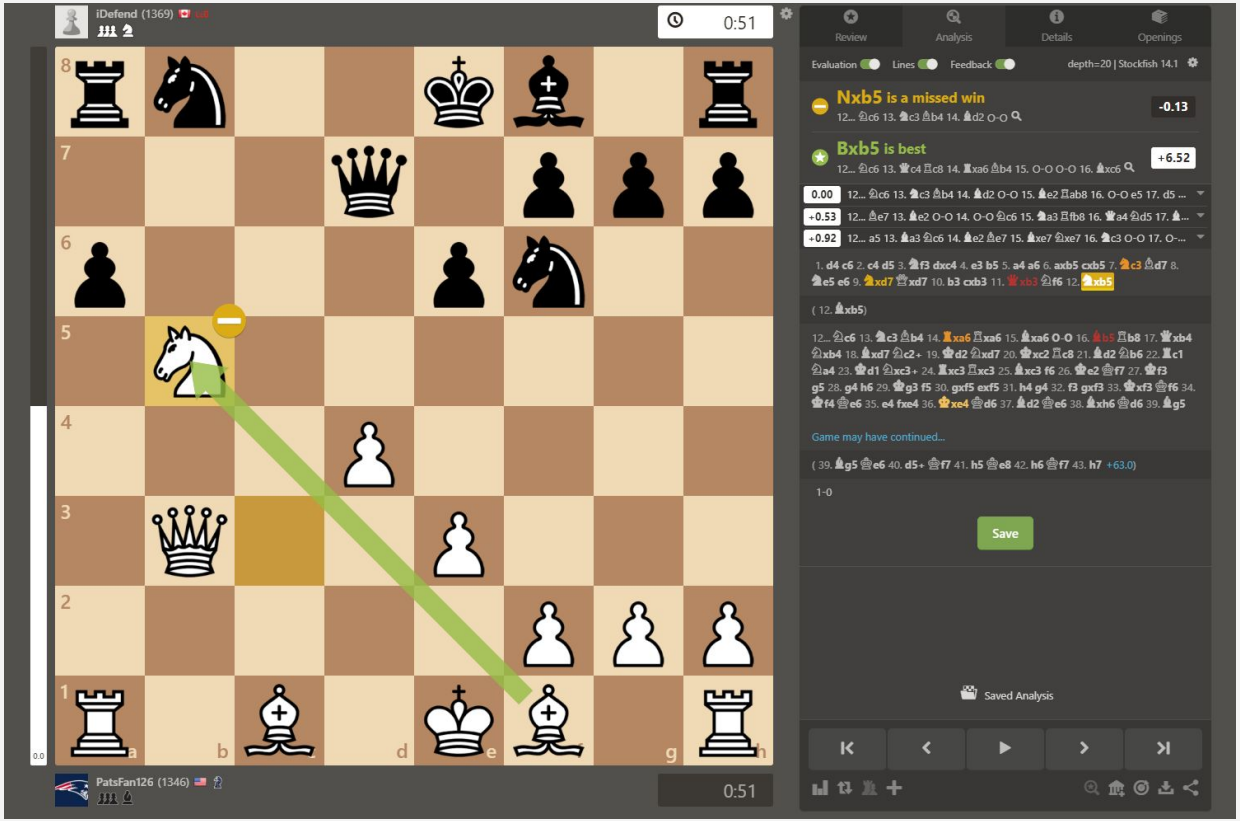
A Naive Analytical Valuation of Chess Pieces

BY RAJ DASANI

HOW DO WE LEARN CHESS?



- Memorize Openings
- Chess Puzzles
- Study End games
- Review Best Moves
- Practice, Practice, Practice

RESEARCH PURPOSE

- Goal: Not to Reinvent the Wheel
  - Chess AI are getting significantly ahead of humans, and they probably won't stop anytime soon

- Look at chess from a learning perspective that is **not geared towards perfection** but rather understanding the individual pieces
  - How they differ among player levels and time intervals

- Can we create a new way to improve at chess?

