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CSE 352 Artificial Intelligence

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AI IN CHESS PLAYING

Sources

- **Machine Learning in Computer Chess: Genetic programming and KRK (2003)** by David Gleich
- Wikipedia

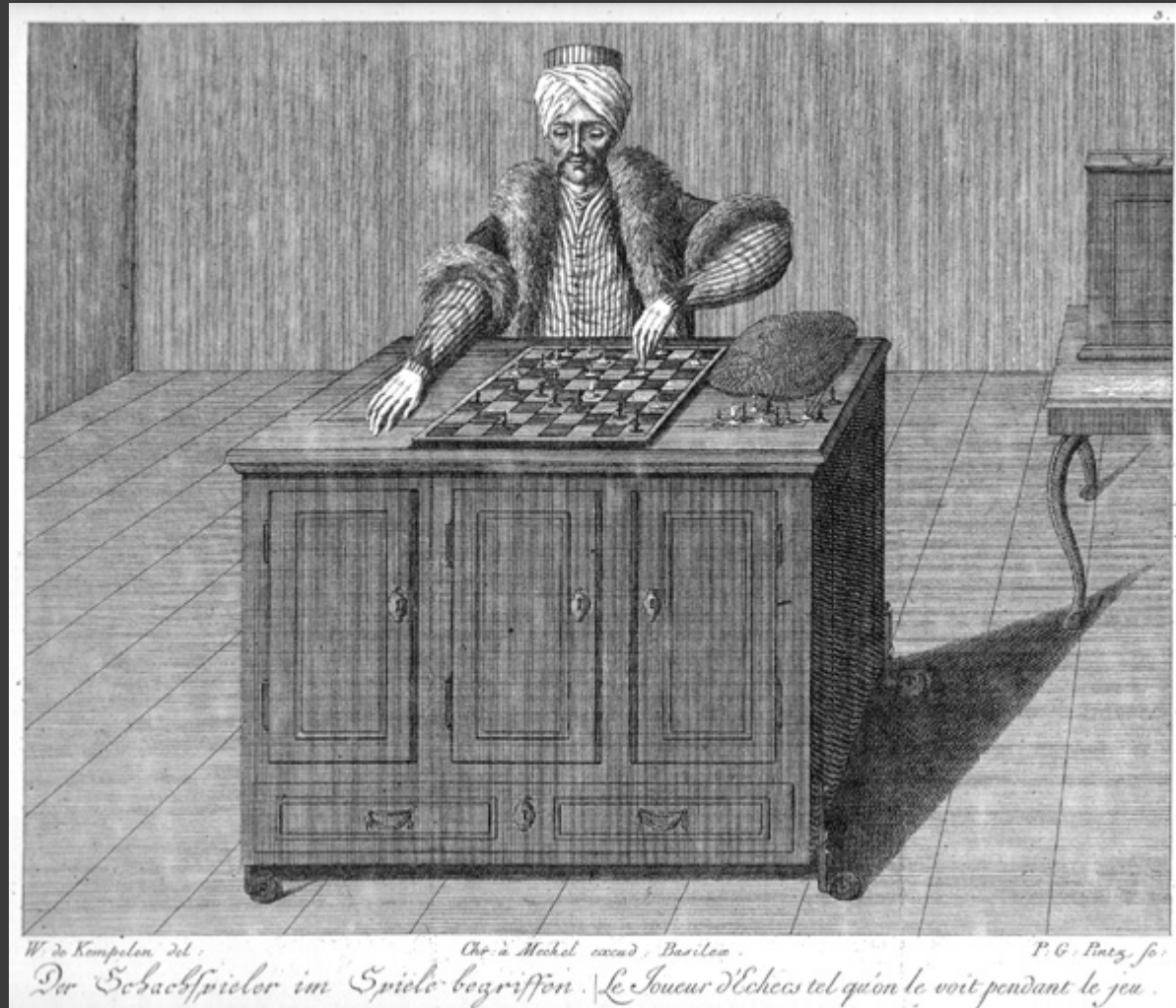
Overview

- The Turk
- Traditional ways– Static Program
- Machine Learning in chess playing

