Image-Based Product Recommendation System

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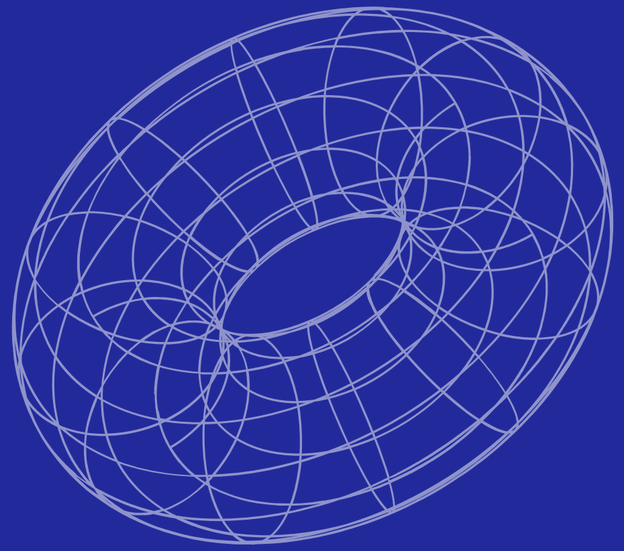
In this Presentation

Overview

Problem Definition



- Online shopping search engines use information from users' profiles and textual descriptions (content-based models) to make recommendations, which easily generate irrelevant suggestions to users due to the ignorance of users' intentions and the visual similarity among products.

- Hence, here the aim is to design a product recommendation system that takes in image as an input, and retrieves relevent images from the database.

Introduction

- In the online marketplace world, companies make use of user history and product data to make recommendations to user.
- The data collected to make these recommendations are search terms, purchase history, product category, items in cart information and many more.
- Most commonly, recommendation engines make use of text based keyword matches to identify products that consumers may like.
- Another alternative and less widely used technique is to make use of images to compare product similarity. Images may be better representative of consumers interest than text.

Motivation

- Since computer vision, AI is evolving and machines have begun to see and understand more, visual search implementation is growing widely.
- With the introduction of visual search, a change in user’s search habits has been noticed.
- Thus e-commerce websites need to make use of it since visual search is a gateway to new possibilities in cases where the buyer lacks clarity about how to describe a certain product, but a visual reference.
- Thus machine learning in the back-end studies the product image dataset learning through features like shapes, colors, brands, and returns visually similar results according to the user’s requirement.

Literature Survey

INDEX	PAPER NAME	AUTHOR NAME	OBSERVATION
1.	Image-Based Service Recommendation System: A JPEG Coefficient RFs Approach	Farhan Ullah, Bofeng Zhang, and Rehan Ullah Khan	Proposed model uses a Random Forest classifier in the classification phase and JPEG coefficient vectors are used to calculate similarity scores by means of Euclidean distance and Cosine similarity in the recommendation phase to provide most closely matching images to the user input.
2.	Image-based Product Recommendation System with Convolutional Neural Networks	Luyang Chen, Fan Yang and Heqing Yang	Authors have discussed how deep convolutional networks like AlexNet and VGG models with a baseline SVM model can be used to solve the classification problem and Jaccard similarity is used to solve the recommendation problem.

Literature Survey

3.	Image Based Fashion Product Recommendation with Deep Learning	Hessel Tuinhof, Clemens Pirker and Markus Haltmeier	In the proposed model, the authors train a convolutional neural network (CNN) which is used as a problem-specific feature extractor, where the features serve as inputs for the ranking system. The k-nearest algorithm (k-NN) is used for ranking in feature space.
4.	Image Based Search Engine Using Deep Learning.	Surbhi Jain and Joydip Dhar	The paper proposes an architecture of Deep Learning for CBIR systems. A pre-trained CNN model, that is, Inception-v3 model, a GoogleNet deep architecture is applied on the dataset for classification. Further, Euclidean Distance is used as similarity metric and closely matching products are retrieved.

