Reflections on the First Man vs. Machine No-Limit Texas Hold 'em Competition

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NYCE 2016

Brains vs. Artificial Intelligence

- April 24-May 8, 2015 at Rivers Casino in Pittsburgh, PA
  - The competition was organized by Carnegie Mellon University Professor Tuomas Sandholm. Collaborators were Tuomas Sandholm and Noam Brown.
- 20,000 hands of two-player no-limit Texas hold ‘em between “Claudico” and Dong Kim, Jason Les, Bjorn Li, Doug Polk
  - 80,000 hands in total
- Used “duplicate” scoring

Brains

Doug Polk
@DougPolkPoker

March HUNL PR
1 West Coast Gangsters
2 Big Dick
3 AZNflushie (RIP)
4 Rumble man
5 Swarmmy
6 Kaby
7 Ike
8 wheyprotein
9 80%carry
10 muumi

RETWEETS 4 LIKES 13

4:24 AM - 28 Feb 2015

Nick Frame
@TCfromUB

Follow

The REAL power rankings for OCT 2014 are out

TC power rankings OCT 2014

1. WCG (0)
2. ike (+1)
3. sauce (+1)
4. TCfromUB (+1)
5. jungle (+5)
6. pandorasbux (-4)
7. kabydf (0)
8. donger (-2)
9. carrycakes (-1)
10. KPR (-1)
11. asianflushie (+3)
12. kanu7 (+3)
13. bajskorven (U)
14. OTBredbaron (U)
15. Rperfumo (-4)
16. mokoma1 (0)
17. Billiomucks (-5)
18. dougiedan (-5)
19. ForTheSwarm (U)
20. Willhasha (U)

Brains

02-04-2015, 09:53 AM #1

Donger Kim
enthusiast

Join Date: Feb 2015
Location: South Korea
@dongerkim
Posts: 54

Donger Kim to Nick Frame (TCfromUB) HU Challenge

I am a high-stakes heads up nlhe regular on PokerStars where I play under the name "Donger Kim". There's been quite a bit of discussion on heads-up rankings lately, particularly from TCfromUB (Nick Frame, TooCuriosso1 on 2p2). I've played quite a bit with him and think he's a top player. I respect his game and it would be humbling to play him and represent my country.

However, as he ranks himself ahead of me, I'd like to have a chance to play him in a challenge-type format. I think it would be a fun experience and something that would also be enjoyable for the community.

I propose we do a 15k hand challenge at 100/200 nl with a $50k sidebet escrowed with ike or sauce. I suggest we put some reasonable time frame conditions on this, we're both grinders so we should be able to finish this in a 1-2 week time frame.

Nick, let me know when you'd like to begin. Ideally, I'd like to get started right away.

Brains

MAR
2

Donger Kim wins heads-up challenge against TCfromUB

Poker News

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Dong "Donger Kim" Kim won $103.992 from Nick "TCfromUB" Frame in the15,000 hand heads-up challenge, which not only earned him the respect of the high stakes community, but also an additional $15,000 from the sidebets for the challenge.

Results

- Humans won by 732,713 chips, which corresponds to 9.16 big blinds per 100 hands (BB/100) (SB = 50, BB = 100)
  - Statistically significant at 90% confidence level, but not 95% level
- Dong Kim beat Nick Frame by 13.87 BB/100
  - $103,992 over 15,000 hands with 25-50 blinds
- Doug Polk beat Ben Sulsky by 24.67 BB/100
  - $740,000 over 15,000 hands with 100-200 blinds

