

# *Problem Statement*

Develop a fashion recommendation system that can suggest similar items based on a query image.

**Goal:** Assist small fashion businesses with personalized recommendation features.

**Given:** A query image by the user.

**Objective:** Learn a model that recommends compatible outfits.

**Constraints:** Limited labeled data, No textual or semantic metadata used, computational power for training models.

**Approach/Technology Used:**

- Siamese Neural Network with color histogram fusion
- CNN from scratch (I/P: (3,128,128) #Layers: 3)
- Cosine similarity for similar item generation

**Motivation:** Bridging the gap in fashion e-commerce by offering ML-driven stylistic recommendations.

**Application:** Fashion retail platforms, boutique businesses, styling assistants, face detection.

# Dataset Description

**Dataset:** Repolyvore Dataset

**Train:** Repolyvore Fashion Dataset (dress, shoes, pants) [25k images]
















**Test:** Query folder[10 images]
















**Data Type:** Images (.jpg), RGB images

**Description:** The dataset includes various curated outfits which includes serveral items which look compatible together.

**Machine Specification:**

- CPU: AMD Ryzen 5 5600H
  - RAM: 16 GB
  - GPU: NVIDIA RTX 3050 (used for training)
  - Programming Language: Python (PyTorch-CUDA, TorchVision)
  - Platform: Jupyter Notebook
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  2. Re-Polyvore/<class-name>/<compatible-set-id>\_<class-id>.jpg

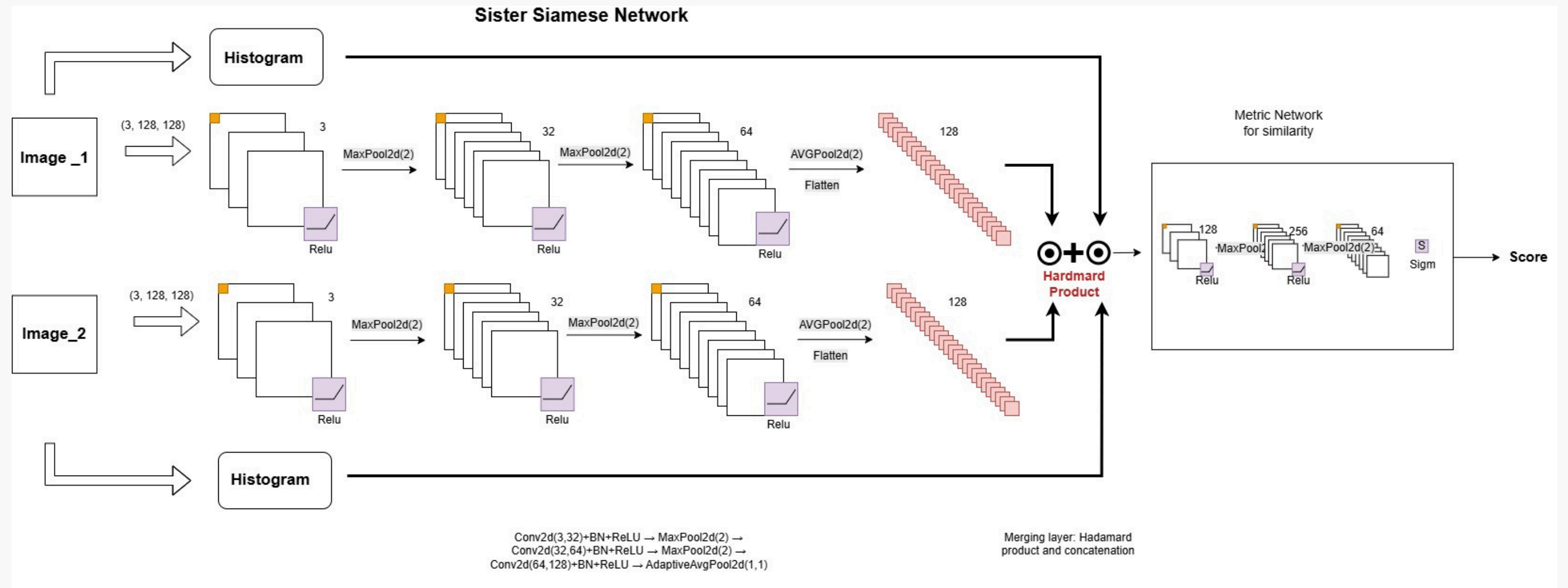
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	gloves	12-04-2025 07:12 PM	File folder
	hairwear	12-04-2025 07:13 PM	File folder
	hats	12-04-2025 07:15 PM	File folder
	jumpsuit	12-04-2025 07:15 PM	File folder
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	outwear	12-04-2025 07:31 PM	File folder
	pants	12-04-2025 07:38 PM	File folder

