

Artificial Intelligence Application in Mobile Phone Serious Game

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Abstract—This paper is to discuss the importance of artificial intelligence (AI) in entertainment and in serious game, the methods of AI applications beyond entertainment, and the technology features of AI in and beyond entertainment. In addition, it analyses the weakness when AI is applied in mobile phone serious game, and provides solutions.

Keywords—AI; mobile phone; serious game; AI application; entertainment

I. ABOUT SERIOUS GAME

What is game for? Many people may say all with one voice: 'ENTERTAINMENT!' However, in the first day of GDC (Game Developers Conference) 2004, Mr. Sawyer brings a new concept to attendees: 'Serious Game', which is moving beyond the mainstream gaming and entertainment market and into a new sector of games that educate and train.

According to Mr. Sawyer (2004), as game developers, they solve the social problem of entertainment. Namely, playing games is a problem solving activity. In this same way, serious games are solutions to problems. They are games whose primary mission is not entertainment, or they can be entertainment games applied in a different manner.

The number of non-entertainment games under development is rapidly increasing. The appreciation for the ideas, skills, technologies, and techniques used in commercial entertainment games is at an all time high. Many commercial games are already in use for purposes other than entertainment. Titles such as SimCity, Civilization, Hidden Agenda, and others have been used as learning tools in schools and universities across the globe. (Quoted from Serious Games Initiative)

Nowadays, The Serious Games Initiative has been founded, which is focused on uses for games in exploring management and leadership challenges facing the public sector. Part of its overall charter is to help forge productive links between the electronic game industry and projects involving the use of games in education, training, health, and public policy.

II. INTRODUCTION TO AI

According to Mr. Luger (2002), artificial intelligence (AI) may be defined as the branch of computer science that is concerned with the automation of intelligent behavior. On

the basis of his definition, AI is a part of computer science and must be based on sound theoretical and applied principles of that field.

Currently, AI has been applied widely and it also has been one of the important components in game industry. Mr. Lowenstein (5th February 2003) considers: Artificial intelligence – a central part of advanced game design - is now so advanced that characters in the games have their own independent, autonomous personalities that players interact with. According to the think of serious games 'utilize game designs, technologies, and development skills in new series of policy education, exploration, management and so on' (The Serious Games Initiative), AI is also significance to be analyzed, evaluated, compared and contrasted in mobile phone area.

III. TECHNICAL DEVELOPMENT BACKGROUND

A. Compatibility

The current mobile gaming panorama is affected by a significant fragmentation problem that precludes making a game available to the entire mobile market. This is caused both by the absence of a standard in terms of software platform for mobile phones and by the specific characteristics (e.g., screen size) of different phones, even when produced by the same manufacturer. Indeed, if game designers wanted to fully exploit the features of a given device, they should renounce to have that game also running on entry-level phones. Another practiced solution is that of developing multiple versions of the same game to have one version specifically designed for each class of mobile phone; clearly this solution has a cost.

Currently, we can identify three software platforms that emerge as the most popular ones when considering mobile games with connectivity capabilities: Symbian, Binary Runtime Environment for Wireless (BREW), and Java Micro Edition (Java ME). The first one is a proprietary operating system that has been developed by a consortium among Nokia, Sony-Ericsson, Siemens, Panasonic, and Samsung. As these brands represent a very wide portion of the global mobile market, Symbian can be considered a very popular operating system. Symbian applications have also the advantage of being fast as they are generally written in C++ and can make use of specific features of the considered mobile phone. On the other hand, this may require specific

programming skills and raises compatibility issues with other software platforms.

All these platforms have both pros and cons, thus demonstrating the need for a solution that will enable the automatic porting of any mobile game on any mobile phone. However, this is not the aim of this work; we simply note that currently Java ME with MIDP 2.0 is the solution that provides the widest portability of the developed software.

B. Connectivity

Different communication technologies are available today on most of mobile phones (e.g., GPRS, UMTS, Bluetooth, Wi-Fi); thereby, being able to exploit them has become an important aspect in the success of a mobile game. The current mobile scenario is dominated by 2G and 3G (GPRS and UMTS, respectively). Phone service providers have done huge investments on this technology; therefore, this communication means present the advantage of being available almost anywhere. Yet, its bandwidth, latency, and cost often block users from using it.

The optimal solution would be that of having the game enabled to work on any of the aforementioned connectivity means and choosing, at any moment, the “best” among the available ones (e.g., the fastest, the cheapest, the most reliable). However, if a mobile game producer decide to create a game with only one connectivity option, we deem that the chosen one should be Bluetooth as it is available on almost any new mobile phone and its use is free of charge. The combination of these two characteristics makes users willing to use it for their leisure.

IV. SIGNIFICANCE IN GAME

AI plays an important role in game industry. Firstly, AI can challenge players (Rouse, 2001). It is primary goal to provide a reasonable challenge for the player for AI in any game. If there is no challenge in the game, players would easy to defeat. Worse, the fun of game would decrease. Secondly, game AI can assist game storytelling. For instance, ‘in an RPG (Role Play Game), a player may travel to a certain town which is home to a number of fearful residents who dread the arrival of outsiders. If the player only observes these people, they can be seen to be navigating the town...’ (Rouse, 2001). Thirdly, AI can instead be used to inhabit the living world the game creates. ‘Players love to see that the world has ambient life in it, creatures they can just look at rather than kill, and depth it adds to the world can be invaluable’ (Rouse, 2001). Fourthly, in multiplayer game, it is one of solutions to provide AI opponents when live opponents are not available. This is, of course, no different from a solo-play game, but at least it provides a way to avoid frustrating players (Nokia, 16th April 2004).

