Playing Aircraft Warfare Game with Reinforcement Learning

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Abstract

1 Introduction

Aircraft Warfare is a classic game we all enjoyed very much, which is also perfect for fully practicing what we have learned in class, as shown in Figure 1. The rule of the game is rather simple. Player (a upward facing aircraft plane)'s **goal** is to make the score as high as possible. The player can get **reward** by managing to hit enemies with five **actions**, namely, up, down, left, right, and using the bomb. The **state** includes the life value and positions of player and enemies and so on. Game overs when life value decreases to 0.

However, playing the game well is quit tough when it comes to difficult mode. Hence we turn to AI for help. To the best of our knowledge, reinforcement learning has shown to be very successful in mastering control policies in lots of tasks such as object recognition and solving physics-based control problems[]. Specially, Deep Q-Networks (DQN) are proved to be effective in playing games and even could defeat top human Go players[]. The reason they can work well is that games can quickly generate large amounts of naturally self-annotated (state-action-reward) data, which are high-quality training material for reinforcement learning. That is, this property of games allows deep reinforcement learning to obtain a large number of samples for training to enhance the effect almost costlessly. For example, DeepMind's achievements such as playing Atari with DQN, AlphaGo defeating Go masters, AlphaZero becoming a self-taught master of Go and Chess. And OpenAI's

main research is based on games, such as the progress made in Dota. For these reasons, we believe that training agents based on deep reinforcement learning techniques is a promising solution

In this paper, we implement an AI-agent for playing the Aircraft Warfare with Q-learning method and Deep Q-learning method.

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.
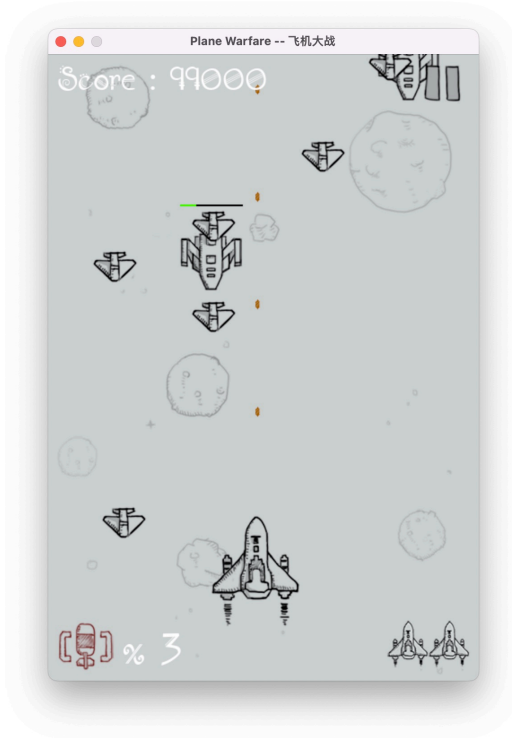
2.2 Action

2.3 Result

Figure 1: The Aircraft Warfare Game