Image Classification and Image Similarity Recommendation Using Deep Learning

SI 670 Applied Machine Learning Final Project: Shivika Bisen, Morgan Durow, Yun Wang

Overview

Objective: Image classification and similarity helps understand visual data, but how does it work? Our project explores different methods of training neural networks to classify images. We also evaluate a variety of models on detecting similar images to an input. Through this project, we were able to experiment with Deep learning models with image data and compare their strengths and weaknesses.

Methods

Dataset

An image dataset was used from DeepFashion website. Data augmentation such as rotation and mirroring was utilized to increase the sample size. The data includes labeled pictures of different items such as shoes, jewelry, makeup, and purses. Also Caltech 256 (Cloud Transfer Learning), Fashion-mnist (distance metric) are used.

Image Classification

Multi-Layer Perceptron vs. Convolutional Neural Network

MLP is a feedforward network. CNN utilizes layers that can capture the spatial and temporal dependencies in an image and therefore perform better. The role of the CNN is to reduce the images into a form which is easier to process without losing features which are critical for getting a good prediction. CNN accuracy can be improved through adjustments to activation functions, dropout layers, and optimization techniques.

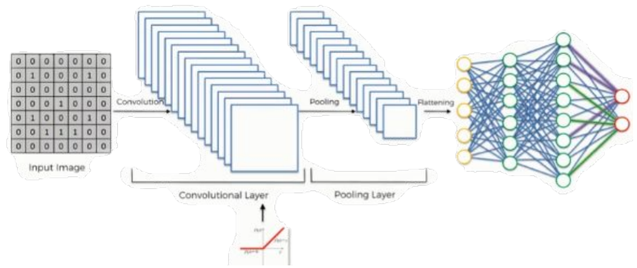
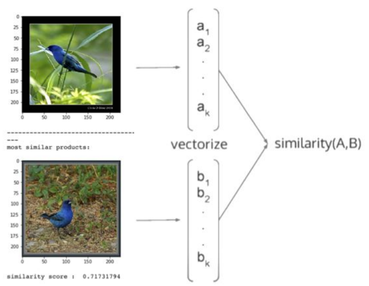
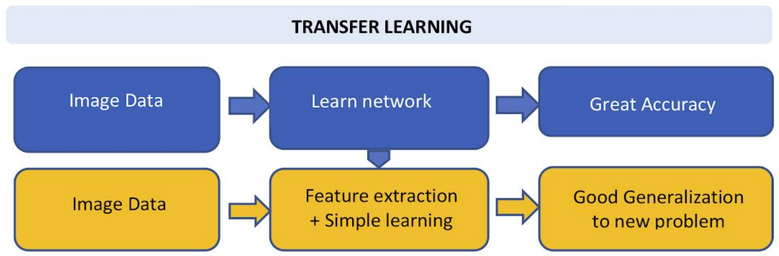
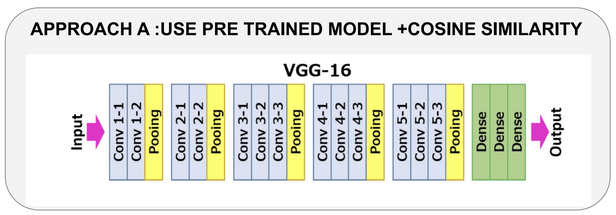
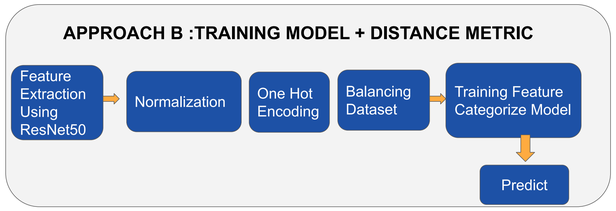