AI in Chess Playing

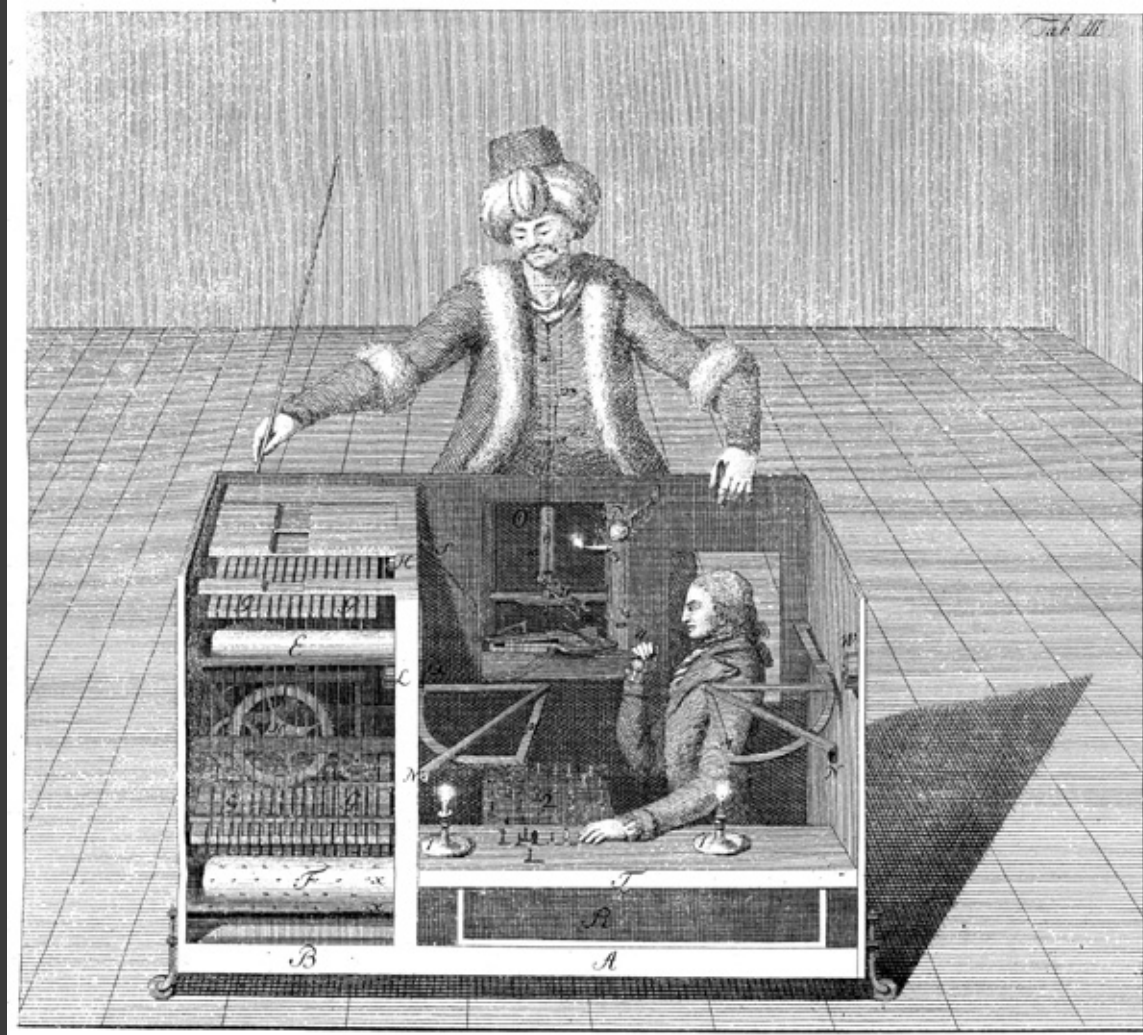
- **The Turk**
- Traditional ways– Static Program
- Machine Learning in chess playing

