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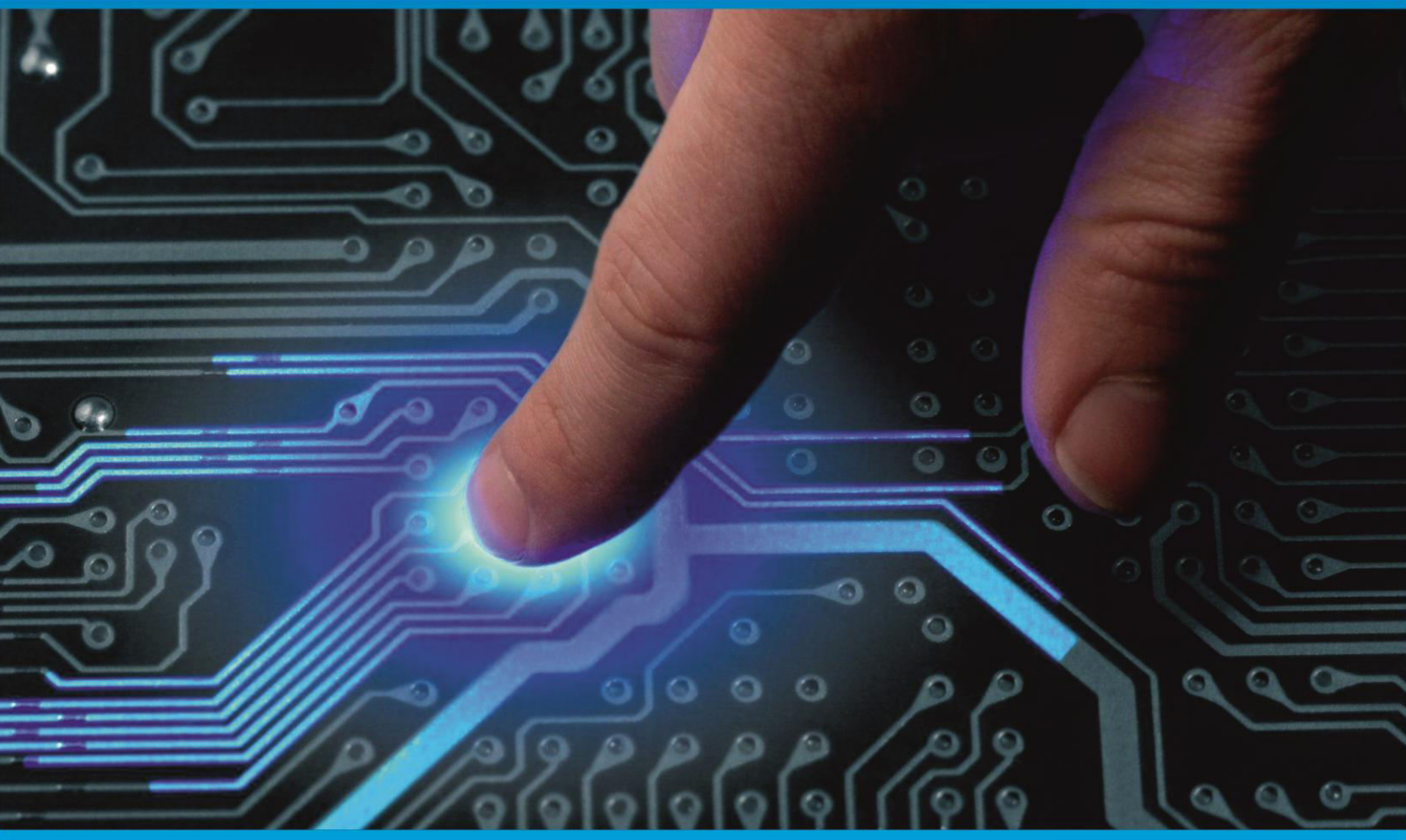

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A Web Application for Fashion Recommendation

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ABSTRACT: Online shopping search engines are still largely depend on knowledge base and use key word matching as their search strategy to find the most likely product that consumers want to buy. This is inefficient in a way that the description of products can vary a lot from the seller's side to the buyer's side. Due to the current situation caused by the Coronavirus, the majority of tasks are done online. Unlike the conventional systems that rely on user's previous purchases and history, this project aims at using an image of a product given as input by the user to generate recommendations since many-a-time people see something that they are interested in and tend to look for products that are similar to that.We develop a two-stage deep learning framework that recommends fashion images based on input images of similar style. For that purpose, a neural network classifier ResNet50 is used as a data-driven, visually-aware feature extractor. The latter then serves as input for similarity-based recommendations using a nearest neighbor algorithm KNN.

