

# Collaborative Filtering: Application, Challenges and Filtering Techniques

Kunal Samant (ksamant2)

CS 410 (Fall 2022)

In this review, I will be discussing Collaborative Filtering, its applications, challenges, and a brief introduction of the 2 types of filtering which occurs within a successful system.

Collaborative Filtering as a concept is based on the understanding that *“relationships exist between products and peoples’ interests”*. It is obtained using 2 main filtering techniques known as User-based and item-based. User-based Collaborative Filtering matches the interest of 2 users to provide accurate predictions to users about the products which they could potentially find interesting. This is done by assigning weights to each item and adjusting them to find a similarity measure between 2 users for the item. Item-based Collaborative Filtering looks for similar items based on the items which the user has previously indicated to be interesting. These 2 techniques are combined by obtaining the dot product of the 2 measures to create a final prediction.

In today’s world we have many applications which use this concept within their systems. Such applications include but are not limited to Amazon, Netflix, and Spotify. These applications use User preferences to create relationship with other users and provide recommendations to other users based on predicted interests creating a well-functioning recommender system. Netflix is one of the biggest products which uses collaborative filtering within its main system. 80% of the Netflix product relies on Collaborative Filtering Algorithms. The system uses the 2 filtering techniques to match user interest and recommend movies. As users interact more with the platform the recommendations become more accurate.

However, since collaborative filtering is a relatively new technique within computing, it comes with its challenges as well. One of these challenges is known as the **“Cold-Start problem”**. The Cold-Start problem occurs due to the model using the heuristics from the items already within the system. If a new item is added, the system may not be able to create an embedding which in result means a query will not pull this item. A solution to this, as a new user/item is added to the system, a heuristic is formulaically assigned to them to not disrupt the flow of the original model. Other challenges which are commonly faced are **Sparsity** and **Scalability**. In many applications recommender systems evaluate a large data set and given that a user may interact with less than 1% of items, the recommendations provided to them will be less accurate. This problem grows as the number of items and users added increase.

In conclusion, Collaborative Filtering as a concept is used in many commercial applications and we as users come across systems which use this concept daily. As time goes on, I believe that the challenges which come will be tackled and we will have access to better and more reliable recommender systems.

### References:

Mehmat Toprak (May 1<sup>st</sup>, 2020), Collaborative Filtering

<https://medium.com/@toprak.mhmt/collaborative-filtering-3ceb89080ade#:~:text=Collaborative%20filtering%20is%20based%20on,like%20or%20be%20interested%20in.>

Geeks For Geeks (July 16<sup>th</sup>, 2020), User-Based Collaborative Filtering

<https://www.geeksforgeeks.org/user-based-collaborative-filtering/>

Cerys Jenkins (Feb 24<sup>th</sup>, 2021), How Netflix uses recommender systems

<https://reflect.ucl.ac.uk/nsci0010-2021-class-blog/2021/02/24/how-netflix-uses-recommender-systems/#:~:text=Collaborative%20filtering%20systems%20suggest%20items,system%20more%20and%20more%20efficient.>

Google Developers (July 18<sup>th</sup>, 2022), Collaborative Filtering Advantages & Disadvantages

<https://developers.google.com/machine-learning/recommendation/collaborative/summary>

Badrul M. Sarwar (Feb 19<sup>th</sup>, 2001) Challenges of User-bases Collaborative Filtering Algorithms

<http://www10.org/cdrom/papers/519/node9.html>