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CS 410

Google Multitask Ranking System

Google's multitask ranking system was originally described as "a large scale multi-objective ranking system for recommending what video to watch next on an industrial video sharing platform", (Zhao, et al.). With such a large system being put into place many problems would arise not from code driven resources but from the user manipulation of such a system. In what is mentioned as "biases in user feedback", many alternative measures were taken to make sure problems would not arise (Zhao, et al.). Two methods to help these processes be mitigated were the inclusion of "Multi-gate Mixture-of-Experts so as to efficiently optimize for multiple ranking objectives", as well as "mitigated the selection biases by adopting a Wide & Deep framework" (Zhao, et al.). Utilizing these methods to combat the user biases that could be presented led to the development of Google's multitask ranking system.

In the design and development stages of this system two major challenges arose. The first being how the optimization process should be included and how to resolve conflicts that arose. The example that was used was the "want to recommend videos that users rate highly and share with their friends, in addition to watching" (Zhao, et al.). Another measure that was taken into account was implicit bias that could occur in the system. One predicted outcome was, "a user might have clicked and watched a video simply because it was being ranked high, not because it was the one that the user liked the most" (Zhao, et al.). This would lead to having their models being trained using data generated from the current system being biased and causing a feedback loop effect and needed to "effectively and efficiently learn to reduce such biases is an open question" (Zhao, et al.).

To solve the concerns a multitask neural network architecture was to be developed for this ranking system. This would be grown from the wide and deep model architecture by adding on the Multi-gate Mixture-of-Experts for multitask learning. Also introduced was a shallow tower to model and remove any selection bias that may arise. (Zhao, et al.) At the user label two categories would be the standard basis for understanding what a good recommendation would be. The first would be how a user engages with content. This would include user clicks and degree of engagement with recommended videos. The second would be the satisfaction objectives. Liking a video or leaving a recommendation on YouTube would be the measure for satisfaction objectives. The experiments for the multitask ranking system were ran on YouTube with the teams contributions being: introduce an end-to-end ranking system for video recommendations, 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, propose to apply a Wide & Deep model architecture to model and mitigate position bias, and evaluate our approach on a real-world large-scale video recommendation system and demonstrate significant improvements (Zhao, et al.). In comparison it is noted that most comparable industrial recommendation systems rely heavily on large amounts of user logs for building models. Due to cost it was not feasible to incorporate users to have a saying into this system. Implicit feedback such as clicks and engagement with recommended items would be utilized instead. An interesting not that some user engagement may have been due to the current recommendation system in place automatically assigning the user a selection. The ranking system utilizes a neural network that was up to the highest standard in machine learning technology at that point (Zhao, et al.).

In conclusion, the Google multitask ranking system was one that was built off existing user data from YouTube. Seeing the unique complications and standards that were limiting the development of this system was interesting to say the least. The neural network in place has held up to date and is constantly growing. The paper makes not of the great success that the rating system is and not utilizing direct user interaction with the system makes it even more impressive and unique for its architecture.

Citation

Zhao, Zhe, et al. “Recommending What Video to Watch Next: A Multitask Ranking System.” *Proceedings of the 13th ACM Conference on Recommender Systems*, 2019, https://doi.org/10.1145/3298689.3346997.