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| Datum | Zeitdauer | Inhalt, Schritte, Tätigkeit | Reflexion |
| 3.3 | 30min | Changed my leitfrage to nine mens morris | Retrograde analysis seems too computationally intense, maybe smaller game format or neural net? |
| 4.3 | 1h | Looked at minimax and game solutions for three mens morris | Unsure wheather 3 mens morris is fair (player1 winrate = player2 winrate) |
| 19.3 | 30min | Discussed the use of machine learning with mrs steiner | Prob gon use reinforcement learning |
| 29.3 | 60min | Watched video on minimax and tried to implement, way more complicated than I thought | Need some kind of board representation, board evaluation etc. |
| 10.4 | 60min | Talked to mrs steiner, finalized leitfrage | Ill try to use ml for nine mens morris |
| 3.5 | 45min | Worked on implementing a neural net, gonna use python because its easier | Doesn’t work, state and action space need to be huge |
| 4.5 | 2h | Looked at other policy networks like in chess, tried to implement dqn, worked on code to transform board matrix into tensor for dqn. | Action space on big board is actually only like 88 so its fine. Ill make piece removal on mill random to reduce space |
| 28.5 | 3h | Free day, started implementing the nn using pytorch, worked on eval function, notably count\_potential\_mills which counts potentential mills | Eval doesn’t work, nn doesn’t work, god I love sorch vector size missmatches |
| 2.6 | 6h | Got eval board function working, apply\_action seems to be working, worked on minimax, rough structure seems correct | Minimax always seems one error away from working, I wanna use it to train the nn |
| 3.6 | 5h | Took at least 45min to fix a mismatch between get\_possible\_moves and the moves minimax returned in rules.py,  Made it so random piece take algo doesn’t take pieces from mills, tried to follow the minimax movechain but it seems weird and I seem to get stuck so I started work on the nn | Gonna stop working on minimax for now and work on the nn, steiner says its important to first get nn infrastructure running. |
| 4.6 | 5h | Spent an hour implementing weighted list sort function to discover np does it better, spread print statements across the minimax with no success, worked on the nn which seems close to working, figured out a way to save working nns, worked more on minimax and got it running decently | I want to leave the nn to train for some time to see if it learns. |
| 5.6 | 6h | Nn took 22.3 minutes to train on 100k values, torch env doesn’t wanna work, worked on play.py to test the nn against minimax or maybe human. Input command is weird and doesn’t wanna work | Cant measure how good the nn is but the loss function goes down well so that’s a good sign |
| 6.6 | 4h | Got play.py working to a point where minimax can consistently play poorly against me. Worked on animating the game outcome with the function animate\_game. Sent prototype to mrs steiner to see if it works on her device | Nn returns awful move choices, minimax is only slightly better. Ill try replacing cross entropy loss cus I don’t trust it (loss is at 0.0036 and nn is still stupid) and maybe increase nn size |
| 9.8 | 3h | Improved minimax by finally making alpha-beta pruning work, messed with evaluation function and noticed it performs better when I don’t reward mills and partial mills | Need to improve play.py |
| 10.8 | 3h | Created NNevaluation.py using parts from play.py which lets me select which player the network should play against and returns an animation | Nneval has issues and doesn’t work properly, board animation needs to be revamped |
| 28.8 | 1h | Talked to miss steiner about the current state of my progress, she said I should experiment with network architecture and gave me an outline for the report. | I should work on nn architecture and experiment with different parameters |
| 20.9 | 5h | Finalized the neural network and nnevaluation program, introducing a system that lets it restart from checkpoints and improved the input if human plays against nn | I want to introduce a way to let the bots play against eachother multiple times, need to start work on report |
| 21.9 | 4h | Managed to get multi game program working, created interface for visualizing nn training progress, started work on report | Continue report, let nn train |
| 22.9 | 6h | Nn training has gone quite poorly, I think the dataset is the issue so I coded a program which uses the states from the dataset and replaces the actions with actions chosen by the minimax algo. Also programmed a function which generates symmetries for the dataset (now 500k datapoints if symmetries work) First sketch of my theory part of the report is done | Let my dataset modification code run overnight, continue with report |
| 23.9 | 6h | Dataset augmentation worked, training the neural net on it, seems more promising but still bad.removed data batching since it could be causing worse results, convergence of the nn is at about 20%. wrote first sketch of the rules.py documentation for report. | Rules.py documentation is still bad, nn is converging poorly, maybe increase size? |
| 24.9 | 6h | introduced nn dropout and normalization, reintroduced batching cuz otherwise training is too slow, convergence is at around 25% but still bad in practice against other bots. | Run the nn overnight, continue work on report |
| 25.9 | 4h | Ran the nn for 400 epochs on a batch size of 256, continued to let it run. Worked on the report, almost done with theory part, finished rules.py documentation. | Finish nn theory sheet, write visualization documentation, results and reflection |
| 26.9 | 5h | Wrote a scrypt to generate checkpoints and let me resume training, increased the size of the nn so the biggest layer is 1024, which could make convergence better, worked on improving the report | Continue working on report, see if nn finally converges tomorrow. |
| 27.9 | 3h | Worked on report and kept nn training the entire time. Finished the nn theory documentation, worked on visualization documentation. | Continue with report, make code to test the nn every few epochs to see if its improving |
| 28.9 | 3h | Created visualization code to show network progress over epochs by matching every few epochs against a randomizer, doesn’t look very promising, worked on report by finishing sketch of visualization | I may need to try self-play or a different dataset to train the nn |
| 29.9 | 4h | Familiarized myself with selfplay theory, gonna try to make a double dqn based selfplay nn. Worked on preface of report | Selfplay nn seems like a lot of work, seems interesting tho, should continue working on report |
| 30.9 | 6.5h | Got a working self-play based nn trainer running using temperature based exploration and a double dqn (basically using a different loss function cuz maybe that was the issue) | Self-play seems to be learning but is very slow. I may have to run it for a couple of days. |
| 1.10 | 2h | Had to debug the checkpoint system of the selfplay algo but otherwise it worked, let it train the entire day and it can win against the randomizer about 90% of the time. Worked on the theory part of the report a bit. | Keep the selfplay running, continue working on the report, I now have to add theory and stuff for selfplay |
| 2.10 | 1h | Worked on report |  |
| 5.10 | 2h | Made the minimax algorithm more efficient by adding a memory system and deterministic piece removal. Worked on correcting the report. Introduced an opening\_random\_moves variable for the nnevaluation to make it possible to get multiple different matches when two deterministic opponents play. | Continue work on report, minimax should be written in eg. Cython for faster speed but that’s a lot of work |
| 6-16. 10 | Around 1.5h per day | Worked on the report |  |
| 11.10 | 1.5h | Gave the report to mom and dad to correct. |  |
| 16.10 | 2h | Formatted my code to form the appendix and a cleaned up github repo. |  |
| 17-19.10 | 2h | Corrected the report, worked on the github repo and all the additional things to hand over. |  |