

Introduction

YouTube is one of the largest video sharing platforms on the internet. One of the main draws to the site is its video recommendation system. Millions of people spend time each day watching YouTube videos because of what is recommended to them in their feeds. When you open up the website homepage you are greeted immediately with videos that are custom tailored to your likes and interest. Googles multitask ranking system is behind this and is a very fascinating subject to explore.

Body

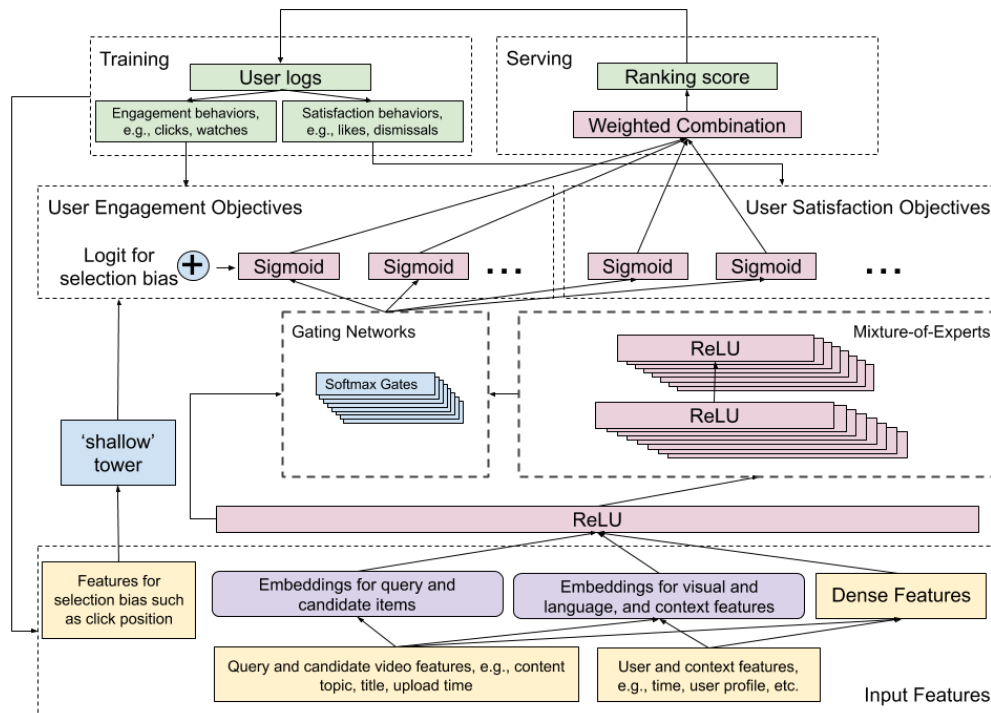
When designing the multitask ranking system Google had some major topics they wanted to accomplish, and this is what their contributions were.

- We introduce an end-to-end ranking system for video recommendations. [1]
- We formulate the ranking problem as a multi-objective learning problem and extend the Multi-gate Mixture-of-Experts architecture to improve performance on all objectives. [1]
- We propose to apply a Wide & Deep model architecture to model and mitigate position bias. [1]
- We evaluate our approach on a real-world large-scale video recommendation system and demonstrate significant improvements. [1]

The end goal was to build a successful recommendation system that removed as much bias as possible and provided accurate results to the end user. There are many different mediums that google could use to build and train this model. Listed below are many of different user engagement features that are used to power the results of the ranking system

- Clicks
 - Watch time
 - Sharing
 - Liking
 - Disliking
- [2]

These features are all strong indicators of whether a user likes or dislikes a video. The ranking system takes the users engagement features and user satisfaction features and sends them to a Mixture of Experts which will determine whether to share or not share a video with the user. In order to reduce the bias introduced with ranking, the google team introduced a shallow tower which takes the inputs listed above to create a value to determine the level of bias. By utilizing a shallow tower, the google team expanded upon the Wide and Deep architecture model. The graph below outlines the process of the ranking system.



Now that we've discussed how the ranking system works, let's look at the two largest problems the team faced while developing this model. The first of these issues is the multimodal feature space. There are multiple different mediums which the model must learn from on YouTube, things such as thumbnails and descriptions of videos all have a factor on the relevance to the user, so the model had to be able to learn from these features. The next issue is scalability, whatever model is built needs to be able to work and work efficiently since millions and millions of users will be using the site. If the ranking system was perfect 100% of the time with no false positives, but it couldn't be replicated on a massive scale then the model wouldn't really be useful for this objective. Thanks to the use of MMOE and the Deep and Wide architecture the model developed and expanded on by the team at google proved to be successful. The model was able to avoid bias and provide accurate results to the user. During live testing the model provided higher user satisfaction with the site and also improved how much/long they interacted with the site.

Conclusion

YouTube is one of the largest and heavily visited website on the internet. One thing you know when you visit the site is you will always get relevant video recommendations. This is due to the hard work put in to build a strong model that takes many relevant user engagement features and turns out relevant results. Without this multitasking ranking model YouTube might not be what we know it as today.

References

- [1] Zhe Zhao, Lichan Hong, Li Wei, Jilin Chen, Aniruddh Nath, Shawn Andrews, Aditee Kumthekar, Maheswaran Sathiamoorthy, Xinyang Yi, Ed Chi. (n.d.). *Recommending What Video to Watch Next: A Multitask Ranking System*. <https://daiwk.github.io/assets/youtube-multitask.pdf>. Retrieved November 6, 2022, from <https://daiwk.github.io/assets/youtube-multitask.pdf>
- [2] Cristos Goodrow. (2021, September 15). *On YouTube's recommendation system*. Blog.Youtube. <https://blog.youtube/inside-youtube/on-youtubes-recommendation-system/>
- [3] Moin Nadeem. (2018, July 7). How YouTube Recommends Videos. *Towardsdatascience.Com*. <https://towardsdatascience.com/how-youtube-recommends-videos-b6e003a5ab2f>