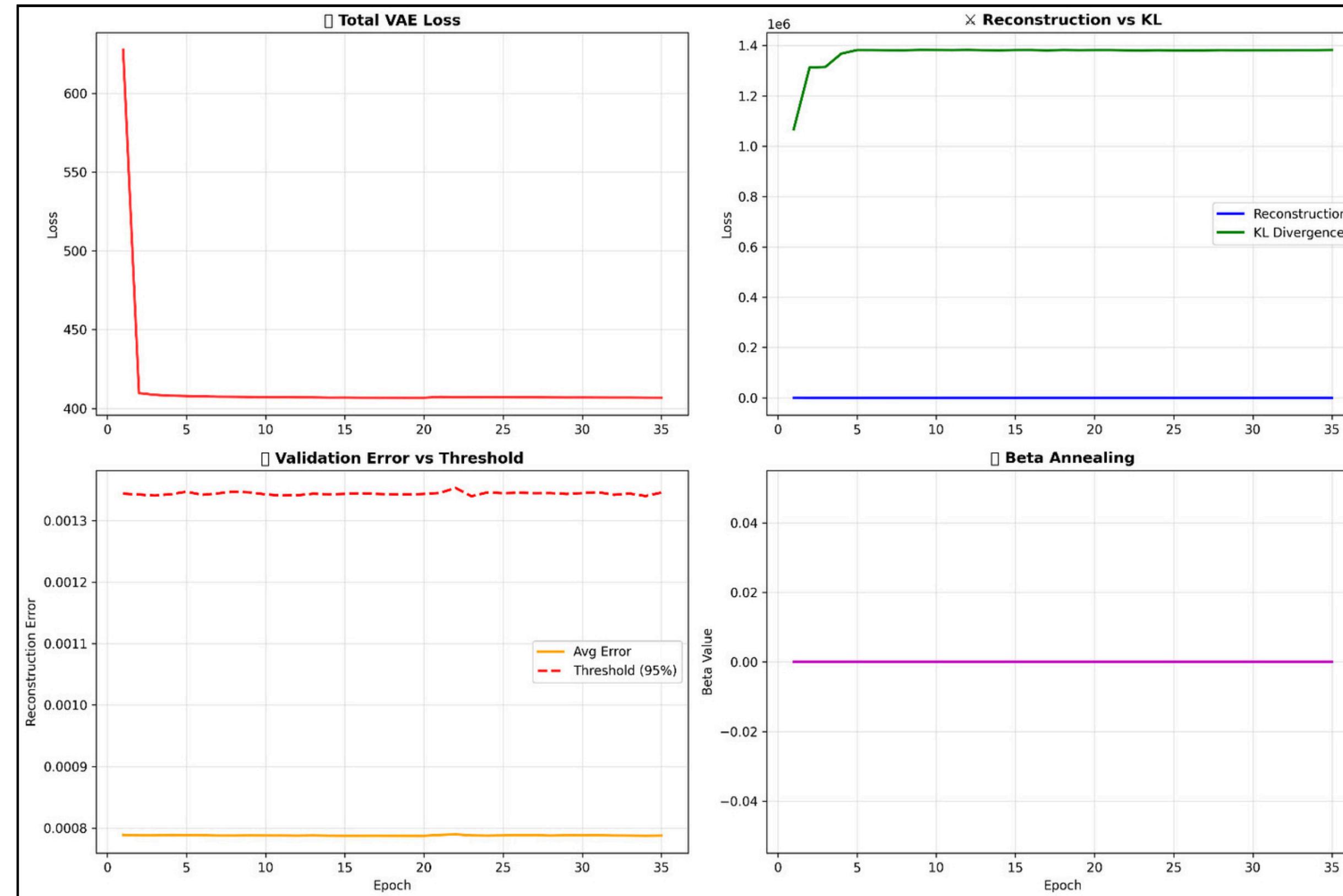
Phase 3: Data Extraction



Layer Structure

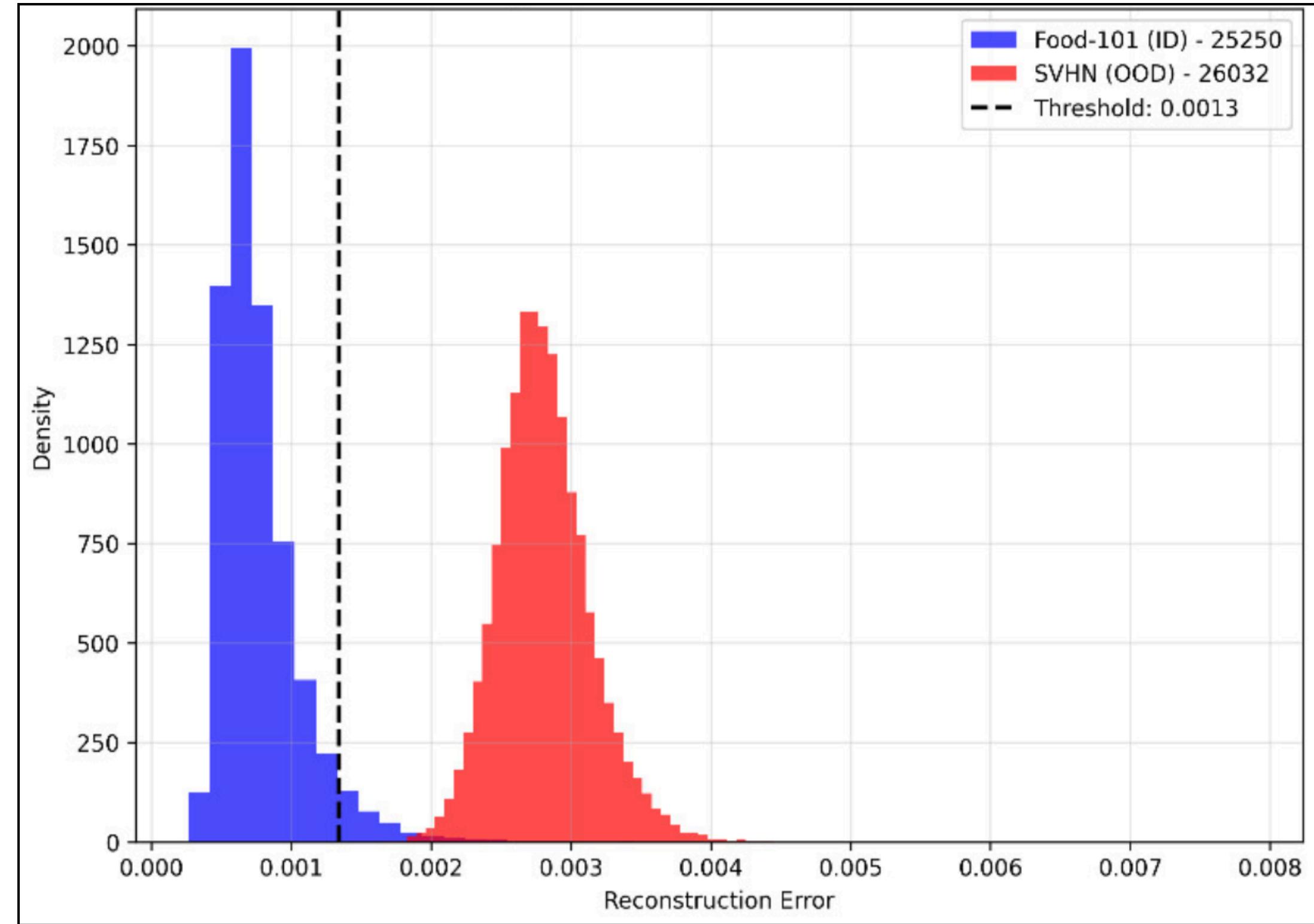


Phase 4: VAE training



