

# Chess AI with Minimax $\alpha$ - $\beta$ Pruning

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- 1951: Alan Turing suggests theoretical possibility
- 1989: Chess world champion Gary Kasparov defeated IBM's Deep Thought in a chess match
- 1997: IBM's Deep Blue becomes the first chess AI to defeat a grandmaster in a match
- 2017: AlphaZero, a neural net-based digital automaton, beats Stockfish 28–0, with 72 draws in chess matches

<https://builtin.com/artificial-intelligence/chess-ai>

10 moves give around  $10^{29}$  possible configurations

Reference

# Board Representation

```
int _board[8][8] = {  
    { bR, bN, bB, bQ, bK, bB, bN, bR },  
    { bP, bP, bP, bP, bP, bP, bP, bP },  
    { NA, NA, NA, NA, NA, NA, NA, NA },  
    { NA, NA, NA, NA, NA, NA, NA, NA },  
    { NA, NA, NA, NA, NA, NA, NA, NA },  
    { NA, NA, NA, NA, NA, NA, NA, NA },  
    { wP, wP, wP, wP, wP, wP, wP, wP },  
    { wR, wN, wB, wQ, wK, wB, wN, wR }  
};
```

Figure: 8 x 8 Array of Enums

# Board Representation

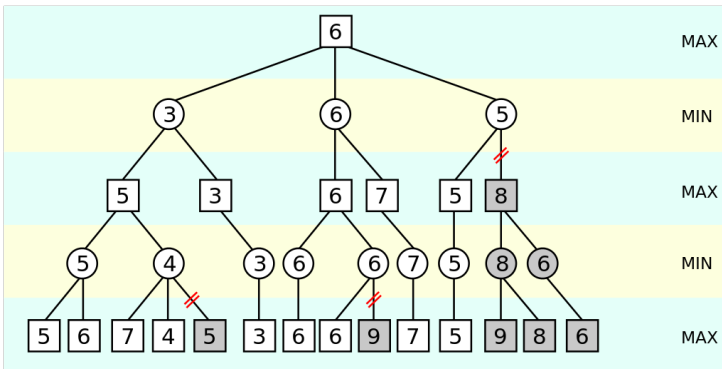


Figure: 8 x 8 Array of Enums

Wikipedia

Chess Piece	Value
Pawn	1
Knight	3
Bishop	3
Rook	5
Queen	9
King	50

**Table:** Values assigned to each chess piece for evaluation.

# It's Playable! ([github.com/Aki78/ChessAI](https://github.com/Aki78/ChessAI))

	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
8		r		n		b		q		k		b		n		r											
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
7		p		p		p		p		p		p				p											
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
6														p													
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
5																											
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
4												P															
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
3																											
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
2		P		P		P		P		P				P		P											
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
1		R		N		B		Q		K		B		N		R											
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+
		A		B		C		D		E		F		G		H											



# Against 1500 Elo AI (chess.com)

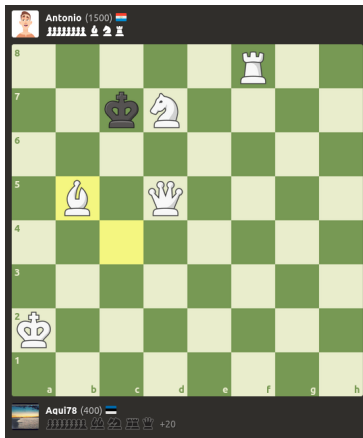


Figure: Draw: easily took all pieces, but couldn't finish it. (depth = 5 )

# Further Development

- Better Evaluation Function
- Reordering Moves for  $\alpha - \beta$  pruning
- Using bit operations with a bit representation
- Use Opening books and End Game Tables
- Machine Learning?  $\rightarrow$  Need a super computer
- etc. etc.