What am I wearing? Outfit of the Day Assistant

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Abstract

This project aims to use machine learning techniques to provide outfit recommendations based on an image of an article of clothing. I feel connected to this problem as I am often struggling to pick out my own outfit or am struggling to find a piece of clothing to match another. This project would take image classification and combine it with an analysis of datasets to help predict what color and what type of clothing you should wear with what you have on. This project will also use datasets to help provide inspiration and products from companies by using predictive modeling to predict what is popular. To complete this, the project will need to train the model with clothing data sets and introduce complementary color and brand datasets afterwards. Testing will need to be done to evaluate the accuracy and usability of the model. Through this, I hope to relieve some stress to picking out an outfit.

Introduction

Outfit of the Day Assistant (OOTDA) is a project to address the challenge of picking out an outfit. For many, picking out an outfit can be time consuming or overwhelming in order to look complete and put together, and in other situations, you might be curious what might go with an article of clothing you found. OOTDA aims to alleviate that stress by using machine learning to simplify picking out clothes. OOTDA aims to use image classification in the form of VGG and integrating datasets on complementary colors, market share of brands, and clothes from those brands to help suggest clothes to go with the user submitted image.

Literature Review

The inspiration for this project comes from my indecisiveness to pick out an outfit or buy an article of clothing. In order to prep for this project, I looked at examples provided in class, and found a few examples that fit with my idea. One student project I found especially helpful was “Clustering And Querying Images From Unknown Classes Using Metric Learning” by Chinmayee Shah. I also looked at various websites to grasp a better understanding of image classification and overall machine learning. I have identified some of the datasets that will be useful in my model. One dataset is 5,000 articles of clothing, with classes and labeling. This will be my primary source of data for the basis of my model’s image classification. This data is free to use and is public domain, as are the rest of the datasets I have found.

Technical Plan

OOTDA will start by collecting and preprocessing datasets of clothing images with labels, and normalize the pixel values of the images. Then, the plan is to utilize a VGG Convolutional Neural Network (CNN) architecture of image classification and fine tune the model on the clothing image dataset. I will then plan on leveraging the learned representations from the image datasets, and integrate in datasets on complementary colors and popular brands. These integrations will be for the recommendation portion of the model, and will be implemented after

the classification has been fully realized. Finally, I will conduct testing to ensure that the functionality, reliability, and performance of recommendations and classifications are there.

Intermediate Results

Since the approval of the proposal, work began on creating the model for the program. At the time of submitting the first progress report, the model had been created and was trained to recognize clothes based on images from the fashion MNSIT being used. In figure 1.1, the accuracy of the trained values and test values are charted with accuracy over epoch for checkpoint 1. The first model accuracy is 94% for trained data and 88% for test data in the 10th epoch. In the figure 1.2, the loss of the first model is charted over the course of 10 epochs. In this, the training loss was at 15% by the end of the training and around 27% for the test data.

