

# Project proposal

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## N-size queen problem solved with reinforcement learning

The project aims to address the classic N-Queens problem using reinforcement learning. The N-Queens problem involves placing N chess queens on an  $N \times N$  chessboard in such a way that no two queens threaten each other. In this reinforcement learning approach, the task is to train an agent to find a valid solution to the N-Queens problem.

\*\*N is given by the user by command line and it can be an integer between 2 and 8

A neural network will be employed to approximate the Q-values, which represent the expected cumulative rewards for each possible action in a given state.

Q-learning will be utilized to train the agent. The Mean Squared Error (MSE) loss function is the metric chosen to minimize the difference between predicted Q-values and target Q-values during training.

Probably the strategy for exploration and exploitation could be made by an epsilon-greedy search, and with probability=epsilon the agent can take a random action to explore, meanwhile with probability=(1 - epsilon), it exploits the current knowledge by selecting the action with the highest Q-value.

The reward function has to provide positive reinforcement when a valid solution is found, with a higher reward for placing all N queens correctly. A smaller reward can be given based on the number of queens placed, encouraging the agent to find solutions efficiently.

The training process should involve multiple episodes, starting from a random initial state. The agent, then, should iteratively take actions, updating Q-values thanks to the Q-learning update rule, and backpropagates the experience to improve its understanding of the problem.