Payoffs

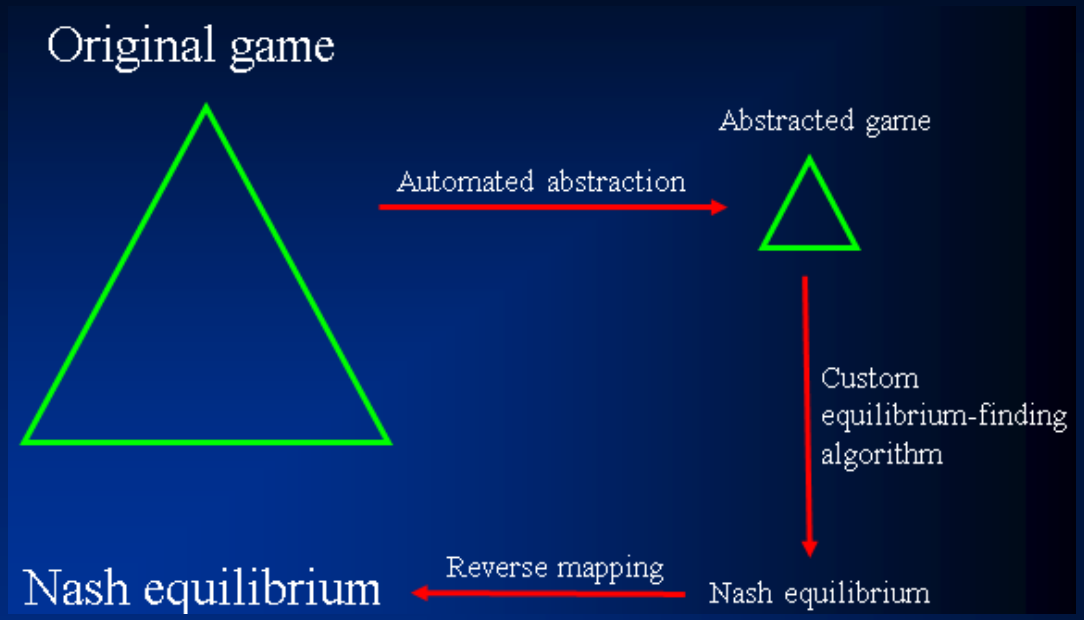
- Prize pool of $100,000 distributed to the humans depending on their individual profits.

$$
\begin{aligned}
&\text{If } x_1 > x_4 \\
&\quad p_1 = \$10,000 + \$60,000 \cdot \frac{x_1 - x_4}{x_1 + x_2 + x_3 - 3x_4} \\
&\quad p_2 = \$10,000 + \$60,000 \cdot \frac{x_2 - x_4}{x_1 + x_2 + x_3 - 3x_4} \\
&\quad p_3 = \$10,000 + \$60,000 \cdot \frac{x_3 - x_4}{x_1 + x_2 + x_3 - 3x_4} \\
&\quad p_4 = \$10,000 \\
&\text{Else} \\
&\quad p_1 = p_2 = p_3 = p_4 = \$25,000
\end{aligned}
$$

I Limp!

- "**Limping is for Losers**. This is *the most important fundamental* in poker -- for every game, for every tournament, every stake: If you are the first player to voluntarily commit chips to the pot, open for a raise. Limping is inevitably a losing play. If you see a person at the table limping, you can be fairly sure he is a bad player. Bottom line: If your hand is worth playing, it is worth raising" [Phil Gordon's Little Gold Book, 2011]
- Claudico limps close to 10% of its hands
  - Based on humans' analysis it profited overall from the limps
- Claudico makes many other unconventional plays (e.g., small bets of 10% pot and all-in bets for 40 times pot)