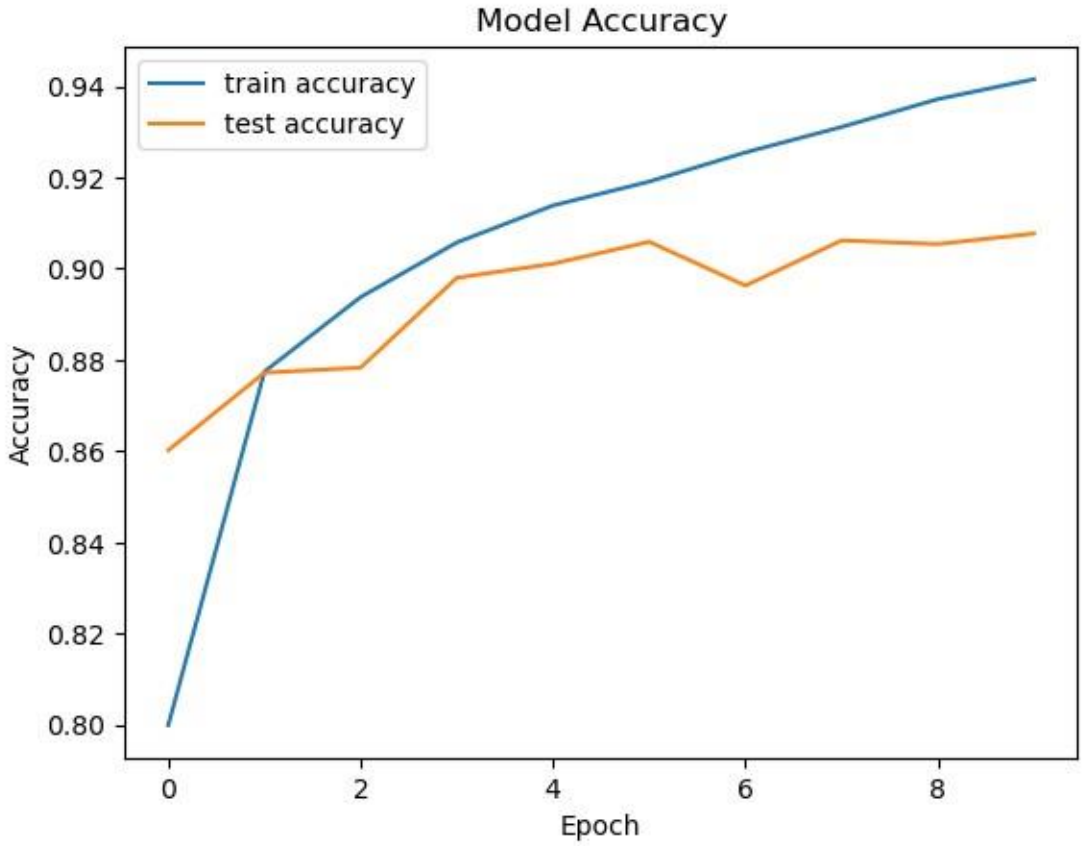

fig 1.1 Accuracy over epoch is shown. The orange line represents the average accuracy percentage per epoch over the course of the training for the test values. The blue line represents the average accuracy percentage for the training values. In this case, a higher percentage is preferred, which is shown for both the test and the training values.

