What is the dissertation topic?

Learning to play imperfect-information game with Deep Learning Neural Network and Reinforcement Learning

What game to play? How to determine if it was a success.

I personally want to play the game of contract bridge because I myself is a bridge player. However I would focus on the bidding of contract for the purpose of this research. We can determine the success and failure of the program using the double-dummy analyser.

We can start by randomising different bridge hands, then pass them into the double-dummy analyser DDS written by Bo Haglund and Soren Hein. This gives us the maximum number of tricks obtainable when different suits were set as trump and played by different players when all players are rational and know the whereabouts of all cards. Then to determine whether it was a success, all we need to do is to observe whether the contract was set more in our programs' favour using a trained network.

How would it be conducted?

It would be conducted in 3 parts. The first part includes the construction of the program's bidding system. I plan to use a modified version of the 2/1 system simply because it has long been used by me. I am hoping that ~90% of the time, 4 bots using the same system should reach the ideal equilibrium contract.

I would then modify one program to bluff/underbid its bidding so that it "lies" to everyone, including partner. The ideal result is that it would be able to identify what information would be OK to incorrectly convey to others and lead the contract into its own favour. This would be stage 2, where the program still uses the same system.

My last stage, if time is in my favour, is to let the program devise its own bidding system so as to counter the 2/1 system that I have created. It should adhere to the rule of bridge and the meanings of bidding should be transparent to the opponent still.

Where should I start?

Research: Libratus have had significant success in Heads-up Poker
Techniques: Reinforcement Learning, Counterfactual Regret Minimization (CFR), CFR+, Game Theory