Distribution of Artificial Intelligence in Digital Games

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ABSTRACT

This paper reports on the creation of an application capable of producing intelligent character behavior based on distribution of Artificial Intelligence. To develop, test and experiment on applied Artificial Intelligence, computer games are quickly becoming the ideal simulation test bed for the implementation of computer generated AI. The application of Artificial Intelligence algorithms create immersive game-play where human players can interact with non-player characters and interactions with the environment helps shape the way in which games are played. A-Star pathfinding utilizes a heuristic function implementing cost of moving through a virtual world, this actively affects how an agent responds to a situation and can alter its decision making. This paper describes the implementation of the A-Star algorithm combined with gameplay mechanics used to simulate multi-agent communication within a randomly generated game-world.

Keywords: Artificial Intelligence, A-Star Algorithm, Distributed AI, Multi-Agent, Procedural Content Generation, Unity 3D

1. INTRODUCTION

Advancements in the area of computer science and the increasing need for improved computer generated intelligence, computer games are changing and quickly becoming a world perfect for implementing and simulating Artificial Intelligence (AI). The combination of Computational Intelligence (CI), Artificial Intelligence and Machine Learning (ML) are being adapted into the world of computer games allowing the creation of smart agents capable of communication and learning over a period of time; this allows adaption to a large range of situations creating immersive gameplay in a large variety of environments. Computer game AI first begin with the idea of supporting interactions between player and game expanding to the creation of intelligent in game characters capable of interacting not only with the player, but also with each other. The exchange of information based on individual interactions and experiences with a game world shapes the way in which a game can be played; the creation of smart AI revolutionized how human players interacted with non-player characters and inspired the creation of games such as Naughty Dogs ‘The Last of Us’ were immersive story telling based on computer controlled AI.

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gripped players. In this paper the connections between artificial intelligence and game creation are discussed, were the main goal is to design and implement a multi-agent system capable of taking in game intelligence and distributing it between two non-player characters (NPC’s). Procedural content generation (PCG) is a term used to describe the algorithmic generation of game content; it removes the manual set of rules included within the computer games code and allows quick level design. This technique has been utilized during design stages to greatly decrease the workload of artists, level designers and game creators (Van der Linden, Lopes, & Bidarra, 2014), who used PCG for the quick generation of game worlds via pre-programmed parameters. In using PCG to create random worlds, test beds for the application of computer generated AI can be achieved and used to not only improve computer game AI, but improve the area of Artificial Intelligence as a whole. Exploration is a vital component of computer game AI, implementation of pathfinding is widely regarded as one of the most used examples of artificial intelligence in games today; the control of an NPC via pathfinding creates movement and allows exploration through a virtual world of game assets and obstacles. Navigation is regarded as a sub-field of AI with the main goal of specifying a start point, an end point and calculating an optimal path between the two. Implementing pathfinding opens up a range of possibilities, NPC’s can explore and created environments can influence the decision making process of players as well as in game characters. Exploring these possibilities requires the creation of an application that supports interactions between virtual characters, Unity 3D is a cross platform game engine with an integrated development environment used for the creation of mobile, pc and console based games and can be adapted to create a simulation environment capable of testing the distribution of artificial intelligence.

The increased motivation of game designers to improve the complexity of game environments has led to the implementation of techniques such as multi-agent systems (MAS). MAS converge information between a number of NPC’s within the boundaries of the game creating a information network between agents where in game experiences can be shared; it’s this realistic nature that makes the current generation of games exciting and dynamic to play allowing the gaming industry as a whole to implement film like techniques combined with educational scopes such as machine learning and artificial intelligence.

2. EXISTING WORK

Distributing Artificial Intelligence concerns the distribution of information and the co-ordination of actions and knowledge among a decentralized group of agents (Nakamiti, Fkeitas, Prado, & Gomide, 1994), one of the fall backs of this type of computer generated AI is the distribution of incomplete data through lack of knowledge, leading to inaccuracies. In tackling this problem the use of continuous co-ordination allows for one agent to act in real time based on constant distribution of information from agent to agent within the same world, one agent collects the information and the second can act accordingly. The use of Artificial Intelligence in digital games calls upon existing AI techniques such as pathfinding that has also be utilized in a various number of relating fields such as robotics, were control of individual non-player characters (NPC’s) can provide strategic direction within gameplay and allow for parameter adjusting increasing or decreasing the difficulty of the game (Laird, 2001). Current advancements in computer game AI are leaning towards tackling challenges that allow for the enhancement in gameplay with the majority of game models adapting the use of the A* pathfinding Algorithm to control NPC’s and allow the finding of an optimal path through game worlds (Charles, 2003). Future releases are leaning towards implementing AI that can shape the outcome of a game for example Middle
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