DATA OVERVIEW

Data Overview

- 20,000 chess games from LiChess
- Features: time limit of game, ratings of players, script of game

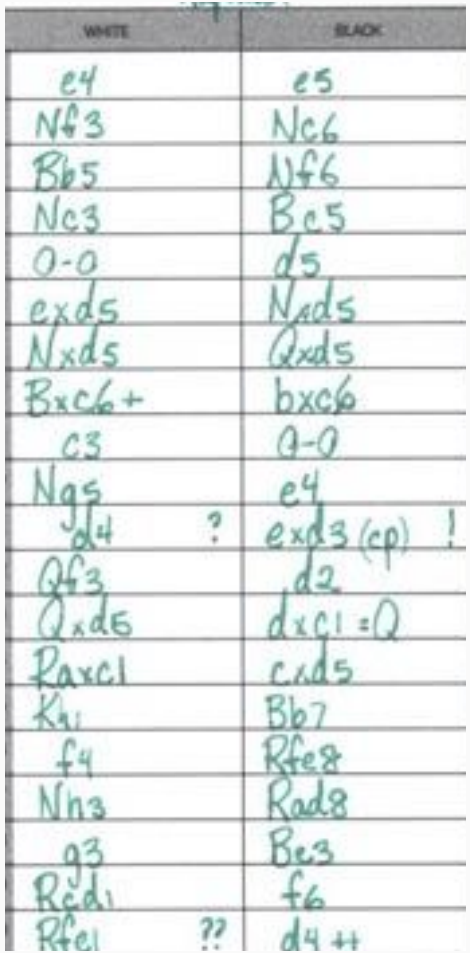
Data Segmentation

- Rating classes per players

Examples:
1800-1999 : Class A
900-1200 : Novice

Pieces and Point Value		
Pawn	♟	1
Knight	♞	3
Bishop	♝	3
Rook	♜	5
Queen	♛	9
King	♚	priceless

Chess Script



WHITE	BLACK
e4	e5
Nf3	Nc6
Bb5	Nf6
Nc3	Bc5
0-0	d5
exd5	Nxd5
Nxd5	Qxd5
Bxc6+	bxc6
c3	0-0
Ng5	e4
d4 ?	exd3 (ep) !
Qf3	d2
Qxd6	dxc1=Q
Raxc1	cxd5
Kh1	Bb7
f4	Rfe8
Nh3	Rad8
g3	Be3
Rcd1	f6
Rfe1 ??	d4 ++

