

Introduction

- Data analytics are frequently used in “traditional” sports
- Can be used to rank players and teams in more informative ways than wins and losses
- No quantitative ranking system currently exists for esports
- Is it possible to replicate methods used in traditional sports?

Traditional ELO System

- Player i has probability $f(R_i - R_j)$ to defeat player j , where

$$f(x) = \frac{1}{1 + 10^{\frac{-x}{\sigma^2}}}$$

- Update ratings using

$$R_i^* = R_i + K\Delta_{ij}(S_{ij} - \mu_{ij})$$

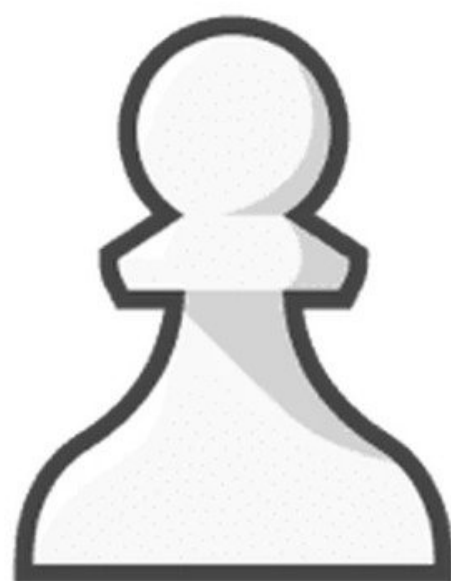
- Actual result

$$S_{ij} = \begin{cases} 1 & \text{if player } i \text{ defeats player } j, \\ 0 & \text{if player } j \text{ defeats player } i, \\ 0.5 & \text{if players } i \text{ and } j \text{ make a draw} \end{cases}$$

- Predicted result

$$\mu_{ij} = f(R_i - R_j)$$

- K -Factor determines “level of recency bias”
- Margin of victory modifier Δ_{ij}
- 500 gold = 1 point, draw if gold difference less than 500



Modified ELO System

- ELOs correspond to predicted score and we use

$$g(x) = f(x) - 0.5$$

- Update ratings using

$$R_i^* = R_i + Kg((X_i - X_j) - (R_i - R_j))$$

- Actual result

$$X_i - X_j$$

- Predicted result

$$R_i - R_j$$

- When results are > 0 , win, when results are < 0 , lose
- $1000 = \eta_n g_n$, η_n depends on position, $X_i = \eta_n g_i$



Gold as a Points System

- It is well-known that team that earns more gold usually wins
- Teams that earn more gold perform better overall
- Quantified using Pythagorean Winrate

