

## **Gaming agent - learn other games based on one**

### **Introduction:**

Gaming agents are basically artificial intelligence programs that learn and play game efficiently without human intervention. For many games like chess, Othello computer programs are designed such that they play the game with best move but they cannot learn other games based on learning one game. Gaming agents known as GGP (General Game Playing) are capable of playing previously unknown games of a wide variety by being told nothing but the rules of the game which are very different from programs which are designed to play specifically a game (such as Deep Blue).

### **Motivation and Importance:**

This is very interesting field in AI of building game playing agents capable of matching wits with the strongest humans in the world. Infact, it is a very interesting and research challenge to build intelligent software agents that can learn a strategy for game playing simulating human behavior. Moreover as per Dresden group of GGP , *"A General Game Playing system, if well designed, would be able to help in other areas, such as in providing intelligence for search and rescue missions"*. Since game playing is to provide fun to humans nothing much can be done in learning the game but it can be used in real world problems. Any useful task can be cast as a digital game where task (may be driving , business related- paying etc.)which provide a well contained environment to operate in.

### **Work done in field:**

The work done by Stanford University Logic Group is remarkable for promoting research in the field. It aims to create a platform for General Game Playing.

Annual world championship of GGP in AAAI conference have been organized since 2005, which promoted research across the world to create benchmark in the field. Previous winners : ClunePlayer(2005), FluxPlayer(2006), CadiaPlayer(2007,2008), Ary(2009,2010) shows the high research potential in the field to build more smart and efficient gaming agents.

### **Method:**

GDL (Game Descriptive language) will be used for describing the game rules , legality of moves and start and termination states to the gaming agent.

Various methods used till date for GGP agents are : automatic feature extraction (ClunePlayer, FluxPlayer, UTexas Larg), Simulation based approach (CADIA\_Player) and Monte-Carlo approach.

Standard approach used in designing gaming agents:

1. Extract feature from game description including structural properties of the game.
2. To create Heuristic Evaluation functions based upon the above extracted features.
3. Using it in minimax tree search.

These valuation functions are updated in real time to adapt to the game by gaining experience from previous game played. As the game agent plays the game it gains experience from it by storing result corresponding to its decision.

### **Our Approach :**

Our work will revolve around the work that has been done previously in the field. Learning the approach and methods incorporated in winners of GGP competition in AAI Conference and further improving their work.

We will be targeting learning and improving of the game agents that has been declared winner in past and are open source. We will try to extend the GGP method for a gaming agent to be able to play non-strategic games also.

### **Source Code:**

1). Cadia Player (Winner of 2007 and 2008 GGP competition in AAI):

<http://cadia.ru.is/wiki/public:cadiaplayer:main>

2).Dresden GGP Server : <http://130.208.241.192/ggpserver/>

3).Palamedes IDE : <http://palamedes-ide.sourceforge.net/>

4). Basic GGP : <http://www.general-game-playing.de/downloads.html>

5). GGP engine of FU Berlin : <http://gameai.mi.fu-berlin.de/ggp/>

### **References:**

1). Lecture and Tutorial Material on GGP :

<http://www.general-game-playing.de/teaching/teaching.html>

2). Tutorial from Scratch to design Gaming Agent :

[http://www.general-game-playing.de/getting\\_started.html](http://www.general-game-playing.de/getting_started.html)

- 3). Ary (Winner of 2009 and 2010 GGP competition in AAAI): <http://www.ai.univ-paris8.fr/~jm/ggp/>
- 4). Course on GGP from Technische University, Dresden :  
<http://www.inf.tu-dresden.de/content/institutes/ki/cl/study/winter09/ggp/>
- 4). Paper by James Clune on Heuristic Evaluation Functions for General Game  
Playing: <http://logic.stanford.edu/classes/cs227/2010/readings/cluneplayer.pdf>
- 5). Experience Generation in Tic Tac Toe by Song, Xiaojian :  
[http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=6245581&tag=1](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6245581&tag=1)
- 6). A Simulation Based General Game Player : <http://www.ru.is/~yngvi/pdf/BjornssonF09.pdf>