**Rating system:**

It’s a system that analyzes the outcomes of games an assigned a rating to each team which can be used to determine who will win the game in the future. It also called power rating as the strength or performance of a team can be represented in numbers.

Sports rating system have been existence for about 80 years now. There were rating systems that were computed on paper. Of all the rating systems that are in existence today, elo based rating are the most popular.

The rating system can be used to:

The predict the outcome of a match.

Forming the matchups so that the teams that are likely to win don’t end meeting in the earlier stages of the tournament.

Can be used for selection process to elite tournaments.

Allows the team to gauge how well they are doing.

**Elo Algorithm:**

Elo algorithm is the most popular rating system in the sports community today.Elo algorithm is used to develop a relative rating system based on match by match basis The elo system models the matches as a pairwise comparison. By pairwise comparison we mean when two teams are compared , one of the team is preferred to win over the other.The elo algorithm was developed by Arpad Elo to rate the players in chess tournaments. Nowadays the elo algorithm is widely used for rating systems in football,basketball and even multiplayer video games.

The difference between the rating of the two team determines the outcome of the system.

A player’s rating is represented as a number which increases/decreases based on whether the team wins or loses.

The elo’s rating system states that the team with the higher rating is more likely to win.

The more the difference in rating between the teams the more likely is the team with the higher rating is going to win.

If a high rating team wins then the increase in that team’s rating is not as much as the when a lower team beats a higher team rating.

The strength of a player is assumed to be normally distributed Gaussian R.V.

Performance of a player is distributed in a logistic curve.

The expected score of a player is Pr(Winning)+Pr(Drawing)

The expected score = 1/1+10^-1\*(Ra-Rb)/400

When the actual tournament score exceeds the expected one the rating should increase.

Ra’=Ra+K\*(Sa-Ea)

Math behind Elo’s rating systems

The strength of a team is modelled as a normal distribution.

Recently the strength of a team is modelled as a logistic distribution as

According to bradley-Terry model, two object with merit parameter lambda1, lambda2.

**Bradley-Terry Model:**

This probability model is used to predict the outcome of a comparison.

P(i>j)=Pi/Pi+Pj

Where Pi and Pj are strengths assigned to player i and player j.

The strengths of a player is assumed as e^(x)

Thus the the probability that P(i>y) would be a logistic distribution.

P(i>y)=1/1+e^(pi-pj)

Simplifying P(i>j)=1/1+10^(-(Ra-Rb)/400)

According to this model, the probability that player 1 outperforms player 2 is the area under the curve on the right of 0.

Though according to the Bradley-Terry model the comparison model leads to Logistic curve while Elo assumes Normal distribution for the layers strength which generates a normal distribution for the comparison model. Comparing both the curve shows slight difference in the curve and for all practical purposes can be assumed to be the same.

It’s easier to use the Bradley-Terry model than using the Thurstone-Mosteller(normal distribution)

Object1 is prefered over object 2 with a probability of Lambda1/Lambda1+Lambda2.

The merit parameter for team1 is modelled as Gaussian.

The probability that team 1 would win over team 2 is 1/1+e^{(Ra-Rb)/400}

The update equation for the elo algorithm Ra’=Ra+K\*(W-We)

**How is K calibrated ?**

The constant K in the update equation can be interpreted as the weight given to a new tournament performance as compared to the pre-tournament rating.The larger the value of K, greater the amount of change allowed in one’s rating.

Write about need for rating system ?

How my gonna improve it ?