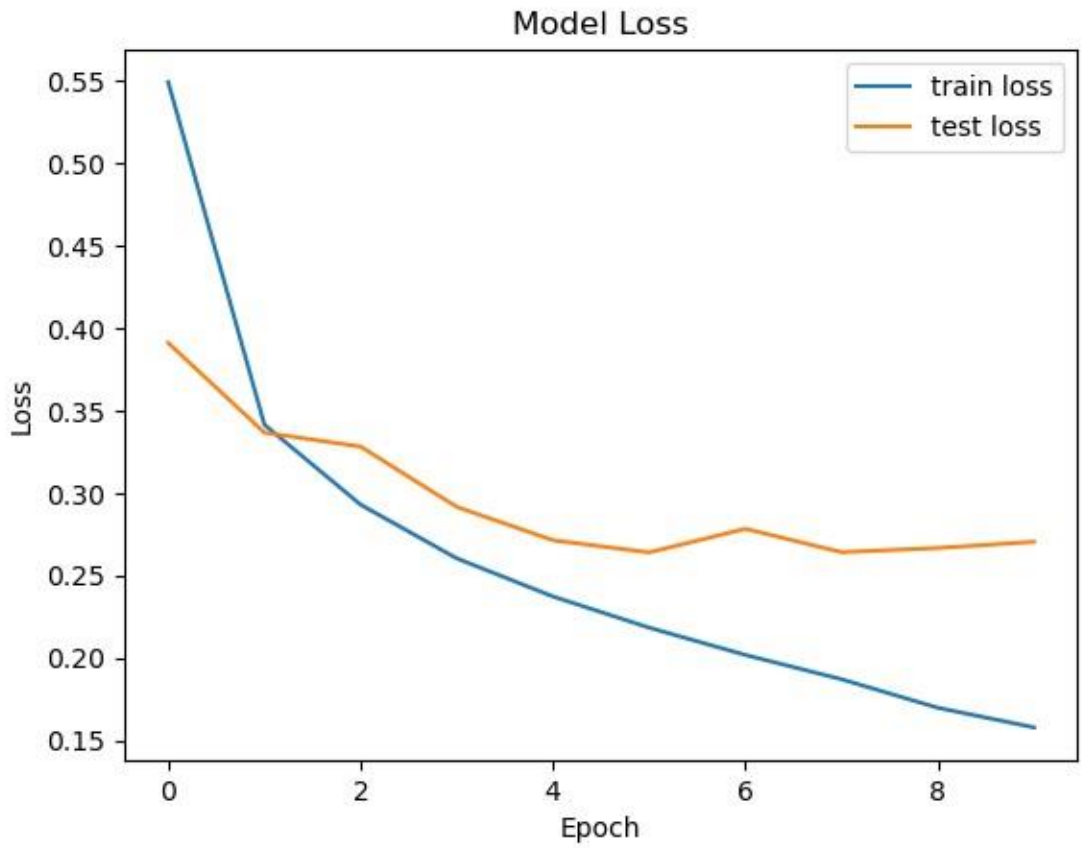

fig 1.2

Loss over epoch is shown. The orange line represents the average loss percentage per epoch over the course of the training for the test values. The blue line represents the average loss percentage for the training values. In this case, a lower percentage is preferred, which is shown for both the test and the training values.

At this stage in the project, the model has only been trained on the data set. It has been given the Fashion-MNIST dataset of 60,000 labeled images and has been trained to recognize them to the labels. The model was not able to accept a user submitted image nor was it able to "view" the colors or offer suggestions for the clothing submitted by the user.

Final Results

As we come to a conclusion for this project report, the final results of the model seem very promising. Since the first iteration, the size of the epochs and the number of epochs has been increased in order to help in improving the accuracy of the model. This has resulted in a significant increase in accuracy in identifying articles of clothing. In fig 1.3, it shows that the accuracy of the model has improved from the first model accuracy of 94% for trained and 88% for test to 88% for trained and 89% for test. In fig 1.4, it can be seen that the loss has decreased as well from the 15% for training and 27% for test data to the 32% for trained and 29% for test. While these numbers in the newer model do not seem to be an improvement, it was found that the accuracy and the loss in the original model, were not precise. Upon further testing, the first

model's accuracy and loss was incorrectly skewed and no images were able to be defined. To achieve these new results the number of epochs were changed from 10 to 50 and the batch size was changed from 64 to 32, and the step size was increased from 32 to 100. Another way that the model was improved was in the augmentation of the dataset. The model uses rotation, width and height shifts, and zoom and horizontal flipping to increase the size of the dataset and further train the model.