SCRIPT ANALYSIS

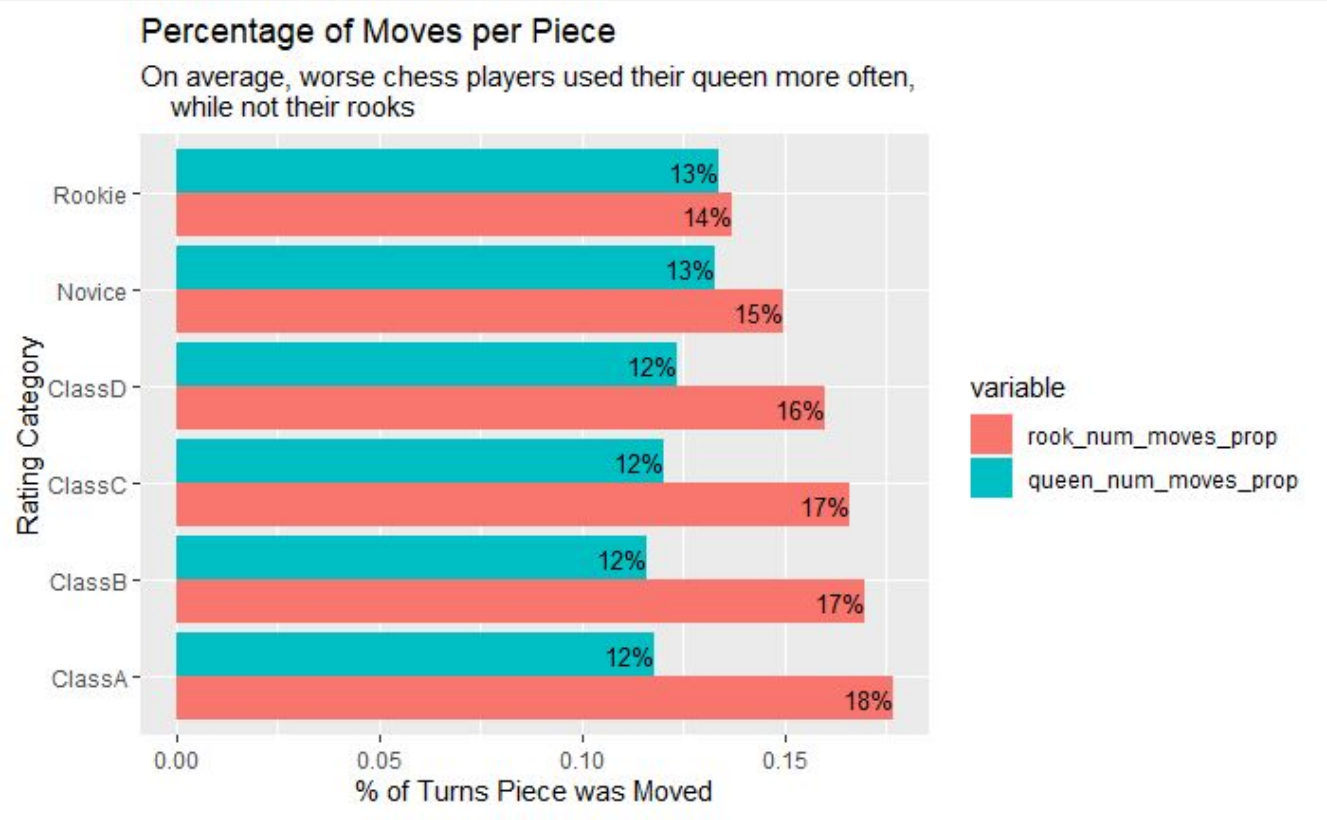
Pull Features per Piece

(Pawn, Knight, Bishop, Rook, Queen, King)

- The pieces it took (indicated by the “x” in the moves)
  - The value of the pieces it took
  - The list of the pieces it took
    - Used especially in Model 2 + 3
- The amount of times it moved
- The amount of checks it made

DIFFERENCES AMONG RATING CATEGORIES

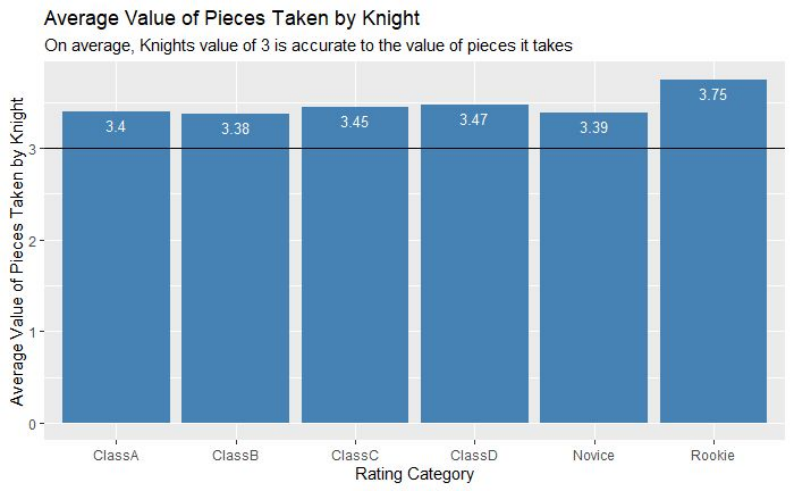
PIECE MOVE TENDENCIES

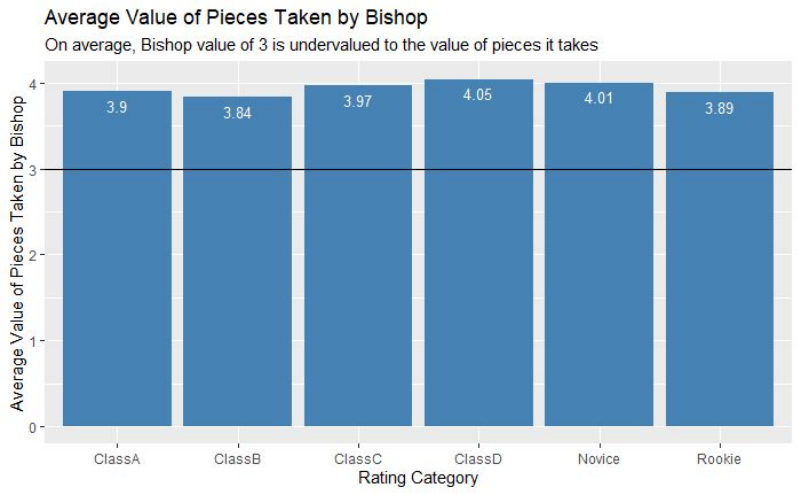


On average, less experienced players moved their might more often, while more experienced players moved their kings more often.