Phase 5: OOD Detection

Error Distribution: ID vs OOD



Model Evaluation

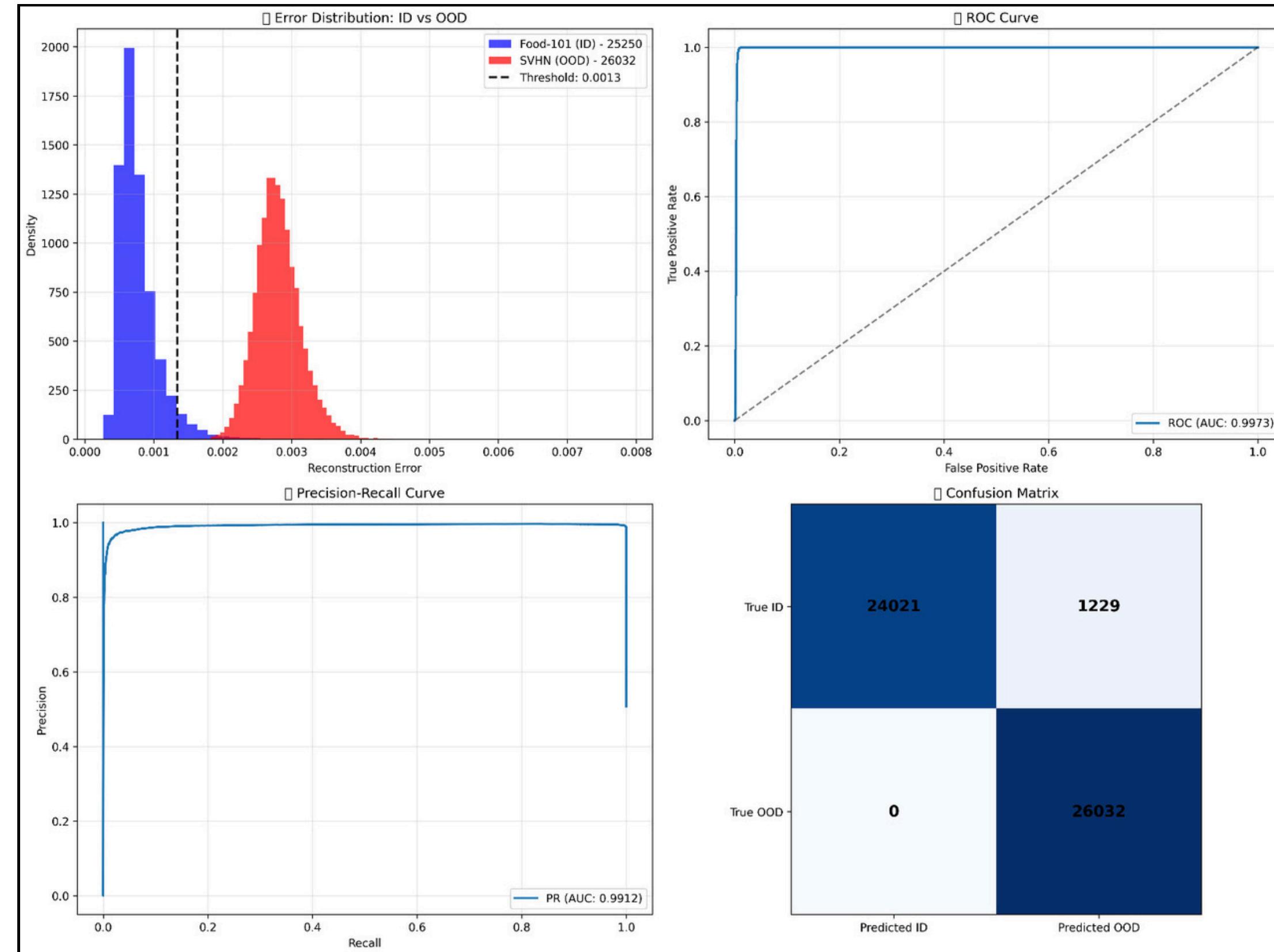


CLASSIFICATION METRICS	
ACCURACY	0.976 (97.6%)
PRECISION	0.9549
