Personalized Outfit Recommendation System

Kaavish Report
presented to the academic faculty
by

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Dedication

For ammi, abbu, and pappu.

Acknowledgements

We want to thank the CS faculty and ...

Abstract

Abstract goes here

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1. Introduction

1.1 Problem Statement

Domain: Fashion e-commerce.

Facts and Figures:

1. Personalized shopping is the future of commerce. It is reported that on average today, at least 27% of retail site revenue in fashion, which totals to around $870 million, comes from personalized recommendations systems. [1]

2. In 2013, over 85% of Amazon sales revenue came through personalized recommendations. [2]

3. Despite all its potential, the Pakistani fashion industry is lagging behind in keeping up with such advances in personalized recommendation systems. [3]

Statement: One of the biggest problems in fashion retail is product curation. Retailers have to spend a large amount of time to come up with different combinations of their products that would as a whole, go well as an outfit, and even then, the options aren't really personalized. A customer buys a new shirt, brings it home, and hangs it up, only to find that the shirt stays in their closet for weeks because they're not sure what to pair it with. This also means a loss in conversion rates and potential revenue at the side of the retailer.

1.2 Proposed Solution

As already described, fashion retailers spend a lot of time manually curating their products, and according to a report published by emerj.com (database of reports on AI technology), at least 40% of potential revenues are lost because of poor outfit

recommendations. We see a business opportunity in this problem, and so the idea behind the project is to solve it by addressing the key issue, product curation, by providing expert recommendations across different clothing items to the end-consumer at the point of sale or as a standalone service.

Our solution is a web application that would allow shoppers to visually search the catalogue of e-commerce stores by uploading pictures of outfits they like or taking a photo with their phone's camera. Using Computer Vision, the outfit would be broken down into its constituent parts (eg. shirt, pants, belt, sneakers) and identical and/or visually similar items from the store would be shown at the same place. This would allow shoppers to quickly and conveniently shop for items they see on social media, significantly increasing conversion rate.

1.3 Intended User

According to a recent study, millennials and Generation Z are the most coveted demographics for e-commerce stores. They do 60% of their shopping online [4] and make more apparel purchases than other generations [5]. On average, they spend three hours per day on their phones, mostly on social media platforms such as Facebook and Instagram, constantly consuming and interacting with visual content.

Our intended user are these audiences, and in order to appeal to them, it is essential for e-commerce stores to change the way shoppers interact with their stores. When someone sees their favourite Instagram influencer wearing an outfit that they want, searching for each piece of that outfit via text is not only cumbersome, it is inefficient and unlikely to yield accurate results. In order to allow customers to shop the same way they interact with social media i.e. via images, fashion e-commerce stores are increasingly looking to Artificial Intelligence and Computer Vision powered solutions.

To ensure practicality and applicability, we have been gathering and incorporating feedback from HU faculty as well as industry professionals from Love For Data, Daraz.pk, and PCSIR.

Our application would primarily provide two sets of recommendations when an item is being viewed by a user:

1. Items **visually similar** (and of the same type eg. shirt for shirt) to that currently being viewed, increasing the likelihood that shoppers will find an item they like that is available in their size and at an agreeable price point.

2. Items **visually complementary** to that being viewed, allowing users to "Complete the Look". This allows stores to upsell and increase Average Order Value

(AOV).

In addition, we will also actively look into personalized fashion recommendations based on user purchase history and general trends.

1.4 Key Challenges

A few key challenges that we have identified to foresee in this project are listed below, along with possible ways to address them.

1. We require a dedicated machine in one of the University's labs for hosting our web-server and preferably also a web hosting service. A possible remedy is to take use of local hosting. However, it must be noted that this would increase difficulty in collaborating.

2. Similarly, unavailability of a GPU can hinder the precision of the recommendation system, which would be created entirely from scratch. A simple remedy is to resort to cloud-based services for GPUs such as AWS or Google CoLab.

3. Another challenge would be to clean and curate the dataset as per our requirements and domain. Pre-existing datasets (explained further in chapter 3) may not be exactly in a usable condition out-of-the-box. Therefore, the data would then need to be scraped and cleaned manually which can be cumbersome. A remedy would be to maintain a clean storage format from the get-go.

4. In addition to this, lack of relevant technical knowledge on part of the team is also a challenge. This will be addressed by taking tutorials and online courses.

5. At the same time, insufficient knowledge and expertise in the domain of e-commerce requires us to reach out to industrial partners and professionals from Daraz and Telemart, whose unavailability at times can obstruct the smooth progression of our project.

2. Literature Review

This chapter presents the current state of the art in the domain and talks about other similar work that has been done in this area. It also establishes the novelty of our work by highlighting the differences between the existing work and our work.

We will keep updating this chapter (especially if our project is research-intensive) as our research proceeds and we come across more work related to our problem.

Of course, we take inspiration from

3. Software Requirement Specification (SRS)

This chapter provides detailed specifications of the system under development.