KEYWORDS: recommendation, deep learning system , feature extractor.

I. INTRODUCTION

People are compelled to gravitate towards more visually attractive objects. Peoples' inclination towards fashion has led to the growth of this industry over time. The retail industry is investing in referral systems because they are used in a variety of areas. To support their business with state-of-the-art technology Fashion has existed for centuries and will continue to exist. Expect to see a lot of it in the coming days. According to digital analytics firm eMarketer online retail sales will continue to grow, accounting for more than 12% of global sales by 2019. According to the Nielsen Global Connected Commerce Survey (2015)1, 63 percent of respondents who bought or purchased travel products or services in the previous six months said they searched for the product online.

A recommendation system, also known as a recommendation engine, is a type of information system that displays only the most relevant results to the user by removing unnecessary data using automatic or computer algorithms. Search engines, social brands, research article recommendations, movies, and other applications use recommender systems. Previous studies show that recommendation tools help consumers make better decisions, reduce search effort, and find the best prices [1]. Specific questioning in customer surveys is one way to derive information about client preferences. However, this is not always achievable and consumer responses may or may not be accurate or sufficient in defining preferences. In this paper, we use an alternative data-driven method in which customer preferences are automatically obtained from available customer data. More specifically, we focus on fashion products and build a system that returns a list of similar style recommendations based on a single input image.

II. LITERATURE REVIEW

This section presents the existing methods and relevant approaches which are surveyed as follows.

Recommendation technology was first presented in the mid-90s during the online internet age. [2] CRESA was proposed, which integrated visual features, textual attributes, and the user's visual attention to create a clothing profile and generate recommendations. Fashion publications were used.To produce recommendations, use images. To learn, multiple features from the photos were retrievedthe items, such as cloth, collar, sleeves, and so forth, in order to provide recommendations,in order to reach the deadline,taking into account the various needs of different users, an intelligent apparel recommender system is being researched.the aesthetic and fashion ideals to produce clothing suggestions, client ratings, andClothing was used in the. Weather conditions were a factor in the history of clothing and

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accessoriestaken into account when making suggestions.In the field of image recommendation,[3] tends to recommend images using Tuned perceptualretrieval(PR), complementary nearest neighbor consensus(CNNC), Gaussian mixture models (GMM), Markov chain(MCL), and Texture agnostic retrieval (TAR) etc. CNNC,GMM, TAR, and PR are easy to train, but CNNC and GMMare hard to test while PR, GMM, and TAR are hard to generalize.Also, since data consists of images, the neural network should be a worth trying method.The focus of paper is also on learning similarity using CNN. However, it focuses on the situation where a multiproduct is contained in a single image. We assume that users are looking for a product in our project, hence the graphic will only contain one product.For text-based image recovery, Y. Bai et al. (2013) presented deep neural multi-task networks. From 2006, Y. Bengio et al., (2013) and Y. LeCun et al., (2015) proposed learning of hierarchical and efficient representations to enhance distinct computer vision activities, inspired by profound and distributed neural network biological design. Deep learning approaches are based on the compositional construction of a very sophisticated fitting function using some fundamental nonlinear neural neurons.In [4] Outfit Recommender System using KNN Algorithm paper the proposed system will recommend the outfits to the user based on the earlier user ratings. The user ratings are collected and are classified based on KNN algorithm.They have used K-nearest neighbor algorithm to detect the ratings of the user. Every time when the user gives ratings, the average value with the previous ratings is calculated and stored and is used to detect the next nearest ratings in the product specified.Euclidean distance function is used to find the distance between nodes. Admin has to add the outfit, he/she can see user ratings and total number of users present in the system. Any new product that has to be uploaded in the recommender system should be done by the admin.In [5] An Intelligent Personalized Fashion Recommendation Systemthe authors Cristiana Stan, Irina Mocanu proposed a method to recommend the products based on a clothing input image, recommendation is done using scores.In[6] Image-based Recommendation System with Convolutional Neural the authors Luyang Chen, Fan Yang proposed a method to recognize and recommend using the same model by utilizing different layers of the AlexNet model. In [7] Inverse Document Frequency-Weighted Word2Vec model to recommend apparelsthe authors PriyankaMeel , AgnivaGoswami proposed a method to recommend apparel based on title and description of the product using IDF weighted Word2Vec to calculate the recommendations. In [8] Naive Bayesian Network for Automated, Fashion Personal Stylistthe authors N. Strain and J. I. Olszewska proposed a method to recommend products using Naïve Bayesian Network. In [9] Image-Based Fashion Product Recommendation with Deep Learningthe authors HesselTuinhof , Clemens Pirker, and Markus Haltmeier proposed a method to recommend products using CNN and KNN. In [10] CFRS: A Trends-Driven Collaborative Fashion Recommendation Systemthe authors Maria Anastassia Stefani, VassiliosStefanis, John Garofalakis proposed a system which recommends products based on trend score. In [11] Clothing image recognition based on multiple features using deep neuralthe authors S Shubathra , S Santhoshkumar compared different recommendation systems built using multi-layer perceptron (MLP), convolutional neural network (CNN) and extreme learning machine (ELM). In [12] Content-based Clothing Recommender System using Deep Neural Networkthe authors ChitraDadkhah, LorenceDaryoush proposed a model that recommends apparels based on users data.Convolution neural network is used to detect categories, product gender, and to extract features from an image.The similarity between the extracted feature vectors of the images is calculated using the cosine similarity.