RECALL	1.0000
F1-SCORE	0.9769

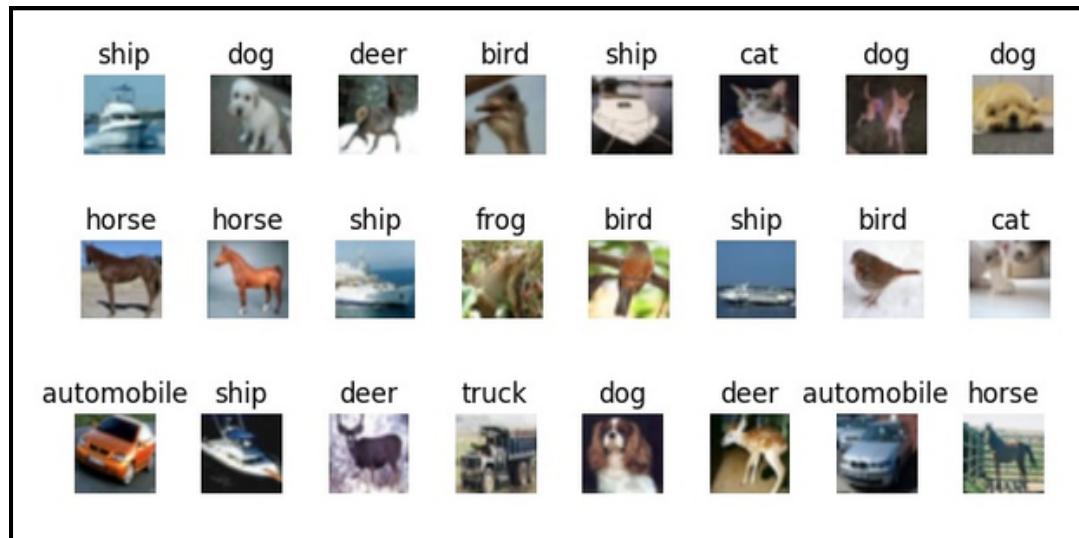
OOD DETECTION METRICS	
AUROC	0.9973
AUPR	0.9912
FPR@95TPR	0.0046
DETECTION ERROR	0.0240

