

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

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# History

- 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

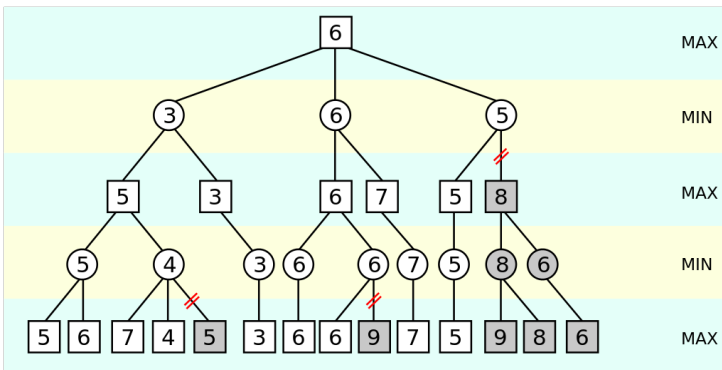


Figure: 8 x 8 Array of Enums

Wikipedia

# 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													

Chess Piece	Value
Pawn	1
Knight	3
Bishop	3
Rook	5
Queen	9
King	20

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



# 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.