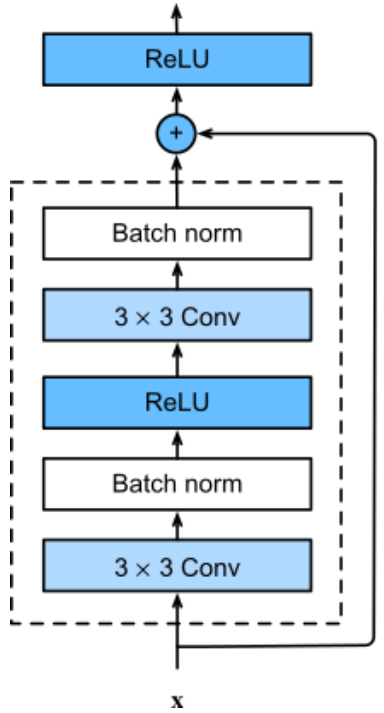
# ChessBreaker

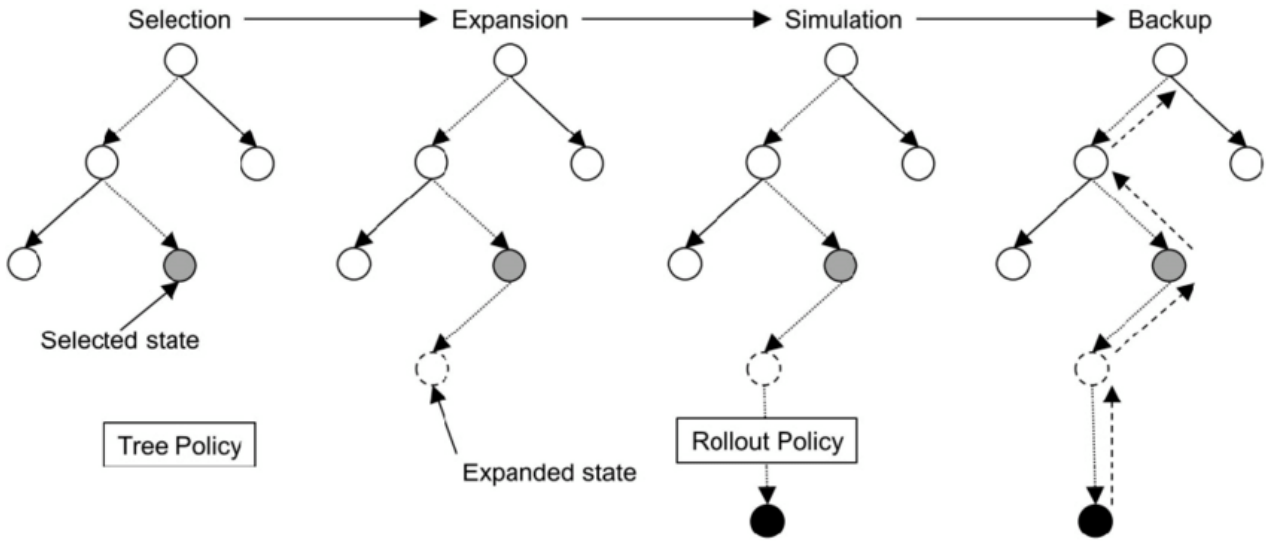
A smaller AlphaZero for endgames

Marcello Ceresini – 2021/2022

# Chess, Neural Network MCTS and Self-play

- Game of perfect information, but state space ~ $10^{123}$
- Resnet variant: constant space dimension and channels + two heads
  - Policy head
  - Value head
- MCTS nodes:
  - P → prior
  - Q → action value
  - N → visit count
- Training loop (exp. buffer):
  - Series of games
  - Series of training steps



