

Test-time Similarity Modification for Person Re-identification toward Temporal Distribution Shift

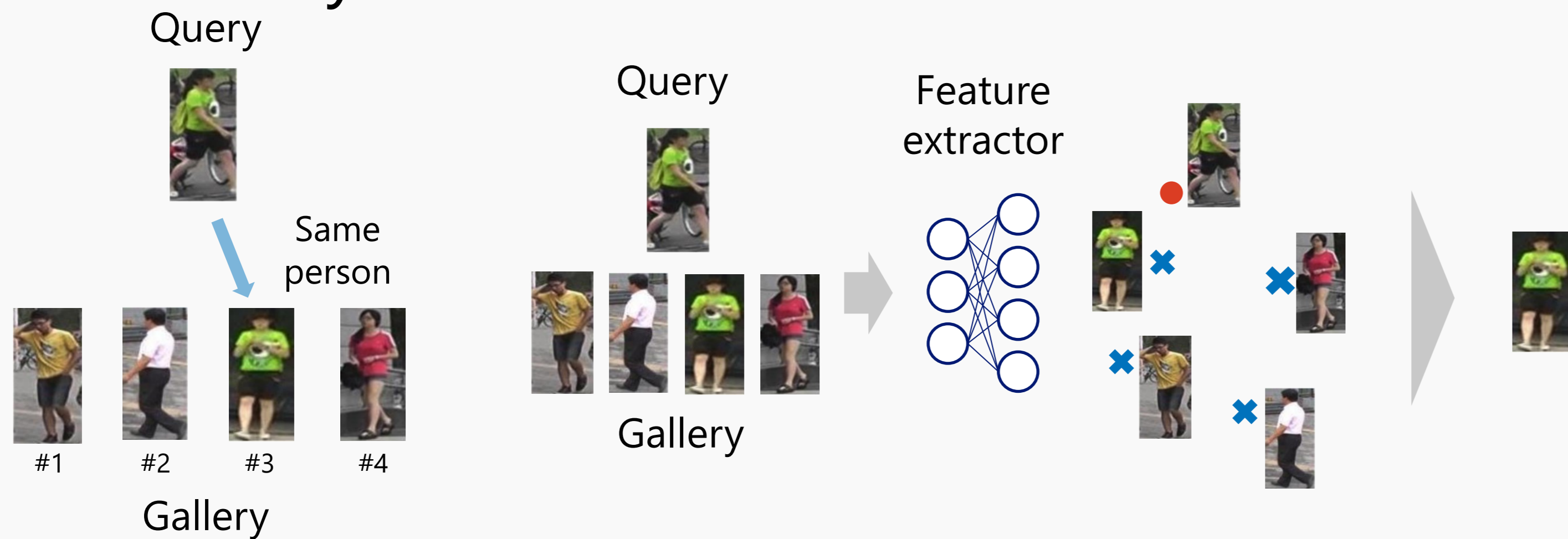
Kazuki Adachi*, Shohei Enomoto*, Taku Sasaki*, and Shin'ya Yamaguchi**

