Research document

Individual Project

Fontys

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# Introduction

The video game market has experienced exponential expansion in recent years, with millions of players worldwide enjoying a wide range of games on numerous platforms. The desire for personalized suggestions of new games based on user tastes has grown along with this rise. In order to satisfy this need, numerous video game developers have put in place recommendation systems that make use of machine learning algorithms to determine which games a player is most likely to enjoy based on their prior gaming activity.

Despite the potential advantages of these recommendation systems, little is known about how well various machine learning algorithms work for recommending video games. By analysing the precision, recall, and accuracy of several popular machine learning algorithms when recommending games, this research seeks to close this gap.

The research question for this research is: "Which machine learning algorithm would be suited for video game recommendations?".

These are the sub-questions that will be addressed in this research paper to provide insights into the effectiveness of machine learning algorithms for video game recommendations:

* What are the common machine learning algorithms used for product recommendations?
* Which machine learning algorithm has the best accuracy for video game recommendations?
* What are some challenges in implementing machine learning algorithms for product recommendation systems on a large scale?

# Methodology

**Question:** What are the common machine learning algorithms used for product recommendations?

**Library:** A literature study will be conducted to view which machine learning algorithms are being used the most.

**Question:** Which machine learning algorithm has the best accuracy for video game recommendations?

**Field:** An interview, I will be asking my friends to fill in the collaborative filtering model to see how accurate collaborative filtering is for video game recommendations.

By using a program that I found on GitHub that recommends people a few games based on filling rating for games of their own choice. Basically how it works is that you can select a game from the Steam library and give it a rating, you will have to do this five times and then you can request game recommendations.

**Library:** A literature study will also be conducted to learn what big gaming platforms/gaming review sites are using for their sites.

**Question:** What are some challenges in implementing machine learning algorithms for product recommendation systems on a large scale?

**Library:** A literature study will be conducted to learn about what people in the industry think is hard to implement and why it is different because it is on a large scale.

# Results

## What are the common machine learning algorithms used for product recommendations?

There are several machine learning algorithms used for product recommendations, the most common ones are collaborative filtering, content-based filtering, and hybrid approaches that combine both techniques (Kumar, 2022).

### Collaborative filtering

Collaborative filtering is a recommendation system approach that predicts a user's interests based on identifying patterns and preferences from many users, where if users have similar tastes in one product, they are likely to have similar tastes in other products as well, and it can be achieved through either memory-based or model-based approaches, with the former predicting ratings on the basis of neighbourhoods of user-item combinations and the latter using predictive models such as decision trees, rule-based approaches, and latent factor models, among others. Collaborative filtering is advantageous for its simplicity of implementation and high coverage, but it suffers from the cold start problem and performs poorly on highly sparse datasets.

### Content-based filtering

Content-based filtering is a recommendation system approach that utilizes item attributes to generate recommendations based on a user's preferences and profile, where the level of similarity between items is generally established based on attributes of items liked by the user, and it requires a strong source of item-level data and user feedback, making it advantageous for recommending items when there is a lot of data available, but with the disadvantage of providing "obvious" recommendations and being ineffective for providing recommendations for new users (Vatsal, 2022).

### Hybrid

Hybrid approaches combine these two techniques to overcome the limitations of each and provide more accurate recommendations. Additionally, deep learning algorithms such as neural networks are also becoming increasingly popular for recommendation systems due to their ability to capture complex patterns and relationships in large datasets (Covington et al., 2016).

Hybrid systems mix various models to overcome the drawbacks of each individual model. Overall, this lessens the drawbacks of utilizing individual models and helps produce recommendations that are more reliable. As a result, users receive more detailed and individualized recommendations.

Hybrid models are however not without drawbacks. These models require a large database that will require a lot of work to maintain.

## Which machine learning algorithm has the best accuracy for video game recommendations?

### Steam recommendation system

A few years ago Steam introduced an interactive recommender, is a recommendation system where you can adjust parameters (that is why it’s called interactive).

How it works? It uses a machine learning model that is based on the playtime history of millions of Steam users. This model is not directly affected by tags and reviews and only looks at the playtime of the users. The main premise is that if other players who have similar interests in games as you and they play a game that you haven't yet played, then that game is probably going to be one you'll like as well. According to their data, there had already been over 10,000 games been purchased because it got recommended with this system (Valve, 2020).

According to reviews the interactive recommender is a great way to find out about less popular games.

**Collaborative filtering**

Using a program that is able to recommend games to you based on a few ratings, I have asked some of my friends to run the program and tell me what they thought about the recommendations that they were given and I also did it myself.

Table

Description automatically generatedThis was my input and it gave me the following output:

Text

Description automatically generatedPayday2 and Counter-Strike Global Offensive are both games that I have played before and enjoyed. BioShock Infinite is a game I’ve never heard of but it looks like a game I would play. Fallout 4 and DayZ are both games that I have watched on YouTube in the past and they definitely are games that I would play.

Graphical user interface, application

Description automatically generatedThis was my first participant’s input and it gave the following output:

Text

Description automatically generatedHe played Payday 2, Garry’s Mod and Rust before and he enjoys playing them. Counter-Strike: Source is basically the same as Counter-Strike: Global Offensive so I don’t think that really counts as a good recommendation. DayZ is a game that he never heard of but he said it looked interesting.

Graphical user interface, table

Description automatically generated with medium confidenceThis was my second participant’s input with the following output:

Text

Description automatically generatedHe played Team Fortress 2, Counter-Strike Global Offensive and Terraria before, all of them are games that he enjoyed playing. He has never heard of Dungeons of Dredmor and Papers, Please before, after looking them up he said he probably wouldn’t enjoy playing those games.

The machine learning model that Steam used for its interactive recommender seems to be fairly accurate but the reason why it is possible for Steam to create such an accurate recommender is because Steam has a lot of users and a lot of data which is a very crucial part of why it is so accurate.

The research for the collaborative filtering method was fairly successful, since collaborative filtering works better when you provide more data for the model it will definitely give more accurate recommendations. For this research only 5 games where being used to determine possible recommendations and even with only 5 games it was already pretty accurate.

## What are some challenges in implementing machine learning algorithms for product recommendation systems on a large scale?

The implementation of machine learning algorithms for product recommendation systems on a broad scale presents a number of difficulties, according to Narapareddy (2019). The amount of data that must be processed and examined in order to produce recommendations is one difficulty. Accuracy and efficiency must be balanced because it might be expensive computationally to process big amounts of data. However, it might be difficult to guarantee that recommendations are varied and pertinent to particular users and to swiftly adjust to shifts in user behaviour and preferences. Lastly, the article emphasizes that when developing large-scale machine learning algorithms for product recommendations, challenges related to data quality, privacy, and security must be carefully considered.

# Conclusion and recommendation

To be able to accurately recommend video games to people it is very important that users already have data based on what they like and don’t like. The most common machine learning algorithms are mainly memory based algorithms and The study also emphasized the significance of data security, privacy, and quality when applying machine learning algorithms for making large-scale product recommendations.

For gaming platforms I would highly recommend to use the same machine learning model that they use. The reviews for the interactive recommender are really good with the only drawback being that it will not recommend the newest games. For other platforms (like review websites for games) I would recommend to use a hybrid model. Using individual models will have its own drawbacks and a hybrid model will be able to balance out most disadvantages.

# References

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