# CASPER
# a case-based poker bot

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## Motivation

- Poker is a stochastic, imperfect information game
  - Elements of chance, hidden cards, bluffing
- Decisions with uncertain information and deception
- Therefore results may be applicable to real world problems (e.g., negotiation, tendering)

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## Motivation

- Several competitive poker bots in existence
- University of Alberta
  - http://poker.cs.ualberta.ca/
- Machine vs. Man Poker competition
- AAAI/IJCAI Poker competition
  - www.cs.ualberta.ca/~pokert/



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## Motivation

- Poker bots use:
  - Rule-based systems
  - Simulation-based approaches
  - Game theoretic optimal solutions
  - .....
- Could we build a competitive poker bot
  - Just using a memory of poker games
  - Using simple *vanilla* case-based reasoning



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## Texas Hold'em Poker

- Currently the most popular & most strategically complex variation of poker
- Offers the best skill-to-luck ratio
- The best hand usually holds up
- But experts do better than novices

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# The rules of Texas Hold'em - *Preflop*

- Each player dealt two cards, face down
  - Hole cards
- Round of betting occurs

Skip Rules

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# The rules of Texas Hold'em - *Flop*

- Three community cards dealt
- Players make their best 5 card hand
- Another round of betting

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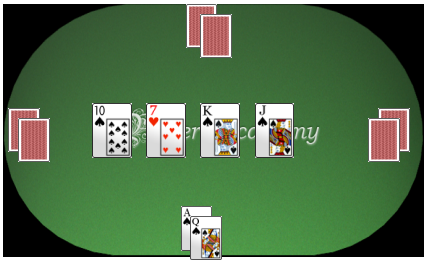
# The rules of Texas Hold'em - *Turn*

- Another community card dealt
- Players make their best 5 card hand
- Another round of betting occurs



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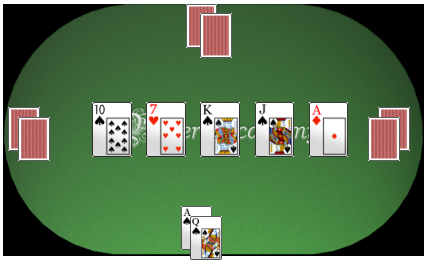
# The rules of Texas Hold'em - *The River*

- Last community card dealt
- Players make their best 5 card hand
- Last round of betting occurs





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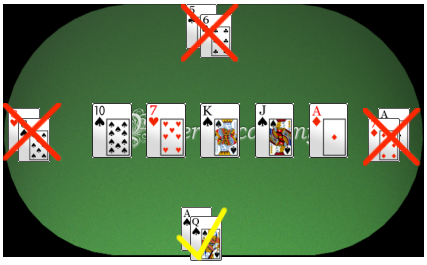
# The rules of Texas Hold'em - *Showdown*

- If there are at least two people still left in the hand all players reveal their hidden cards
- Highest ranking hand wins the pot
- Split pot if hands are equal





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# The rules of Texas Hold'em - Betting

- Limited betting e.g. $10/$20
- First two rounds (preflop and flop) betting in increments of small bet
- Last two rounds (turn and river) betting in increments of big bet

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# The rules of Texas Hold'em - Betting

- Fold
  - Exit the hand
- Check/Call
  - Invest the min to stay in hand
- Bet/Raise
  - Increase the sum needed to stay in the hand

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# Case-base Construction

- ~20,000 hands from University of Alberta poker-bots
- Bots were result of intensive KE process
- Profitable against human competition
- Casper reuses recorded instances
- Therefore, bypasses intensive KE effort
- Retrieval uses a simple k-NN algorithm
- Case reuse is by proportional representation



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# Results

- Random vs. Casper
  - Makes random decisions
  - Baseline comparison
- Casper01 vs. Alberta Bots
  - ~7000 poker hands
- Casper02 vs. Alberta Bots
  - ~20,000 poker hands

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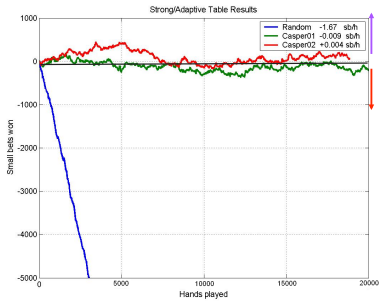
# Strong/Adaptive Competition




Profit

Loss



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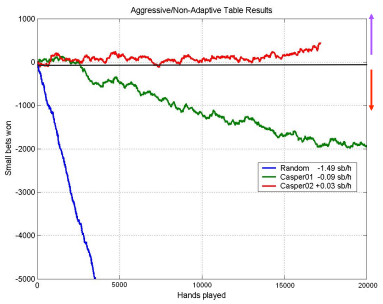
# Aggressive/Non-Adaptive Competition




Profit

Loss



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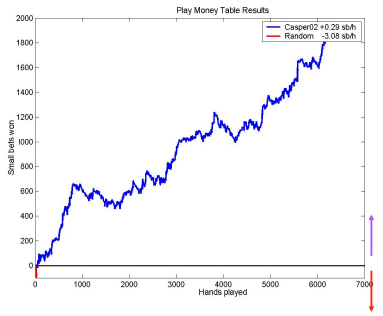
# Online Real Opponents – Play Money




Profit

Loss

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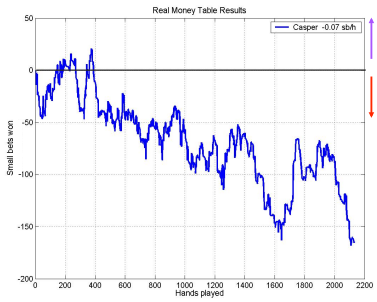
## Online Real Opponents – Real Money




Profit

Loss



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## Discussion

- Proven CBR works – CASPER is competitive against the Alberta bots
- CASPER is competitive against people for play money (but they play badly)
- CASPER loses real money
  - It's case-base isn't representative
  - Av. similarity < 60%



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## Future work

- Ongoing PhD project
- Will improve the bidding system
- Will develop an opponent modelling system
- Plan to compete in the 2010 AAAI poker competition

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# Thanks