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Fashion Recommendation System and Virtual Trial Room

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Abstract: ***The fashion industry has recently witnessed massive growth in the clothing and textile industries. In e-commerce marketplaces, where there are many options accessible, relevant product material or information can be filtered, arranged, and efficiently communicated to users.***
As the standard of living increased, people's attention began to shift towards fashion, which is considered to be a common form of aesthetic expression. The development of the fashion business over time has been influenced by this human tendency. The abundance of clothing alternatives on e-commerce sites, however, has made it more difficult for customers to select the ideal outfit. In this article, we describe a personalised fashion recommender system that generates suggestions for the user based on input.
In order to enhance the consumer shopping experience, we developed a software application that combines a recommender system with the OpenCV and TensorFlow technologies. This will enable customers to virtually try on clothing without having to wait in a large queue. The application uses OpenCV to map the clothes onto the customer's body, the customer can then have a look at it and decide whether to buy the clothes or not. According to the results, there is no need to visit trial rooms because the mapping is done precisely onto the user's body. Thus, our app offers a quick, simple, and accurate method of trying on clothing, and we think that will help shape the retail sector.

I. INTRODUCTION

A machine learning-based fashion suggestion system will work similarly to highly personalise online purchasing suggestions.
People outside appearances serve as a kind of symbol, communicating their inner sentiments through their clothing. It conveys information about their interests, perspective on the world, personality, professions, and social position. As a result, it is thought that clothing affects how one appears from the outside and may be used to communicate nonverbally.
User response forecasting is included in a complete collection of web applications known as a recommendation programme. By selecting helpful items from a huge collection of resources, a recommendation system seeks to give the user the most pertinent and accurate information possible.
The recommendation engines are able to spot data patterns in the data set by analysing consumer preferences and providing results that are pertinent to their needs and interests.
A large crowd of people shopping for clothes implies a long line for the trial room. This means a large clothing wait would extend the time spent shopping from 15 minutes to close to an hour. As a result of the lengthy lines, customers must bring all of the clothing they wish to try on at once to the trial room since if they leave, they will have to re-join the line. Also one has to try on several clothes in the trail room which can be time consuming as well. It might be tiring to continuously change clothing and attempt different combinations. The whole shopping experience is ruined by this issue. To address this issue, retail malls developed the concept of virtual mirrors.
A virtual trial room is the answer we came up with. Customers may digitally try on clothing using a virtual trial room application, eliminating the need to physically visit a trial room. The user signs in and chooses the clothing items they want to try on. The user may also arrange the clothing in the catalogue according to the event and gender for which they require the items. The consumer then uses the programme to digitally try the clothing on. Using OpenCV, which first recognises the customer's body and then maps the garments on to it, the mapping of the clothes is carried out. Thus, the customer can try on as many outfits as they like without having to constantly change or wait in long lines. Consequently, the virtual trial room makes it simple to try on new clothes and gives the user more options to try on in less time.

A. *Motivation*

We were inspired by the straightforward inquiry, "What is Fashion?" How can we communicate our inherent understanding of what kinds of clothing "work" (or "look well") to computers?
We found this subject intriguing since fashion is a dynamic industry. The outcomes can vary depending on what is popular right now.
In order to develop a simple potential workflow for a fashion recommender system that suggests people's outfits depending on their selections, we proposed and executed it. Later we came up with another problem regarding to fashion that long waiting's for trial room so along with recommendation system we built a virtual trial room also.

II. LITERATURE SURVEY

The paper is written by M.Saravanan, Rakhi Thayyil and Shwetha Narayanam they wrote the model paper which prediction using mobile call detail records of suspects and victims to understand their presence in crime. It records of cell tower near crime scene have been analysed to track the real perpetrators. Most of the data mining technique are used by them as prediction techniques these techniques are clustering, classification, pattern mining, event extraction from textual documents, nearest neighbour method, etc.
The paper is written by Xinyu Chen, Youngwoon Cho, and Suk Young jang they wrote the model paper which prediction using Twitter sentiment and weather. They tell that when statistical analysis is applied to unstructured data Twitter reveals valuable insights. In this paper, they predict the time and location in which specific type of crime will occur. They only take the previous weather data and also at this weather which type of crime will be occur according to this data they will be able to predict the crime with very low accuracy.
To achieve the Virtual Trial Room task the author uses an encoder decoder architecture along with a refinement network. Wang et al proposed a system which works on Geometric Matching Module which would align the input cloth on the person representation. Using their paper author Rogge et al wants to depict their work in Monocular Pose Reconstruction which would be used in Augmented Reality Clothing. The author proposes the use of a marked suit for pose reconstruction and Relevance Vector Machine regression along with image descriptors that include neighborhood configurations of visible colored markers and image gradient orientations.
Author Andriluka et al introduces a novel benchmark "MPII Human Pose" to evaluate various human pose estimation models. Carreira et al presents Iterative Error Feedback system for the purpose of 2-D human pose estimation.