The Turk



<http://upload.wikimedia.org/wikipedia/commons/2/25/Turk-engraving5.jpg>

A hoax!



http://upload.wikimedia.org/wikipedia/commons/8/8b/Tuerkischer_schachspieler_windisch4.jpg

AI in Chess Playing

- ⦿ The Turk
- ⦿ **Traditional ways– Static Program**
- ⦿ Machine Learning in chess playing

Shannon's view

“A Chess-Playing Machine” [Shannon 88]

- ⦿ Playing perfect chess is impossible!
 - Too complicated
 - 10^{120} nodes in a full-width chess tree

Static Program

- Rules
- Alpha-beta pruning

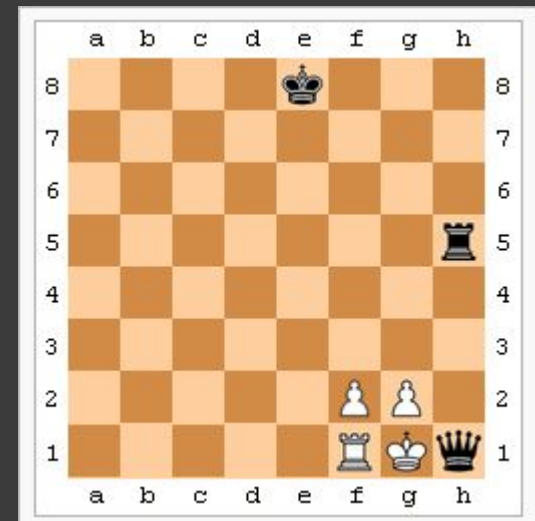
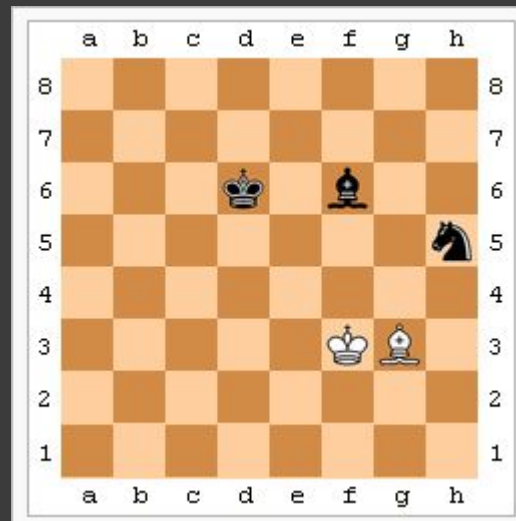
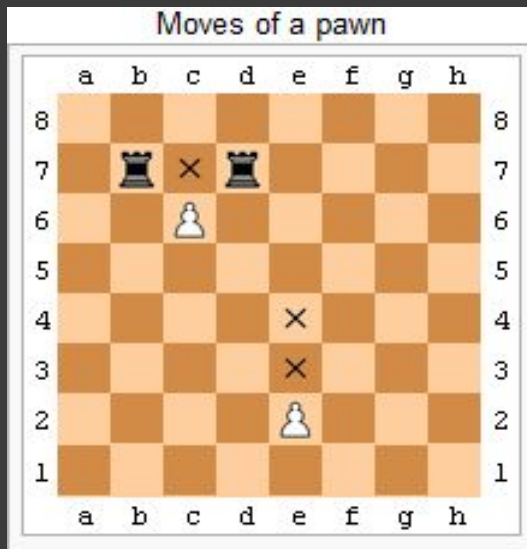
[Shannon88], [Mar81], [Sch86], [Sch96],
and [Hyatt90]

