

# **Bringing Artificial Intelligence to Gaming**

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## **Abstract**

This paper outlines our research and development efforts to integrate some artificial intelligence (AI) techniques to strategy and action games. The AI techniques and algorithms integrated in the games enable more intuitive human-computer interactions, realistic virtual environments, and advanced decision making based on chasing/evading strategies, special moves and tactics. The results are accomplished while taking a Special Topic course on Game AI.

# 1 Introduction

The many applications areas of Artificial Intelligence (AI) include neural networks, fuzzy logic, genetic algorithms, virtual reality, and intelligent agents. AI in gaming is an attempt to build intelligent virtual worlds and artificial characters, or to create environments that are similar to the human decision making in certain aspect.

There are three fundamental types of AI in games:

**Roaming AI** Roaming AI refers to AI that models the movement of game objects, and the decisions game objects make that determine how they roam around a virtual game world. Roaming AI is used whenever a computer-controlled object must make a decision to alter its current path either to achieve a desired result in the game or simply to conform to a particular movement pattern. The implementation of roaming AI involves altering an object's velocity or position based on the position of another object. The roaming movement of the object can also be influenced by random or predetermined patterns. There are three different types of roaming AI:

- chasing,
- evading, and
- patterned.

*Chasing* is a type of roaming AI in which a game object tracks and goes after another game object or objects. *Evading* is the logical counterpart to chasing; it is another type of roaming AI in which a game object specifically tries to get away from another object or objects. *Patterned movement* refers to a type of roaming AI that uses a predefined set of movements for a game object. Patterns can include circles, figure eights, zigzags, or even more complex movements. A simple example of patterned movement is horizontal or vertical movements.

**Behavioral AI** Although the types of roaming AI strategies are independently important, a practical gaming scenario often requires a mixture of all three. Behavioral AI is another fundamental type of gaming AI that often uses a mixture of roaming AI algorithms to give game objects specific behaviors. For example, a character can have the following behavioral breakdown:

- chase 40% of the time,
- evade 20% of the time,
- move in a pattern 30% of the time, and
- move randomly 10% of the time.

**Strategic AI** Strategic AI is any AI designed to play a game with a fixed set of well-defined rules. For example, a computer-controlled checkers player would use strategic AI to determine each move based on trying to improve the chances of winning the game. Strategic AI tends to vary more based on the nature of the game. Strategic AI, involves a look-ahead approach to determine the best move. The look-ahead is usually used in conjunction with a fixed table of predetermined moves.

## 2 Implementation

The prototypes of two games have been created integrating roaming, behavioral and strategic AI:

**Family Guy** Strategy game based on themes from the television cartoon “Family Guy”.

This game is trying to provide another way for Family Guy fans to pass the time until a new episode or another movie is created. This game is a combination of few smaller games merged as levels. These individual levels depict particular Family Guy episodes or the movie and elaborated to create a way for a Family Guy fan to take part in a particular event. The objective of the game is to navigate the family (Father-Peter, Mother-Lois, Daughter-Meg, Son-Chris, Baby-Stewie, Dog-Brian) through their hometown of Quahog to reach the Quahog Airport for a family vacation to Milwaukee. Each different level displays different characters and different types of gameplay.

**Level 1 (Lois Hunter)** This level is based off of the game called 'Deer Hunter'. The only character in this level is Lois. When the level is started Lois automatically appears on the screen and starts moving in a random direction. The goal of the level is to click on Lois as many times as possible to get a high score. Each time the player clicks on Lois the score increases by ten points. Also, each time the player clicks on her she jumps to a random position on the screen and starts moving in a random direction. Her speed increases slightly each time you click on her as well which increases the difficulty of playing. After about 1.5 seconds Lois' direction changes automatically to prevent predictability. The level ends after a counter runs out of time and if the player's score is high enough then the player goes to the next level. If not, then this level restarts and the player tries again.

**Level 2 (Peter vs. The Giant Chicken)** Peter vs. The Giant Chicken In two episodes Peter battles The Giant Chicken. The theme of this level is a spoof off of “Mortal Kombat”, an “old school” fighting game which involves hand-to-hand combat. At the beginning of the level Peter and The Giant Chicken start off on different sides of the screen. The player controls Peter using the arrow keys. The Giant Chicken is set to randomly move about the level and to react in an attack or block when the player (Peter) is too close. Other features in this level include a health counter, life counter, and a timer. If either Peter or The Giant Chicken has “0” health then that character will lose a life and then the two players will restart at their original positions, thus starting a new round. There is a maximum of three rounds and 30 seconds allowed for each. To pass this level, the player must beat The Giant Chicken two times or else if The Giant Chicken wins twice then the level restarts all of the counters and the player must go through it all again.

**Ong Bak: Quest of the Thai Warrior** Action game based on the movie “Ong Bak”.

Sacred incarnation of Buddha, you must retrieve this statue head in order to regain

the protection for your village, time is running out. While searching the world for the sacred head of Ong Bak you will travel to many exciting and different places. Ting from Pradu is an incredibly gifted fighter who has honed his skills and abilities over a lifetime. He has been named a protector of the village and has sworn to retrieve the sacred head of Ong Bak. Although he upholds his teaching to fight only when absolutely necessary, he will need all his skill in order to save the village from disaster.

It was decided that the game should be implemented as a side-scrolling fighting game with AI components. The tracking system for all characters of the game is based off chasing and evading tactics. Several markers were set in place to log each movement and corresponding  $(x,y)$  coordinates. These markers were set on the main character and enemies. By using a chance variable with the probability of 75%, the enemy moves towards the player character analyzing the distance and  $(x,y)$  coordinates of the characters. These coordinates are taken from the collision boxes created for each sprite. With the probability of 25%, the enemy moves away from the player in a random direction to simulate the evasion.