A. *Technology Used*

1) Python: Python is an interpreter-based high-level general-purpose programming language. The design philosophy of Python heavily emphasises code readability and utilises whitespace. Its language features and object-oriented approach are designed to help programmers write clear, understandable code for both small and large projects. Dynamic typing in Python supports all programming paradigms, including procedural, object-oriented, and functional programming.
2) PyCharm: The Python programming language is utilised with PyCharm, an Integrated Development Environment (IDE). In addition to supporting Django web development, it offers code analysis, a graphical debugger, an integrated unit tester, integration with version control systems, and more. The JetBrains firm in the Czech Republic creates PyCharm.
3) Machine Learning: Machine learning is the scientific study of the statistical models and methods that computer systems use to complete a task effectively without the need of explicit instructions, relying instead on patterns and inference. It is regarded as a component of artificial intelligence. Machine learning algorithms build a mathematical model using sample data known as "training data" in order to provide predictions or judgements without being explicitly trained. The term "picture processing" describes the use of computer techniques for handling digital images.
4) Image Processing: In computer science, digital image processing refers to the use of computer techniques to the image processing of digital images.
5) OpenCV: A collection of programming functions, known as OpenCV (Open Source Computer Vision collection), is mostly used for real-time computer vision. It was first created by Intel and afterwards sponsored by Willow Garage, Itseez, and Intel (which eventually purchased Itseez).
6) MediaPipe: It is a framework that allows you to construct pre-built processing pipelines to generate rapid, engaging, and valuable output for your users, MediaPipe allows you to deploy machine learning (ML) solutions to your apps.

B. *Project Scope*

The project's goal is to create a model that can make fashion recommendations simply by glancing at its photograph. When a model accepts a photograph, she first assesses whether or not it features a fashion item before making a recommendation. This project's primary goal is to

1) To identify the fashion type of the given input image.
2) If the given fashion image is valid then a similar set of clothing will be recommended.
3) Retrieving similar search query products from different e-commerce websites.
4) Reduce the waiting time outside the trial rooms.

III. SYSTEM OVERVIEW AND DESIGN

A. *Various Phases of the Application*

1) Color detection: The deep learning CNN model used to identify the kind of apparel in the input image was built using the model architecture listed below. The numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 designate pictures of clothing in the hues "black," "blue," "brown," "green," "grey," "khaki," "marron," "orange," "pink," "red," "white," and "yellow."
2) Clothing Detection: The deep learning CNN model for identifying the kind of apparel in a picture presented to the model was built using the model architecture listed below.
3) Fashion Recommendation Algorithm: The outfit will be locally saved on the disk following the detection of color and type. The wardrobe's clothing is next subjected to the fashion suggestion algorithm.
4) Virtual Trial Room: These part of the application uses PoseDetector library for finding a pose in a supplied image. Make choices available so that clothes can be tried virtually by scaling up and scaling down the sizes according to human figure.