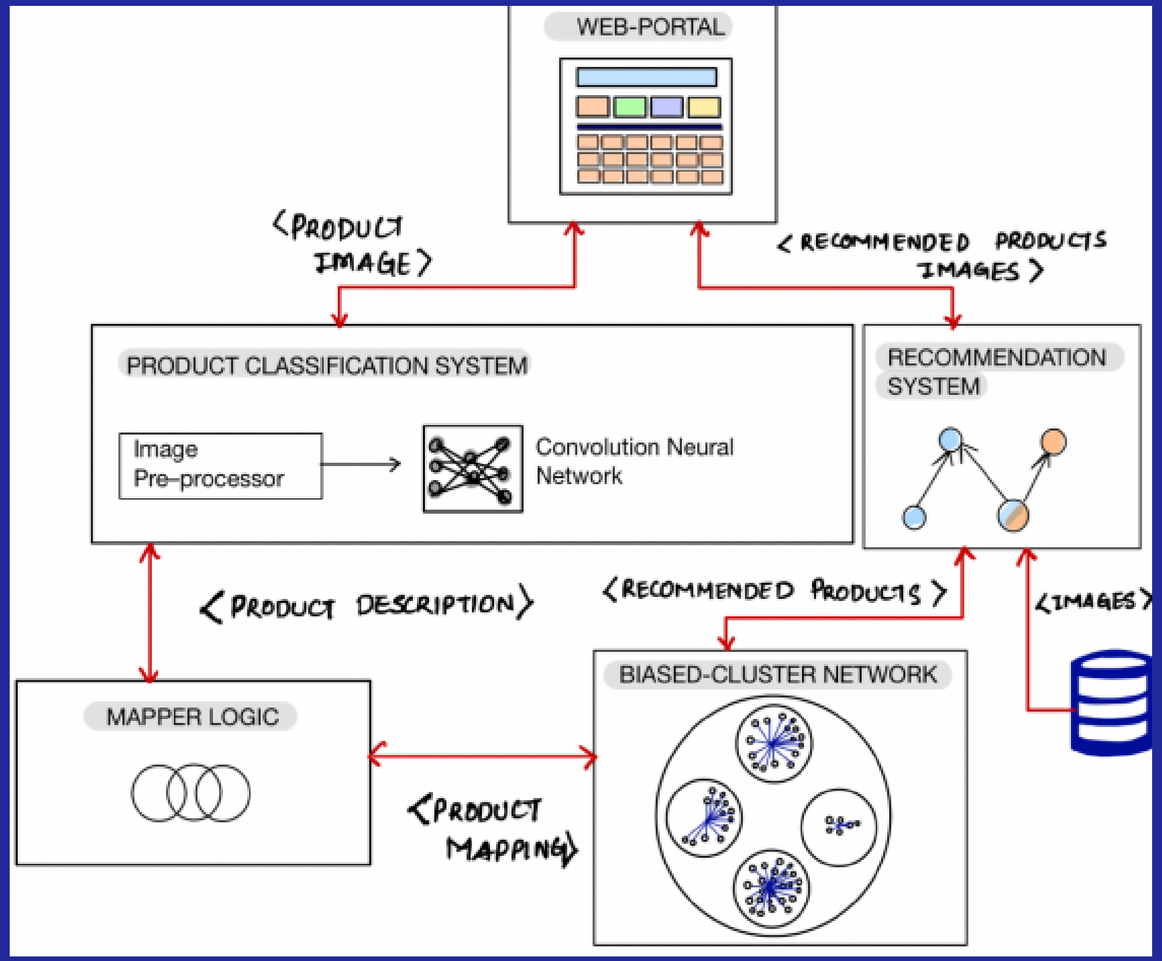
Advantages

- Most of the approaches followed by the papers mentioned above have proved that their approach works better. Some of the papers proved that their work outperforms the state-of-the-art approaches in uncovering rating dimensions and modelling user item interactions. All of the papers showed that given a large data set, the accuracy is more and hence more efficient the recommendation system is. With CNNs, it is able to extract the features of the image and using the suitable Machine Learning classifiers helped to achieve the more accurate recommended system.

