Playing Aircraft Warfare Game with Reinforcement Learning

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Abstract

摘要没写

1 Introduction

1.1 Motivation

'Aircraft Warfare' is a classic game introduced in WeChat 5.0 version released in August 2013. The rule of the game is rather simple. In brief, players need to control the plane movement through the up, down, left and right keys on the keyboard, or shoot bullets to destroy the enemy aircraft to obtain points. Players can obtain points by destroying enemy aircrafts, but they may also be attacked by enemies. When the

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player's blood volume is 0, the game ends. The gameplay of the game is very simple, but the performance of the player in the game is very complex. This is because the aircraft in the game are intelligent, and they will react according to the player's behavior. For example, when the player's plane is close to the enemy plane, the enemy plane will actively launch an attack on the player's plane.

In this project, we use this game as our simulation environment, and train the aircraft through the reinforcement learning method to make the aircraft autonomous in the game.

图 1: The Aircraft Warfare Game

1.2 Aircraft Warfare game settings

In this project, we use the original rules of the 'Aircraft Warfare' game, but we make some changes to the game settings to adapt to our reinforcement learning algorithm. We use the pygame library to implement the game interface, as shown in Figure 1.

In the game, the player's plane will continue to fire bullets, and the player can control the plane movement through the up, down, left and right keys on the keyboard. The player can fire a full-screen bullet through the space key, which can clear all the enemy planes that appear on the screen. But the number of full-screen bullets is limited.

The player needs to hit the enemy plane to get points.

There are three types of enemy planes, namely small, medium and large enemy planes. Small enemies can be destroyed by a single bullet hitting. Medium and large enemies have a certain blood volume that hitting once will reduce it, and the enemy will be destroyed when the blood volume is 0.

At the same time, there will be blood bags and double bullets appearing in the game. The player can increase the number of lives by touching the blood bag, and can fire

double bullets with a larger attack range in the next period of time by touching the double bullet.

2 Model Setup

We will use an approximate Q-learning to train the aircraft to play the game. The approximate Q-learning algorithm is a model-free reinforcement learning algorithm, which uses a weighted sum of features to approximate the Q function. It is suitable when the state space is large.

2.1 Features and Reward function

The features consists of mainly the position of the aircraft, enemies, and bouns (double bullet and additional life). In addition, the current status including the score, the life number remaining are also used. We will take a weighted sum of these features as the current state.

2.2 Action

2.3 Result