Introduction

**Challenge of Person Re-identification**
Large intra-class variations (i.e. illumination, pose, occlusion, camera view) lead to highly-curved manifolds in the feature space.

**Motivation**
- Euclidean distance is inappropriate.
- Geodesic distance is not available due to the unknown distribution.
- Like manifold learning, using local Euclidean and graphical relationship to approximate Geodesic distance for training CNN.
- Reduce the intra-class variance while preserving the intrinsic graphical structure.

Contribution
- **Moderate Positive Mining**: A novel positive sample selection strategy for training CNN while the data has large intra-class variations.
- A metric weight constraint in FC layer to for better generalization ability.

Our approach

**Moderate Positive Mining**
- Step 1. In a mini-batch with a given anchor sample, find the hardest negative sample.
- Step 2. Find the positive samples that have smaller distance than that of the hardest negative sample.
- Step 3. Mine the hardest one among these chosen positives.

Experiments

**CUHK03 Validation**
- Moderate positive mining improves the rank-1 accuracy by 10 percent.
- Weight constraint gives better generalization ability.

Algorithm 1: Moderate Positive Mining

Input: randomly select an anchor sample $I_1$, its positive samples $\{I_1^P, \ldots, I_n^P\}$ and negative samples $\{I_1^N, \ldots, I_n^N\}$ to form a mini-batch.

Step 1 Input the images into the network for obtaining the features, and compute their distances \(d(\psi(I_1), \psi(I_1^P)), \ldots, d(\psi(I_1), \psi(I_1^N))\) and \(d(\psi(I_1), \psi(I_2^P)), \ldots, d(\psi(I_1), \psi(I_2^N))\).

Step 2 mine the hardest negative sample $I_2^N = \arg\max_{I_2 \in \mathcal{N}} d(\psi(I_1), \psi(I_2^N))$.

Step 3 from the positive samples, choose those $I_2^P$ satisfying $d(\psi(I_1), \psi(I_2^P)) < d(\psi(I_1), \psi(I_2))$.

Step 4 mine the hardest one among those chosen positives as our moderate positive sample $I_2^P = \arg\max_{I_2 \in \mathcal{P}} d(\psi(I_1), \psi(I_2^P))$.

If none of the positives satisfies the condition in Step 3, choose the positive with the smallest distance as the moderate positive sample.

Output: The moderate positive sample $I_2^P$.

**Metric Weight Constraint**
- Implement the Mahalanobis distance in the FC layer.
- Limit the metric matrix close to an identity matrix.

Experiments

**CUHK03 & 01 Performance**
- See more results on V1PeR in the paper.