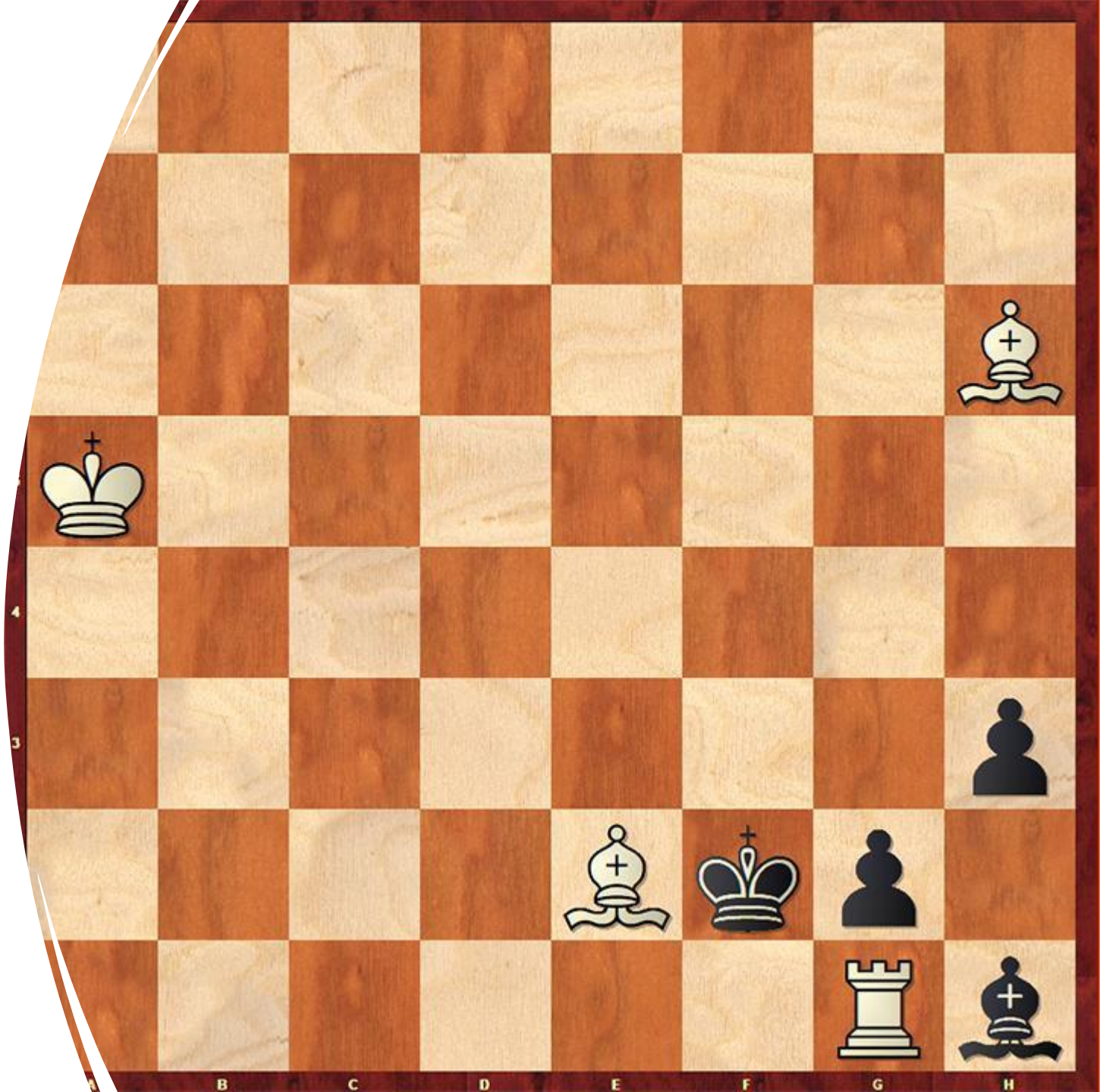
# ChessBreaker vs. AlphaZero

Caused by hardware constraints:

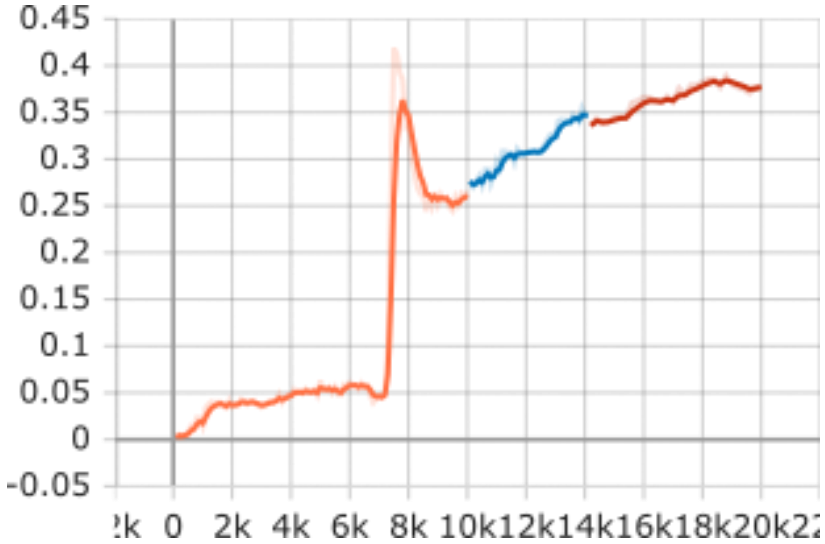
- Smaller model
- Faster MCTS (but less powerful)
- Smaller experience buffer, batch size
- Less training steps
- Evaluation on bare NN

