**Can the Expected SARSA algorithm be used to create a dynamic and sustainable ecosystem for use in games?**

# Abstract

# Literature Review

## Dynamic AI in Games

## Reinforcement Learning Methods

## Policy Equations

## Predator Prey simulations

## Lotka-Volterra Equations

# Tools and Methods

## Unreal Engine

### Blueprint

### C++ Classes

### Performance Profiling

### Artificial Intelligence tools

### Rama’s Victory Plugin

## Project Design

### Collision Detection

## Terrain

### Height Map

### Textures

## Agents

### Plants

The plants are modelled as a cube with a leaf texture applied to them. Plants do not inherit any AI behaviour and instead multiply periodically depending on specific external conditions.

#### Components

Plants are made up of a cube mesh object and a collision cube named “TouchCollision”. The collision component is used as a formality so that the prey detection functionality can be extended to the functionality of deer agents detecting plants.

### Variables

|  |  |  |
| --- | --- | --- |
| **Variable Name** | **Data Type** | **Description** |
| State | Enumerator | The current state of the plant. This is based on overlap events. |
| Health | Integer | The current health value of the plant between 0 and 100. |
|  |  |  |
|  |  |  |

#### States

Plants have two states: MULTIPLY and BEING\_EATEN.

The current state of each plant has the potential to be modified when an overlap event is detected.

#### Functions

### Animals

#### Components

#### Variables

#### States

#### Animation

## States and Actions

## Rewards

## Boltzmann Softmax Equations

### Temperature Constant

## Expected SARSA

### Learning Rate

### Reward Discount

# Testing and Results

## Pre-Test Run

## Performance Testing

## Sustainability Testing

# Results and Analysis

## Performance Results

### Analysis

## Sustainability Results

### Analysis

# Conclusion

# Further Work

# Appendices

## Asset Licenses

## Class Diagram

## Enumerators

## Reward Data

## Blueprint Classes

## Text File Manager Class

## Test Data