$$W\% = \frac{PF^n}{PF^n + PA^n}$$



Updating Algorithm

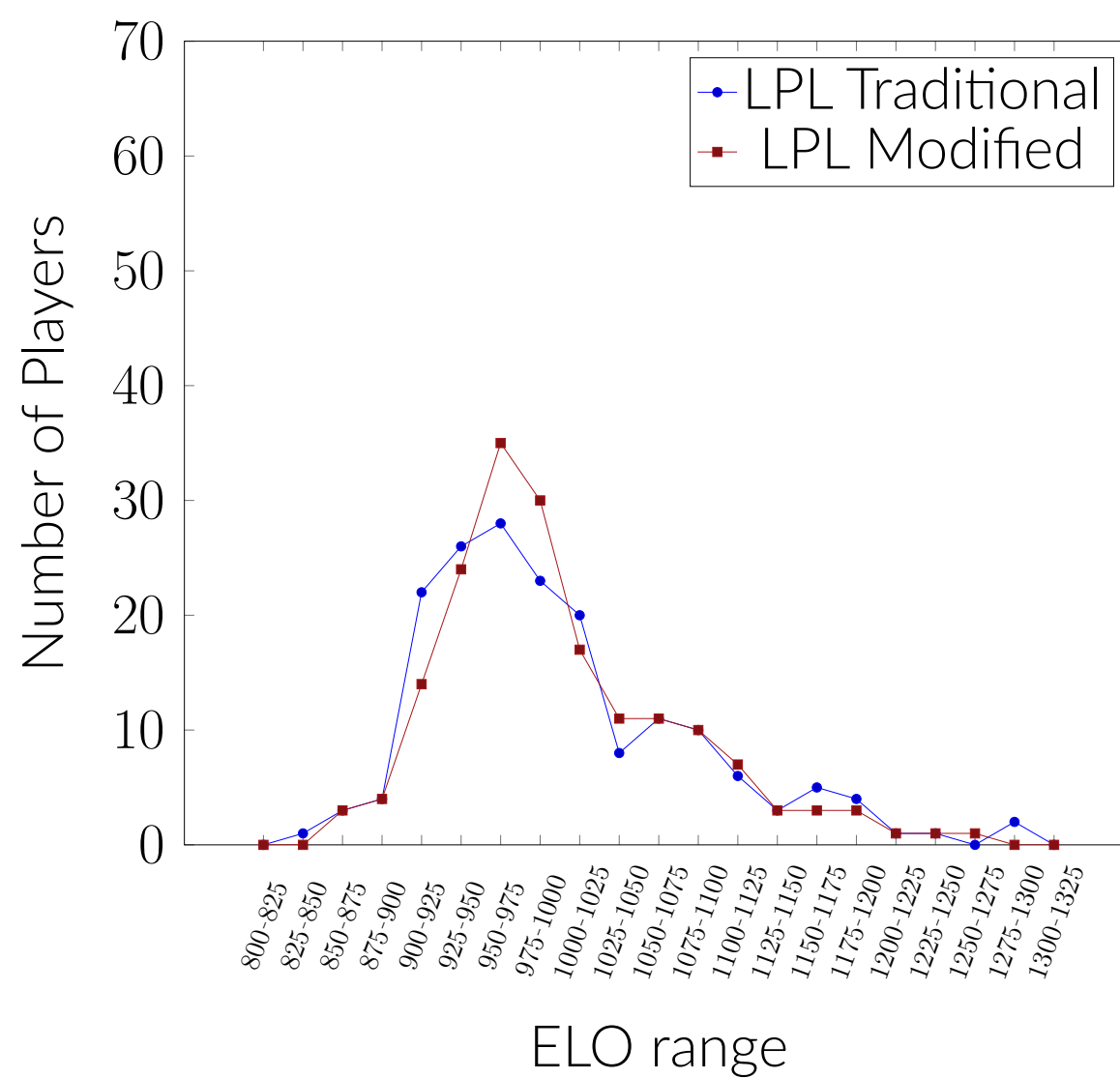
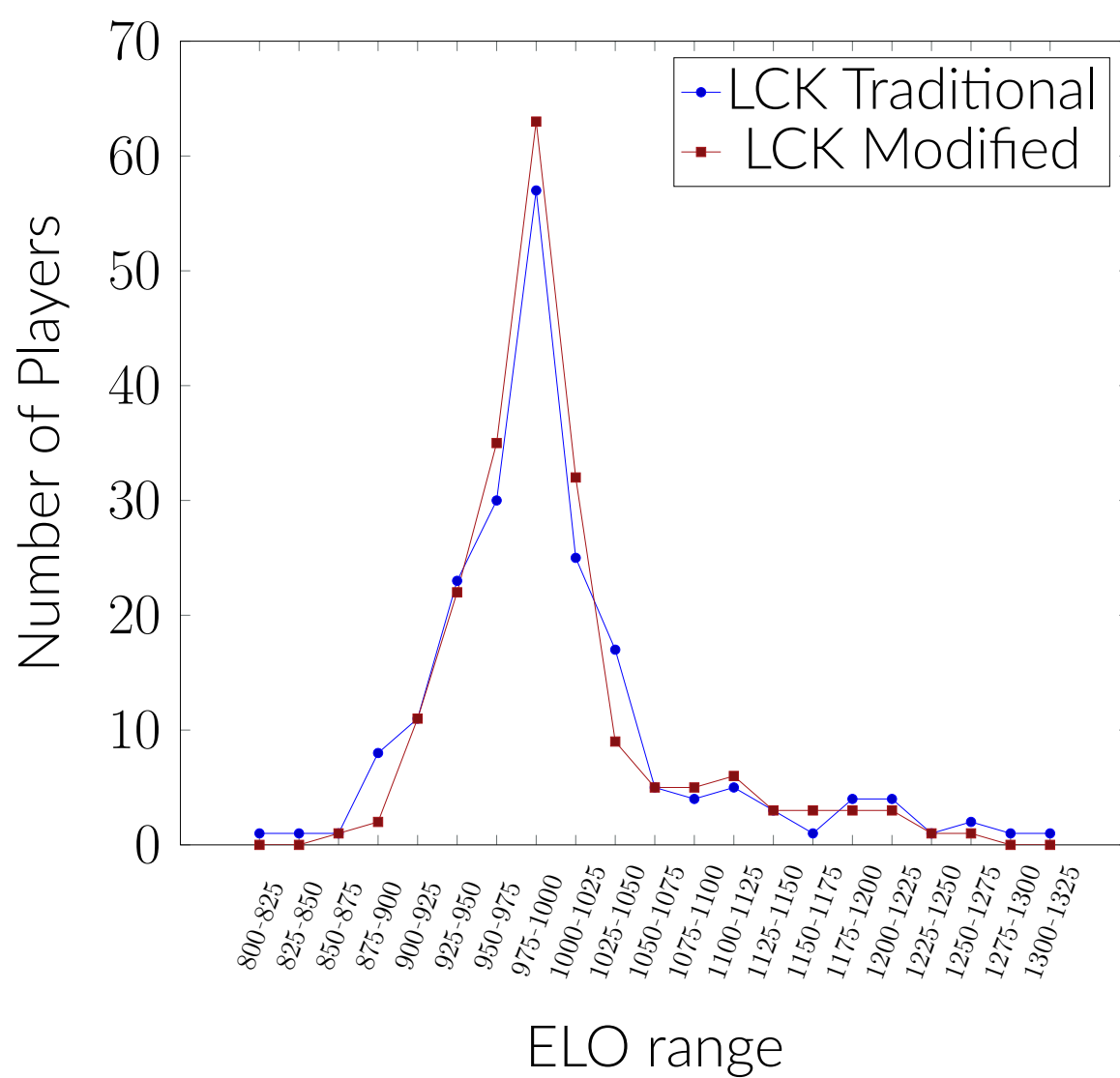
