

AI Strategies for Probabilistic Turn Based Games



Before we get started...

- Slides: <http://blgsi.com/ecgc2016>
- Who we are – BlueLine Game Studios
- Purpose of the talk



AI Strategies for Probabilistic Turn Based Games

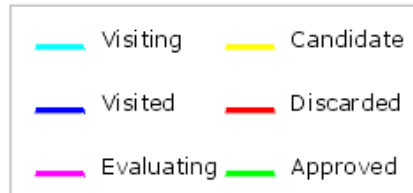
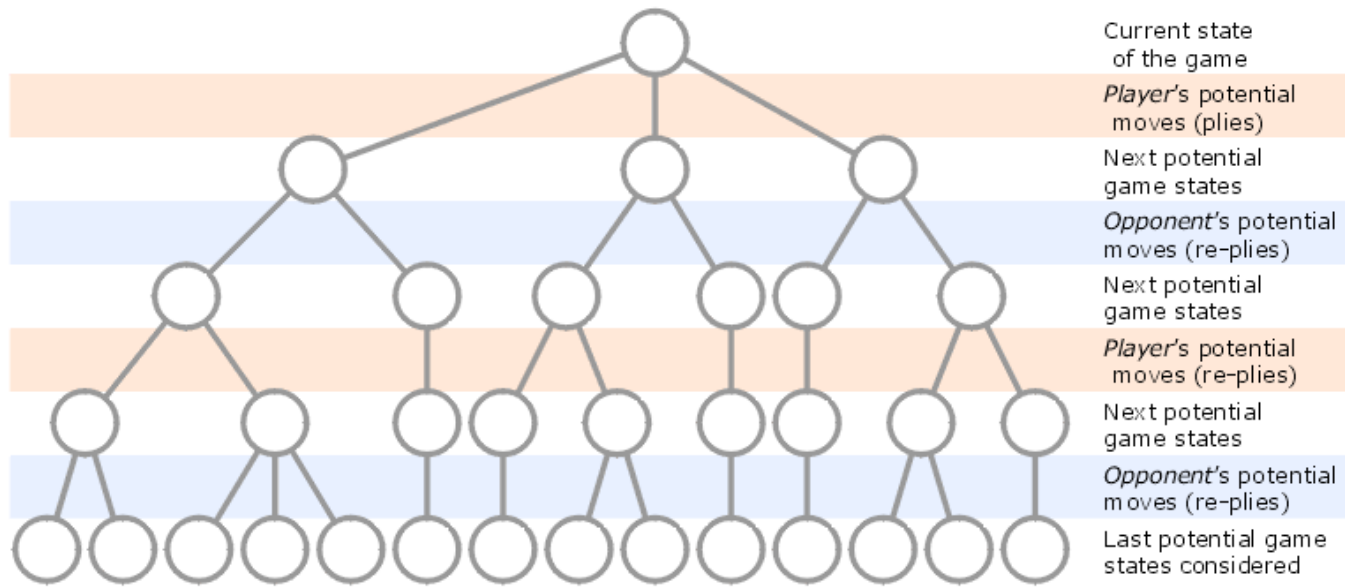


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1. Minimax Recap
2. Difference in Challenges of Probabilistic Games
3. AI Methods for Probabilistic Turn-Based Games
4. GAMES!
(which systems work for which games)

Minimax (briefly)

Minimax on a two-person game tree of 4 plies



Minimax

- For more info:
 - <http://blgsi.com/ecgc2013>
 - Wikipedia article is really great:
<https://en.wikipedia.org/wiki/Minimax>

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Vocab side-note

- Deterministic (Chess/Tic-Tac-Toe)
- Stochastic vs Probabilistic
 - Technically interchangeable
 - Stochastic – sometimes used to refer to outcomes that depend on intermediate probabilities (stock)
 - Probabilistic – often for more independent events (lottery)

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 - Stochastic sounds scarier ;)

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Challenges of Probabilistic Game AI

- Random events are different TYPE of branching
 - Dice/cards
 - In deterministic games, can assume opponent makes advantageous moves.
 - Often have weights (probabilities)

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AI Methods

- Anti-pattern “dice oracle”
 - PRNGs
 - Reduces problem-space to 'normal' AI
 - It's cheating...