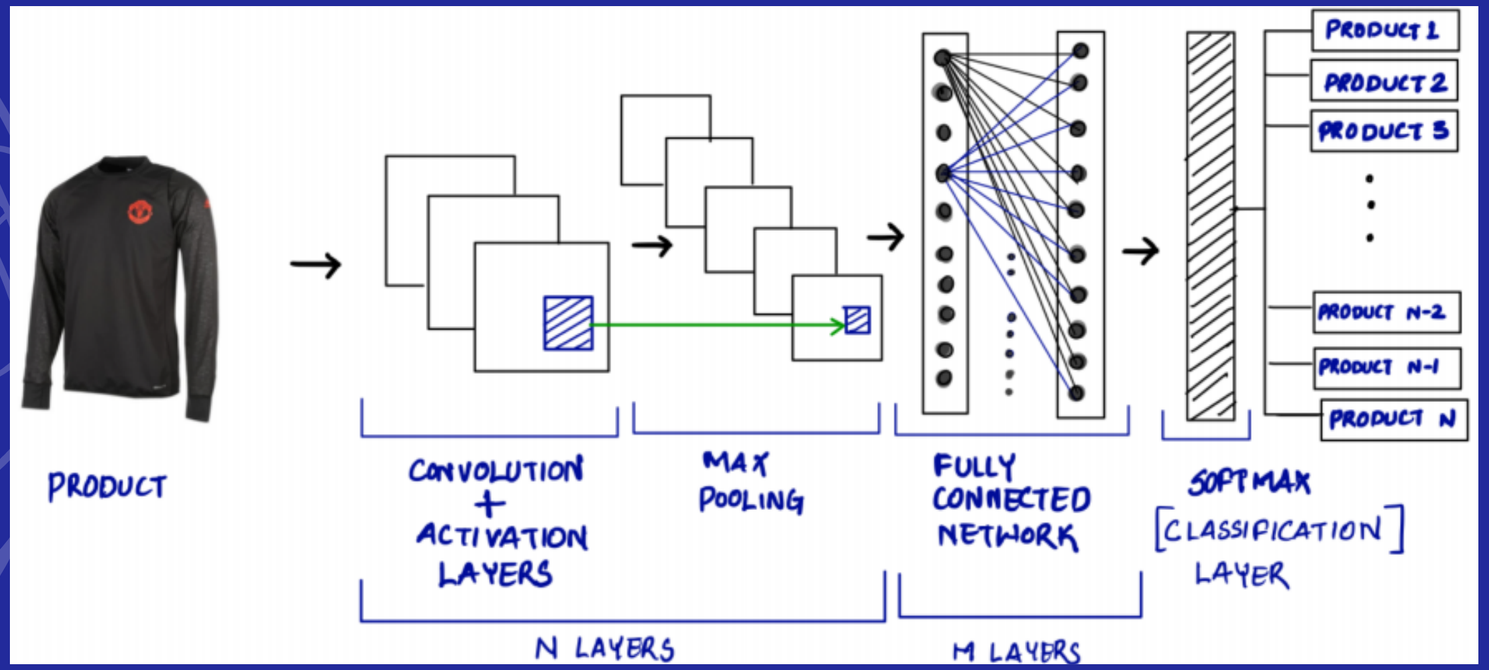
Disadvantages

- Most of the related works did not consider the problem of sparse data. The approaches consider would have lot of sparse data and did not mention how they would deal with such redundant sparse matrix. Recommendation Systems usually need a lot of data inorder to recommend appropriately. But they did not consider the problem of Cold Start.

System Design



CNN Architecture



Methodology

Step 1

Selenium is used to send a request to the website from which the data is collected (images of the product). Python uses a Selenium driver to open the version of the web browser (chrome, Firefox, safari etc.)

Step 2

Foremost all, in the beginning, we need to train our convolutional neural network with the product dataset we have collected for the project. Data cleansing the other activities is also required while making the dataset ready for the training. Once the training is done the model can be used with the system to predict the product present in the images.

Step 3

If a product is selected amongst the available products, then the system would pass the product information to the “Recommendation system” and wait for the set of products with the images that are related to the product that was selected. Here, to find the similarity relationship to the “Recommendation system” would make use of the “Cluster-network” which would store these relationships