MODEL I: TAKES + CHECKS MODEL

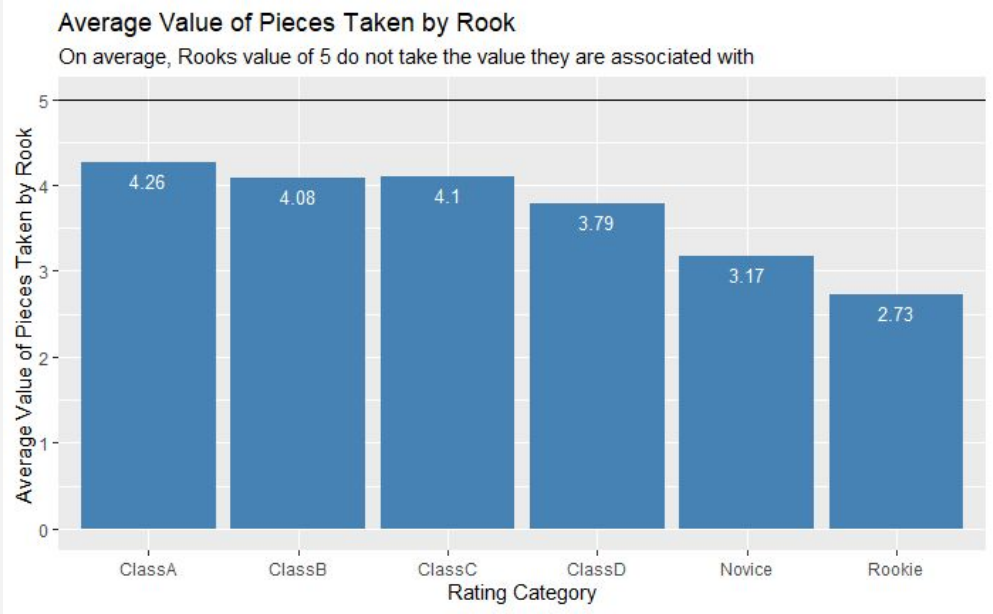
Think “Counting stats”