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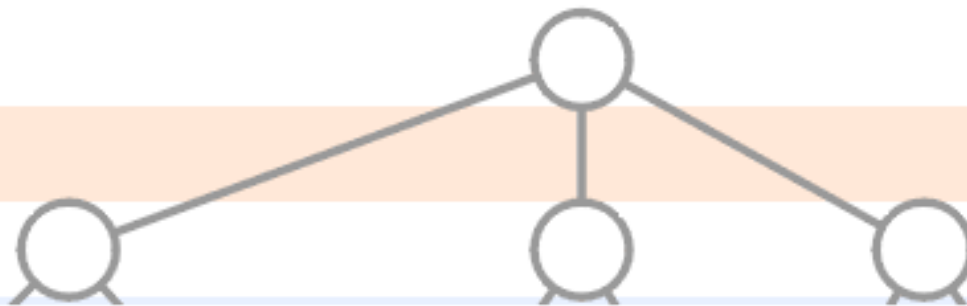


AI Methods

- Minimax w/a twist!
 - Weight scores being passed up from nodes, based on probability

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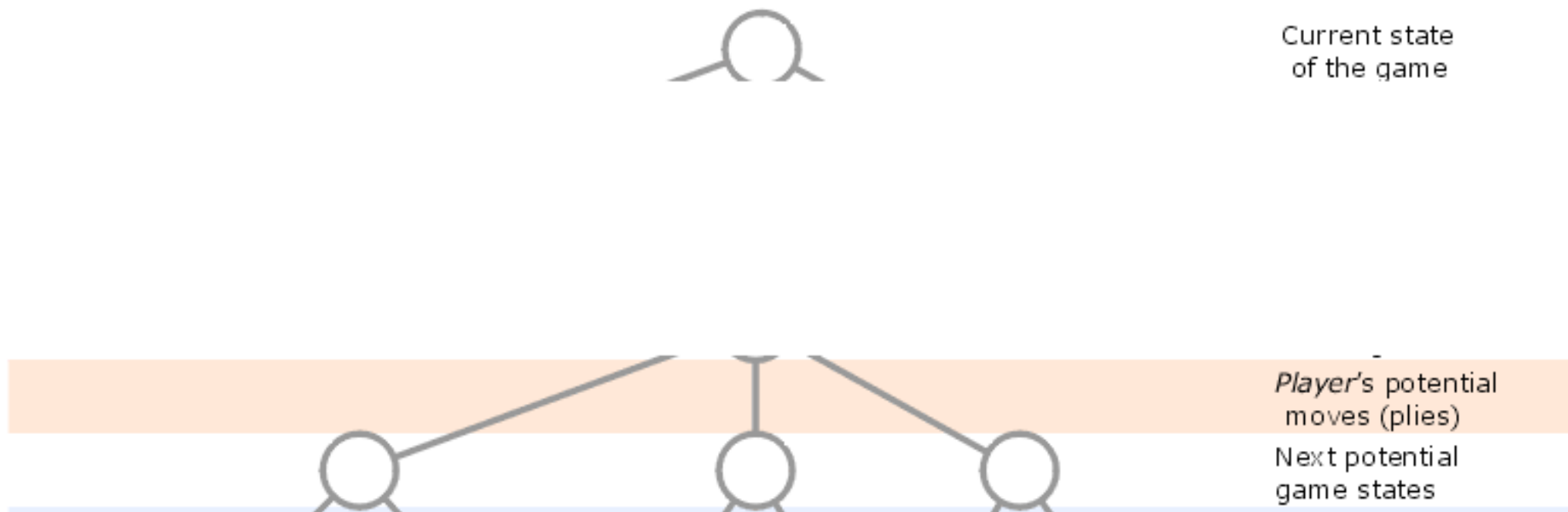
Current state
of the game

Player's potential
moves (plies)