Architecture

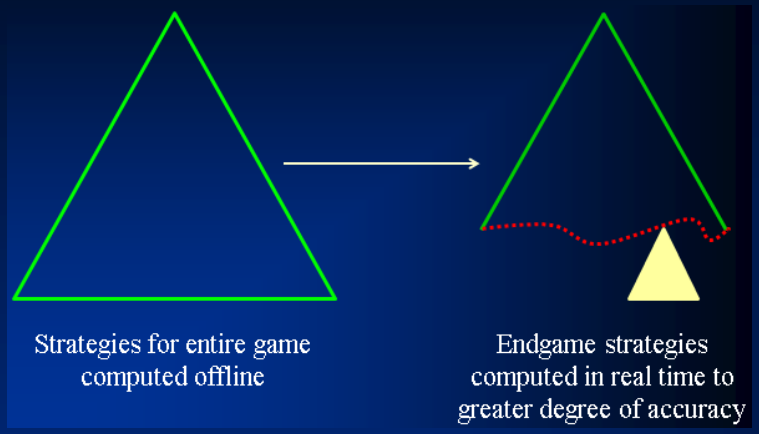


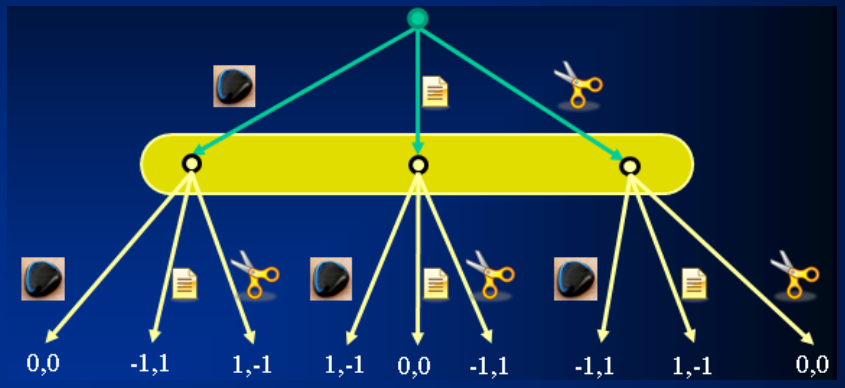
- Offline abstraction and equilibrium computation
  - EC used Pittsburgh's Blacklight supercomputer with 961 cores
- Action translation
- Post-processing
- Endgame solving

Pseudo-harmonic mapping

- Maps opponent's bet x to one of the nearest sizes in the abstraction A, B according to:
- $f(x) = \frac{(B-x)(1+A)}{(B-A)(1+x)}$
- f(x) is probability that x is mapped to A
- Example: suppose opponent bets 100 into pot of 500, and closest sizes are "check" (i.e., bet 0) or to bet 0.25 pot. So A = 0, x = 0.2, B = 0.25.
- Plugging these in gives f(x) = 1/6 = 0.167.

Endgame solving





- Doug Polk related to me in personal communication after the competition that he thought the river strategy of Claudico using the endgame solver was the strongest part of the agent.

Problematic hands

1. We had A4s and folded preflop after putting in over half of our stack (human had 99).
   - We only need to win 25% of time against opponent's distribution for call to be profitable (we win 33% of time against 99).
   - Translation mapped opponent's raise to smaller size, which caused us to look up strategy computed thinking that pot size was much smaller than it was (7,000 vs. 10,000)
2. We had KT and folded to an all-in bet on turn after putting in ¾ of our stack despite having top pair and a flush draw
   - Human raised slightly below smallest size in our abstraction and we interpreted it as a call
   - Both 1 and 2 due to "off-tree problem"
3. Large all-in bet of 19,000 into small pot of 1700 on river without "blocker"
   - E.g., 3s2c better all-in bluff hand than 3c2c on JsTs4sKcQh
   - Endgame information abstraction algorithm doesn't fully account for "card removal"

Conclusions and directions

- Two most important avenues for improvement
  - Solving the “off-tree problem”
  - Improved approach for information abstraction that better accounts for card removal/“blockers”
- Improved theoretical understanding of endgame solving
  - Works very well in practice despite lack of guarantees
  - Newer decomposition approach with guarantees does worse
- Bridge abstraction gap
  - Approaches with guarantees only scale to small games
- Diverse applications of equilibrium computation
- Action translation axioms
- Theoretical understanding of post-processing success

- www.ganzfriedresearch.com
- http://forumserver.twoplustwo.com/29/news-views-gossip-sponsored-online-poker-report/wcgrider-dong-kim-jason-les-bjorn-li-play-against-new-hu-bot-1526750/
- https://www.youtube.com/watch?v=phRAyF1rq0I