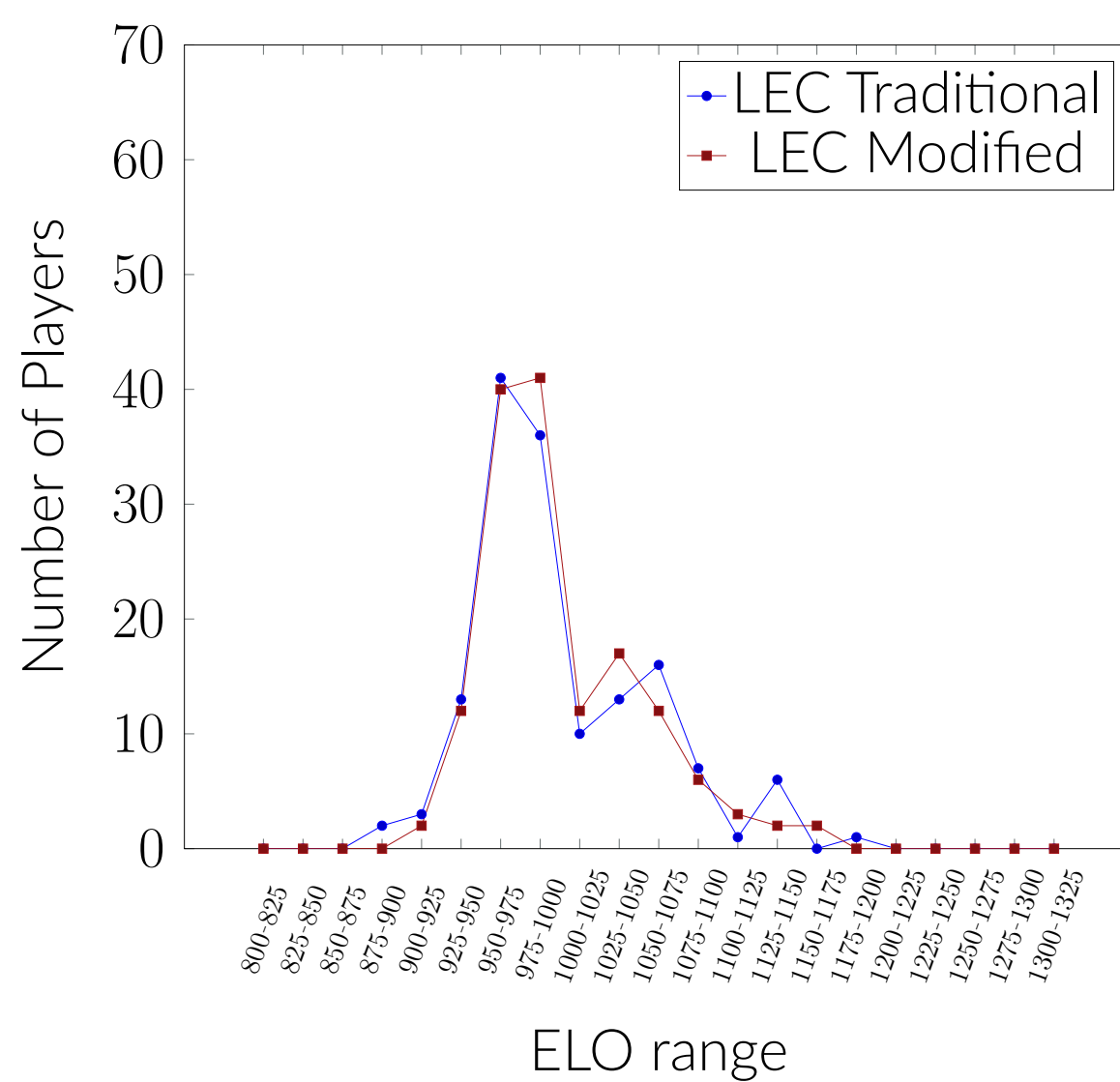
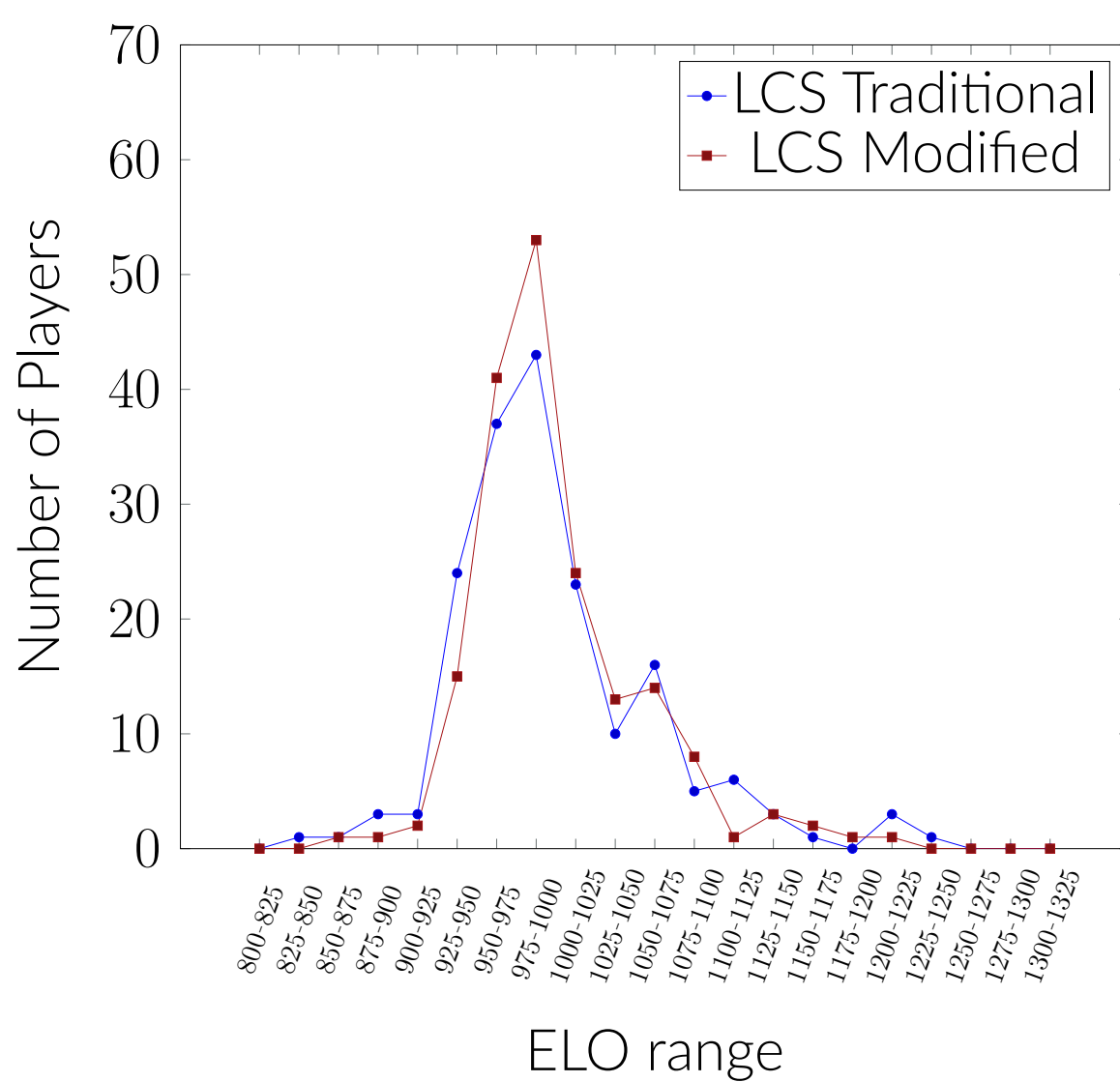