### **3 Features**

The following components have been integrated into the engine of both games:

- completed storylines;
- developed levels, character sprites, worlds, and AI;
- implemented scripts to manage the following: character controls, AI movements, miscellaneous world elements.

Other AI relevant features include:

- multiplayer environment;
- ability to chose a path in the game;
- ability to change level difficulty;
- penalty for cheating, etc.

Our games run on the Windows platform and require DirectX 8 or higher compatible graphics card with at least 16MB of video memory (preferably 32 MB or more). These games also require a monitor that is capable of 1024x768 viewing resolution. The characters are rendered in a 2D format. Figures 1 and 2 give some screenshots of these games.

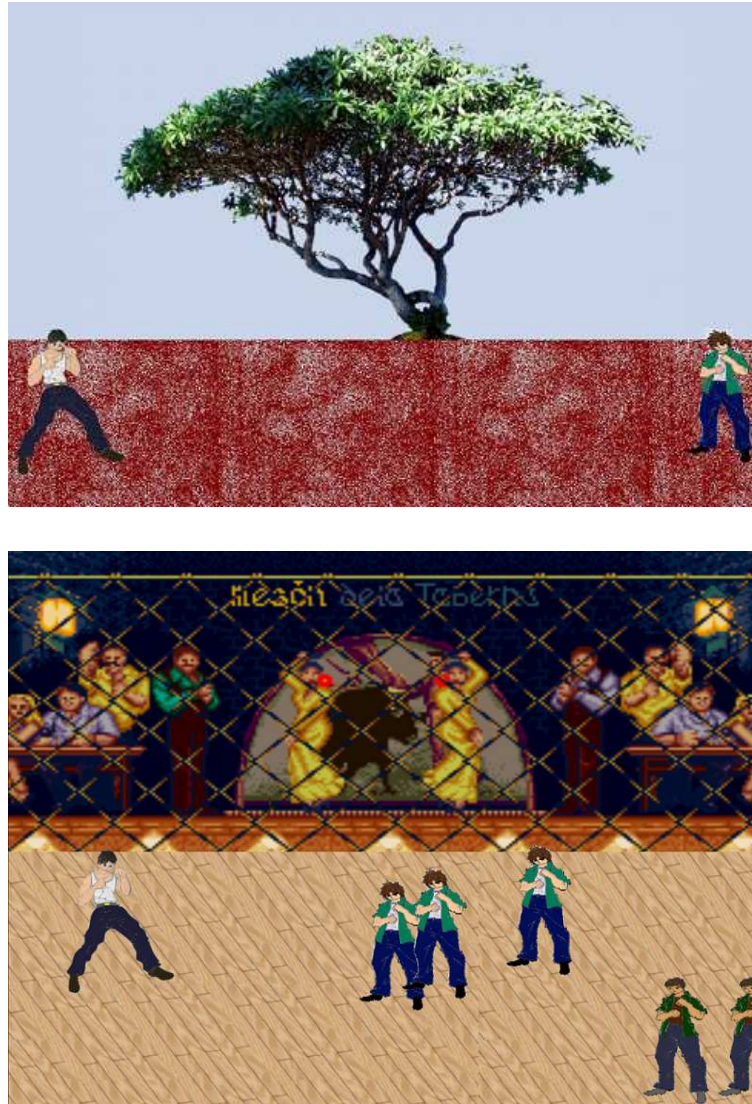


Figure 1: Game screenshots from Ong Bak: single enemy, and group attack

## 4 Concluding remarks

This paper outlines AI techniques and algorithms integrated in two developed games. The AI techniques and algorithms enable more intuitive human-computer interactions, realistic virtual environments, and advanced decision making based on chasing/evading strategies, special moves and tactics. Although much of the existing AI maneuvers had been completed, a large amount of specification remains necessary before the game meets projected goals. Specifically AI relating to group tactics and large levels is still incomplete.

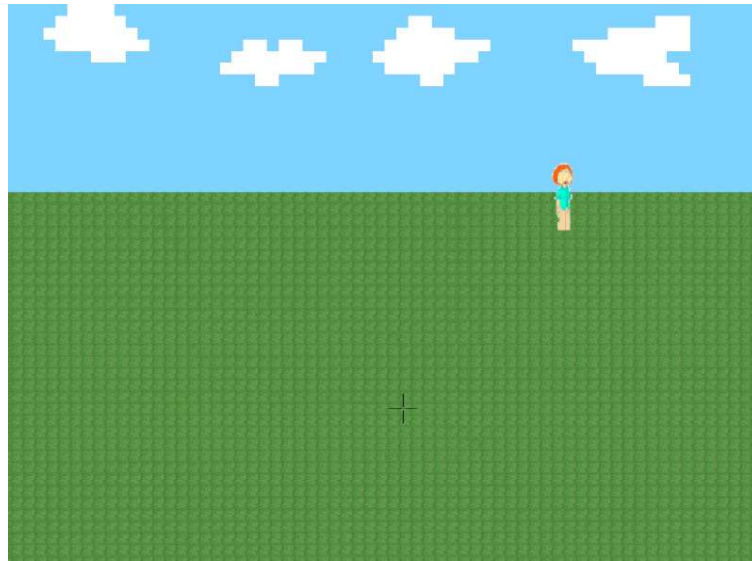


Figure 2: Game screenshots from Family Guy: Lois Hunter, and Peter vs. The Giant Chicken

## Acknowledgements

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