

## Explanation about slides of presentation

- **Slide 1** - Title and team details.
- **Slide 2** - Approaches we have used to implement our system. It states different approaches which were used in our model (like Item – Item based Collaborative Filtering, Content based Filtering, learning to rank, etc)
- **Slide 3** – It shows where we have used each approach (stated in slide 1) in our system by graphical representation.
  - We have used Matrix factorization, Content based similarity and Item – Item based collaborative filtering approach in **pre-processing**.  
**Learning to rank algorithm** is used by robot to get the recommendation list of books.  
**Reinforcement learning approach** is used in interaction between user and robot to give better recommendation list.
- **Slide 4** – This slide describes pre processing module in detail.
  - Item – Item based Collaborative filtering – how we are calculating similarities between books so that output will be book – book similarity matrix.
- **Slide 5** – Continuing describing pre processing module, this slide explains content based similarity finding approach which outputs item – item content wise similarity matrix and Matrix factorization approach which predicts user's rating.

➤ **Slide 6** – This slide explains how learning to rank approach is applied in our system for existing user.

- Step 1 - Get list of Books ( $L_1$ ) from user's past history records which have high reward (**we are maintaining users past history with each book in history have numeric value showing user's liking or disliking towards book i.e. reward / penalty given to book**)
- Step 2 - Find Books list ( $L_2$ ) similar to list  $L_1$ , using similarity values calculated by correlation based similarity (in item - item collaborative filtering) in pre processing stage. We will be taking each book from  $L_1$  and bring some similar books of it and create book list  $L_2$ .
- Step3 – We will calculate rank of each book in  $L_2$ . So our final list will contain 8 books with highest rank from  $L_2$  and 2 books will be selected which are newly arrivals or recent popular or it can be chosen randomly to provide serendipity.

➤ **Slide 7** – It explains how we will create list  $L_2$  from  $L_1$  (how we will decide which similar books to include in list  $L_2$ )

**Number of similar books included in  $L_2 = n + j * \alpha * k$**

( $n$  = Minimum number of books to be include,  $j$  = Variable based on reward,  $\alpha$  = Learning rate,  $k$  = Constant)

- We will take each book from L<sub>1</sub> and find number of similar books based on its reward value (as we are fetching books in L<sub>1</sub> from users past history which have higher reward value). We will bring more number of similar books for book which have high reward value.

So this equation will find how many similar books will be inserted in L<sub>2</sub> for each book in L<sub>1</sub>.

➤ **Slide 8** – This slide explains how to calculate the rank for the items.

- The equation for the Rank is define as below,

**Rank of a book =  $\alpha_1$  \* Item-item similarity value +  $\alpha_2$  \* Content based similarity value +  $\alpha_3$  \* Predicted rating (Using SVD) +  $\alpha_4$  \* Popularity (global rating) +  $\alpha_5$  \* Frequency (Where  $\alpha_1$ ,  $\alpha_2$ ,  $\alpha_3$ ,  $\alpha_4$ ,  $\alpha_5$  = weights)**

- First we have found the Item Item similarity value , After that we have found the content based similarity value for each book from the list of fetched state books with list of similar book list and added to the Item Item similarity value.
- After that we have found the predicted rating for the list of similar books and added to the previous result.

- After that we have added their global value As the measure of popularity value.
- Finally we have added frequency value of books
- Thus by combining all these factors we have calculated the Rank of the Item.
- In our case in we have taken the all weighs as 1.

➤ **Slide 9** - In this slide we have explained the exploration and exploitation.

- $\text{Explored\_items} = \text{Exploration\_Rate} * K$
- $\text{Exploited\_items} = K - \text{Explored\_items}$   
 $K = \text{Constant-total number of items to be recommended}$
- In which Exploited items will come from the highest Ranked items and explored items will come from serendipity factor.
- In our case we have taken the **Exploited rate as 0.8** and **Explored Rate as 0.2**.
- It mean by that 8 items will come from highest ranked items and 2 items will come for serendipity and exploration. Which will include random as well as new item.

➤ **Slide 10** - In this slide we have explained the concept of Reinforcement learning. We have explained the **State** and **Actions** of our system.

- States : Recommended List of items.
- Actions : We have considered the user actions which are explained as below ,
  - Click
  - Like
  - Dislike
  - Rate

➤ **Slide 11** – In this slide we have explained the state transformation.

- The current state will contains the recommended list of items , Users will perform actions such as click , like , dislike and rating.
- Based on these actions the reward will be calculated.
- When user refreshed or perform back operation from the system then the current state will store with updated reward in the state table.
- And when user comes for the next time then next state will fetch from the state table with highest reward.

➤ **Slide 12** - In this slide we have explained the reward calculation.

- **Reward=Click\_Reward + Like\_Reward + Dislike\_penalty + Rating\_Reward**
- In which the different values are associated with different actions.
- For example ,
  - Dislike\_penalty: -2
  - Click\_Reward : 1
  - Like\_Reward : 2
  - Rating\_Reward: {2,3,4}
- If rating is greater than 3 then reward will be considered as 4 , and will be considered as 3 when rating will be between 2 and 3 , it will be 1 for rating will be between 1 and 3.
- After that the rating will be stored in prediction rating database,

➤ **Slide 13** – In this slide we have explained the cold start problem solution .

- **For new User:**
  - It will show 2 new arrivals, 3 random books and 5 popular books.
- **For new Item:**
  - For existing user it will be covered in exploration part.

- **Slide 14** – In this slide we have shown the Demonstration of our system , Which will show the show the recommended items list based on existing or new user. And User will choose the item.
- **Slide 15** – In this slide the user will perform the actions on the selected books.


### Demonstration:

```
1. New User?
2. Existing User?
2

Enter User ID
2
Book List (Select interesting book ) :
1   Kafka on the Shore
2   The Bluest Eye
3   Twenty Thousand Leagues Under the Sea
4   The Purpose Driven Life: What on Earth Am I Here for?
5   The Lucky One
6   Harry Potter Boxset (Harry Potter, #1-7)
7   Last Sacrifice (Vampire Academy, #6)
8   The Girls' Guide to Hunting and Fishing
9   Harry Potter and the Goblet of Fire (Harry Potter, #4)
10  Fahrenheit 451
11  Refresh
12  Exit

Choose an option : 7|
```

title : Last Sacrifice (Vamp



Author name : Richelle Mead  
Publication year : 2010.0  
Language of book : eng  
Average rating : 4.42  
1. Like  
2. Dislike  
3. Rate  
4. Back  
Choose an option : 1|