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	2333598	4/13/2025 4:48 AM	File folder
	2797101	4/13/2025 4:51 AM	File folder
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	3812619	4/13/2025 4:58 AM	File folder
	4035878	4/13/2025 5:01 AM	File folder

# Neural Network Architecture



*Model:  
Custom  
CNN with  
siamese  
framework*



*Training Process:*

1. Siamese sister network (for feature extraction)
  - [Input: 3 channels of 128x128 Pair of like and unlike images] ,
  - [Output: Vector embedding of length 128]
2. Metric Network (for similarity training and score)
  - Hadmard Product of feature embeddings of images and histogram
  - Concatenated feature embeddings of images and histogram

*Loss function: Binary Cross Entropy*

$$L = - [y \cdot \log(\hat{y}) + (1 - y) \cdot \log(1 - \hat{y})]$$

*Optimiser: Adam Opt.*

*(Learn Rate= 1e-3)*

*Batch size: 32*

*Epochs: 10*

Result- Qualitative- Similarity Search

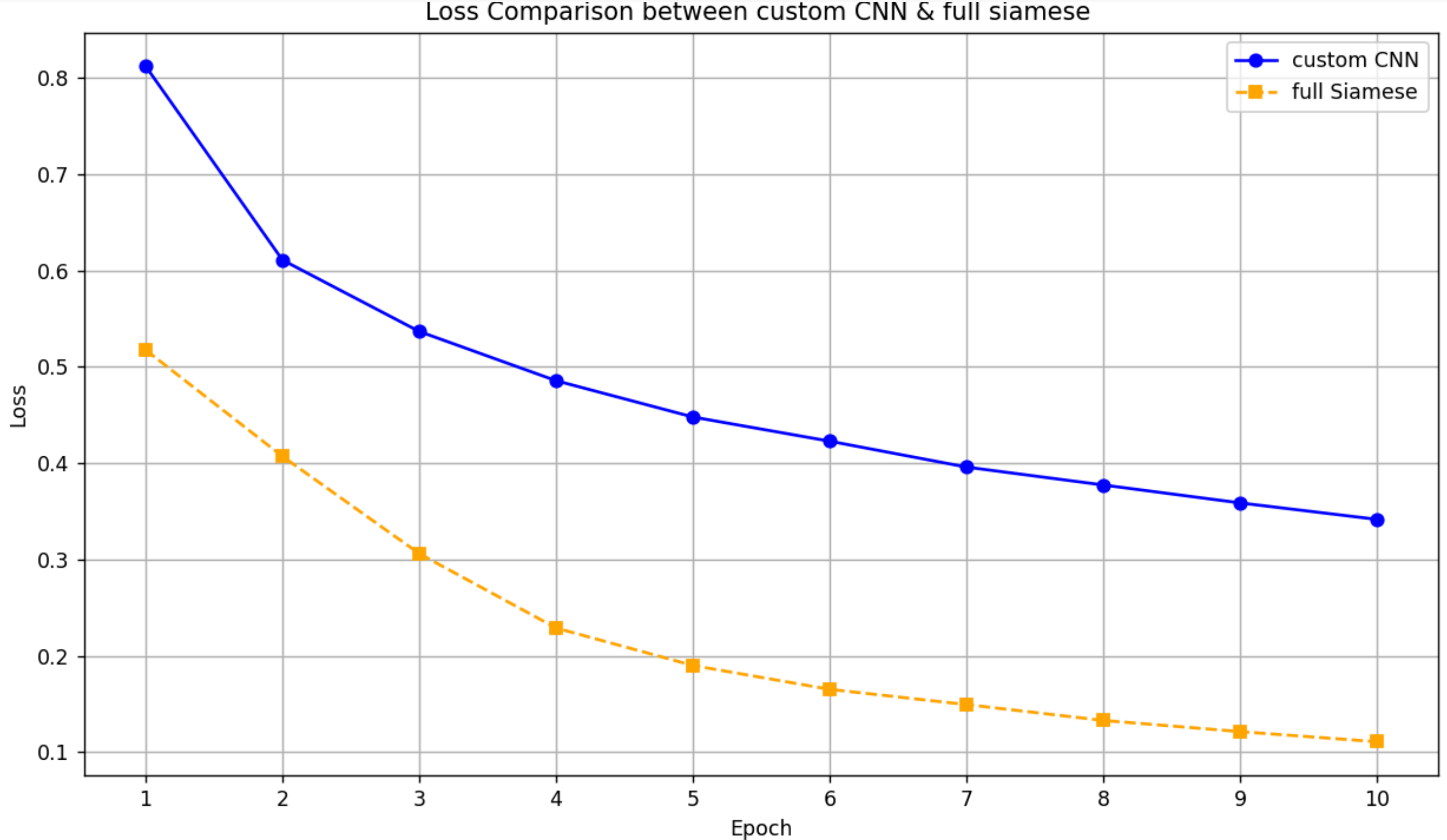
	Image 1	Image 2	Image 3	Image 4	Image 5
Naive CNN					
Siamese & Color Hist.					