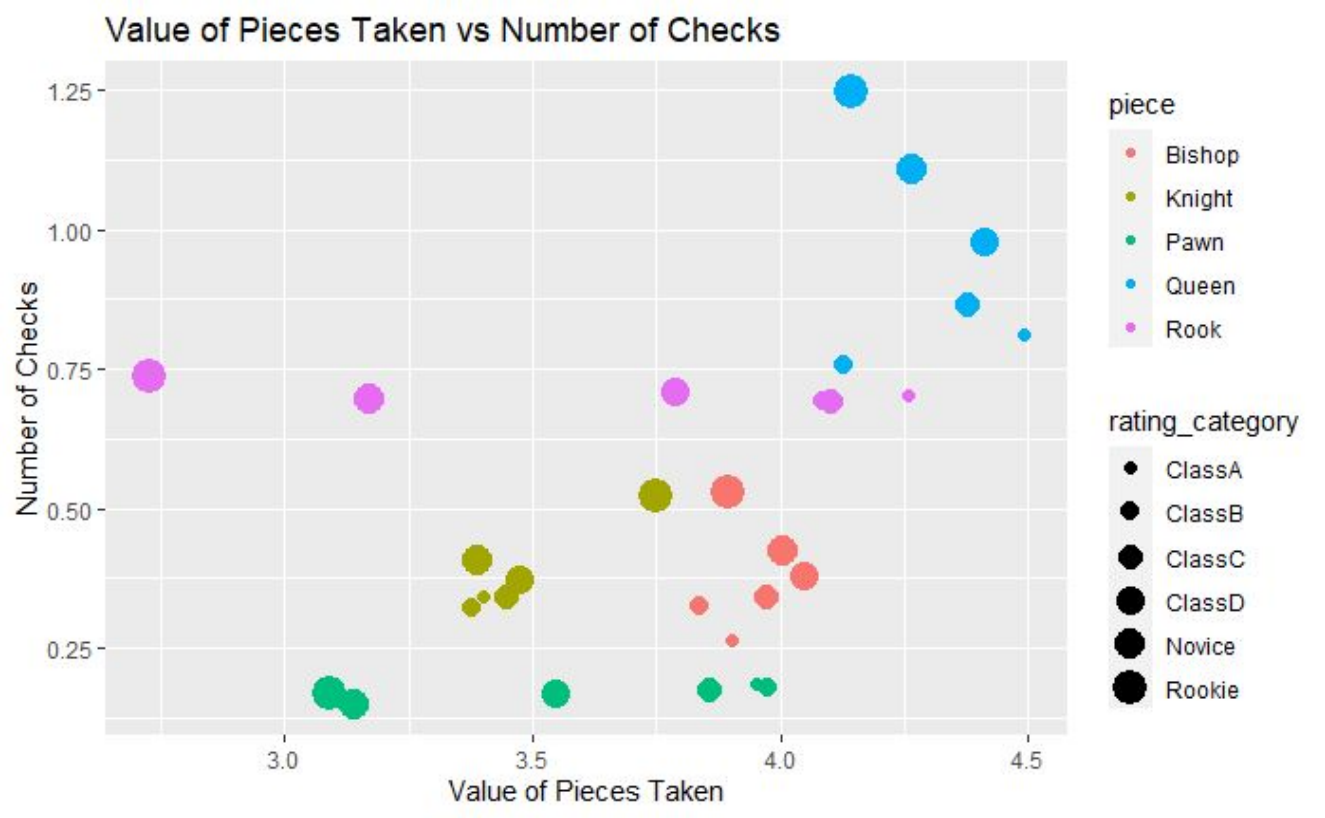


VALUE OF PIECES TAKEN

Via values of pieces taken,
the knight slightly exceeds its value of 3,
the bishop definitely exceeds its value of 3,
but the rook subceeds its value of 5