Rules

- ⦿ Judge every possible move
- ⦿ Build a value system

Example for the rules

- “Eat”/Check/Checkmate
- Assign an value



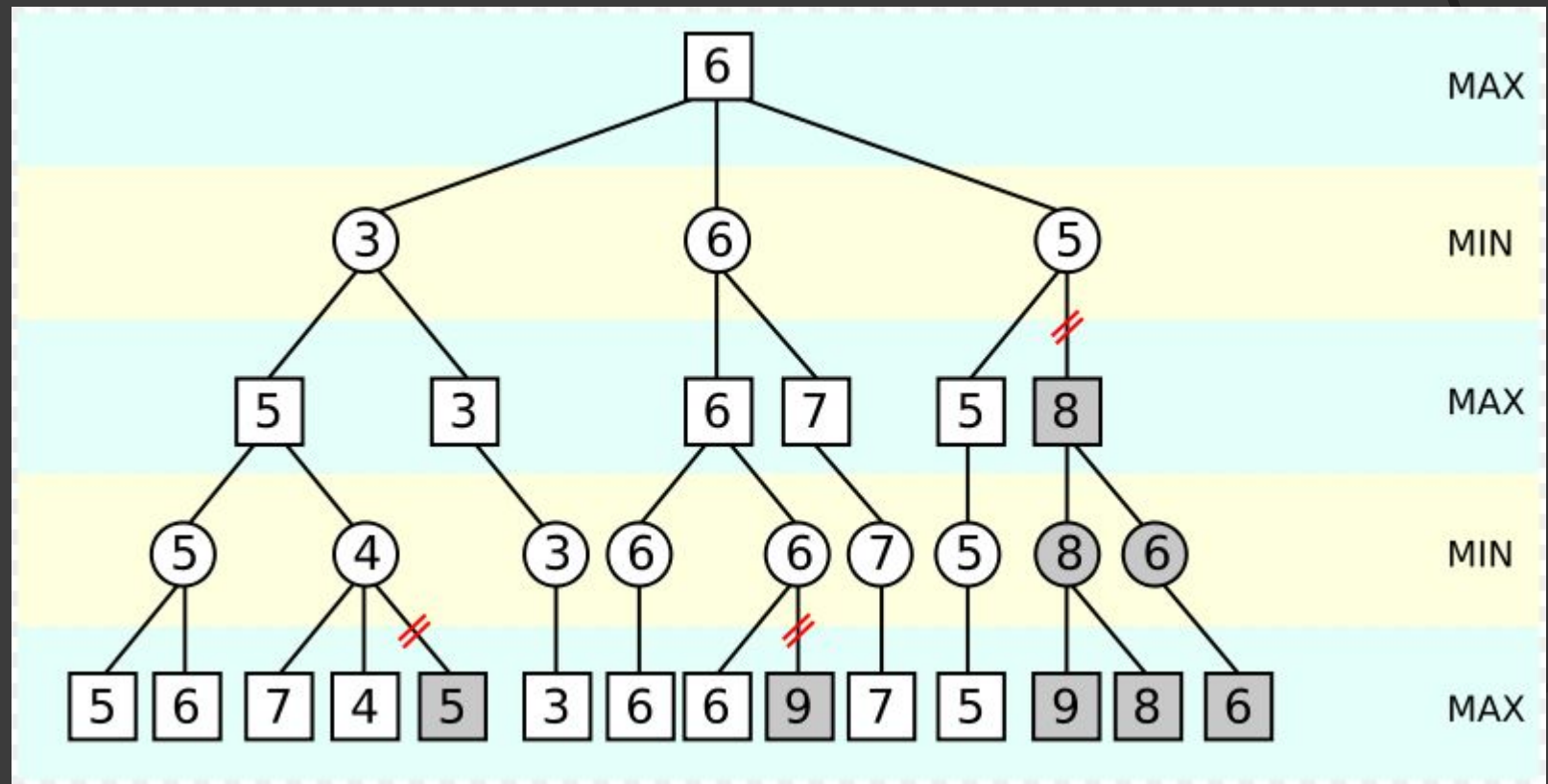
http://en.wikipedia.org/wiki/Rules_of_chess#CITEREFHarkness1967

Alpha-beta pruning

- ◎ **Alpha-beta pruning** is a search algorithm which seeks to reduce the number of nodes that are evaluated in the search tree by the minimax algorithm.