3.1 Functional Requirements

This section describes each function/feature provided by our system. These functions are logically grouped into modules based on their purpose/users/mode of operations etc (as per our system). A functional hierarchy may look like:

- Module 1:
  - Function 1:
  - Function 2:
    - Sub Function 1
    - Sub Function 2
- Module 2:
  - Function 1:
  - Function 2:
- .....

3.2 Non-functional Requirements

3.2.1 Performance Requirement

- The specification of the computer on which our system is hosted need to be extremely high because thousands of users might use the portal at the same time. Therefore, high performance of the computer on which the server is hosted is needed.
- Fetching the dashboard to view information and recommended outfits shall take no longer than 5 seconds to load the page.

3.2.2 Safety Requirement

- The system must not halt or lag, especially during the update time and must not go down under high traffic. In order to ensure safety of the server, it is suggested that it is hosted on two computers - one kept as a backup.
- The system is harmless and would not case harm to any human being.

3.2.3 Security Requirement

- It must be ensured that only the authorized admins, with valid user credentials, have access to the data of the users in order to ensure user privacy.
- The system will use databases from authentic sources and fashion stores.
- Any user other than the system admin can only view the information but can in no way modify it except their personal information and their cart details.
- System has different two different types of users and both of them have constrained access.

3.2.4 User Documentation

- A user will not be provided with the manual as such but would be given some tutorials about how to use the website which would be available on the web portal.

3.2.5 Error Handling

- The system prevents data loss by carefully handling all expected and non-expected errors.

3.3 External Interfaces

3.3.1 User Interfaces

This section includes our mockup screens and briefly explains them.

3.3.2 Application Program Interface (API)

This section describes the library or API interface to our system.

3.3.3 Hardware/Communication Interfaces

This section describes our project's specific hardware/network interfaces.

3.4 Use Cases

This section presents detailed use cases of our system.

3.5 Datasets

This section describes the specific dataset(s) used to build our system. An appropriate snapshot of the dataset(s) is also included. Futher details, when needed, are presented in the appendix.

3.6 System Diagram

The following diagrams gives an overview of different modules of our system.

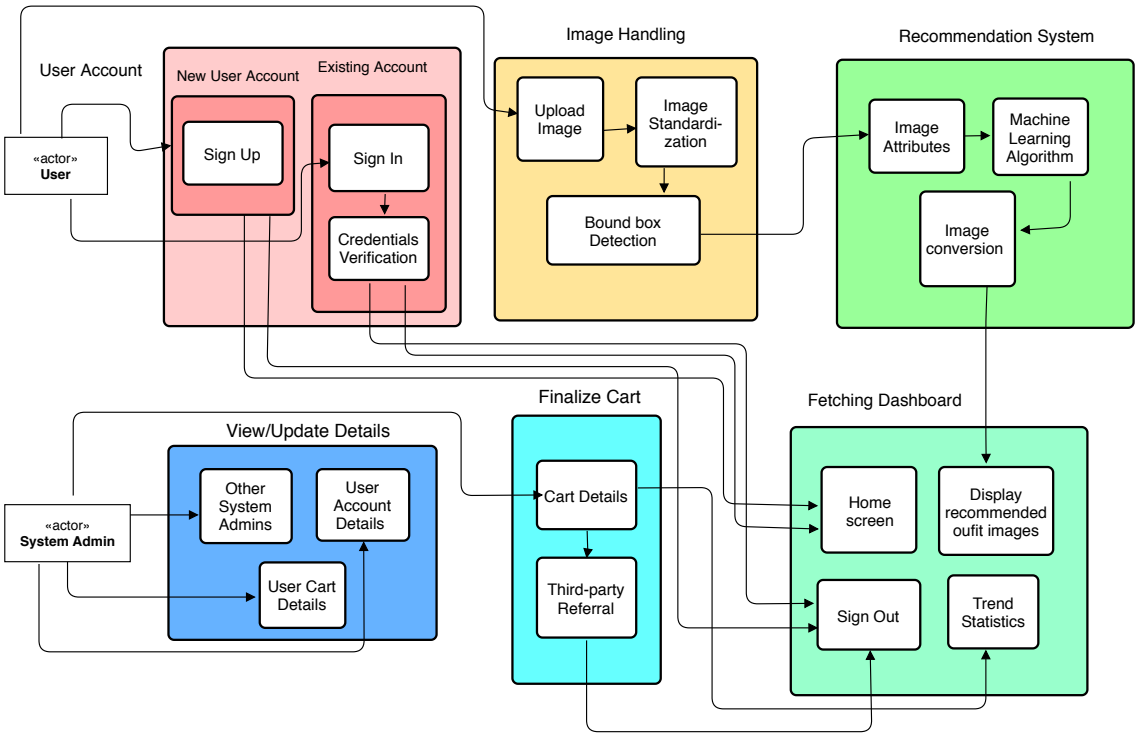

Figure 3.1: Module-wise System Diagram

3.7 Data Flow Diagram (DFD)

Rudimentary data flow diagrams for the system have also been constructed, given below:

