

Clothing Recommendation System

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Introduction to Machine Learning

Abstract—This paper presents a clothing recommendation system developed using a pre-trained ResNet50 model and Pinecone for efficient vector search. The system recommends similar clothing items based on user-uploaded images from a high-resolution dataset. The approach leverages advanced feature extraction and vector embedding techniques to deliver personalized recommendations.

I. INTRODUCTION

The primary objective of this project was to create a clothing recommendation system capable of suggesting similar items based on images provided by users. The system uses the VITON HD dataset, a high-resolution clothing dataset, and employs the ResNet50 model to extract features from images. Pinecone is utilized for efficient storage and querying of vector embeddings.

II. DATASET DESCRIPTION

The VITON HD dataset, used in this project, is a high-resolution clothing image dataset available on Kaggle:

- **Number of Images:** Over 10,000 high-resolution images
- **Content:** Diverse clothing items categorized into various classes

III. MODEL AND FEATURE EXTRACTION

The ResNet50 model was used for feature extraction:

- **Model Used:** ResNet50, a pre-trained Convolutional Neural Network (CNN)
- **Feature Vector:** Images are converted into 2048-dimensional feature vectors
- **Embedding Storage:** Pinecone manages the vector embeddings efficiently

IV. SYSTEM WORKFLOW

The recommendation system operates as follows:

- 1) **Image Upload:** Users log in and upload an image of clothing.

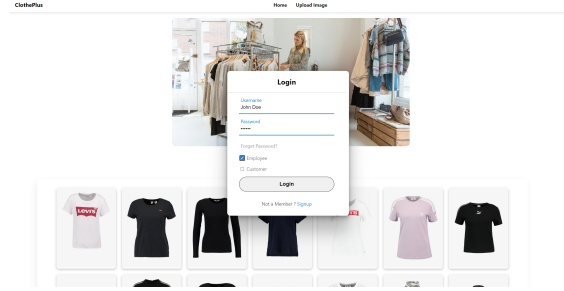


Fig. 1. User login process

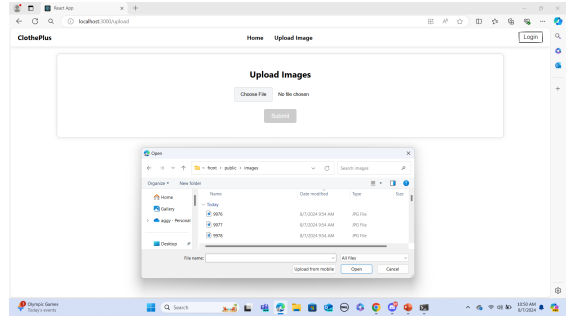


Fig. 2. Image upload process

- 2) **Feature Extraction:** The uploaded image is processed through ResNet50 to extract features.

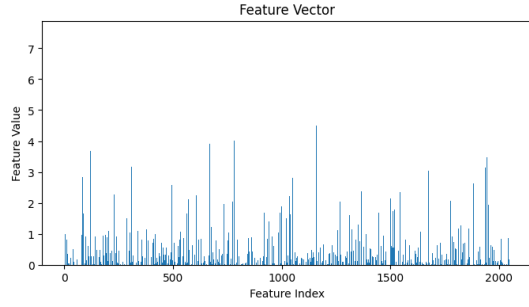


Fig. 3. Feature vector graph of uploaded clothing

```
feature_list[0]
array([9.6319889e-04, 4.2315435e+00, 9.8404720e-02, ..., 9.3276493e-02,
       0.0000000e+00, 4.4840339e-01], dtype=float32)
```

Fig. 4. Feature embedding

- 3) **Querying Pinecone:** The extracted feature vector is used to query Pinecone for similar clothing items.

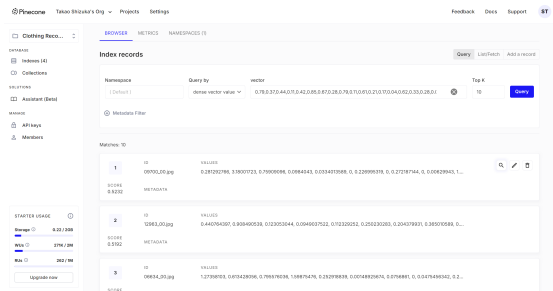


Fig. 5. Querying Pinecone

- 4) **Results Display:** The top 10 similar items are retrieved and displayed to the user based on similarity scores.

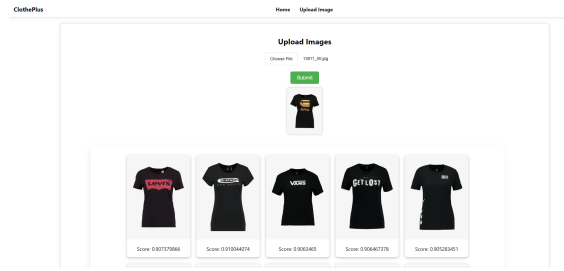


Fig. 6. Displaying results to the user

V. RESULTS

The recommendation system effectively identifies and suggests similar clothing items based on user-uploaded images. Recommendations are sorted by similarity score. Although specific training accuracy metrics are not available due to the use of a pre-trained model, the recommendations' effectiveness is demonstrated through practical use.

VI. FUTURE WORK

Potential improvements include:

- **Feature Selection:** Allow users to filter recommendations based on attributes like color, shape, size, and brand.
- **Model Enhancement:** Investigate advanced neural network architectures and transfer learning techniques to further improve recommendation quality.
- **User Experience:** Refine the web application to enhance user interaction, with features like real-time recommendations and personalized suggestions.

VII. CONCLUSION

The clothing recommendation system demonstrates the effective use of a pre-trained model and Pinecone for vector search, providing valuable recommendations based on user-uploaded images. Future work will focus on model refinement and enhancing user experience.

REFERENCES

- [1] VITON HD Dataset, Available: <https://www.kaggle.com/datasets/marquis03/high-resolution-viton-zalando-dataset>.
- [2] Keras Documentation, Available: <https://keras.io/api/applications/resnet/>.
- [3] Pinecone Documentation, Available: <https://www.pinecone.io/docs/>.