*NTT Corporation **Kyoto University



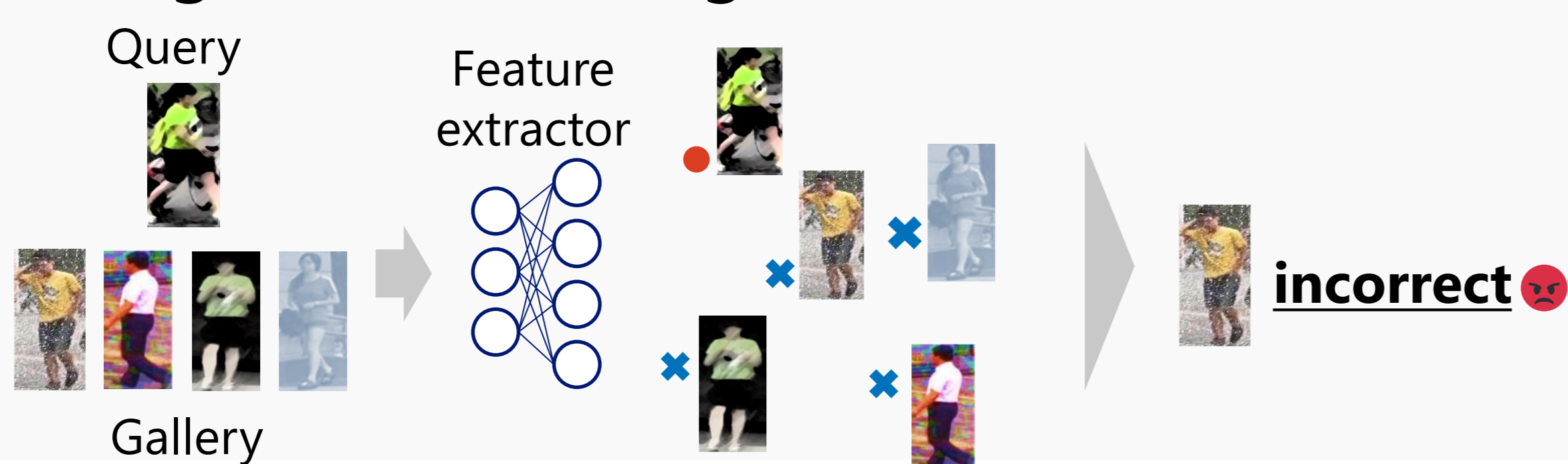
Person Re-identification

- Aims at identifying a person in an image
- Retrieves images of the same person as an input image (query) from a database (gallery)
- Uses a feature extractor (DNN) for measuring similarity



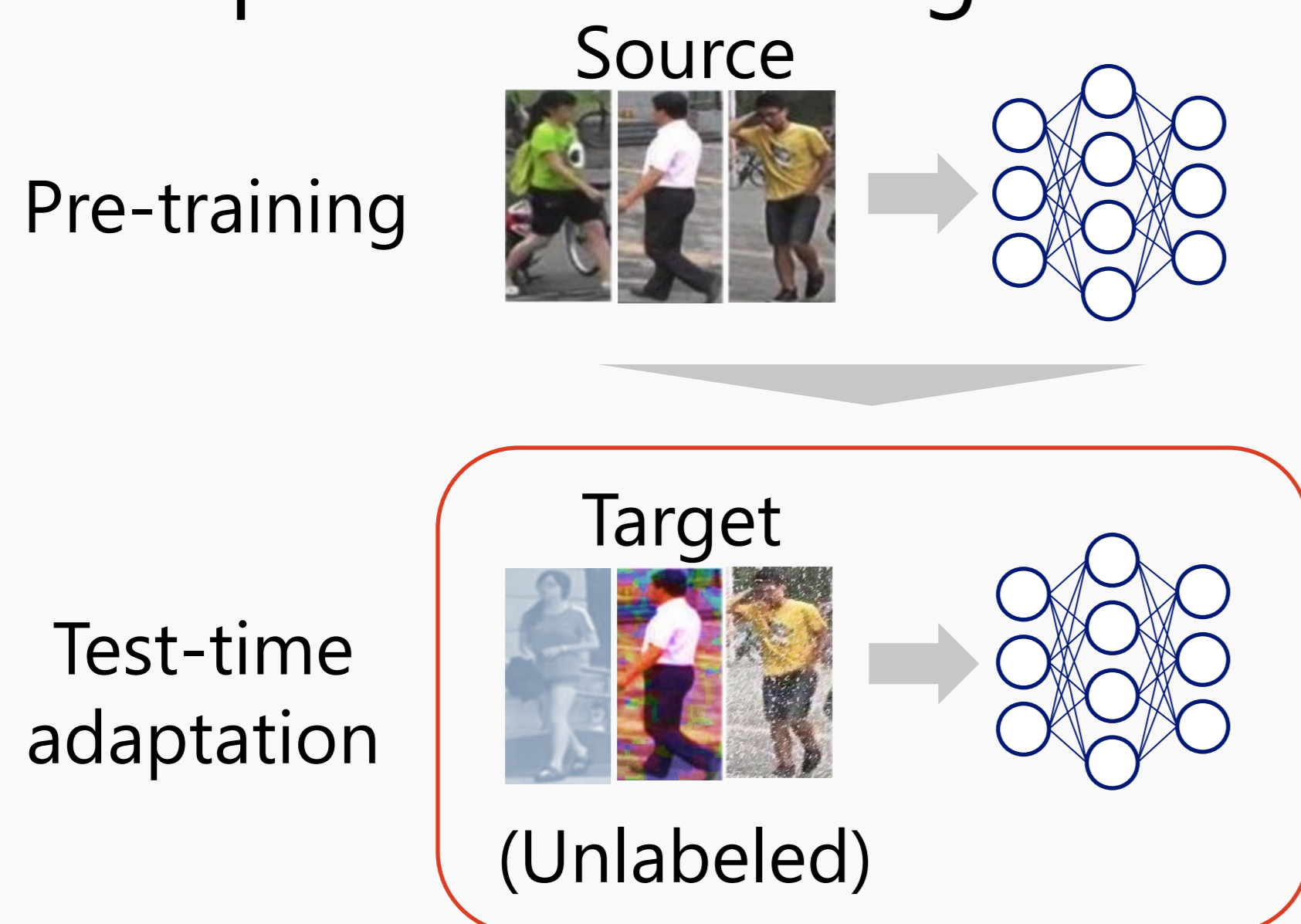
- **Problem:** Performance degradation when distribution changes

