Personalized AI for Groups of Non-Player Characters

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Abstract. Since the birth of video games they have become more popular every year. Because of that, now we have a lot broader type of people that play videogames and they demand better and more complex experiences every new game that comes out. To be able to meet that demand, algorithms that we find in current games have become so sophisticated that take state of the art techniques from computer science. This complexity in video games has turned them in perfect testbeds for computer scientist.

One of the biggest areas that focus in improving the user experience is artificial intelligence (AI) for non-player characters (NPC). Many studies and surveys [1] [2] [3] show that users find very annoying and frustrating to play with NPC that do not behave in a human-like manner.

What we want to achieve with this work is a real-time general AI framework that will allow us to create human-like non-player characters for teamwork multi-agent system, with the objective of delivering a better user experience. We focus on improving current approaches for multi-agent parallel systems and machine learning techniques such as reinforcement learning.

1 Motivation

Since the birth of video games they have become more popular every year. Because of that, now we have a lot broader type of people that play videogames and they demand better and more complex experiences every new game that comes out. To be able to meet that demand, algorithms that we find in current games have become so sophisticated that take state of the art techniques from computer science. This complexity in video games has turned them in perfect testbeds for computer scientist.

One of the biggest areas that focus in improving the user experience is AI for non-player characters (NPC). Many studies and surveys [1] [2] [3] show that users find very annoying and frustrating to play with NPC that do not behave in a human-like manner. In great part, this is why on-line play is so popular these

days, user finds playing with or against other humans a lot more interesting and challenging. The problem is that it is not always practical for all the characters in a game to be controlled by people. Hence most of the games need an AI system to control the NPCs.

If we categorize the research areas related to AI in video games we can find two main groups: machine learning and multi-agent systems. In the next paragraphs we will discuss more in detail which techniques are the most used and what problems are meant to solve.

The use of machine learning techniques is broad in video games, we can find supervised and unsupervised algorithms aimed to solve many different problems. What most of these approaches have in common is: offline learning, require numerous trials to learn an effective behavior, require previous learning for each specific area or level and require a lot of computational power. We can find in literature that these techniques are normally used to model opponents [4], adaptive AI [1], difficulty scaling [5], enhance agent believability [3] [6] or learn how to play a specific game [7], for example.

In most of the games we find multiple NPC that interacts between them and the user, which is why the integration of multi-agent systems is very natural. Some research areas of interest related to multi-agent system are: planning, parallel multi-agent systems, group formation and group dynamics. Usually, these techniques are aim to solve the next problems found in video games: online adaptation [8], offline learning of suitable parameters [8], dynamic formations [9], decision making strategies and building cooperative teams [10], just to list a few.

Another important aspect that makes video games such a complex problem is the inherent uncertainly they have. This uncertainly arises because video games are non-deterministic, we have incomplete information and multiple parallel agents. Additionally, we have to optimize long term pay-off and the video game must run in real-time.

2 Previous work in this area

In the previous section we talked about the state of the art of AI in video games in a very general manner. For this section we will focus on specific papers that we find interesting and shares with our research one or more objectives.

Sander Bakkes et al. in the series of papers [1] [2] [11] focus on how to allow rapid and reliable adaptation in games. Their approach is based in behavioral adaptation, inspired by the human capability to solve problems by generalizing over previous observations in a restricted problem domain. They also propose

an adaptive architecture for game AI and discuss its design considerations.

3 Research objectives

Our main objective for this work is to develop an AI framework that will allow us to create human-like NPC characters for teamwork multi-agent systems that improves user experience. To achieve this goal, we investigate the following research questions:

- How can we achieve a fast online adaptation of our video game AI?
- Which architecture should have our AI framework?
- Which architecture should we use for our multi-agent system?
- How should we model the user?

4 Methodology

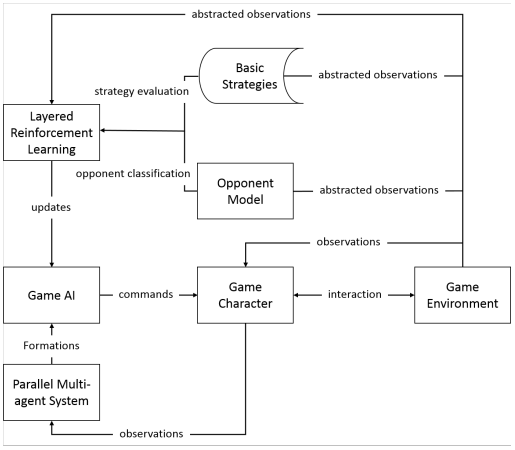

Fig. 1. Proposed AI Framework Architecture

To be able to achieve our objectives we propose the AI architecture shown in Figure 1. The main modules of our approach are the layered reinforcement learning algorithm, the parallel multi-agent system for strategy selection and the opponent modeling system. We choose this approach to make our framework as general as possible and avoid having previous encounters information to generate cases.

We have chosen the game Unreal Tournament 2004 for testing and we will evaluate our human-like behavior system using the Turing test that the BotPrize competition held annually.

5 State of the research

We have been working on the problem definition and the state of the art of AI in video games. Also, we have design the architecture for our system and the methodology to follow.

6 Preliminary conclusion

- The opponent modeling module is key if we want to achieve good results.
- We will need a combination of offline and online machine learning techniques to achieve a real-time application.

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