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III. SYSTEM ARCHITECTURE AND PROPOSED SYSTEM

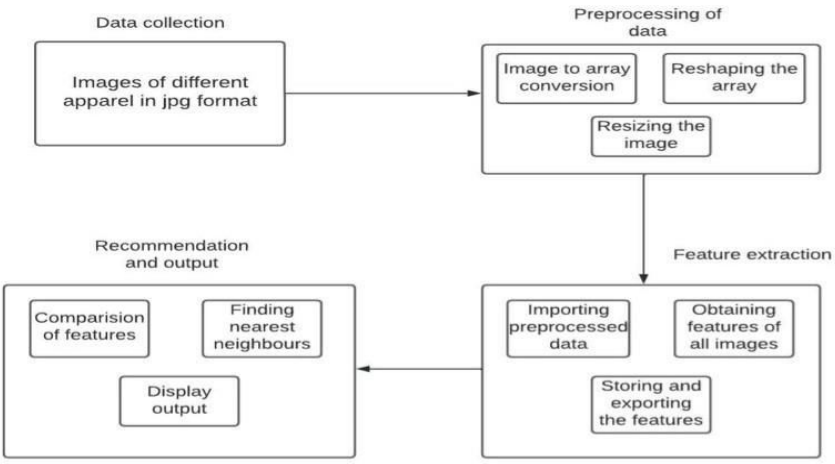

Figure 1: System Architecture

In the proposed system we use the feature of deep learning, neural network (ResNet50) to extract the features of different clothes.In our system, we will be using the output of recognition model as input to KNN model that will find the closest neighbors to a given query image that will serve as recommendation, our system will include ResNet50 as recognition model and KNN as recommendation model.

"ResNet50" provides the detection and extraction of features of different apparels for the given input. ResNet50 uses CNN algorithm for feature extraction, it contains 48 convolution layers, 1 Max Pool and 1 Average Pool layer. KNN(K nearest neighbor) is used for recommendation.

IV. MODULEDESCRIPTION

The module description of the system architecture are:

1. **Loading the dataset** - The dataset that we are going to use in this project is Fashion Product Images dataset from kaggle. This dataset contains around 45,000 images. This dataset is loaded into system for extraction of features.

2. **Pre-Processing** - This module handles various transformations that have to be applied on the images before feature extraction. The resolution of each image are scaled appropriately. The steps that are carried out in pre-processing are:
   - Conversion of Image to array
   - Expanding dimensions of an array
   - Normalizing the array

3. **Loading the model** - The trained model is loaded into the application for apparel detection and feature extraction.

4. **Extracting features** - Feature extraction is a process where we extract all the different features of an image. This is done using ResNet50 which consists of 48 convolution layers, 1 Max Pool and 1 Average Pool layer. ResNets are being implemented here to create state-of-the-art systems. The principle on which ResNets work is to build a deepernetworks compared to other plain networks and simultaneously find a optimized number of layers to negate the vanishing gradient problem.