➢ Distribution often changes dynamically in the real world, e.g., weather or light



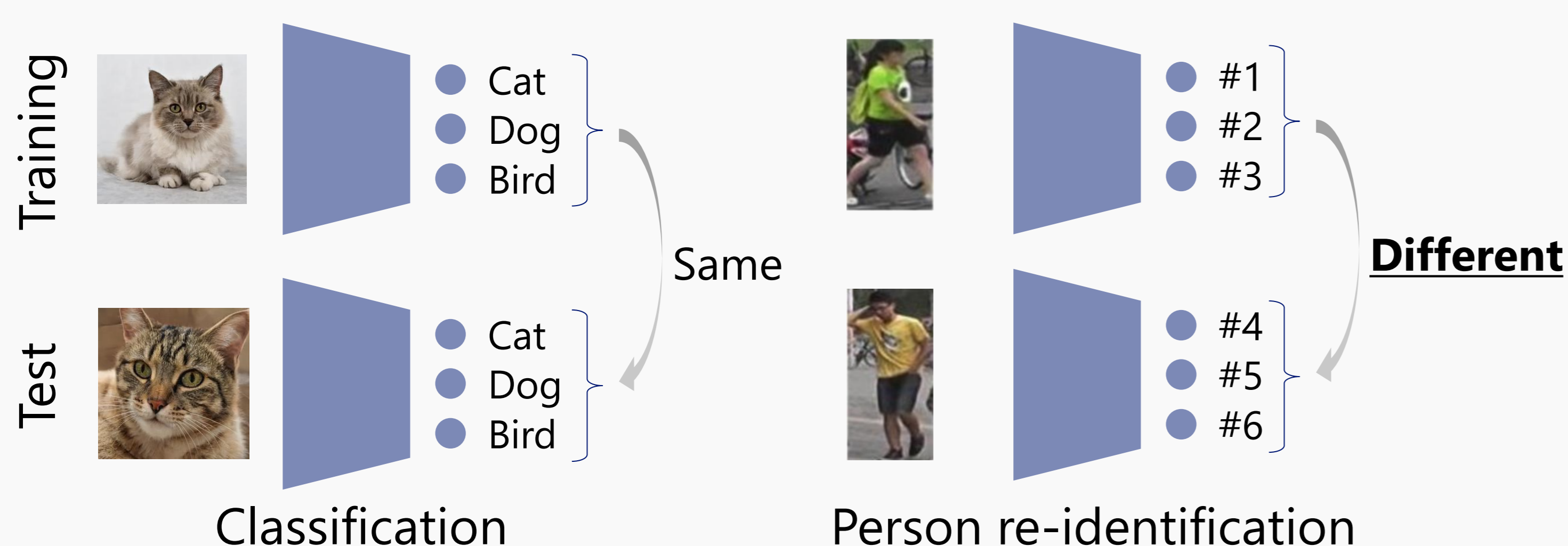
Test-time Adaptation (TTA)

- Adapts a pre-trained model to the target domain with only unlabeled target data
- Can adapt to unseen target domain instantly



TTA for Person Re-identification

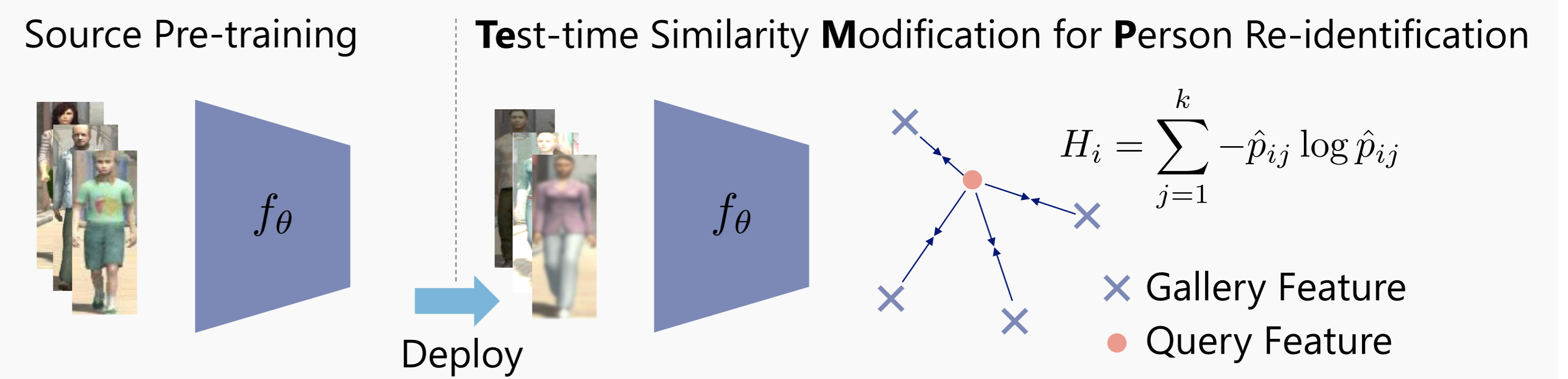
- Existing TTA methods are designed for closed-set classification
- Person re-identification is an open-set recognition task