General scope changed → endgames:

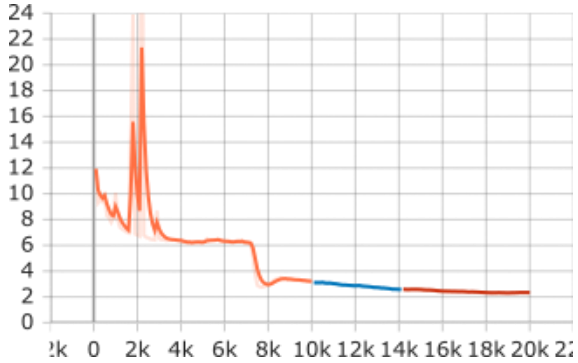
- Reduction in depth and breadth
- Datasets of starting positions
- Less need for initial exploration



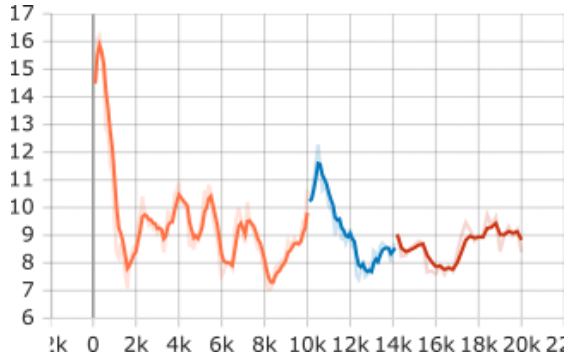
Accuracy



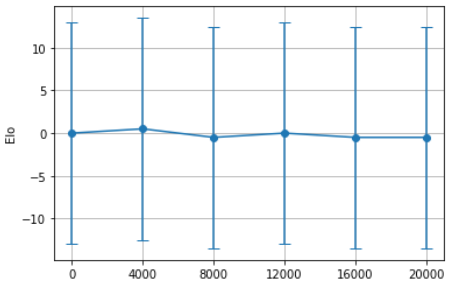

Loss



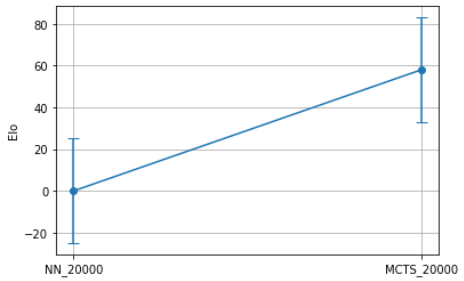

Decisive games



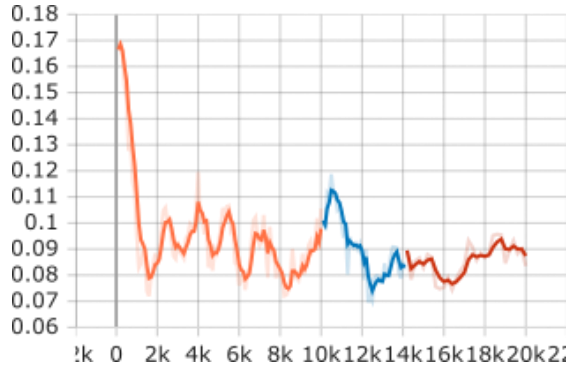

NN Elo vs. steps




NN Elo vs. MCTS Elo




Value loss




# Results

- Total: 20k steps
- Accuracy tranding up
- Policy loss contributes most
- Value loss collapsed to zero

Evalutation: Elo through logistic regression

- $P(a\ vs.\ b) = \frac{1}{1+e^{c(e(b)-e(a)}}$
- Bare NN didn't improve
- MCTS >> NN