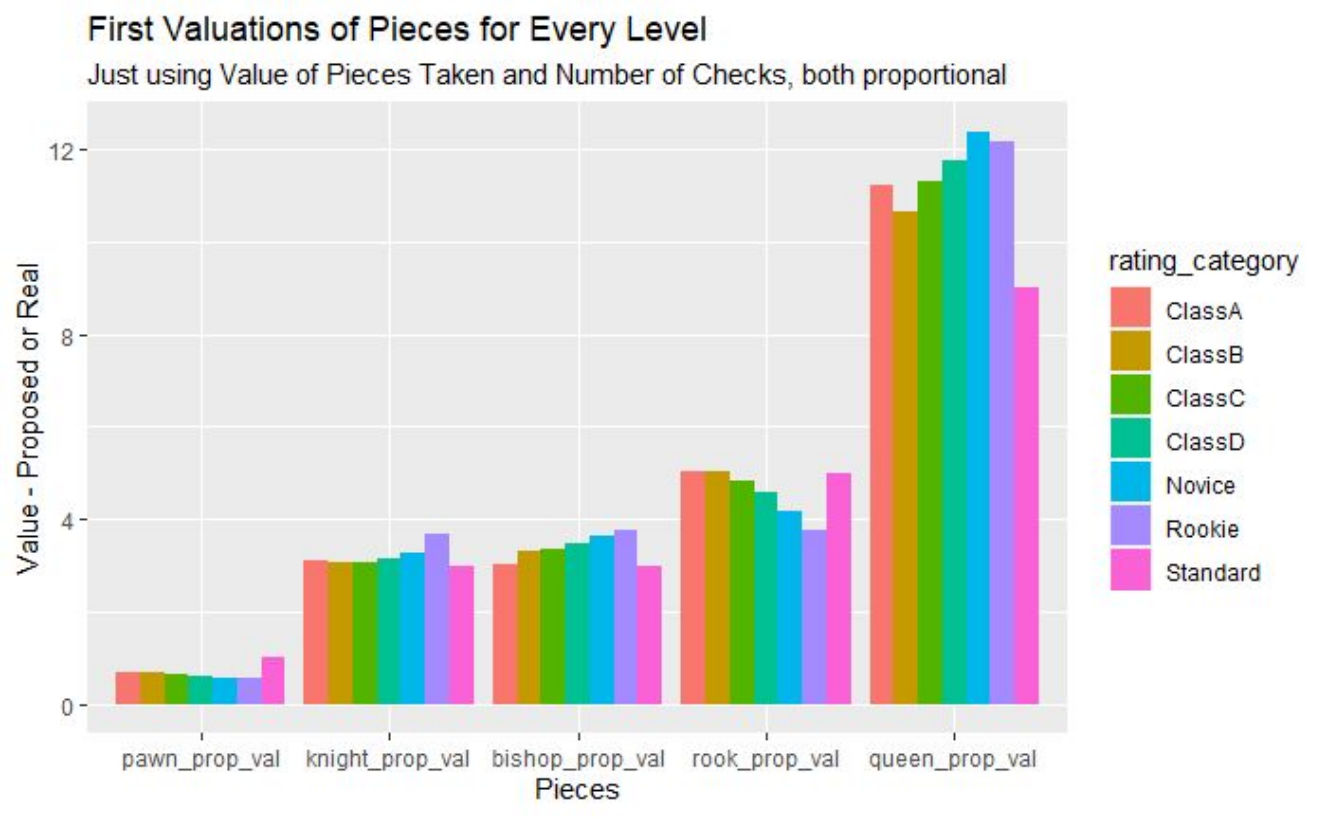
FIRST VALUATION



Different colors are different pieces

Smaller the circle, the better the player rating

FIRST VALUATION



Taking a proportion of the amount of checks and the value of pieces each piece took, and scaling it to 39 (the total value of typical pieces on a board, we get these proposed values for every level

Common trends:
- Pawn overvalued
- Bishop + Queen currently undervalued
- Rook appropriately valued for better players, not for worse

FIRST VALUATION

Comparing the top(ish) rating category, the bottom(ish) rating category, and the standard values

	rating_category	pawn_prop_val	knight_prop_val	bishop_prop_val	rook_prop_val	queen_prop_val
1	ClassA	0.68	3.11	3.02	5.05	11.23
2	Novice	0.56	3.26	3.66	4.16	12.38
3	Standard	1.00	3.00	3.00	5.00	9.00

Overall, the standard values are **a lot closer to both then I initially thought** for how arbitrary these values are. The values are extremely close to the better pro players interestingly enough