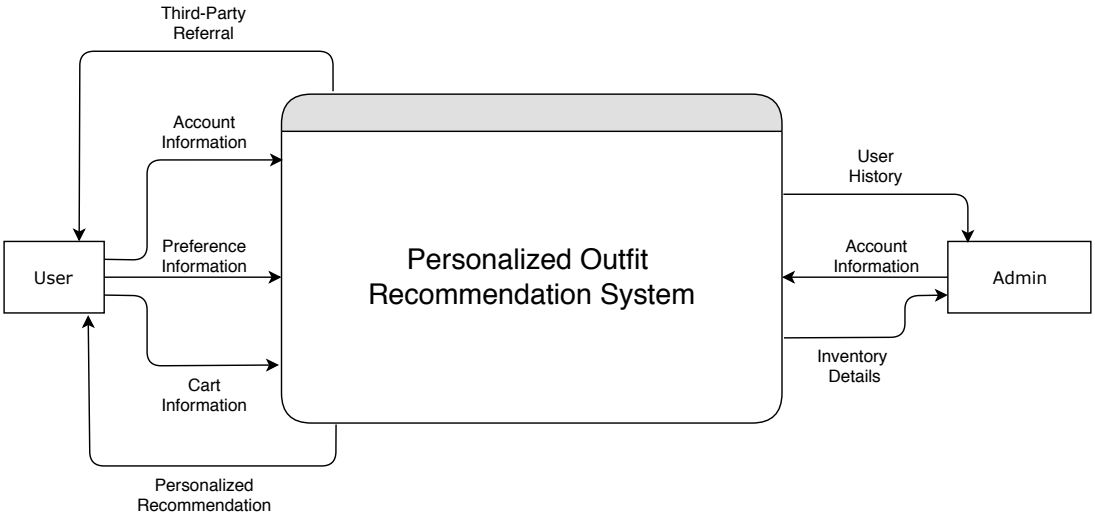

Figure 3.2: Context Level DFD

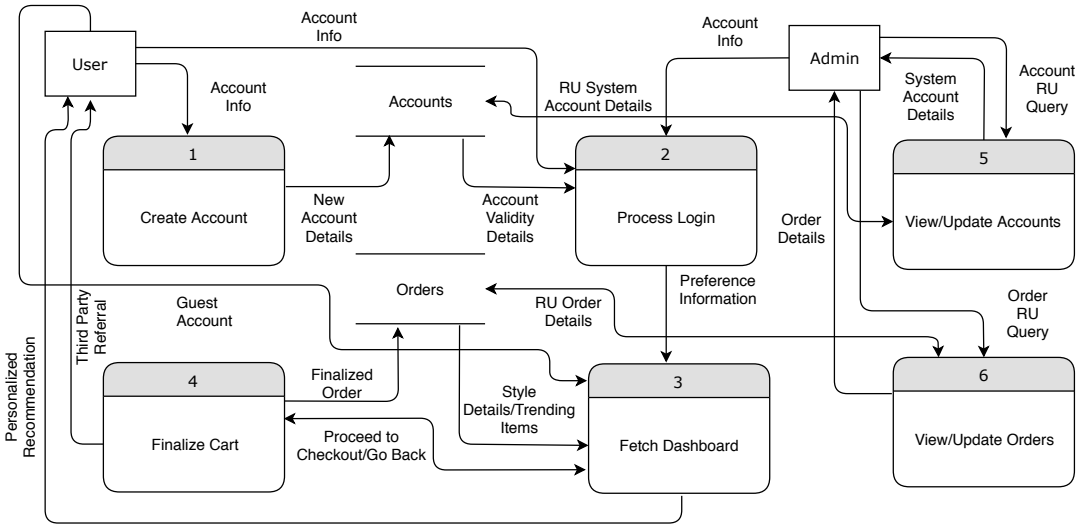

Figure 3.3: 0-Level DFD

4. Software Design Specification (SDS)

TBA.

5. Experiments and Results

TBA.

6. Conclusion and Future Work

TBA.

Appendix A. More Math

Here, we describe the background math for the techniques used in the text.

Appendix B. Data

Here is a dump of our 2TB data set. Enjoy!

Appendix C. Code

Here is our code. Bits over trees, courtesy of HEC!

```
print('Hello World!')
print('Computing true random number.')
print('Capturing interstellar radiation.')
print('This will take time!')
import random
import time
time.sleep(3600*random.randint(1,10))
print(4)
```

Our code can be found at this GitHub link.

References

[1] Salesforce. *The Power of Personalized Shopping*. URL: https://www.salesforce.com/form/commerce/power-of-personalized-shopping.

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[4] Digital Commerce 360. *US millennials now do most of their shopping online*. URL: https://www.digitalcommerce360.com/2019/03/26/millennials-online-shopping/.

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