Next potential
game states

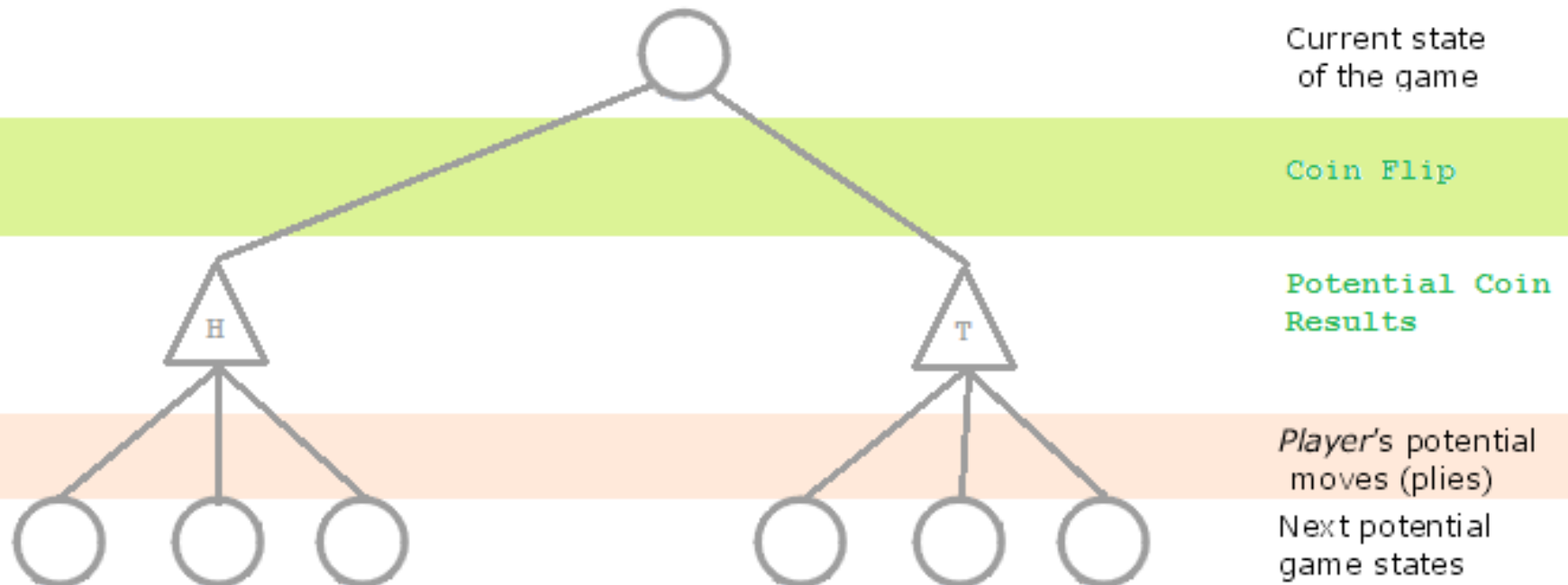
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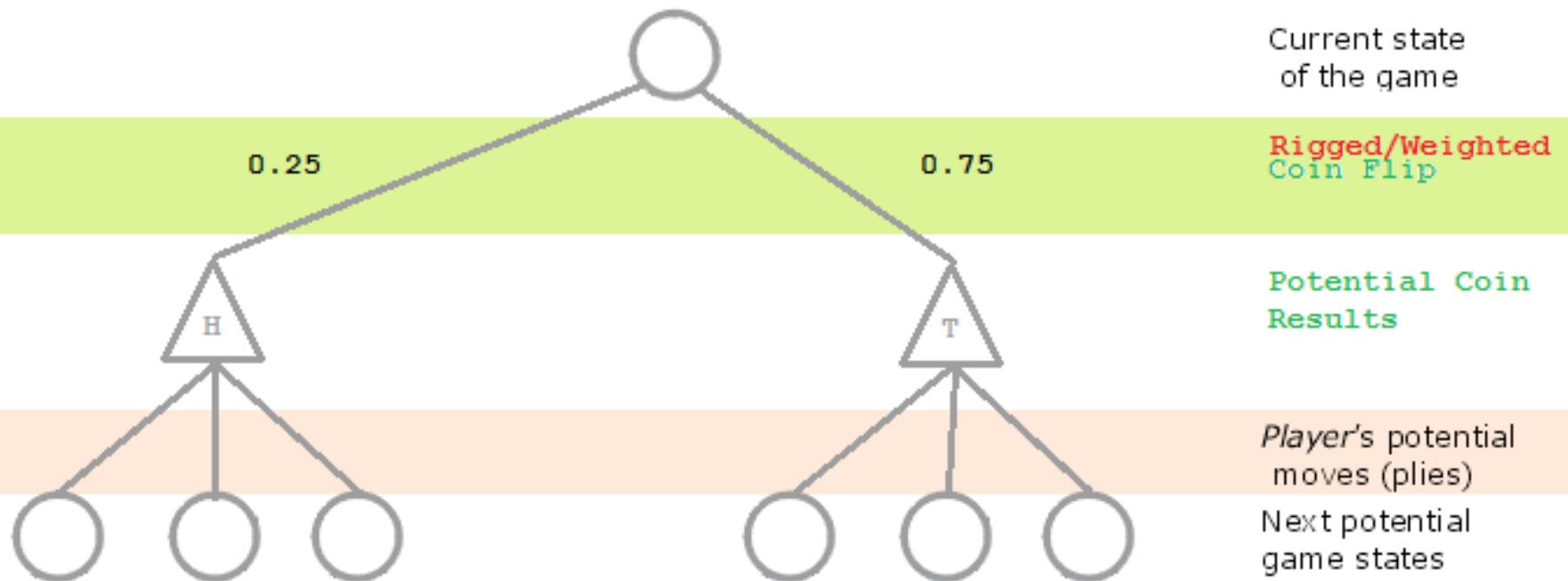
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AI Methods