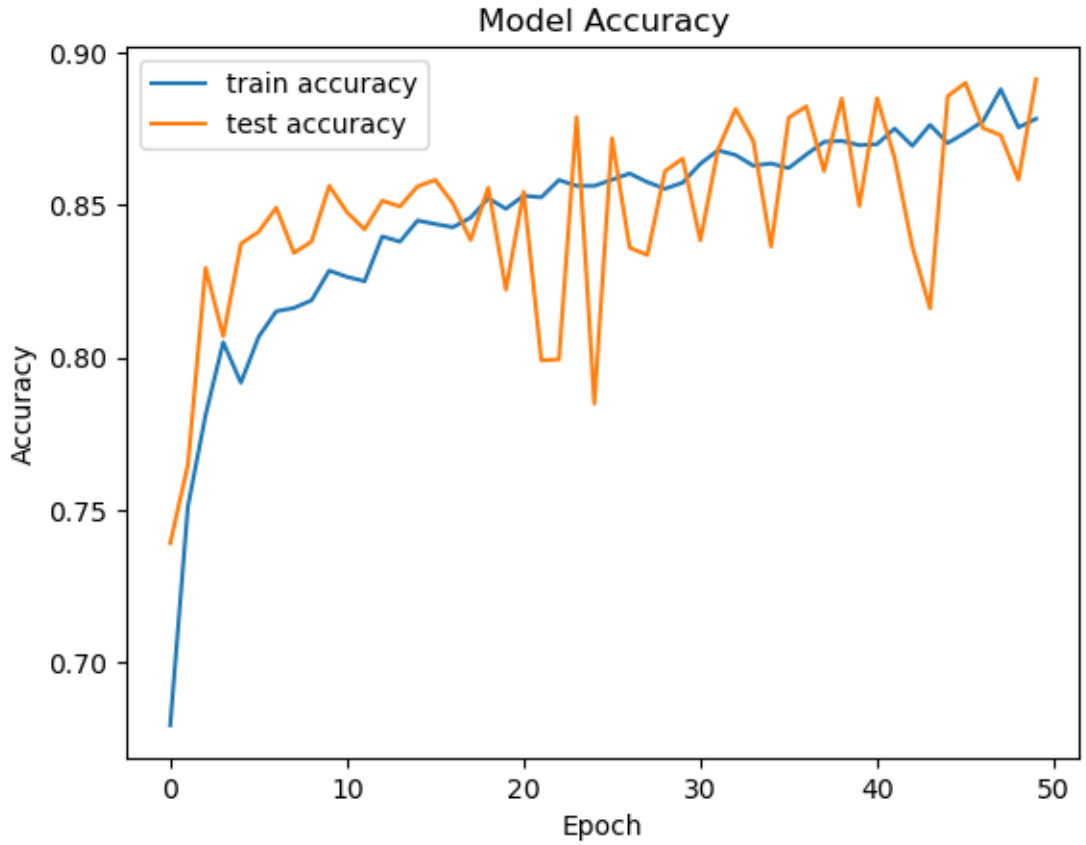

fig 1.3

Accuracy of the model after changes to the training system and changing the number of epochs to 50, batch size to 32, and steps per epoch to 600. As The image demonstrates, the accuracy of is more chaotic, but the overall accuracy and the true accuracy of model has been improved greatly.