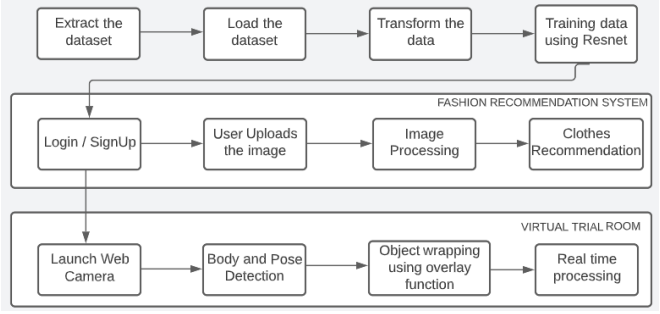

Figure.1: Working of application

IV. METHODOLOGY

A. *Application Working*

Owing to the fashion recommendation and long queues for the trial room and the problems regarding to it we came up with the solution of building an application to overcome these problems. The application has the following features:-
a. The user first signup or logins into the application using his/her credentials.
b. Once logged in the user is presented with the option for recommendation system or virtual trial room.
c. If the user selects for recommendation system they have to upload the image of clothes of which they want similar recommendations.
d. After uploading, the application shows the top five similar products to the uploaded image.
e. If the user selects for Virtual Trial room, they are asked for their gender and according to it the fashion choices.
f. After selecting the choices the system camera launches and the user can try on various clothes and select fashion sense.

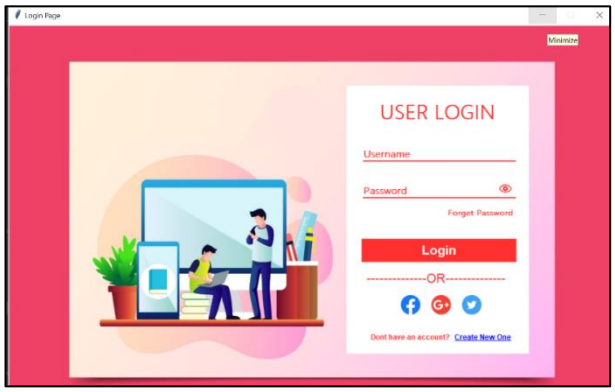

Figure 2: SignUp/Login Page

Figure 3: Welcome Screen

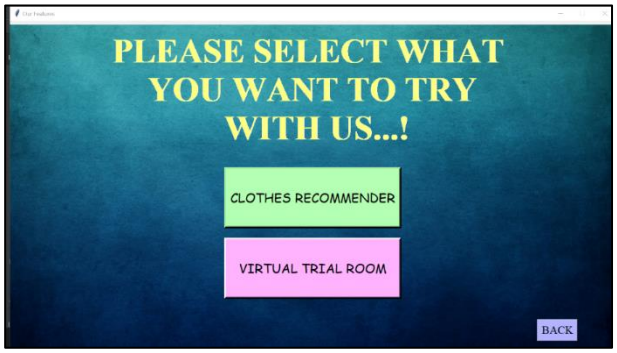

Figure 4: Selection Screen

B. Dataset

The clothing we selected for our application have to have a plain background and just one person visible to the camera. From Kaggle, we downloaded the dataset of various fashion products. The dataset includes 44000 recently trained photos for the project.

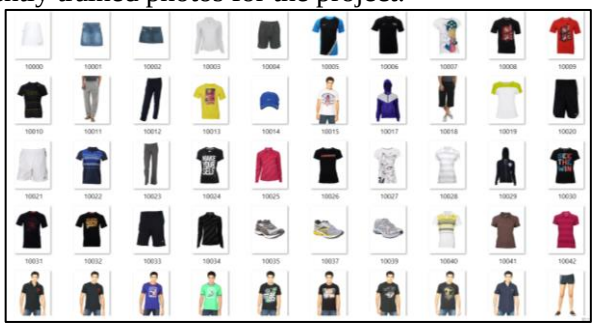
Figure 5: Dataset

C. Fashion Recommendation System

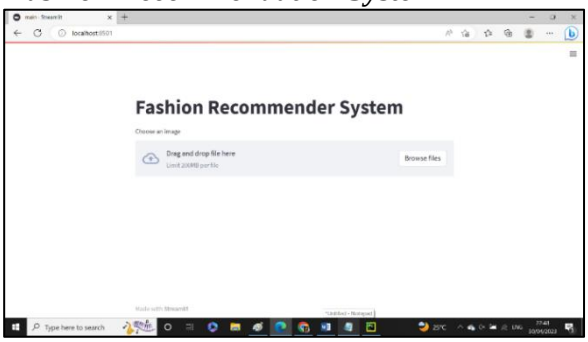

Figure 6: Fashion Recommendation System

D. Virtual Trial Room

Figure 7: Male Virtual Trial Room

Figure 8: Female Virtual Trial Room

E. Mapping

For the particular criteria, we tested a variety of algorithm designs and selected the most effective one. Here, we will describe the most efficient method.

a) Pose Estimation :

The points of interest (POI) in the image must first be located in order to map a particular set of clothing items onto the user. The shoulders and hips would be our POIs for apparel on the upper part of the body. In order to locate them, we turn to the pose estimation issue in deep learning, which identifies a person's skeletal system key points in an image. We choose the appropriate data from these key places (such as hips and shoulders for the upper body).