http://en.wikipedia.org/wiki/Alpha_beta_pruning

Example of Alpha-beta pruning



http://en.wikipedia.org/wiki/Image:AB_pruning.svg#file

AI in Chess Playing

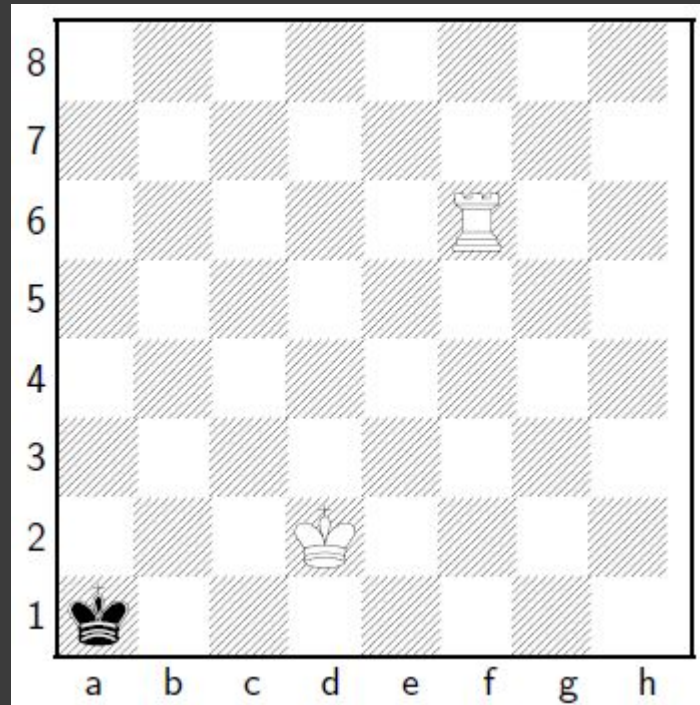
- ⦿ The Turk
- ⦿ Traditional ways– Static Program
- ⦿ **Machine Learning in chess playing**

See the paper again

- **Machine Learning in Computer Chess: Genetic programming and KRK (2003) by David Gleich**

What is KRK?

- king-rook-king

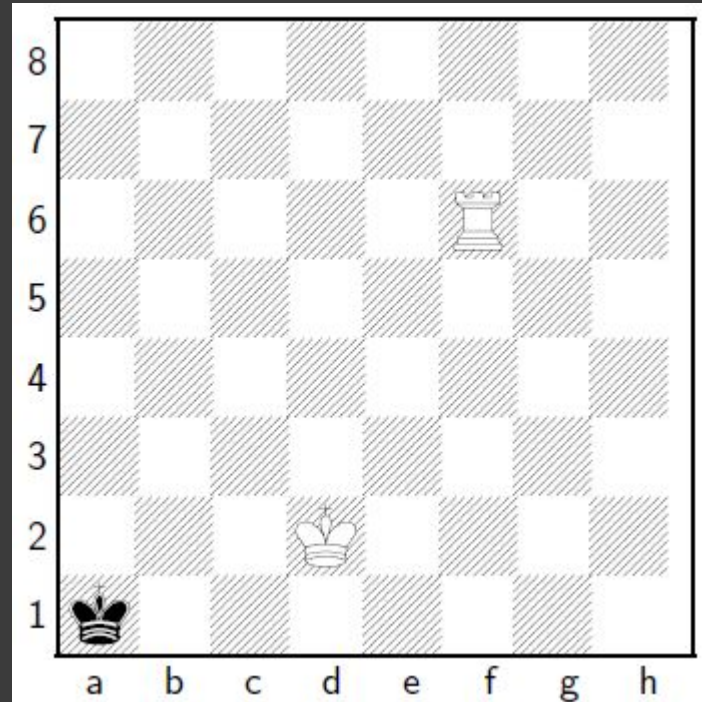


Why KRK?

- the king-rook-king (KRK) set from the University of California Irvine machine learning database [BM98]
- This dataset contains all the positions where a sole black king stands against a white king and white rook with the black king's turn to play.

