

## 02466 Project work in Artificial Intelligence and Data **LOGBOOK**

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The main purpose of the logbook is that it serves as a tool for you to keep track of the project and document project meetings.

### **Project Meetings**

#### **Week 01: 05.02.20-11.02.20**

*Questions:*

*Which project is the best?*

*Advantages and disadvantages of each?*

*Reading, who and what*

*Getting overview of methods and state of art for the different projects. - All*

*Implementation, who and what*

*Implementation of base UI to easier visualize the game - MF*

*Results, who and what*

*Choosing the "Myretuen" - project*

*Decisions, who and what, what do you do alone, what do you do together*

*Magnus implement UI and game logic so we have the environment ready before creating the AI*

## Supervisor Meetings

### Week 02: 12.02.20-18.02.20

*First meeting:*

*Discussing basic ideas for implementation*

*Discussing ideas for AI*

*Showing the UI and discussing our choices of limitations and which game rules we did not include in first version*

*Action points for next week*

*Continuing with the game implementation - Magnus*

*Consider his ideas next meeting same time next week*

## Project Meetings

### Week 02: 12.02.20-18.02.20

*Questions:*

*What is the best ways to start our project - All*

*What is our timeline - All*

*How should we structure our time - All*

*Reading, who and what*

*Saw online lectures from David Silver - Deepmind - Hanlu*

*Read code - Jakob*

*Implementation, who and what*

*Implementation of game logic and finishing UI - Magnus*

## Supervisor Meetings

### Week 03: 19.02.20-25.02.20

*Presentation of results since last meeting*

*Showed our random agents playing and discussed the implementation of the first simple Linear Model*

*Plans for this week is to implement our first simple linear model.*

## Project Meetings

### Week 03: 19.02.20-25.02.20

*Questions*

*Saw online lectures from David Silver - Deepmind - Magnus*

*Started reading Impala paper - Hanlu*

*Started on online reinforcement course - Hanlu*

*Implementation, who and what*

*Finished implementation of game - Magnus, Jakob*

*Implemented first linear model (LM) - Magnus*

*Results, who and what*

*After 525 rounds of play against a random agent - Magnus*

*Score LM 327 vs random 182 (16 ties) - (No self-play,... No search... The training was included in these games)*

*Decisions, who and what, what do you do alone, what do you do together*

*We saw first prove that a agent could play this game, by beating the random agent 2:1*

*Discussed improvement of AI for later implementation*

*Saved state in git under branch 'version-0.1'*

*Finished Project Plan - All*

## Supervisor Meetings

### Week 04: 26.02.20-03.03.20

Suggested implementation of TD lambda

Suggested self-play

## Project Meetings

### Week 04: 26.02.20-03.03.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*Refactoring code for speed improvements and easier to create new agents – Magnus*

*Created a Player Agent controlled using the UI - Magnus*

*Implemented simple Linear Model – Magnus and Jakob*

*Implemented explore mode – Magnus*

*Implemented self-play – Magnus*

*Implemented Neural Network AI – Jakob*

*Feature engineering for better features (the state vector) – Magnus & Jakob*

*Score NN win rate score of +90%-97% against random Agent*

*Much faster learning due to TD lambda*

*Saved state in git under branch 'version-0.2'*

## Supervisor Meetings

### Week 05: 04.03.20-10.03.20

*Presentation of results since last meeting*

*Action points for next week*

*Showed code as well as talked about our current progress*

*Talked about the implementation of IMPALA*

*Discussed a possible ELO system*

*Discussed the report*

## Project Meetings

### Week 05: 04.03.20-10.03.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*Implemented TD lambda – Jakob*

*Configured High performance computing for easy training of multiple agents – Magnus*

*Saved state in git under branch 'version-0.3'*

*Implemented Impala v1 – Magnus*

*Implemented Elo v1 – Magnus*

*Created probability game specific feature - Jakob*

*Feature engineering – Magnus and Jakob*

*Fixed reward system – Jakob*

*Wrote first version of method for report – Magnus*

*Tested Elo with NNAgent and Random – Elo Random  $\approx$  1100 vs Elo NNAgent  $\approx$  1500*

*Saved state in git under branch 'version-0.4'*

## Supervisor Meetings

### Week 06: 11.03.20-17.03.20

*Presentation of results since last meeting*

*Action points for next week*

*Talked about improvements to the Elo system*

*Talked about improvements to the impala system*

*Talked about the report*

## Project Meetings

### Week 06: 11.03.20-17.03.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*Speed improvements – Magnus*

*Simplified process of testing for more organized testing – Magnus*

*Fixed Elo system for absolute scoring – Magnus*

*Minimax search – Jakob*

*Minimax added hyperparameters – Jakob*

*Minimax made it work with the softmax function – Jakob*

*New optimizing function - Jakob*

*Changed Impala system to a batch training process – Magnus*

*Implemented new way of controlling the exploration by Boltzmann Approach – Magnus*

*Read TD-Gammon – Jakob*

*Read enough of IMPALA to conclude it could not be used – Magnus and Jakob*

*Rapport introduction and references – Hanlu*

*Rapport method and Environment – Magnus and Jakob*

*Saved state for Midtvejsaflevering under branch 'version-0.5'*

## Supervisor Meetings

### Week 07: 18.03.20-24.03.20

*Presentation of results since last meeting*

*Action points for next week*

We discussed the fact that the impala system could not be used due to our limitations of not having a policy network, which is not easily implementable due to the complexities of the action space.