- TTA for open-set recognition is necessary

Proposed Method

- **Test-time Similarity Modification for Person Re-identification (TEMP)**



- Minimizes Re-ID entropy computed based on similarities
- Procedure

1. Compute cosine similarities between query and gallery features: $s_{ij} = \cos_s(\mathbf{z}_i^q, \mathbf{z}_j^g)$
2. Select top- k similar gallery features for each query feature $\mathbf{z}_i^q: \{\mathbf{z}_{a_i}^g\}_{i=1}^k$
3. Compute softmax probability and re-id entropy based on the similarity

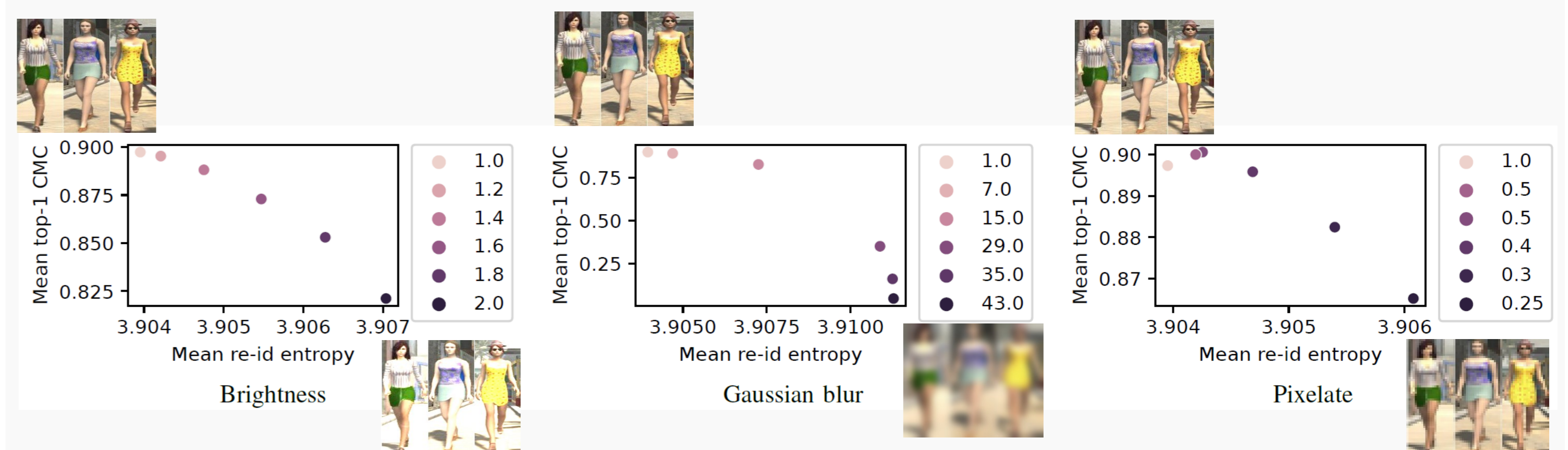
$$H_i = \sum_{j=1}^k -\hat{p}_{ij} \log \hat{p}_{ij}, \quad \hat{p}_{ij} = \frac{\exp(s_{i,a_j})}{\sum_{j'} \exp(s_{i,a_{j'}})}, \quad j \in \{1, \dots, k\}$$

4. Update the feature extractor

$$\min_{\theta} \frac{1}{B} \sum_{i=1}^B H_i + \lambda \|\theta_0 - \theta\|_2^2$$

Experiment

- Can the re-id entropy be a proxy of the accuracy?
- **Yes.** Re-id entropy strongly correlates with distribution shift



- Online performance in changing test environments
- **TEMP keeps better performance!**