It consists of a series of convolutions that repeatedly create 2D belief maps to identify each body part. The belief maps increase confidence for position detection across each portion with each iteration of the stage. And later on, give improved estimations for localisation of each component or important point.

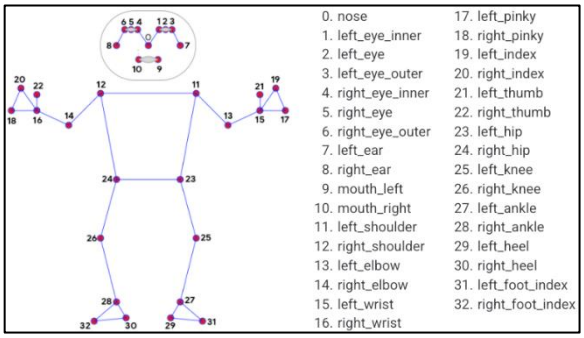

Figure 9: Pose Detector

F. Algorithms

1) CNN (Convolutional Neural Network) - CNN is a subset of the several artificial neural network models that are employed for diverse purposes and data sets. A CNN is a particular type of network design for deep learning algorithms that is utilised for tasks like image recognition and pixel data processing.
2) KNN (K-Nearest Neighbor) - KNN uses proximity to classify or predict how a set of individual data points will be arranged. Although it can be applied to classification or regression problems, it is typically used as a classification algorithm because it relies on the idea that similar points can be found close to one another.
3) Bayesian Network - Bayesian networks use probability theory for prediction and anomaly detection in addition to being created from a probability distribution, making them probabilistic in nature.

G. System Requirements

Python: Python 3.9 and higher version
Libraries: NumPy, Tensorflow, Pickle, Streamlit, Resnet, OpenCV, Pytorch, etc.
Operating System: Windows

H. Hardware Requirements

Processor-Intel(R) Core(TM) i5-6440HQ CPU @ 2.60GHz 2.59 GHz 64-bit operating system, x64-based processor
1) RAM: 4 GB or more.
2) HDD: 20 GB of available space or more.
3) Display: Dual XGA (1024 x 768) or higher resolution monitors.
4) Camera: A detachable webcam.

V. RESULT

The application was then tested out on people to see how effective the mapping is done.

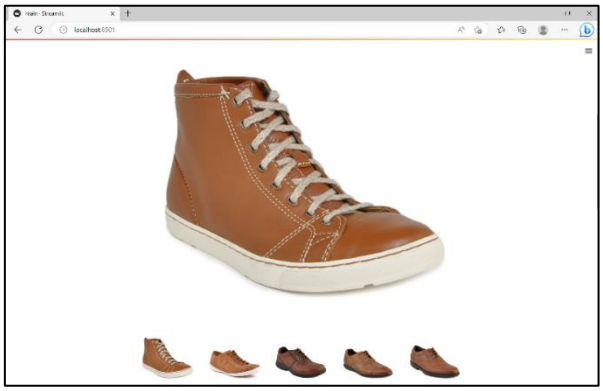
Figure 10: Output of Recommendation System

The above figure shows the output obtained with recommendation system. For an instance, a shoe photo was uploaded and similar to it top five out of the dataset are recommended below down.

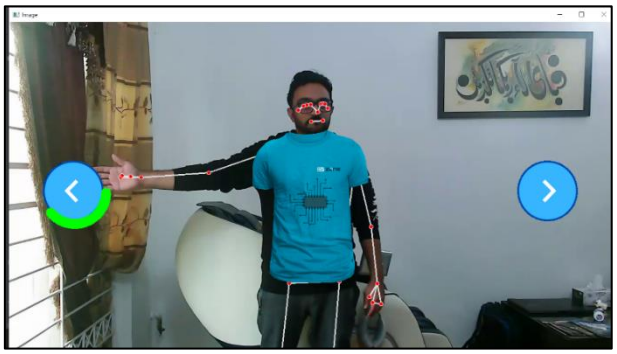
Figure 11: Output of Virtual Trial Room-1