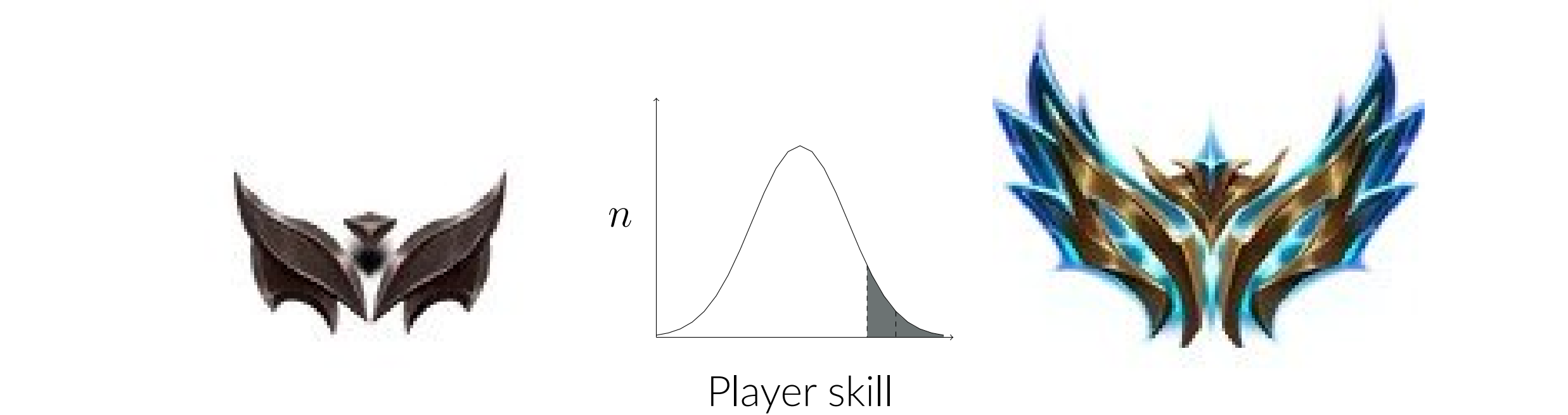
- Data was collected from Oracle's Elixir, includes 2019 Spring to 2023 Spring for LCS, LEC, LCK, 2021 Summer to 2023 Spring for LPL
- Initialize all players to 1000 ELO
- Convert all gold to gold per 30 minutes
- For each match, update using $f(x)$ (Traditional) and $g(x)$ (Modified), repeat
- Regress back to mean after every season using