Example of the dataset

- 1 . . . Kb2
- 2 Rf3 Kb1
- 3 Kc3 Ka2
- 4 Rf1 Ka3
- 5 Ra1#



d,2,f,6,a,1,four

Genetic Programming

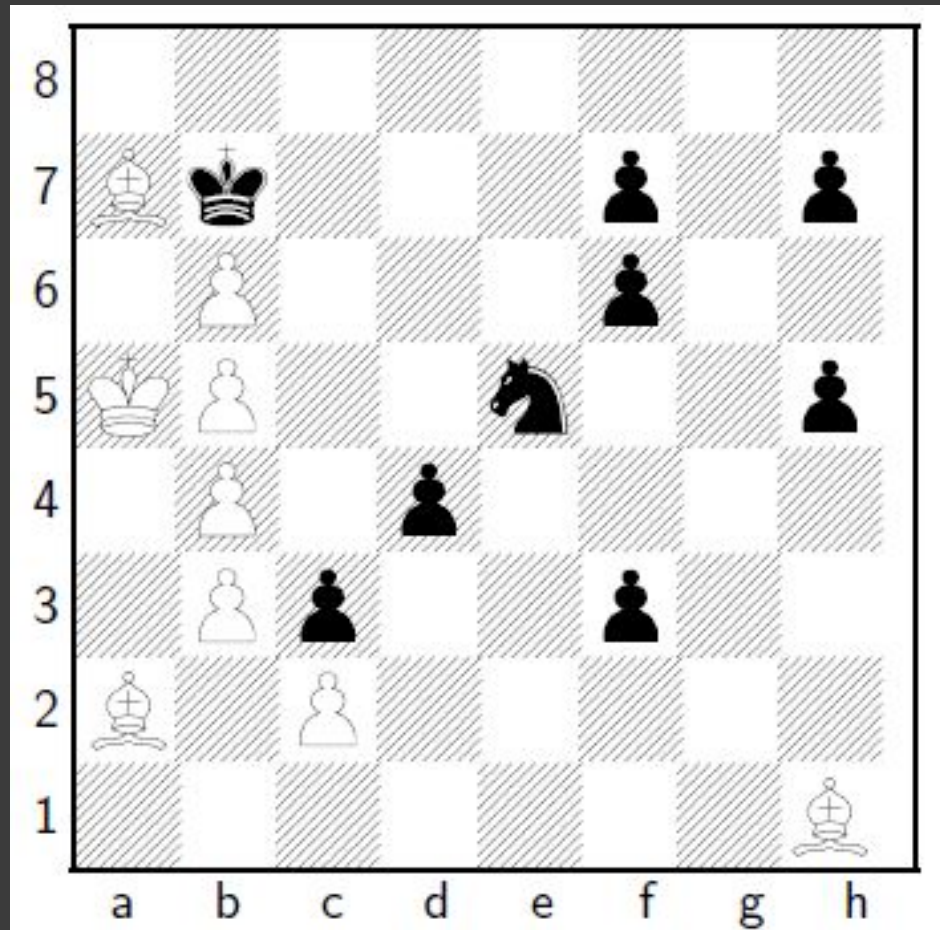
- According to Langdon and Poli, genetic programming is a type of evolutionary algorithm [LP98].
- In general, evolutionary algorithms borrow from Darwinian evolutionary concepts to solve search problems.

His result

*krkPetite*₁ learned positions over 145 generations

Class	Correct	Learned	Class	Correct	Learned
C_0	21/27	+21	C_9	1680/1712	+1296
C_1	78/78	0	C_{10}	1910/1985	+1367
C_2	171/246	+171	C_{11}	2763/2854	+1977
C_3	53/81	+47	C_{12}	3509/3597	+2251
C_4	187/198	+148	C_{13}	4146/4194	+2133
C_5	428/471	+370	C_{14}	4501/4553	+2533
C_6	583/592	+443	C_{15}	2166/2166	+1253
C_7	649/683	+529	C_{16}	390/390	+112
C_8	1377/1433	+1012			

Last piece of cake...



Johannes F"urnkranz. A Brief Introduction to Knowledge Discovery in Databases. "OGAI-Journal, 14(4):14-17, 1995

Thank you!