Methodology

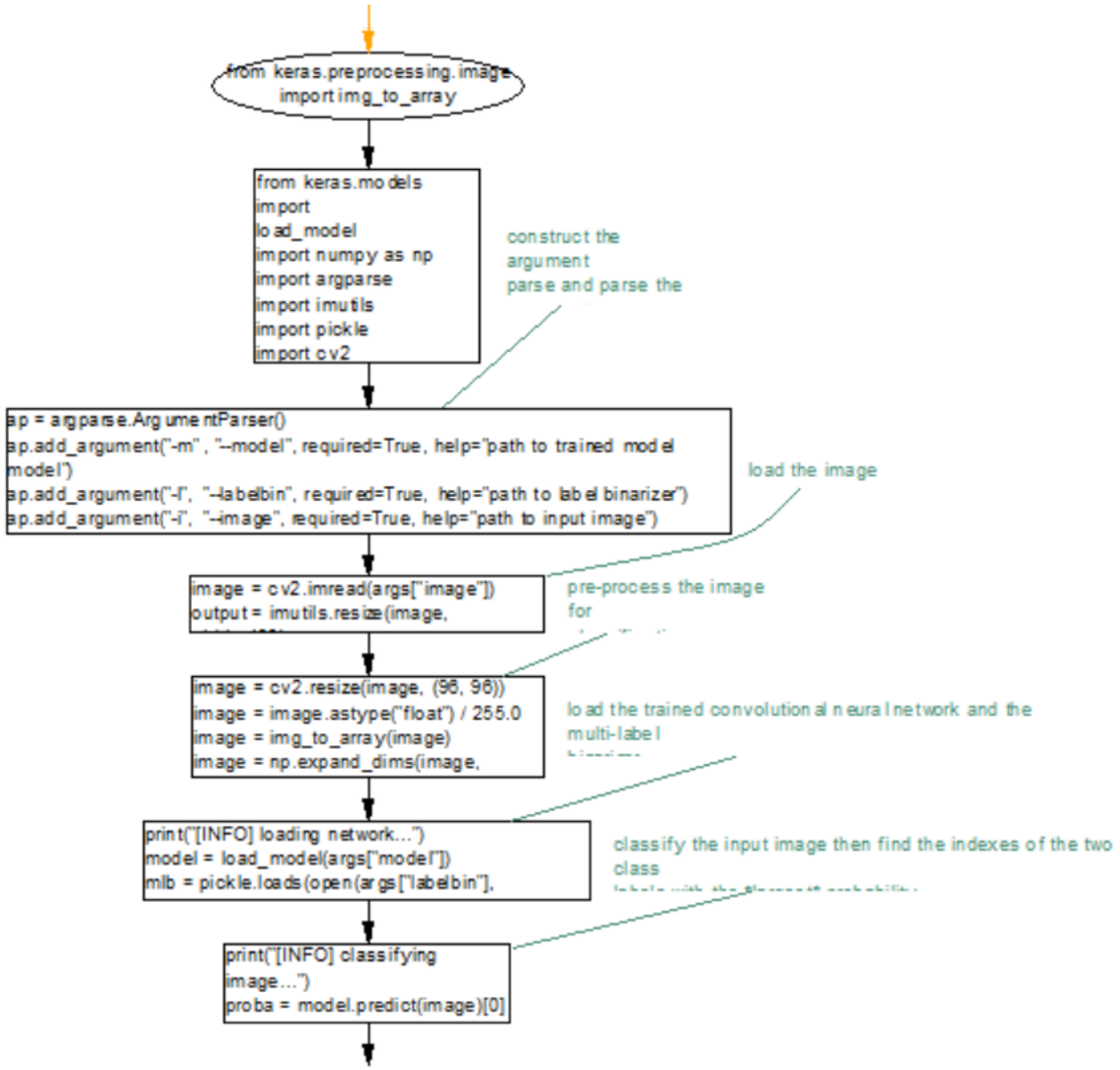
Step 4

The “Recommendation system” is a hybrid model of Collaborative filtering and Content-based recommendation. The “Recommendation system” first finds the products which users may like based on other user’s history (Collaborative filtering). Then these products are passed to the second sub-model i.e. Content-based recommendation. This model uses the output of Collaborative filtering as input and generates more recommendation which user may like

