Presentation - Positional analysis of chess games

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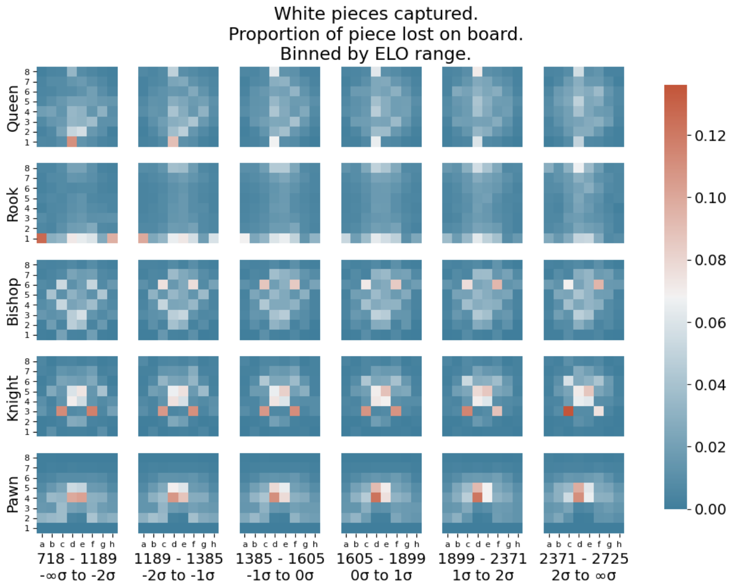
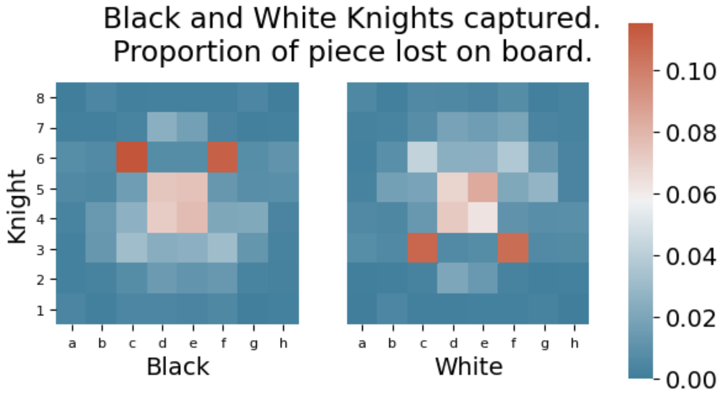
May 7, 2021