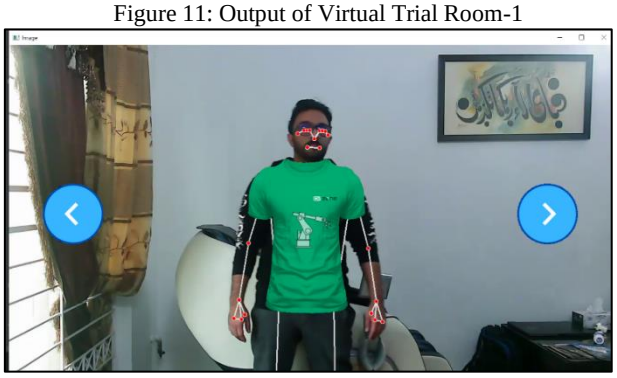
Figure 12: Output of Virtual Trial Room-1

This is what the virtual trial room produced. The array of images in the dataset advances by i+1 positions when a user raises their right hand, and by i-1 positions when they raise their left hand (where i is the current position of the image in the array). PoseDetector library manages all of these gesture moments.

VII. FUTURE ENHANCEMENT

At present the application is only built for customers to try on virtual clothes. We plan to implement another application which will be made especially for the shopkeeper or the owner. This application will provide the owner with the daily statistics as to how many people tried the clothes, how many ended up buying it, which clothes should be kept more etc.

VII. CONCLUSION

Recommendation Systems and Virtual trial rooms are a stepping stone towards revolutionizing the shopping industry. In this paper we presented a method of how we can recommend similar clothes and how clothes can be mapped onto a customer's body effectively using the technologies of TensorFlow and open CV. This prevents the customer from standing in long queues and allows him/her to try on various combinations of clothes easily and without any hassle. Results obtained shows that the mapping is done accurately and can be used as a good substitute to actually trying on clothes. Recommendation System helps users to save their time in searching for similar clothes in a huge dump of clothes or scrolling online websites. Fashion Recommendation System and Virtual Trial Rooms are the future of the shopping industry, as time goes on people become more and more busy and thus won't have time to search clothes and stand in long queues. It is in situations like these that the application acts as a relief and provides a quick getaway for the customer. Our application will change the retail industry and pave a wave for a shopping culture.

VI. ACKNOWLEDGMENT

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VII. REFERENCES

1) Mohamed Elleuch, Anis Mezghani, Mariem Khemakhem, Monji Kherallah "Clothing Classification using Deep CNN Architecture based on Transfer Learning" ,2021 DOI:10.1007/978-3-030-49336-3_24
2) Saurabh Gupta, Siddartha Agarwal, Apoorve Dave. "Apparel Classifier and Recommender using Deep Learning." (2015).
3) Bossard, Lukas, Matthias Dantone, Christian Leistner, Christian Wengert, Till Quack and Luc Van Gool.
4) "Apparel Classification with Style." ACCV (2012).
5) Krizhevsky, Alex, Ilya Sutskever and Geoffrey E. Hinton. "ImageNet classification with deep convolutional neural networks." Communications of the ACM 60 (2012): 84 - 90.
6) https://www.researchgate.net/publication/342325776_A_Virtual_Trial_Room_using_Pose_Estimation_and_Homography
7) https://www.kaggle.com/datasets/agrigorev/clothing-dataset-full
8) Alexander Toshev, Christian Szegedy, "DeepPose: Human Pose Estimation via Deep Neural Networks," pp. 1-8. [Online]. Available: http://openaccess.thecvf.com/content_cvpr_2014/papers/Toshev_DeepPose_Human_Pose_2014_CVPR_paper.pdf
9) Shih-En Wei, Varun Ramakrishna, Takeo Kanade, Yaser Sheikh, "Convolutional Pose Machines," pp. 1-9, April 2016. [Online]. Available: https://arxiv.org/pdf/1602.00134.pdf
10) Frédéric Cordier, WonSook Lee, HyeWon Seo, Nadia Magnenat-Thalmann, "Virtual-Try-On on the Web," pp. 1-11, May 2001. [Online]. Available: https://pdfs.semanticscholar.org/bbc0/39122b37934488c32b0fe713e3ed1a6d36d6.pdf