Weekly Report – Week 2

Ahmedabad University

Project Name:

Person Re-identification

Course Name: CSE623 Machine Learning Theory and Practice
Professor Name: Prof Mehul Raval
University: Ahmedabad University

Team Members:

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Summary of Work Done This Week:

During Week 2, our team progressed into the initial phases of implementing the Person Re-identification system by focusing on training the dataset and understanding its structure. Our main tasks for the week included:

Preprocessing and Data Preparation:

- Downloaded and preprocessed the Kaggle dataset (Person Re-identification dataset).
- Inspected the dataset to understand the format, number of images, labeled identities, and annotation details.
- Conducted data augmentation techniques such as random cropping, horizontal flipping, and normalization to increase the dataset variability and improve generalization.
- Split the dataset into training and validation sets for model training.

Feature Extraction Implementation:

- Implemented traditional feature extraction methods:
    - **Histogram of Oriented Gradients (HOG):** Extracted shape and texture information from pedestrian images.
    - **Scale-Invariant Feature Transform (SIFT):** Extracted key points and descriptors for matching individuals across different camera views.
    - **Color Histograms:** Used to extract color-based features for identity representation.
- Conducted comparative analysis of the feature descriptors in terms of computational efficiency and robustness to variations in lighting and pose.

Dimensionality Reduction Techniques:

- Applied **Principal Component Analysis (PCA)** to reduce the dimensionality of extracted features, improving computational efficiency.
- Explored **t-SNE** for visualizing high-dimensional feature spaces in 2D/3D space for better understanding of identity clustering.
- Compared PCA and t-SNE to determine the best approach for dimensionality reduction in terms of data separability and variance retention.

Similarity Computation for Person Matching:

- Implemented various distance metrics for computing similarity between feature vectors:
    - **Euclidean Distance:** Measures the straight-line distance between two feature vectors.
    - **Cosine Similarity:** Measures the cosine of the angle between two feature vectors.

    - **k-Nearest Neighbors (k-NN):** Evaluated k-NN for identifying similar individuals based on feature distances.
- Analyzed the efficiency of each metric in correctly ranking and matching individuals.

Challenges Faced:

- High dimensionality of extracted features increased computation time.
- SIFT feature extraction was computationally expensive compared to HOG and Color Histograms.
- Selecting the optimal number of principal components for PCA was challenging as higher values retained more information but increased processing time.
- Need for fine-tuning similarity metrics for improved accuracy.

Plan for Next Week:

For Week 3, we will focus on training and performance evaluation. We will optimize feature extraction and similarity computation methods, tuning parameters such as k-value in **k-NN**. The dataset's features will undergo dimensionality reduction using **PCA and t-SNE** for improved efficiency. Further, we will generate CMC curves to evaluate person-matching accuracy and compute **Rank-1 and Rank-5** accuracy scores. We will also assess various distance metrics, such as Euclidean distance, Cosine similarity, and k-NN, to enhance identification accuracy. Finally, we will document our findings and compare them with existing literature.

Conclusion:

This week, we successfully initiated the training phase by implementing feature extraction and dimensionality reduction techniques. The team analyzed the PRW dataset and experimented with different feature descriptors. While we encountered challenges related to high-dimensional data and computational costs, we plan to address these issues next week by optimizing the similarity computation and fine-tuning the model to enhance efficiency and accuracy.

In the next phase, we will focus on training the model, analyzing performance through CMC curves, and improving feature extraction and similarity matching techniques. We also aim to compare our results with existing deep learning-based methods and evaluate their effectiveness for real-time person re-identification.