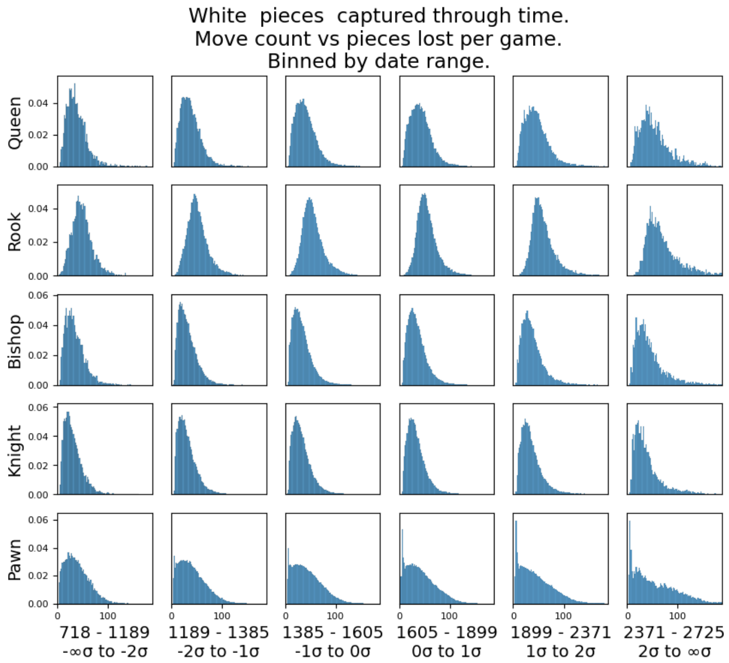
Heat map grid



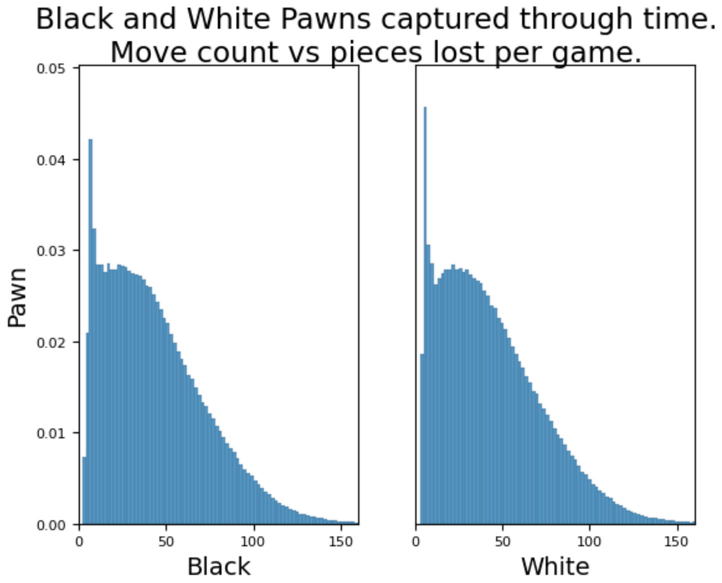
Head map single



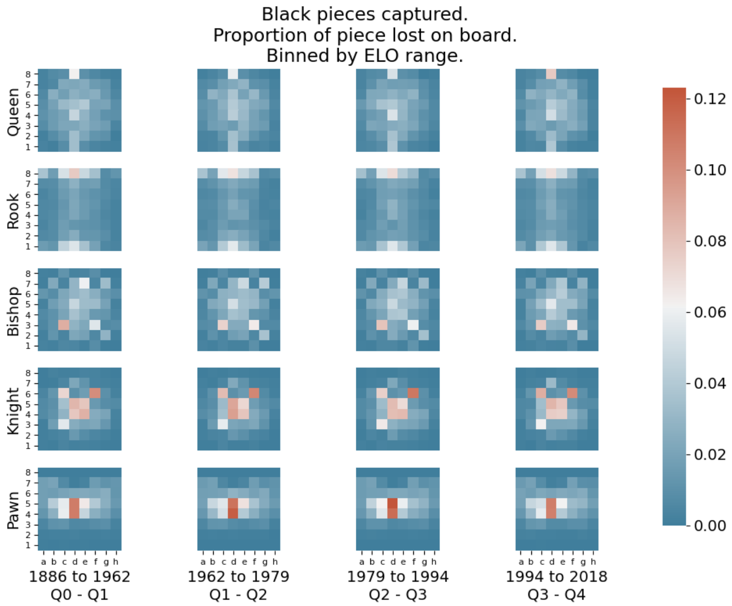
Histogram grid



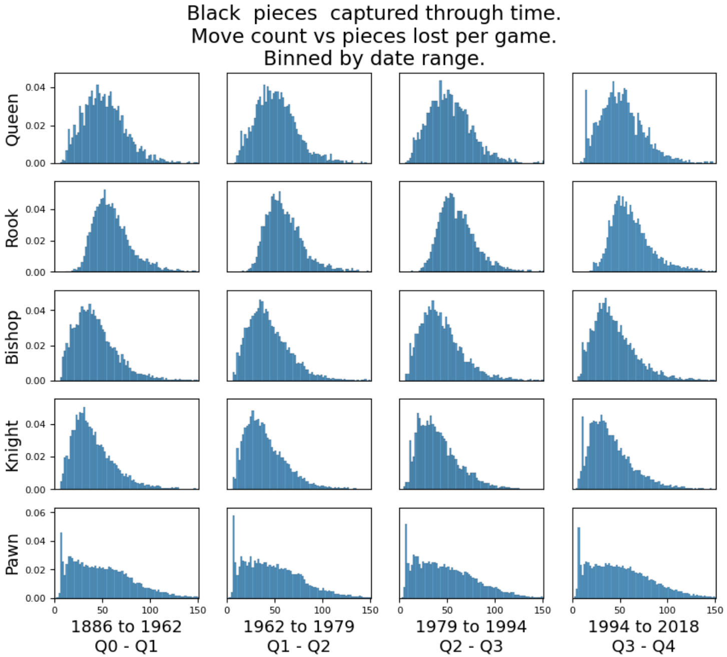
Histogram single



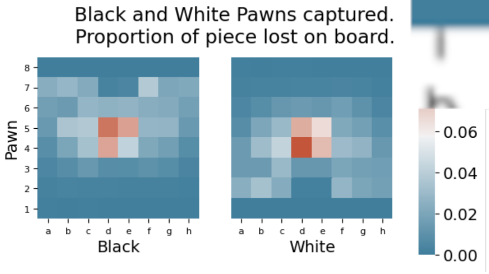
Date based plots



Date based plots



Pawn capture on 8th rank



Pawn capture on 8th rank

> *3.7e) When a pawn reaches the rank furthest from its starting position it must be exchanged as part of the same move on the same square for a new queen, rook, bishop or knight of the same colour. The player's choice is not restricted to pieces that have been captured previously. This exchange of a pawn for another piece is called 'promotion' and the effect of the new piece is immediate.*

