

# Presidents Game Playing Agent

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## 1 Introduction

A description of the purpose, goals, and scope of your system or empirical investigation. You should include references to papers you read on which your project and any algorithms you used are based. Include a discussion of whether you adapted a published algorithm or devised a new one, the range of problems and issues you addressed, and the relation of these problems and issues to the techniques and ideas covered in the course.

Investigating the best way to make an AI agent that plays the game Presidents. Chose this because of multiplayer games and uncertainty. Sturtevant was primary expert on this, see his thesis [here](#). Also see MCTS paper. Adapted published algorithms, with inventions based on how to deal with uncertainty (sampling and heuristic). Built a lot on ideas from two player game in course, but more complicated by expanding them.

## 2 Background

Motivation for AI research into games. History of research into two player games. Extensions to multiplayer games, reasoning under uncertainty.

## 3 Related Work

For instance, [?].

## 4 Body 1

Sampling based on cards that haven't been played

### 4.1 Paranoid

Modified minimax, where leaf/terminal nodes are a tuple of values representing the scores (or a heuristic estimate of those scores). Calculate intermediate values by subtracting all scores from first player score. Too deep to expand full game tree, so terminate at terminal node or after a certain depth or a certain number of nodes has been expanded (keep track of nodes expanded for pruning).

Score
Approach 1
Approach 2

Table 1: Description of the results.

#### 4.1.1 Pruning

Standard a-b pruning works here

#### 4.2 Max-n

#### 4.3 MCTS

A clear specification of the algorithm(s) you used and a description of the main data structures in the implementation. Include a discussion of any details of the algorithm that were not in the published paper(s) that formed the basis of your implementation. A reader should be able to reconstruct and verify your work from reading your paper.

## 5 Body 2

Unsure if we want this?

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**Algorithm 1** Here is the algorithm.

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```

procedure MYALGORITHM( $b$ )
   $a \leftarrow 10$ 
end procedure

```

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## 6 Experiments

Analysis, evaluation, and critique of the algorithm and your implementation. Include a description of the testing data you used and a discussion of examples that illustrate major features of your system. Testing is a critical part of system construction, and the scope of your testing will be an important component in our evaluation. Discuss what you learned from the implementation.

Can test on a number of different axes—time to run, nodes expanded, how it does playing against dummy agents, how it does playing against other algorithms, how it does playing against itself, number of times we sample.

### 6.1 Methods and Models

Wrote dummy agents to play lowest legal card-naïve algorithm. Baseline to test against that for how good our agents were.

## 6.2 Results

For algorithm-comparison projects: a section reporting empirical comparison results preferably presented graphically.

Table 1: showing time to run on 50 games, average score

Graph 1: Paranoid (5 trials, include error bars)

Bar graph showing:

Average score for Dummy vs Dummies

Paranoid vs Dummies (sample once, 500 nodes)

Paranoid vs Dummies (sample 5 times, 500 nodes)

Paranoid vs Dummies (sample 25 times, 500 nodes)

Paranoid vs Dummies (sample 25 times, 1500 nodes)

Graph 2: Max-n

Graph 3: MCTS

## 6.3 Discussion

How we could improve. How important the heuristic was. RL and some of the challenges (discretizing state space)

## A Program Trace

Appendix 1 A trace of the program showing how it handles key examples or some other demonstration of the program in action.

## B System Description

Appendix 2 A clear description of how to use your system and how to generate the output you discussed in the write-up and the example transcript in Appendix 1. N.B.: The teaching staff must be able to run your system.

## C Group Makeup

Appendix 3 A list of each project participant and that participants contributions to the project. If the division of work varies significantly from the project proposal, provide a brief explanation. Your code should be clearly documented.