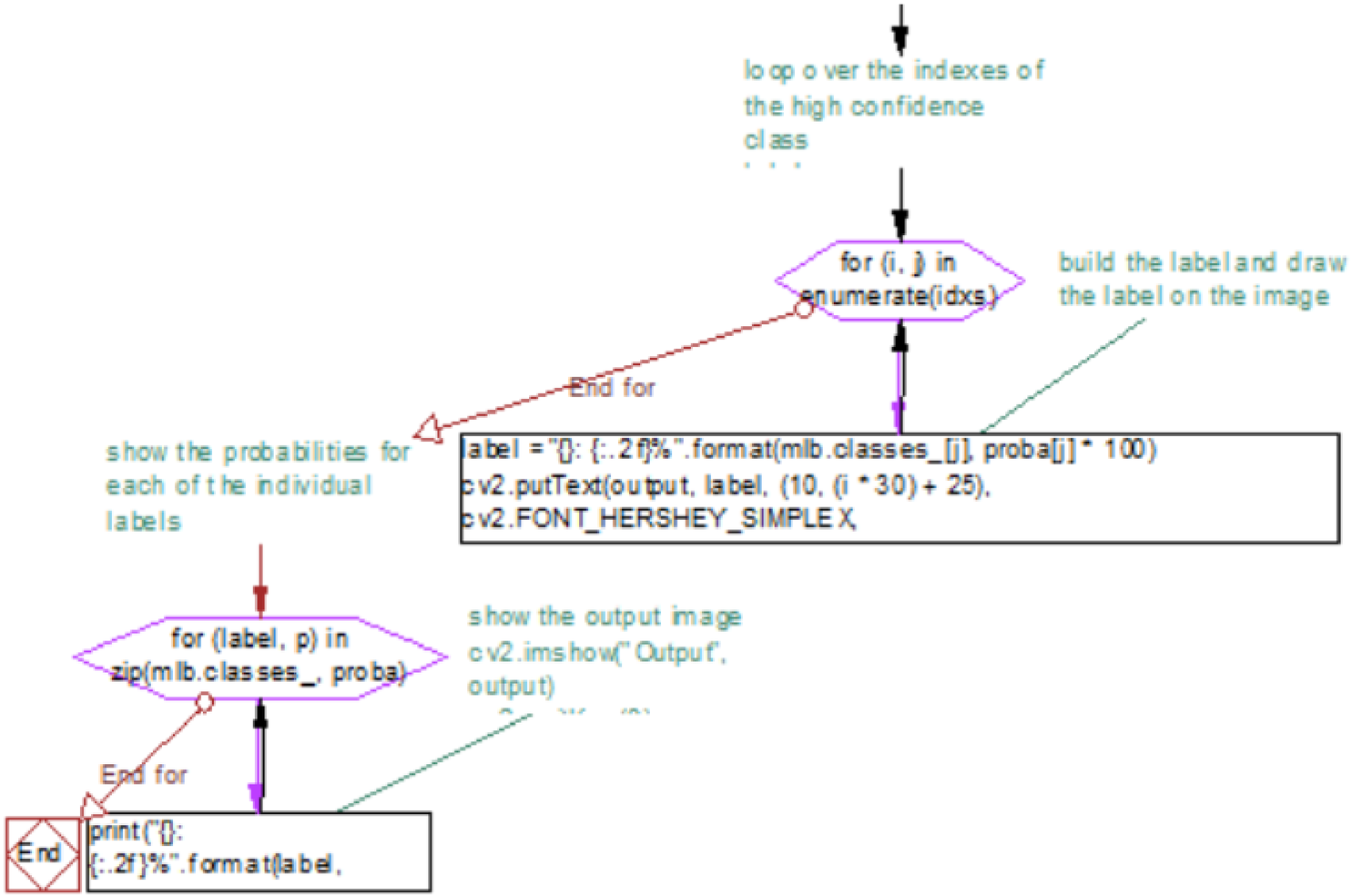
Step 5

By incorporating both techniques the model can be made more accurate. In addition to this, the model will use both Jaccard similarity and Pearson correlation coefficient to find similar users/products in the system. Since the model uses both models, it will give better recommendation accuracy when compared to other models.

FLowchart


from keras.preprocessing.image
import img_to_array
from keras.models
import
load_model
import numpy as np
import argparse
import imutils
import pickle
import cv2
construct the
argument
parse and parse the
ap = argparse.ArgumentParser()
ap.add_argument("-m", "--model", required=True, help="path to trained model
model")
ap.add_argument("-l", "--labelbin", required=True, help="path to label binarizer")
ap.add_argument("-i", "--image", required=True, help="path to input image")
load the image
image = cv2.imread(args["image"])
output = imutils.resize(image,
pre-process the image
for
image = cv2.resize(image, (96, 96))
image = image.astype("float") / 255.0
image = img_to_array(image)
image = np.expand_dims(image,
load the trained convolutional neural network and the
multi-label
print("[INFO] loading network...")
model = load_model(args["model"])
mlb = pickle.loads(open(args["labelbin"],
classify the input image then find the indexes of the two
class
print("[INFO] classifying
image...")
proba = model.predict(image)[0]

FLowchart (continued)



Conclusion

- A two-phase recommendation model is discussed, which performs classification and recommendation in respective phases.
- Machine learning models are used for classification purposes and similarity scoring is done using algorithms like Euclidean Distance and Cosine Similarity for the recommendation phase.
- In some cases, the machine learning model is integrated into a Deep learning setup for enhanced results.
- Hence, better recommendations can be provided to the user based on visual search.

Future Work

Build a recommendation engine that incorporates both the image-based and text-based methods.

Try to train our model on a larger amount of data using batches. This can potentially increase the accuracy of the model

Create a web app to deploy the model- Classification & Recommendation

References

- Farhan Ullah, Bofeng Zhang, and Rehan Ullah Khan, “Image-Based Service Recommendation System: A JPEG-Coefficient RFs Approach”,IEEE, 2020.
- Luyang Chen, Fan Yang and Heqing Yang, “Image-based Product Recommendation System with Convolutional Neural Networks.“, Stanford University cs213n reports, 2017.
- Hessel Tuinhof, Clemens Pirker and Markus Haltmeier, “Image Based Fashion Product Recommendation with Deep Learning ”, July 2018.
- Surbhi Jain and Joydip Dhar, “Image Based Search Engine Using Deep Learning.”, Proceedings of 2017 Tenth International Conference on Contemporary Computing (IC3), 10-12 August 2017.

Do you have any questions?