5. **Recommendation** - The recommendation is done using KNN (K nearest neighbor). Where we find the nearest neighbors using Euclidian distance metrics. K-Nearest Neighbor is one of the simplest Machine Learning algorithms based on Supervised Learning technique. K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new dataappears then it can be easily classified into a well suited category.

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V. PSEUDO CODE

Step 1: Start.
Step 2: Load Dataset.
Step 3: Preprocess the images by reducing the resolution and creating multiple batches.
Step 4: Extract features using ResNet50.
Step 5: Store the extracted features in a file using pickle.
Step 6: Calculate the Euclidean distance between features of input image and features of dataset images.
Step 7: The nearest neighbors(images) are displayed to the user.
Step 8: End.

VI. RESULTS

It is a collection of five images which is closest to the input.The result is given on the basis of KNN algorithm we use the Euclidean distance formula to find the five similar images to the user input. The system first extracts the features of all the images present in the dataset. When user provides the input image, the system extracts the features of the input image and recommends using KNN.

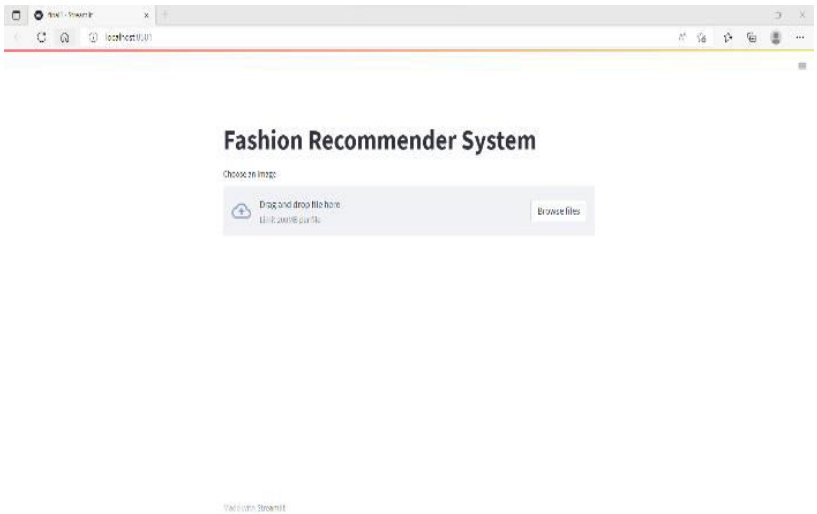

Figure 2: Web application of fashion recommender system

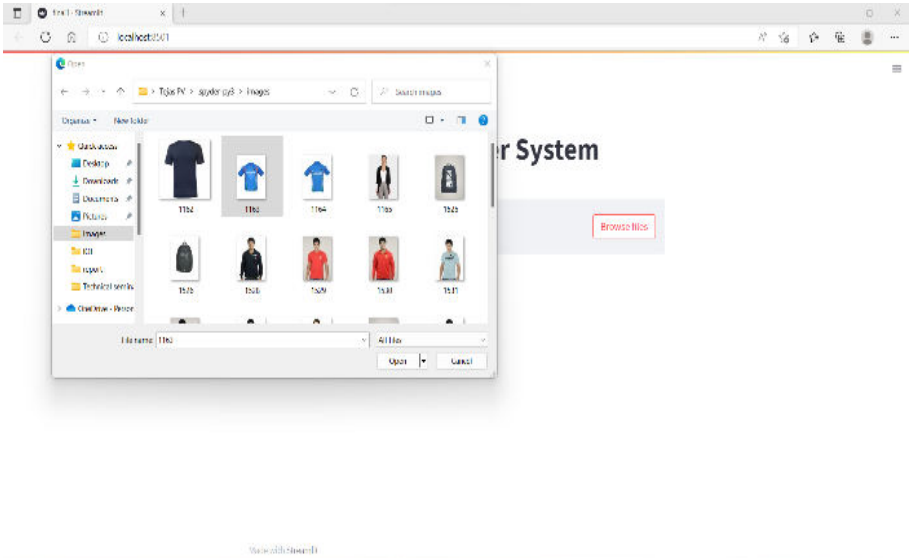

Figure 3: Selecting an input image

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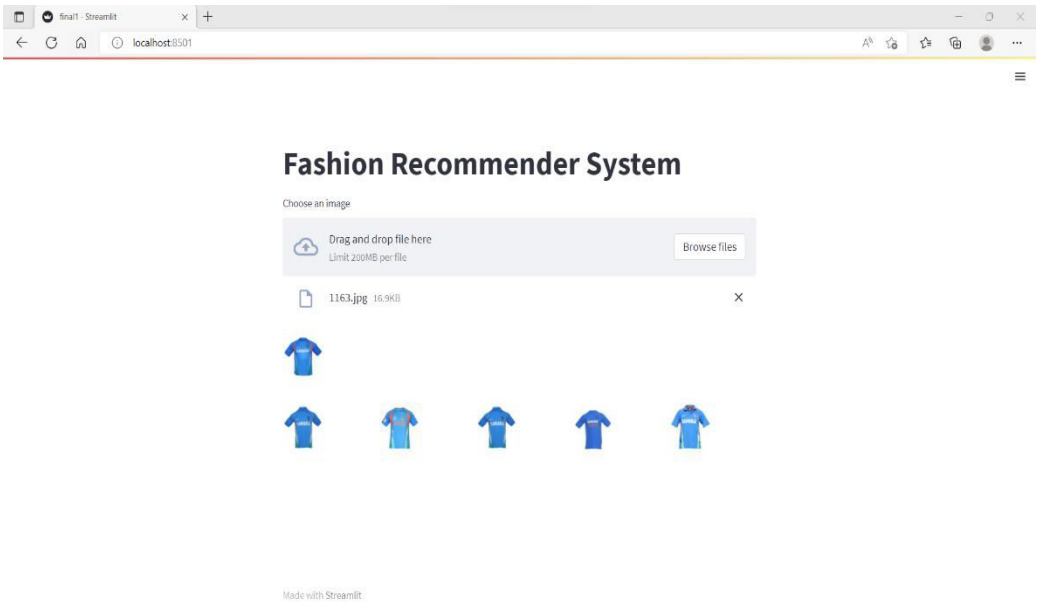