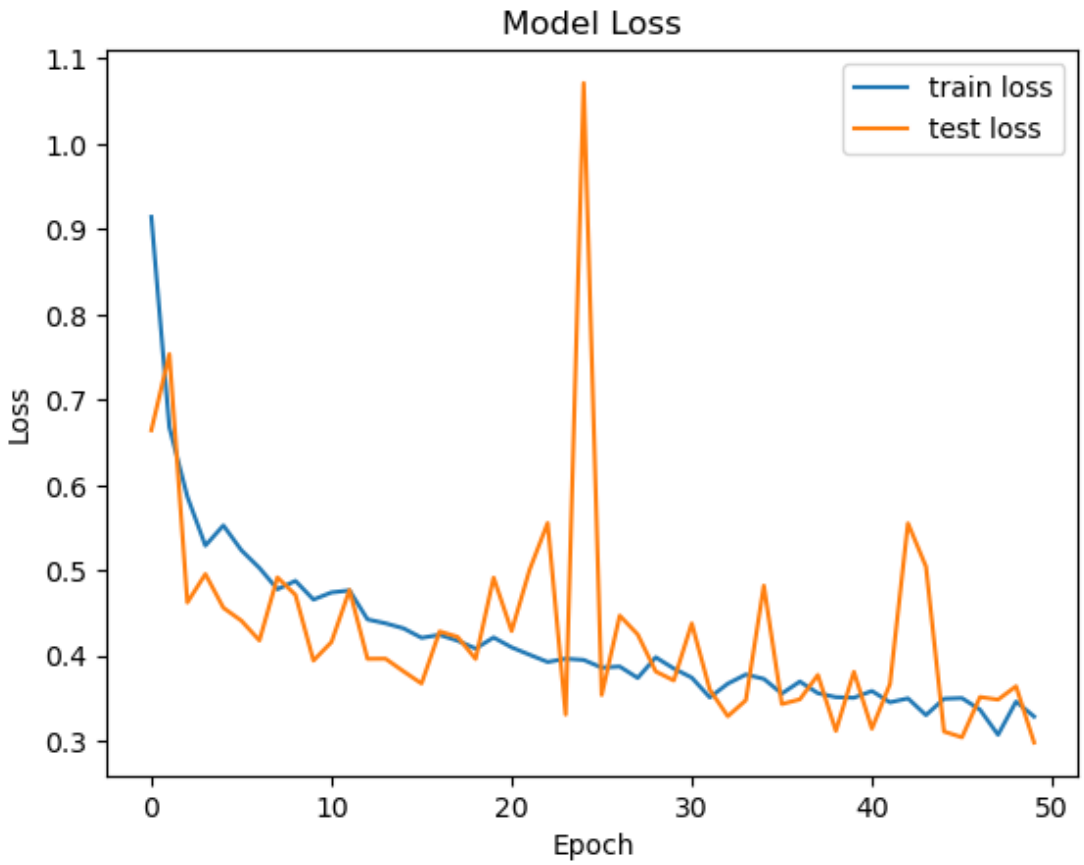

fig 1.4

Loss of the model after the changes to the training system and changing the number of epochs to 50, batch size to 32, and steps per epoch to 600. As The image demonstrates, the loss of is more chaotic, but the overall loss value and the true loss value of model has been improved greatly.

After the model has been improved, the team implemented definitions for functions to allow user input and process the image submitted. First, the image is brought in as a file, and resized to fit the model. The image is converted into grayscale and returned to be processed. Next, the image is processed through the model to be identified, and the returned label, is given through a list of clothing options. These options are then returned to the user as suggestions for what type of clothing to wear with the image they submitted.

Another new feature for the model is the ability to recognize color and return complementary colors to the user based on the color of their clothes. The program extracts the dominant color using K-means clustering and returns the complements to that color. This is to provide the user with colors that would go well with the article of clothing they are submitting.

To test these new features of the model, I submitted various pictures of clothing and measured the results some examples are included including images that were not successfully identified:

Image Submitted	Recognized as:	Suggested:	Pass/Fail
	• T-shirt • Red	• Jeans • Sneakers • Complementary colors: White, Blue	Pass
	• Shirt • Blue	• Jeans • Sneakers • Necklace • Complementary Colors: Green, Orange	Partial Fail. Model failed to recognize the pants. Improperly labeled as a shirt.
	• Hoodie • Grey	• Jeans • Shirt • Hat • Complementary Colors: Green, Blue	Partial Fail. Model failed to recognize the T-shirt. Improperly labeled as a hoodie.

These results show that the model is able to recognize colors pretty reliably, but is still experiencing issues with identifying clothing items to the specifics. It seems that shirts are biased pretty heavily in the model, and will need to be tweaked further to reduce these biases.

Overall, the model is at a point where it can roughly do its intended purpose. It is able to accept user input, understand the colors of the article of clothing submitted, and suggest clothing combinations based on what was submitted. While the accuracy of the model could be improved, in most cases, especially with tops, the model is able to correctly identify the article of clothing. Along with that the model has been accurate continuously with identifying the colors in the article as long as the pattern is not too different. To conclude, while the model and the overall system functions, there is still improvements that can be made in the future.

Future Work

It is the team's goal to continue work on the model after the semester and this submission. The goal is to better identify clothes that have been submitted by user. More training will need to be done on the model in order to improve this. The team would also like to implement the identification of patterns and have that carry weight on the model and its identifications, and

suggestions. Another feature that the team would like to add is brand and brand awareness, suggesting popular brands over unpopular brands. The goal is to have a fully functioning model by the end of the summer.

Reference

Data Sets

https://www.kaggle.com/datasets/agrigorev/clothing-dataset-full

https://www.kaggle.com/datasets/bhanupratapbiswas/fashion-products

https://www.kaggle.com/datasets/zalando-research/fashionmnist?select=fashion-mnist_test.csv

Student Report

http://cs231n.stanford.edu/reports/2017/pdfs/107.pdf

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http://cs231n.stanford.edu/reports/2017/posters/425.pdf

https://cs229.stanford.edu/suggestions.html

Articles

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