Source: FIDE Laws of chess

Bug location

```
def piece_delta(board: chess.Board, count: int, piece_count: Dict[int, int],
                colour: bool) -> Tuple[int, int, int]:
    piece_position = (0, 0, 0)
    for key, value in piece_count.items():
        current_count = bin(board.pieces_mask(key, colour)).count('1')
        if current_count < value: # Detects lost based on previous state
                piece_position = (key, uci_to_1d_array_index(board.peek().uci()),
        ↪   count)
            piece_count[key] = current_count # Modify by object-reference
            break
        elif current_count > value: # Accounts for promotion
                piece_count[key] = current_count # Modify by object-reference
                piece_count[chess.PAWN] = bin(board.pieces_mask(chess.PAWN,
            colour)).count('1')  # Account for pawn count change
                break
    return piece_position # piece id, position, count
```

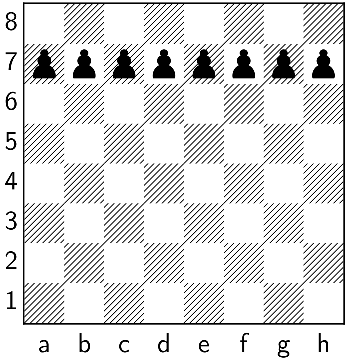
Bug location

```
board.pieces_mask(chess.PAWN, chess.BLACK)
```

Data structure

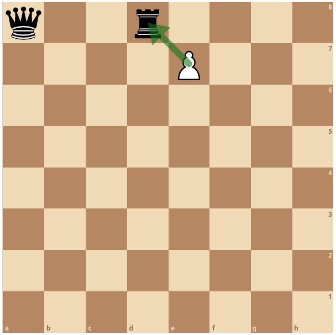
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Board

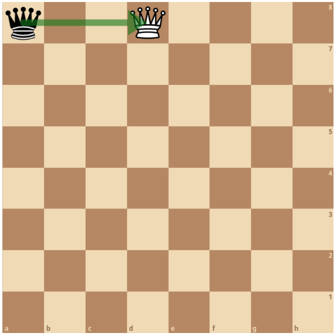


Culprit

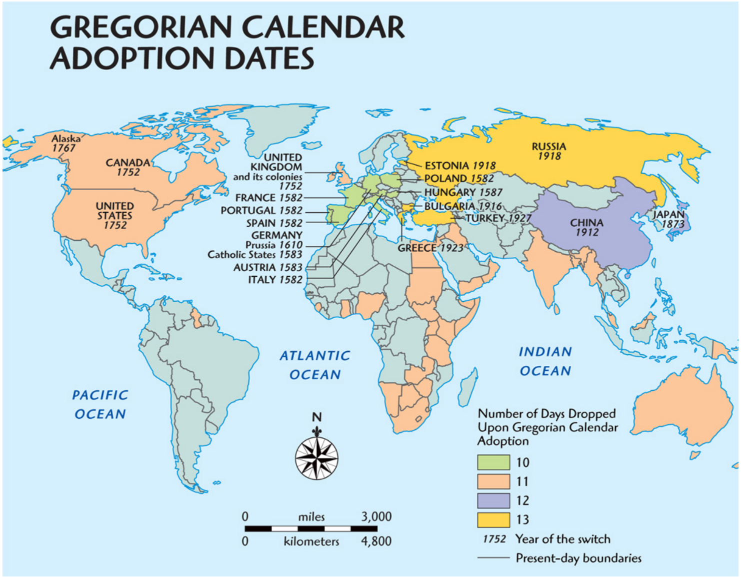
Inital state



Final state



Timezones



https://www.familytreemagazine.com/wp-content/uploads/2018/10/Gregorian-calendar-large.jpg?x73159

Performance

FISC

```
$ wc -l *
    3502985 ficsgamesdb_2000.pgn
    ...
   11126076 ficsgamesdb_2020.pgn
  452107755 total

$ du -h ./
17G

$ ls | wc -l
21
```