$$R_i^* = 1000k + R_i(1 - k)$$

- Probability of player i 's victory is μ_{ij} , mean over all μ_{ij} is probability of team's victory (assumes all players contribute equally)

General Results

About $\frac{2}{3}$ of players in each league are rated below 1000, which is the mean ELO. Consider a distribution of the skill of all LoL players, where the dashed line represents 1000 ELO and the shaded area represents professional players.



Ideal K-Factor

- Traditional:

$$MSE = \sum (S_{ij} - \mu_{ij})^2$$

- Modified:

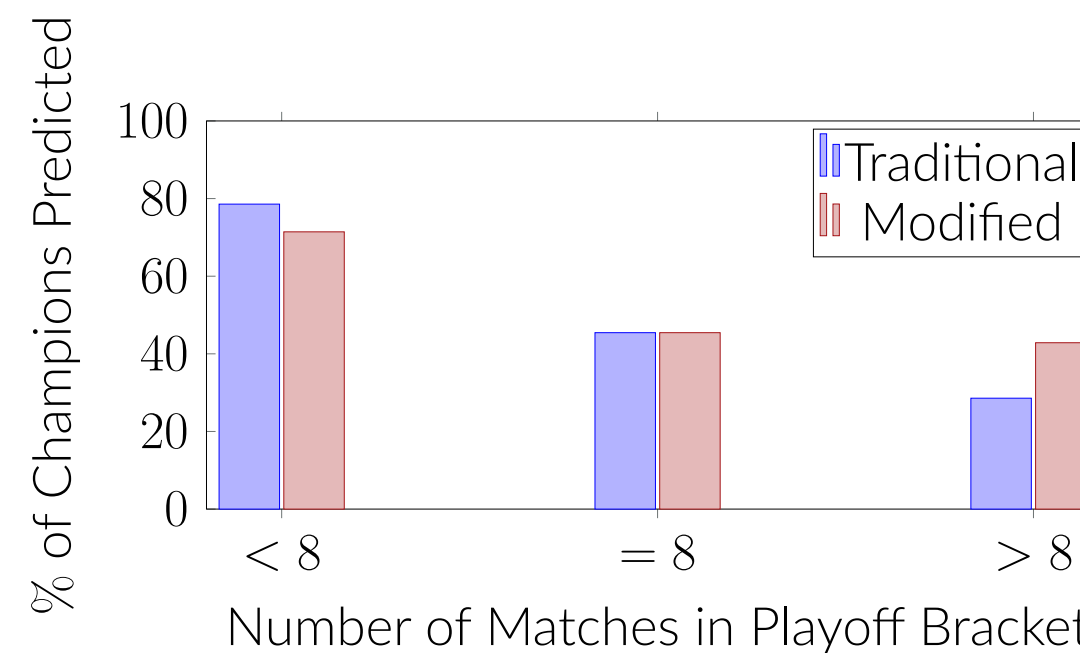
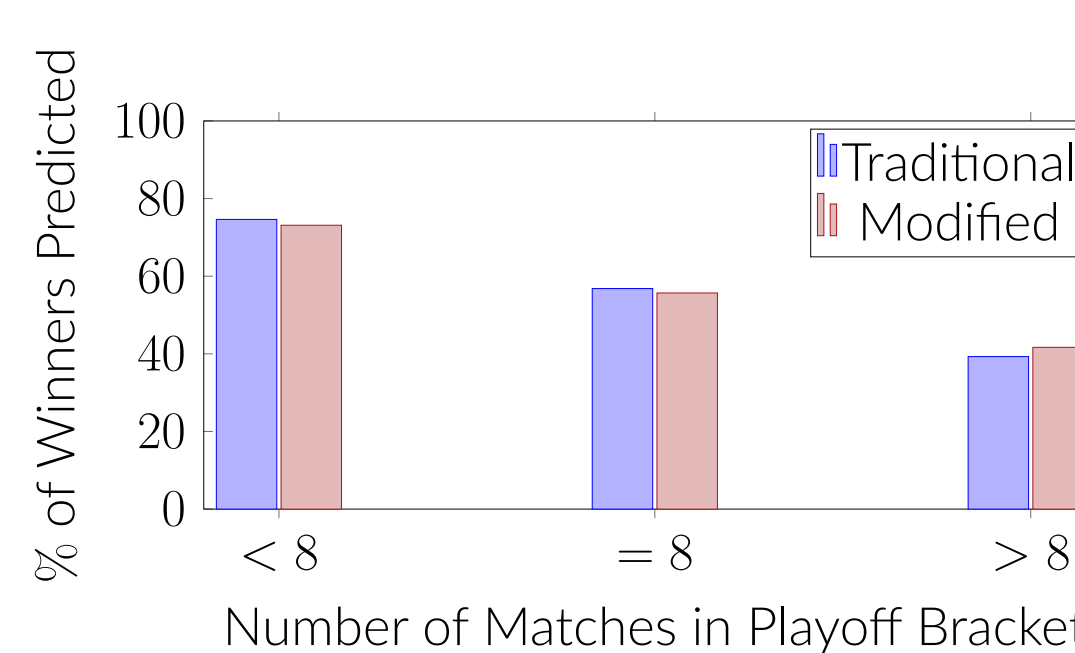
$$MSE = \sum ((X_i - X_j) - (R_i - R_j))^2$$

- Higher than K -Factors used for playoffs

League	Traditional	Modified
LCS	39.5	36.5
LEC	35.5	35
LCK	44.5	41
LPL	35	34

Playoff Predictions

- K -Factors
 - Traditional - $K = 20$
 - Modified - $K = 15$
- One point is assigned for correctly predicting the winner of a match (March Madness).



Difficulty in Predicting Playoffs

- There could be multiple paths to the final
- Many more matches are played
- Rematches: excluding the LPL, losing teams were 8-4 in rematches

Conclusions

- Distribution of player ELO correctly reflects the expected distribution of skill
- K -Factors suggest that experience is more important in playoffs than recent success
- Model is much better at predicting smaller playoff brackets, especially single-elimination
- We would expect to have similar success predicting individual matches

Future Research

- Single game predictions, margin of victory (Modified System)
- Dynamic K -Factor
- Other in-game factors (champion, vision, etc.)
- Cross-league comparisons, World Championship
- Team Synergy



References

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