Bachelor Thesis - Poker Simulator

Notes and Todos

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1 TODOs

1.1 Documentation - Todos

- fix the appendix such that it is an own chapter with sections etc.
- check if chapters and section should be written like this (Poker Basics of Fundamental Poker).

1.2 Program/Code - Todos

- Get the code to run
- check what it still missing

  basic opponent models. Remember the VPIP and PFR and rank hands accordingly. **We can do this on only a single table for testing purposes. To show if it increases the results.**
- think of a way to show some results

2 Open Questions

2.1 OPEN:

Where to change the page settings, so that it does not always start on the right and makes blank pages?

What should be written in cursive and what should be written in bold?

Mild emphasis is cursive and stronger emphasis is bold

Where should I put the poker lingua definitions? What exactly is the appendix used for?

2.2 CLOSE:

what are the basic English writing rules to keep in mind?

- never user I we or you. Always write in passive voice
- write out don?t doesn?t it?s -> it is, do not, does not
- write out e.g (for example) etc?
- do not use that. Instead use which
- the first time an acronym is used, write it out in full and place the acronym in parentheses -> Graphical User Interface (GUI)

3 Notes

3.1 THESIS STRUCTURE AND ORGANISATION

Make the structure like in *Master Thesis - Nuno Passos*. He has a nice structure and we can apply it.

3.1.1 BASIC STRUCTURE

- Cover page
- Acknowledgements [OPTIONAL]
- Abstract (english and german?)
- Table of Contents (List of Figures, List of Tables [OPTIONAL], List of Abbreviations)
- (1.) Introduction (~ 2 pages)
  - (1.1) Motivation
  - (1.2) Problem Statement
  - (1.3) Aim of the Work (Goal)
  - (1.4) Structure of the Work
- (2.) Introduction to Poker (Poker Basics) (~ 2-3 pages)
  - (2.1) What is poker
  - (2.2) NL Texas Hold'EM
  - (2.3) Betting
  - (2.4) rules and how the rounds are played out
  - (2.5) hand rankings (reference to appendix?) How to properly do it?

    maybe just briefly explain the basics of hand ranks and then reference to an indepth list?

  (2.6) also shortly explain what problems algorithms try to tackle (opponent modeling/-player typification, etc...), partial information
- (3.) State-of-the-art/Analysis of existing approaches (~ 2 pages)

  Literature Studies

  Comparison and Summary of Existing Approaches
- (4.) Suggested Solution/Implementation (Main Part) (~ 10 - 14 pages)

  (4. 1)Methodology (~ 3 - 5 page)

  Used Concepts

  Methods and/or Models (Testbed stuff, NNs, Evolutionary algos)

  languages (C++, ...)

  design methods, data models, analysis models

formalisms

how did I engineer the tool

how did I structure the testbed, what are it's capeabilities

how did I rank/evaluate hands

how did I setup the NN

how did I setup the evolutionary algorithm

what did I observe (results)

what did I learn from that?

- (5.) Evaluation/(Results) and Critical Reflection (Conclusion) ($\sim$ 2 - 3 pages)
- (6.) Summary and Future Work ($\sim$ 1 page)
- (7.) Appendix (Source Code, Data Models,...)
- (8.) Bibliography

3.1.2 (1.) INTRODUCTION

Motivate your topic, clearly say what the problem is and why other related techniques/tools don't solve it. clearly state the goals of your work. Discuss the metrics how you can measure success (e.g. my new algorithm will be faster, people will be able to perform a certain task more quickly and with fewer errors, better user satisfaction, people will gain new insights, I can do something that has not been possible before but is important, Note: you will have to show later that you actually met the goals you claimed here! briefly explain the process of your work and the methods you used (e.g. collaborating with domain experts, multiple prototypes, crisply summarize your main contributions at the end of the motivation section

(1.1) Motivation

- poker is a good testbed for AI

  big search space (many variables, many different player types), hidden information unlike chess

- why exactly ENN? What do evolutionary algorithms provide that makes them interesting for poker bot?

- tournament poker instead of cash game (most research focuses on cash game)

  other fitness function than in cash game (CG: net winning, T: avg. winning (place) etc.)

(1.2) Problem Statement

- 1.) Environment:

  mostly not really customizable

  only cash game or other limitations

  not standalone or web dependent

  limited testing opportunities

  less flexible (with my framework, easy change between tournament structure)

- 2.) Autonomous, profitable poker playing agent in tournament environment:

  other techniques often focus on cash game and only on heads up play so far, not full table (6 man, 9man).

  other AI techniques successful but ENN has potential (recent scientific work has shown that)

(1.3) Aim of the Work / Goal

(1.4) Structure of the Work

- briefly explain the upcoming chapters

- After explaining the structure of the work, shortly mention that a review to what poker is follows (Done here: [4]).

3.1.3 (2.) INTRODUCTION TO POKER

- (2.1) What is poker

  [1], [4]

- (2.2) NL Texas Hold'EM

  [1], [3], [2], [4]

- (2.3) Betting

  [1]

- (2.4) rules and how the rounds are played out

  [1]

- (2.5) hand rankings (reference to appendix?) How to properly do it?

  [1]

  maybe just briefly explain the basics of hand ranks and then reference to an indepth list?

- (2.6) What makes a poker player a good poker player?

  also shortly explain what problems algorithms try to tackle (opponent modeling/player typification, bluffing, , etc...), partial information [2]

  [1]

3.1.4 (3.) RELATED WORK (state-of-the-art/analysis of existing approaches

The related work section describes existing work that is conceptually similar to what you are working on. It needs to give a good overview of what others have done to overcome the same problem as you face, or conceptually similar problems.

If you are building, for instance, a network visualization tool for a specific target audience, you should describe state-of-the-art in network visualization as well as in the target domain.

3.1.5 (4.) PRACTICAL PART (Suggested Solution/Implementation)

(4.1) Methodology

- Something about the Testbed? (HandRanker, HandEvaluator?, Monte Carlo)
- Neural Network
- Evolutionary Algorithm for Training Agents

3.1.6 TESTBED

Things to mention:

- Why own testbed:

  better control, easier to test stuff

- *Betting System:* faulty implementation (i.e. reraise bet amount when previous all-in $<$ min raise)

- most of the testbeds only single table and cash game capability. No real tournament (multi-table) simulator out there.

3.1.7 FUTURE WORK

Hand rank algorithm can be improved by taking into account opponent models (i.e Sklansky groups) -» don't iterate over every possible hand but rather only over likely groups of hands. Also hand potential can be improved this way.

Literaturverzeichnis

[1] N. Passos. *Poker Learner: Reinforcement Learning Applied to Texas Hold'em Poker*, Master's thesis, Faculdade de Engenharia da Universidade do Porto, Portugal, 2011. https://paginas.fe.up.pt/~ei08029/Master Thesis - Nuno Passos.pdf

[2] J. Schaeffer, D. Billings, L. Peña, and D. Szafron. *Learning to Play Strong Poker*. ICML-99, Proceedings of the 16th International Conference on Machine Learning, 1999. http://poker.cs.ualberta.ca/publications/ICML99.pdf

[3] L. Peña. *Probabilities and simulations in poker*. Mather's thesis, Department of Computing Science, University of Alberta, 1999.

[4] J. Rubin, and I. Watson. *Computer poker: A review*. Artificial Intelligence, 175(5-6):958-987, 1999.