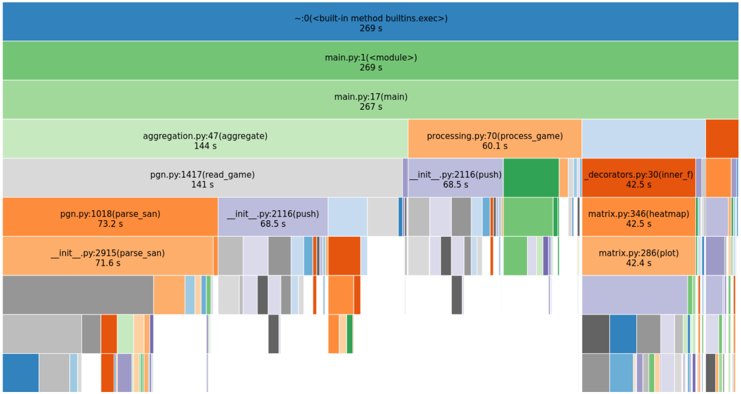
Tournements

```
$ wc -l *
     178 Aachen1868.pgn
     ...
    1196 Zurich2015.pgn
 1786360 total

$ du -h ./
64M

$ ls | wc -l
1059
```

Profiling


~:0(<built-in method builtins.exec>)
269 s
main.py:1(<module>)
269 s
main.py:17(main)
267 s
aggregation.py:47(aggregate)
144 s
processing.py:70(process_game)
60.1 s
pgn.py:1417(read_game)
141 s
__init__.py:2116(push)
68.5 s
_decorators.py:30(inner_f)
42.5 s
pgn.py:1018(parse_san)
73.2 s
__init__.py:2116(push)
68.5 s
matrix.py:346(heatmap)
42.5 s
__init__.py:2915(parse_san)
71.6 s
matrix.py:286(plot)
42.4 s

Evaluation of positions using engines

Learning to Evaluate Chess Positions with Deep Neural Networks and Limited Look ahead

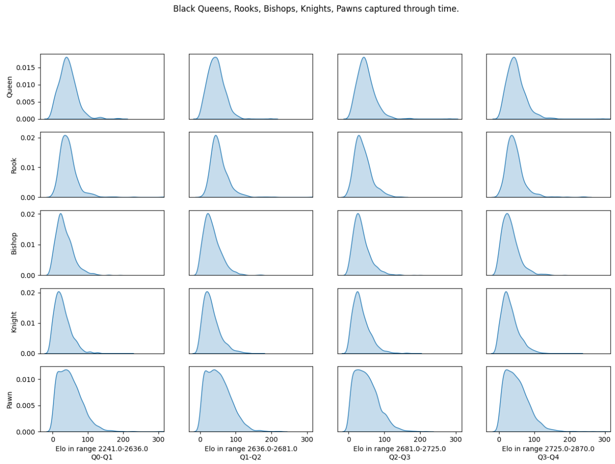
> *. . . We collect around 3,000,000 different chess positions played by highly skilled chess players and label them with the evaluation function of Stockfish, one of the strongest existing chess engines. We create 4 different datasets from scratch that are used for different classification and regression experiments. . . .*

doi:10.5220/0006535502760283

Popular chess engines

- Stockfish
  - Strongest currently
  - Traditional
  - FOSS
- Leela Chess Zero
  - Self-taught through reinforcement learning and repeated self-play
  - FOSS
- AlphaZero
  - First engine to use reinforcement learning and self-play
  - Propriety
- Komodo
  - Propriety
  - Used by `Chess.com` for it's celebrity bots

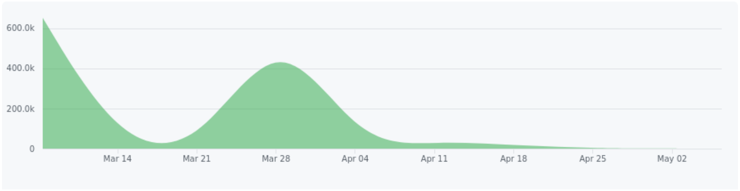
KDE plots



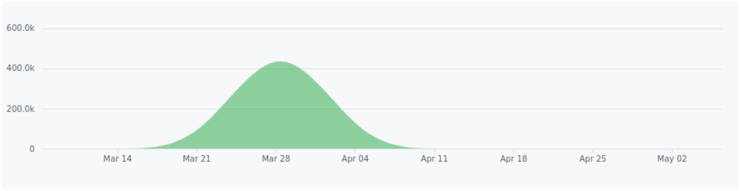
Black Queens, Rooks, Bishops, Knights, Pawns captured through time.
Queen
Rook
Bishop
Knight
Pawn
0.015
0.010
0.005
0.000
0.02
0.01
0.00
0
100
200
300
Elo in range 2241.0-2636.0
Q0-Q1
Elo in range 2636.0-2681.0
Q1-Q2
Elo in range 2681.0-2725.0
Q2-Q3
Elo in range 2725.0-2870.0
Q3-Q4

Final words

Source code: `https://github.com/Jake-Moss/chess-analysis`
Additions:



Deletions:



Broke git once on Mar 7, 2021.
Everything was written in Emacs.