Image Similarity: Transfer Learning





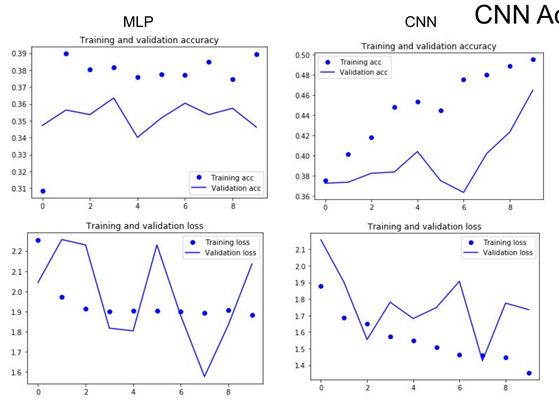




Results

Image Classification

MLP Accuracy: 35.3%
CNN Accuracy: 49.1%



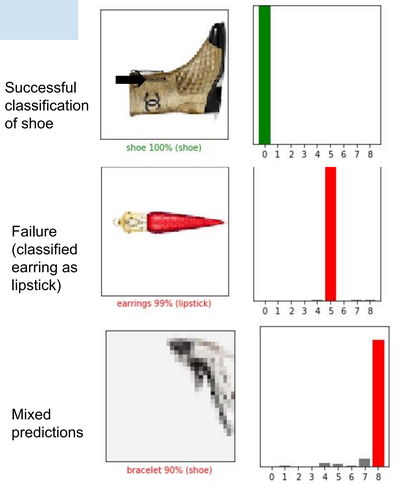
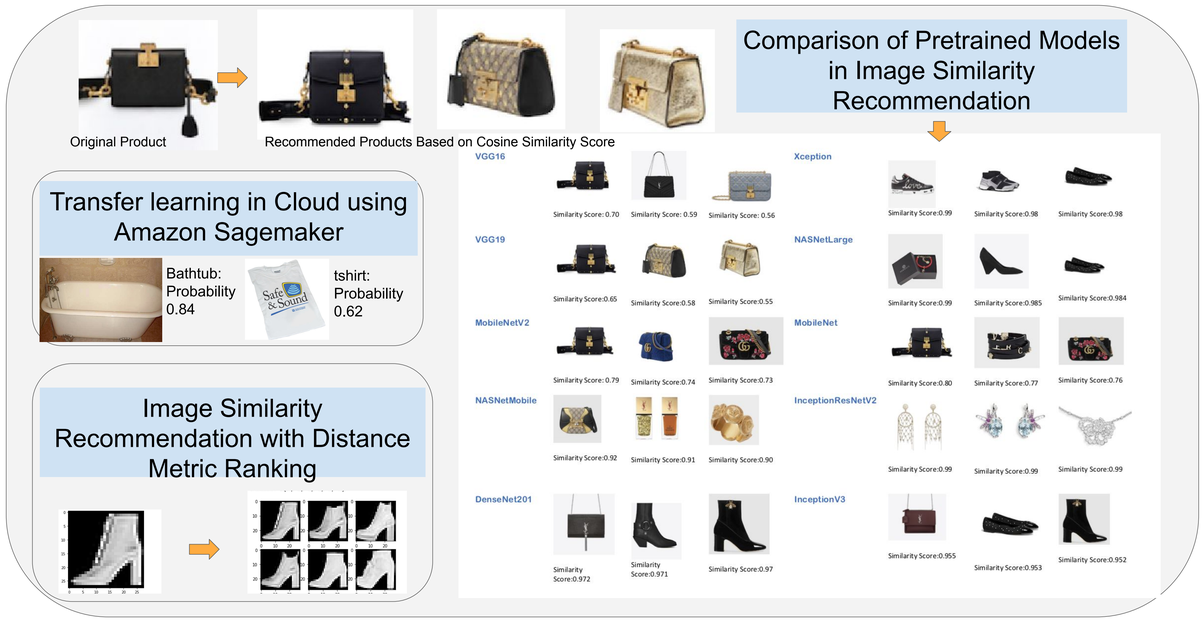


Image Similarity:Transfer Learning

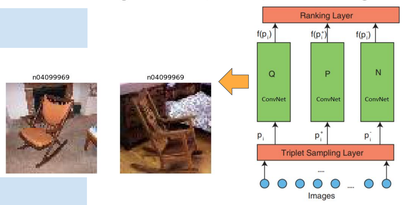


Insights

- CNN models perform the best at extracting pertinent features from training data and successfully classifying images. Several CNN based models for image similarity were also compared.
- VGG-16 , VGG-19 performed the best for image similarity and product recommendation.
- Cosine similarity approach better than Distance metric for image similarity as deals with sparse data.
- ResNet model trained in Cloud using Amazon Sagemaker worked well for large data,complex images

Next Step

- ConvNet captures the only image semantic. Method like Deep Ranking incorporates visual appearance +image semantics.
- Learns directly from image data and Backpropagation based training of ranking layer can give good precision results.



Reference

- Chen, L. et al. *Image-based Product Recommendation System with CNN*. 2015.
- Wang, J.,et al (2014). Learning fine-grained image similarity with deep ranking:*IEEE Computer Society Conference on Computer Vision and Pattern Recognition*, 1386–1393

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