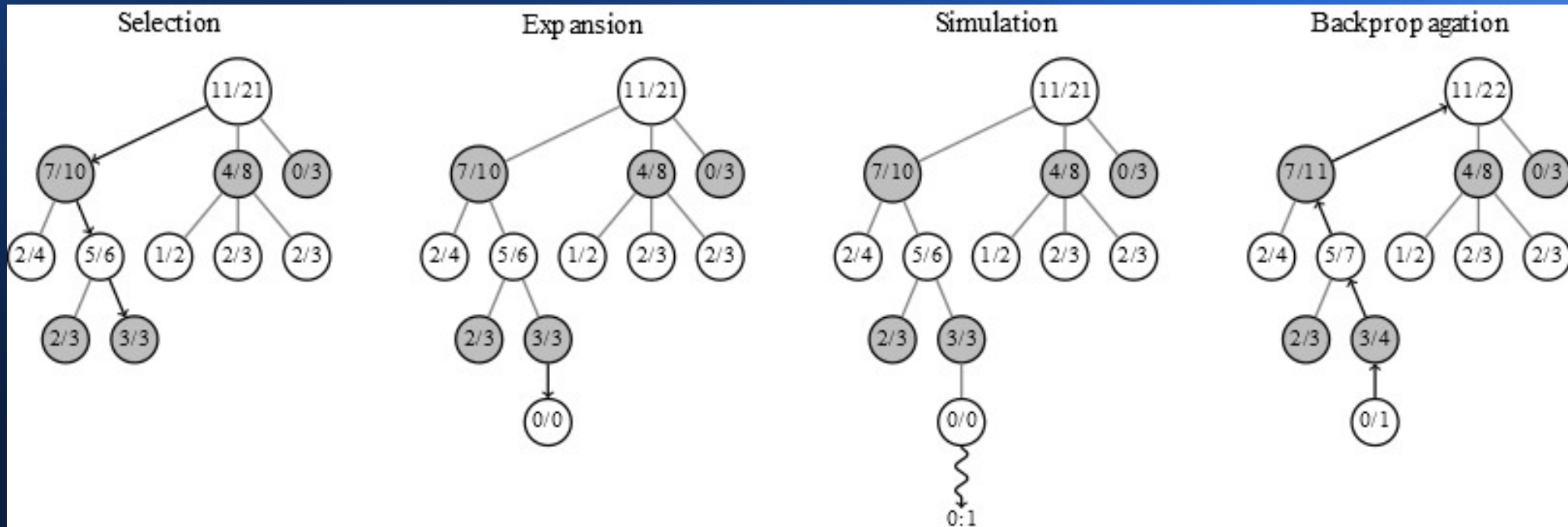
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AI Methods