Talked about doing more tests

## Project Meetings

### Week 07: 18.03.20-24.03.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Given feedback to another group

Made improvements in the testing system, more parameters can now be tested - Magnus

Refactored code – Magnus

Implemented dropout for the linear models - Magnus

## Supervisor Meetings

### Week 08: 25.03.20-31.03.20

*Presentation of results since last meeting*

*Action points for next week*

*Discussed report with general positive feedback but some improvements to notation and so on, which Tue would add as comments in the report because he didn't have write access before.*

*Showed some of the testing we had done and discussed further testing strategies*

*More testing as well as code improvement is the plan for this week*

## Feedback Meetings

### Week 08: 25.03.20-31.03.20

*We gave the prepare feedback to the other group and they gave us feedback*

*They had some structural improvements of the report to make it easier for the reader*

*They gave concrete improvements to some of the sections in the method which they found the hardest to read.*

*They said we should add a better description of the implementation for better reproducibility.*

*They generally liked the report and their feedback was appreciated*

## Project Meetings

### Week 08: 25.03.20-31.03.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Implemented dropout for the NN models – Magnus and Jakob

Changes to Elo system – Jakob

Implemented weighted chooser - Jakob

Created mean variance plot for easier and better comparison between the models – Magnus



## Supervisor Meetings

### Week 09: 01.04.20-14.04.20

*Presentation of results since last meeting*

*Action points for next week*

*Talked about the report and looked at some of the results, focus points for the following week is to create more results and wait with the methods section.*

## Project Meetings

### Week 09: 01.04.20-14.04.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Speed improvements for minmax – Magnus

Both Magnus and Jakob can now run tests on each server, leading to double the testing speed.

Calculating Elo for fixed models cleverrandom +- calcprob.

Small change to reward system

New animation when playing - Magnus

## Supervisor Meetings

### Week 10: 15.04.20-21.04.20

*Presentation of results since last meeting*

*Action points for next week*

*Showed the current plots and discussed Monto Carlo search and Q-learning ideas, as well as an idea to change the rule a bit (fruit mode).*

*Implement these things and do more plots and results.*

## Project Meetings

### Week 10: 15.04.20-21.04.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*A lot of testing – Magnus and Jakob*

*Implemented Monto Carlo search - Jakob*

*New features – Jakob*

*New fruit mode – Jakob and Magnus*

*Generated a lot of good plots as a guidance to the final plots - Magnus*

## Supervisor Meetings

### Week 11: 22.04.20-28.04.20

*Presentation of results since last meeting*

*Action points for next week*

Showed plots and results as well as discussing the new final changes.

Focus on results and report.

## Project Meetings

### Week 11: 22.04.20-28.04.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Planned the tests we must run. – Magnus and Jakob

Run tests, and create results plot – Magnus and Jakob

More plots and testing. – Magnus

The code has been locked and branched

Then all the tests can be re-ran with same underlying code

*Saved state in git under branch 'version-0.6'*

## Supervisor Meetings

### Week 12: 29.04.20-05.05.20

*Presentation of results since last meeting*

*Action points for next week*

*Talked shortly about our plan to run the experiments in the exam period, since most of these tests takes several days.*

## Project Meetings

### Week 12: 29.04.20-05.05.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*Rewrote parts of methods – Jakob*

*Started running the different tests – Magnus*

*Created process for capturing detailed images of UI as well as capturing game play videos. – Magnus*

## Supervisor Meetings

### Week 13: 06.05.20-12.05.20

*Presentation of results since last meeting*

*Action points for next week*

*Short meeting just showing some of our plots and what the next plots we would make was.*

## Project Meetings

### Week 13: 06.05.20-12.05.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*Rewrote more parts of methods – Jakob*

*Ran tests – Magnus and Jakob*

*Created more scripts to plot the different results – Magnus*

*Finalized analyze script to get more detailed view of the AI's – Magnus*

## Exam period

## Project Meetings

### Week 13: 13.05.20-03.06.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

*Ran a lot of tests – Magnus and Jakob*

*Created some more plotting scripts – Magnus*

*Most of the results was made during this process. Due to the large amounts of time needed for each results as well as, since the code was already written, the process of running the test was quick and easy, so we still had time for the exams.*

## Project Meetings

### Week 14: 04.06.20-10.06.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Started writing results with the results from the exam period. – Magnus and Jakob

Ran last test before choosing best AI as well as some missing parts – Magnus and Jakob

Stated running the best version of the AI for the normal game as well as fruit version – Magnus and Jakob

Created plots for the result gathered – Magnus and Jakob

Fixed and small improvements to the report – Magnus and Jakob

## Project Meetings

### Week 14: 11.06.20-17.06.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Ran the cleverrandom estimates for the fruit version. – Magnus and Jakob

Created final plots for the report – Magnus and Jakob

Finished minimax tests – Jakob

Tested AI against people – All + family

Created csv-file with data from all the games – Magnus

Created Jupiter notebook to analyze the data and created several analyses - Magnus

Worked on report – Jakob and Magnus

Started on video pitch - Hanlu



## Supervisor Meetings

### Week 14: 18.06.20-24.06.20

*Presentation of results since last meeting*

*Action points for next week*

*Final feedback of report before the hand in.*

*Discussed different focus point in the report writing.*

## Project Meetings

### Week 14: 18.06.20-24.06.20

*Questions*

*Reading, who and what*

*Implementation, who and what*

*Results, who and what*

*Decisions, who and what, what do you do alone, what do you do together*

Finished Jupiter notebook to analyze the data and created several analyses – Magnus

Created Final plots - Magnus

Finished Report – Magnus, Jakob, Hanlu

Finished *video pitch* - Hanlu

*Saved state in git under branch 'version-1.0'*