MODEL 2: LOG ODDS

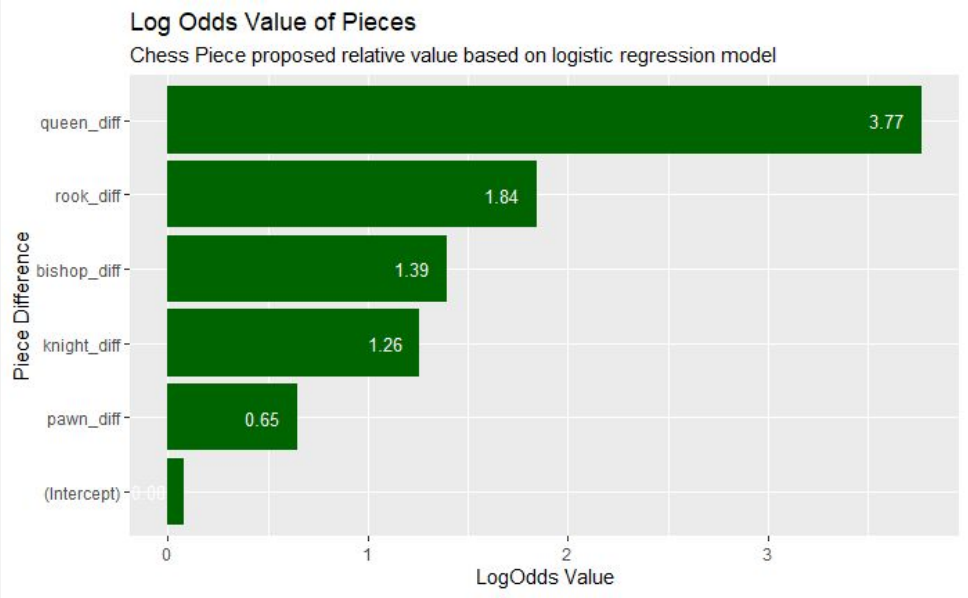
LOGISTIC REGRESSION

Formula

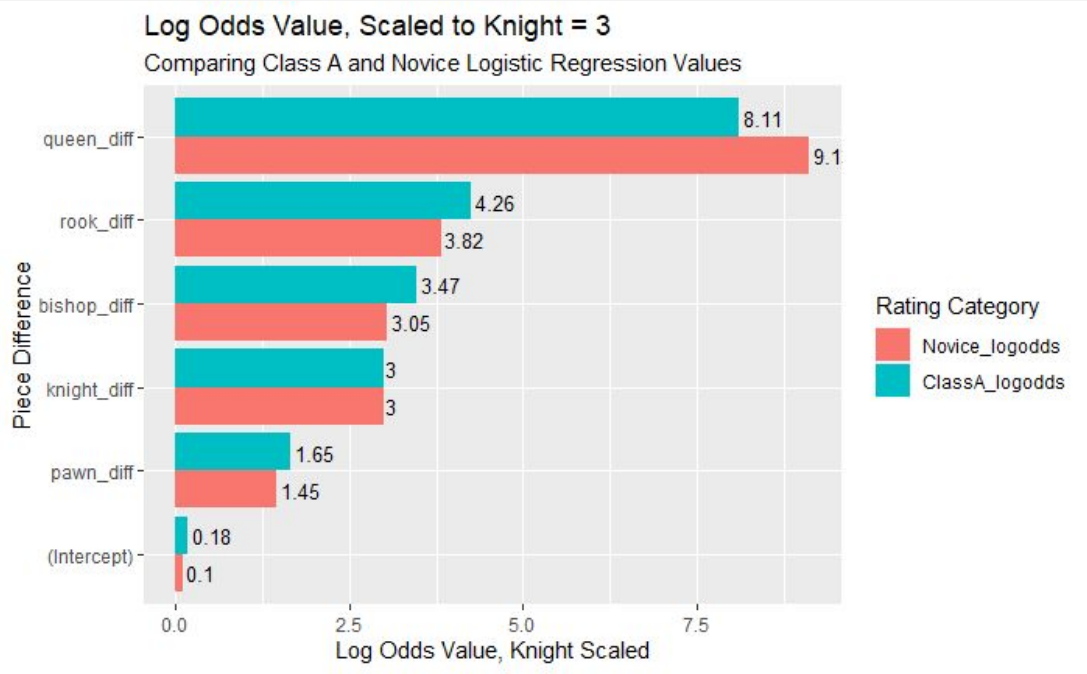
- Correlate the win of a game to the pieces remaining on the board
- *winner ~ bishop_rem + knight_rem + pawn_rem +queen_rem + rook_rem*

LogOdds

- Coefficients of Logistic Model turned positive



COMPARE RATING CATEGORIES - SCALED TO KNIGHT = 3



- For worse players, there persists the overvalue of the Queen for nearly everything else
  - Queen: +1
  - Rook: -0.4
  - Bishop: -0.4
  - Pawn: -0.2

MODEL 3: TREES OF SUCCESS

CONCLUSION, FUTURE PURPOSE

CONCLUSION

Conclusion

- Values differ among player rating categories
- Overuse of the queen at lower levels
- Underuse of pieces, especially the rook at lower levels

Combining Predictions

- Weighted average of models, based on personal confidence / rating of the models
- Predictions for each rating category and different time intervals

Future Parts

- Including pairs of pieces into my analysis (i.e. 2 bishops vs 2 knights, 1 queen vs 1 rook and 1 knight)

Creating a Program for Everyone to Use to Get Better

A System which:

1. Takes in all your personal games (via scripts)
2. Analyzes games on a piece by piece basis, and segments it based on a variety of metrics
3. Provides recommendations of ways to improve with such pieces, such as an opening that gets a rook more involved or a less vulnerable queen