Single Player strategy development for stochastic games

capstone project proposal

team

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# **Jargon**

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| **Word** | **Meaning** |
| Bot | An autonomous program on a network which can interact with systems or users, designed to behave like a user. |
| CNN | **C**onvolutional **N**eural **N**etworks. |
| Evolutionary Algorithms | Algorithms that mimic or implement Darwinian evolution. |
| Stochastic | Having a random probability distribution which can be analyzed using statistical methods but not predicted precisely. |
| Positive-reinforcement Learning | A method of conditioning a subject that involves reinforcing an action by making it more favorable using rewards. |
| Network Configuration | The characteristics and properties of the neural network framework. |

# **Problem Statement**

## **Introduction**

Data scientists all around the world have strived to make algorithms that work and perform approximately like humans. This resulted in the need to automate games that humans play. Games have seen an exponential revolution in the way they are being played, and now video games have become a trend and their complexity has become a challenge.

There are games in which the solution space and the space with which the users can interact is very large and hence for an algorithm, to comprehend and learn from a **stochastic** environment like in video games is a problem that AI specialists face. There are ways developed to better equip the algorithms to develop strategies to play the game in the most efficient way as possible. But the stochastic environment makes it hard for existing techniques to develop a good algorithm for strategy development.

# **Solution**

## **Introduction**

We would like to propose a method to better improve the way a machine learning system views a game to improve how it develops strategies in a stochastic environment using **CNN**s optimized by **evolutionary algorithms** to help evolve the system to excel and improve in an unknown environment to play a game in the most efficient way possible.

## **Procedure**

We would approach the problem in the following way:

* The environment would be studied using Screenshots of the gameplay in real-time and features that would help the algorithm improve the gameplay will be identified.
* The algorithm will then train on these images to learn the features and play the game perfectly.
* The evolutionary treatment will help the algorithm to generate a population of players and will monitor the way they perform based on **positive-reinforcement learning** using points as rewards.
* The algorithm will then continuously improve the player population until it can achieve the best score possible.

The evolutionary algorithms will help the CNN realize the faults and flaws in how it approaches the game and will tweak the CNN to perform at it’s best using the **network configuration** that resulted in the best population based on scores.

# **Scope**

The game we would be using to display the working of the system is a copy of “Flappy Bird”. “Flappy Bird” is a game that is stochastic in the sense that the next configuration of the obstacles is unknown because they are generated randomly and aren’t seen until the frame ends. It is also an endless and an infinitely environment. This would help us to demonstrate the prowess of our system’s ability to learn and develop strategies to play “Flappy Bird” in the best way possible.

The game we would play is an online version of the game, therefore to control the game we would create a **bot** that would help us automate the game and give the control to our system, this bot will also help us generate the dataset on which our CNN would be trained.

We would then write the CNN framework from scratch and also the evolutionary algorithms to help us better command the environment we work in. The system we develop would be completely independent and will be treated as a library for ease of portability and use.

# **References**

**EFFICIENT PARALLEL LEARNING ALGORITHMS FOR NEURAL NETWORKS**Alan H. Kramer and A. Sangiovanni-Vincentelli  
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