V. SIGNIFICANCE AND APPLICATION BEYOND ENTERTAINMENT

A. Significance in Serious game

AI is not the discipline aiming at entertainment only. The two most fundamental concerns of AI researchers are knowledge representation and search (Luger, 2002). The first

of these addresses the problem of capturing in a formal language, for instances, one suitable for computer manipulation, and the full range of knowledge required for intelligent behavior. Search is a problem-solving technique that systematically explores a space of problem states, such as successive and alternative stages in the problem-solving process. On the other hand, return to the concept of serious game, its target is to solve problems (Sawyer, 2004). Thus, AI can be the core in serious games.

B. Application beyond Entertainment

Currently, AI can be applied in many areas (Cohn and Thomas, 1986; Schutzer, 1987; Callan, 2003). Except entertainment, AI can be utilized in: Automated Reasoning and Theorem Proving, Expert Systems, Natural Language Understanding and Semantic Modeling, Modeling Human Performance, Planning and Robotics, Machine Learning, Alternative Representations, Philosophy (Luger, 2002; Nilsson, 1998). Return to The Serious Games Initiative, the goal of the initiative is to help forge productive links between the electronic game industry and projects involving the use of games in education, training, health, and public policy. Thus, the applications of AI overlap the goal of serious game.

For instance, numerous Expert Systems are currently solving problems in areas such as: medicine, education, business, design, and science (Durkin, 1994; Waterman, 1986; Gill, 1986). Planning can help people refine their representation (Cohn and Thomas, 1987). Semantic Modeling can help people correcting errors in their second language learning (Cohn and Thomas, 1987; Gill, 1986).

VI. TECHNOLOGY FEATURES

A. Simple AI

What is ‘simple AI’? Mr. Maxim (2004) sums up many techniques of AI in game programming in his lecture. Hereinto, some of them are based on deterministic rules, flow and procedure can be considered as ‘simple AI’. For instance:

- Deterministic Algorithms: utilizes external conditions to react, such as each clock tick.
- Random Motion: provide seeds, such as clock, to generate random motion.
- Tracking and Pursuit: this technique is for enemies pursuit players. When the players move forwards, the enemies would move forwards, vice versa.
- Tracking and Evasion: this technique is for enemies’ evasion. When the players move forwards, the enemies would move backwards, vice versa.
- Patterns and Scripts: specify series actions to game role. For instance, it would describe when and where the enemies should come out, how many enemies should move, how many should stand by and so on.

Mr. Maxim (2004) considers all the techniques above cost less computer resource, such as less memory, less processing power. Substantively, the simple AI is only the programming strategies in game development not essential

AI, since the fundamental concerns of AI are knowledge representation and search (Luger, 2002).

B. Data Structures Application

Compared with 'simple AI', AI programming techniques in knowledge representation and search are much more complicated. They are concerning data structures utilization widely. According to Mr. Naps and Pothering (1992), if the values of a data type do admit a decomposition into several components, however, then the data type is called 'structured' instead of elementary, and the organization of each component and the relationships between components constitutes what is known as a data structure. Computer science and insightful programmers have developed data structures besides arrays and records that are better suited to other applications. Mainly, data structures involve the following models: Queues, Stacks, Recursion, Binary Trees, General Trees, Graphs and Networks (Naps and Pothering, 1992; Aho, Hopcroft, Ullman, 1983). Actually, data structures are run through the programming in AI (Luger, 2002; Nilsson, 1998). On the other hand, data structures are concerning memory management. When the algorithms of data structures are complicated, they require more memory to store data. At the same time, powerful CPU can shorten the processing time (Aho, Hopcroft, Ullman, 1983).

VII. POTENTIAL BARRIER AND SOLUTIONS

According to section 'Significance in Game' in this chapter, AI plays an important role in game industry. However, the performance of mobile phone is low. Techniques of simple AI are simple and require less memory, less processing power (Maxim, 2004). However, as to serious games application, simple AI is not enough. Various data structures would be required. However, according to Mr. Aho and his workmates (1983), when the algorithms of data structures are complicated, they require more memory to store data; at the same time, powerful CPU can shorten the processing time. On the other hand, compared with console and PC, the memory and processing power in mobile phone is limited. It is hard for mobile phone to run complicated AI algorithms. Thus, low mobile phone performance is the weakness when AI is applied in mobile phone serious game.

Is there any method to solve this issue? The answer is affirmative. On one hand, optimize algorithms is fundamental concern (Aho, Hopcroft, Ullman, 1983). On the other hand, mobile phone is nature mobile network based and connected (Nokia, 16th April 2004). Thus, complicate algorithms can be run in remote server, and then the result would be sent back to mobile phone.

VIII. CONCLUSION

As one component in game technology, on one hand, AI is important in entertainment. AI can challenge players,

assist game storytelling, instead be used to inhabit the living world the game creates and be one solution in multiplayer games while live opponents are not available. On the other hand, AI can be the core in serious games. AI can be the problem-solving solution. For instance, numerous Expert Systems, which is one of the AI applications, are currently solving problems in areas such as: medicine, education, business, design, and science (Durkin, 1994; Waterman, 1986; Gill, 1986).

From technology view point, mobile phone performance is low. Though simple AI running on mobile phone is possible, however, it is difficult to run real AI programmes which are running through algorithms of data structures. In order to overcome this issue, on one hand, optimize algorithms is fundamental concern (Aho, Hopcroft, Ullman, 1983); on the other hand, complicate algorithms can be run in remote server, and then the result would be sent back to mobile phone.

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