Query Image



# Quantitative Results

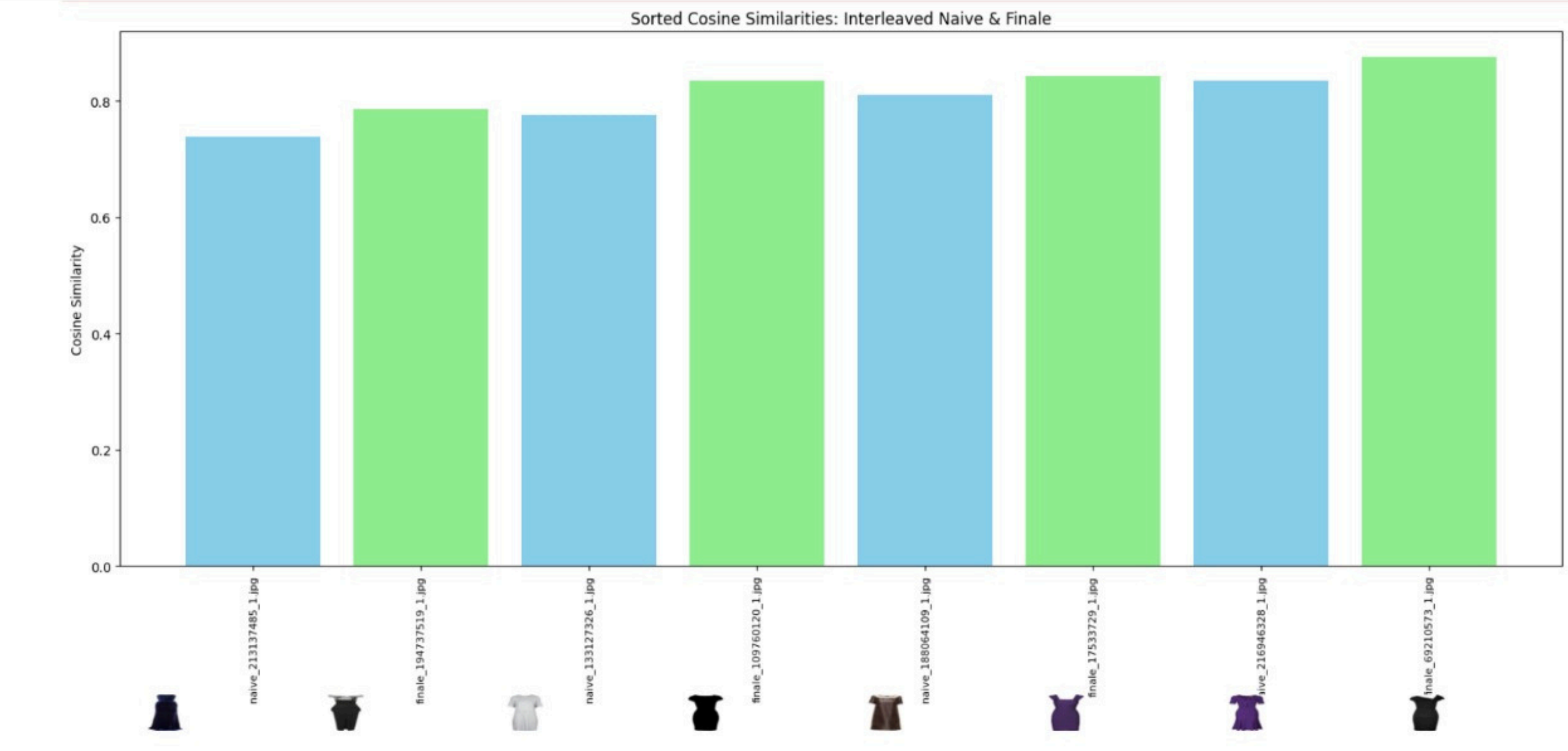
## Loss Comparison





# Quantitative Results

## Cosine Similarity Comparison





# References

Polyvore Dataset: <https://www.kaggle.com/datasets/dnepozitek/maryland-polyvore-images/>

Citation of Paper: *LEARNING FASHION COMPATIBILITY ACROSS APPAREL CATEGORIES FOR OUTFIT RECOMMENDATION* Luisa F. Polan'ia, Satyajit Gupte: [ 2019 IEEE International Conference on Image Processing (ICIP)]

Articles on Siamese Networks:

<https://medium.com/@rinkinag24/a-comprehensive-guide-to-siamese-neural-networks-3358658c0513>

<https://builtin.com/machine-learning/siamese-network>

*Siamese Networks for Face Detection* - <https://youtu.be/IXgr63eRU5U?si=-3DI1iocaaN3LyrB>





*Thank you*