Figure 4: Recommendation result

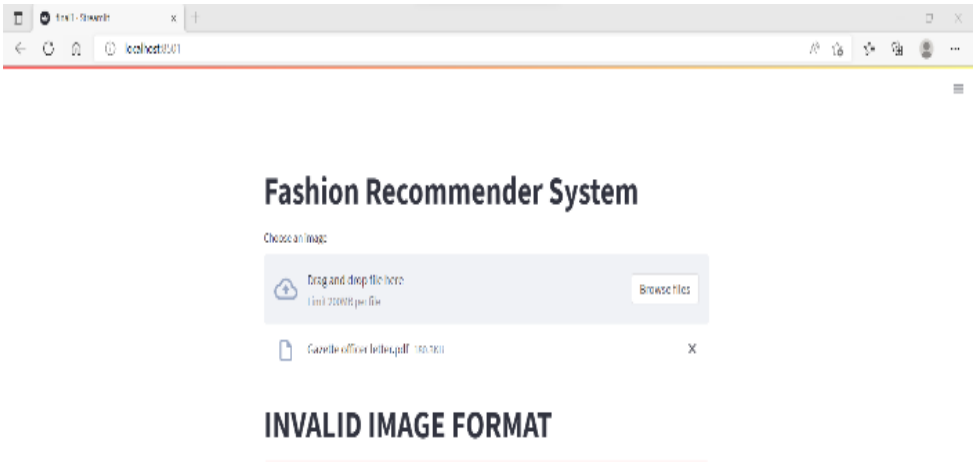

Figure 5: Invalid input

VII. CONCLUSION

We have introduced a visually aware, data-driven and relatively simple yet effective recommendation system for fashion product images. The proposed two-stage approach uses atrain a neural network model (ResNet50) on fashion images in order to extract the feature maps associated with different clothing items. After the first step, we used those feature maps as input to KNN model that returns the nearest neighbour to a given clothing image as clothing recommendations. For example, it can be used in e-commerce by allowing customers to upload a specific fashion image and then offer similar items based on the textures and category type properties of the customer's uploaded image. Furthermore, generalization to other domains, e.g., music recommendation based on raw music data, movie recommendation based on genre and reviews, makes sense, but requires further investigation. Several interesting extensions of our approach are possible. First, it would be promising to integrate two separate training phases into a single one and provide comprehensive fashion product recommendations based on deep learning. In addition, hybrid approaches combining image-based and content-based systems can be implemented. Finally, it is important to evaluate the impact of our image-based approach to customers compared to other recommendation systems through customer surveys.

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