

Literature Review

Guang Yang

1. “TrueSkill 2: An improved Bayesian skill rating system” (Minka et al., 2020)

The summary section of this paper says, “this paper has presented TrueSkill2, a collection of model changes to TrueSkill as well as a new system for estimating model parameters. TrueSkill2 gives significantly more accurate skill ratings than TrueSkill, measured along a variety of axes important to a game studio.” (Minka et al., 2020).

The paper begins by illustrating a set of top priority of qualities needed by a modern game studio, then continues with what TrueSkill model has satisfied and what has not. Following this is the detail of the classic TrueSkill model. TrueSkill 2 is modified in certain ways to meet the requirement omitted by the classic TrueSkill model. The various requirements, or in other words, assumptions of the model, is vital for the theory of the paper to hold. Besides, rigorous explanations on the validity of assumptions are vital as well. The explanations are usually ignored in my paper.

For the parameter estimation section, the author assigns proper values to different parameters. One purpose is to reduce ambiguity, such as fixing β to 1. The other purposes are explained in the paper to fit the design of the game itself. For different game applications, the parameters tend to differ, so game developers should adjust the model to suit better to their games.

The paper also includes the classification of confounding variables. The essential and basic part of the model is developed by disregarding those confounding variables. Then the paper classifies those variables to four categories, with elaboration in section 6, 7, 8 and 9. In each category, the author tests the algorithm, finds the problem or shortcomings, the improve the model to yield a more accurate estimation. Some features that are not added is explained in section 10, and the main reason of not adding them is that they are overlapping with previous four categories.

In summary, TrueSkill 2 model seems very useful in my research direction.

2. Who’s The Best Formula One Driver Of All Time? (Justin Moore, 2018)

This article discusses the Elo rating method applied on Formula One. The rating method is adjusted to rate the competitions with multiple competitors.

Similar to the Elo rating method, competitors are assigned an initial rating of 1300. The largest difference is that “Each session or race is treated as if it were a round-robin 1-on-1 tournament. A

driver who finishes second out of 15 cars is viewed as having gone 13-1 in this tournament, losing to the first place finisher and defeating the rest.” (Justin Moore, 2018). In this version, only competitors’ ranking will determine its rating change, but the actual scores are not taken into account; however, my intended research topic includes the effect of actual scores on rating change, so I could probably only learn the Idea of it. Maybe I could change the simple win-lose score into a weighted version of competitor’s points.

The article also points out that artificial adjustment on rating changes is necessary, in order to prevent rating inflation or deflation. Without the adjustment, the initial uniform standard for determining competitor’s ability would fluctuate over time, certainly unfair for different competitors that stay active in different time.

3. “RANKING METHODS FOR OLYMPIC SPORTS: A CASE STUDY BY THE U.S. OLYMPIC COMMITTEE AND THE COLLEGE OF CHARLESTON” (GREENE et al., 2014)

This paper uses several ranking methods to evaluate the strength of US Men’s Ice Hockey team. It concludes with the global ranking of the team, the chance to win medal in the 2014 Olympics, and the improvement of the team.

For the head-to-head sports, the paper uses the Massey method, the Elo method, and the TrueSkill method to analyze the US Men’s Ice Hockey team’s placement over time. After this is the comparison of the methods. In the comparison part, the Elo rating method is classified as straight Elo (holding k value constant), simple weighted and heavy weighted. This is a signal that I may classify the Elo rating method in my paper in those three cases. Straight Elo rating method predicts better result than the other two variations of the Elo method. Then the passage evaluates the predictions of the three rating methods quantitatively over time.

The major content of this paper is head-to-head sports. Rating systems on multi-competitor sports are mentioned but unfortunately, they cannot be analyzed in the same way as head-to-head sports.

4. “An Elo-like System for Massive Multiplayer Competitions” (Ebtekar & Liu, 2021)

This paper discusses the Elo-MMR rating system. The base case is the Bayesian model for multiple competitors, similar to the first paper but more complicated with more variables. Then the author proposes the two-phase algorithm for skill estimation in detail, and the elaboration has

many advanced formulas and mathematical terms. After that is the discussion on skill evolution over time, and a term “pseudodiffusion” is put forward. A set of pseudocode helps illustrate the idea. Then the paper evaluates the theoretical effectiveness of the algorithm, with calculations of time complexity and optimizations. Finally, data from past contests of different competitive programming sites such as CodeForces and TopCoder is put into the algorithm to determine the effectiveness of prediction. In the appendix part, there is also proof of theorems used in the paper.

Bibliography

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