- Monte Carlo Tree Search (MCTS)



AI Methods

- Neural Networks

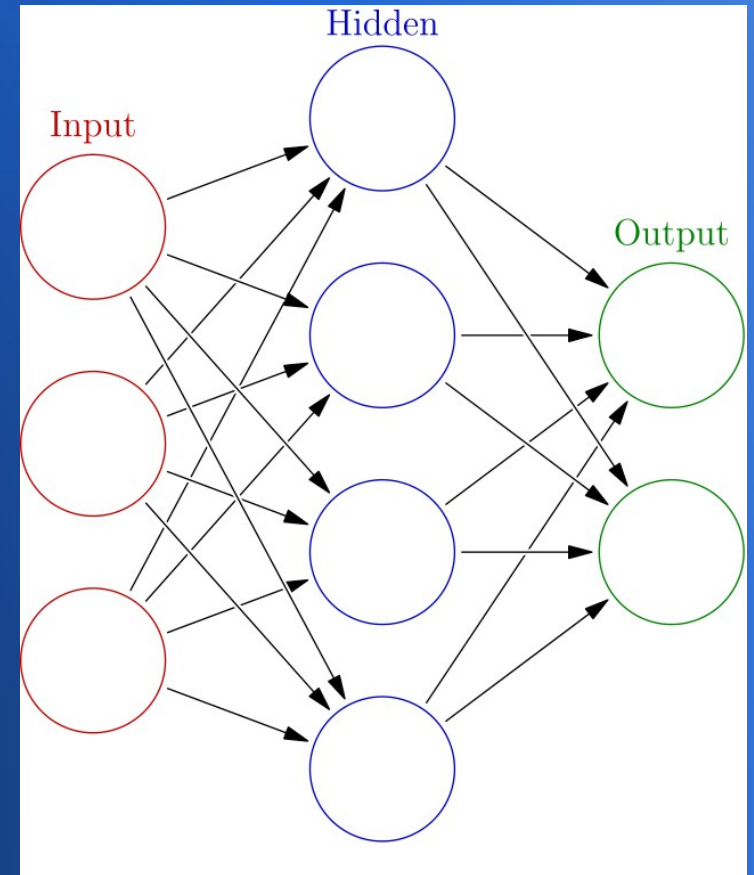


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- Utility Maximization
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 - **Hearthstone?** - imitate intermediate player
 - In commercial games, more than this is often overkill.. Don't need to beat Lee Sudol in Steam game.
 - Things you're afraid to make NNs for

GAMES!

- Minimax w/a Twist
 - World-class level Tatsu play
 - Doesn't apply to all games that use Utility Max (eg: Poker)

GAMES!

- MCTS
 - Risk
 - (not probabilistic): AlphaGo / Pachi

GAMES!

- Neural Networks
 - XCOM
 - Race for the Galaxy (Keldon AI)
 - imho: Risk
 - imho: a poker bot to beat all humanz in WSOP
 - PokerSnowie (used for training)
 - “AlphaPoker”
 - AlphaGo's “value networks” and “policy networks”

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QUESTIONS?

- Download this whole presentation online!
 - <http://blgsi.com/ecgc2016>

- If you have more questions later:
 - <http://twitter.com/SeanColombo>
 - <http://twitter.com/BlueLineGames>
 - <http://BlueLineGameStudios.com>

Bonus: AlphaGo

- I knew you'd ask this.

Bonus: AlphaGo

- I knew you'd ask this.
- “[...]neural networks seem to work extremely well in a variety of domains, even those on which you might not have expected good performance. Go was one of those domains a couple of years ago; until 2014, there was very little work on applying neural networks to Go, chess, or other turn-based strategy games. In principle, a similar approach should prove effective for many turn-based strategy games with discrete action spaces. Removing determinism (stochastic or probabilistic environments) and/or discreteness (continuous environments) makes the problem more complex, but neural nets have done a lot of surprising things so far, so it seems sensible to forecast more surprises in the future.”