CONFIGURATION	
THRESHOLD	0.0013
TOTAL SAMPLES	51282

Model Evaluation



Conclusions: CIFAR

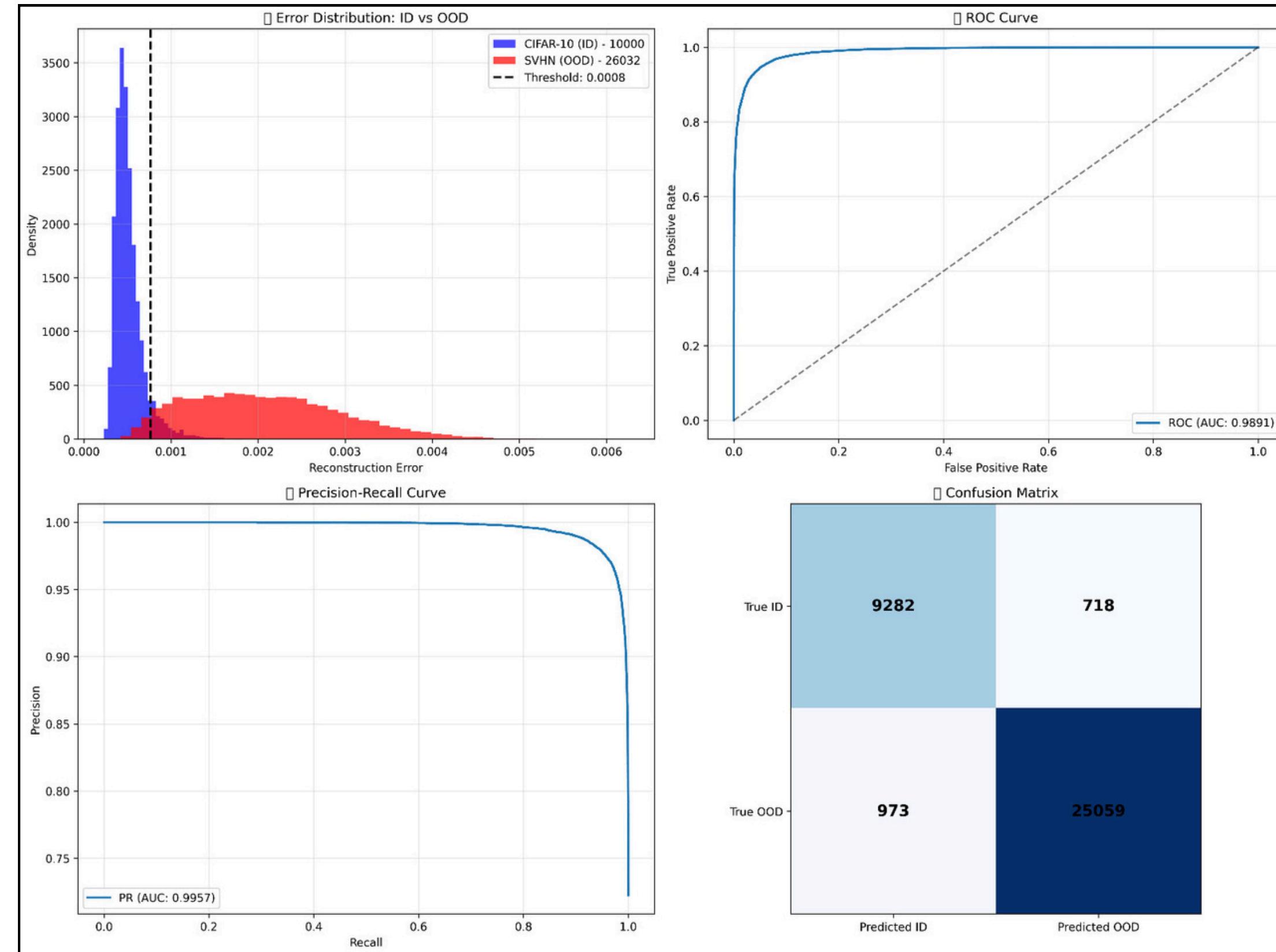


CONFIGURATION	
THRESHOLD	0.0008
TOTAL SAMPLES	36032

CLASSIFICATION METRICS	
ACCURACY	0.9531 (975.31%)
PRECISION	0.9721
RECALL	0.9626
F1-SCORE	0.9674

OOD DETECTION METRICS	
AUROC	0.9891
AUPR	0.9957
FPR@95TPR	0.0551
DETECTION ERROR	0.0469

Conclusions: CIFAR



References

- Liu, W., Wang, X., Owens, J. D., & Li, Y. (2020). *Energy-based Out-of-distribution Detection*. NeurIPS 2020.
- Sharifi, S. et al. (2024). *Gradient-Regularized Out-of-Distribution Detection*. arXiv [Cs.CV].
- Tang, K., et al. (2024, June). *CORES: Convolutional Response-based Score for Out-of-distribution Detection*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 10916–10925.



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