FYP Title: Automatic Generation of Interesting Game (AGIG)

Summary Report

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Fun and entertainment are the major goals in computer games. In previous game development eras, static or nonadaptive games were focused on to the maximum extent. The problem was that such games fail to entertain most of the users after some time because the users get experience and then do not like to play it again due to the known strategies and behavior of the game. So we need to develop games that provide continuous entertainment throughout the game life and for a long time. At the same time, it has always been a hard task for the developers to assess the entertainment for the player because entertainment, or interestingness, is very subjective, and no direct measurement tool exists. Mainly, a game has two factors affecting the entertainment of the game: game type and game content.

Computer games are becoming very popular nowadays. Recently, efforts have been made to evolve the rules of the game, but there is a lot of potential for investment and research in this field. The motivation behind this research project is that we have computer games that are interesting, but these games lack the strategies and techniques to maintain the entertainment level and keep the user involved in the game. Julian Togelius, J¨urgen Schmidhuber, Georgios N. Yannakakis, and John Hallam proposed a way to measure entertainment in the game via certain factors. We are on the way to make use of this proposal, and then by using the evolutionary techniques, we will generate and evolve the contents of the game and make them user-centered. The aim of our project is to create interesting and adaptive game content that is interesting, entertaining, and adaptive. After generating the game contents, these contents will be evolved by using evolutionary techniques like genetic algorithms and artificial neural networks. To assess the quality of the evolving game, we will use a fitness function that uses the values of certain factors like diversity in opponent's behavior, challenge to the user, usability of the playing area, and game duration. It will assign low fitness to a game that has a low challenge mean, requires little effort, or is very hard and impossible, has low learnability, etc., and will assign high fitness to a game that is easy to learn and provides entertainment throughout the game life. The fitness function tests our game on it to measure entertainment in the game and to describe how interesting the game is.

There are a lot of variations in game category, but our focus is on predator/prey games. Our project is divided into several modules: Representation of P/P game in GA, Gaming Generation, User Modeling, Fitness Function, Next Stage Generation, and Comparison with Pac-Man. For evolving the game contents, the following procedure is as mentioned below.

There will be a gene encoder, which encodes the rules on an array, and that will be known as a chromosome. A population of 100 chromosomes (arrays) will be generated randomly, and the values of each gene are assigned according to the defined search space. Each chromosome can be converted into a game, and that game was played by the agent controlled by either a rule-based controller or an ANN. After playing the game, the fitness factors, such as diversity, challenge, game score, etc., were calculated, and these factors were associated with that particular chromosome. The same procedure applies to the full population, and then these chromosomes mutate by changing some of their genes. The mutated population of chromosomes also passes through the same procedure, and their fitness value is also calculated. Then all these chromosomes of two generations were ranked according to their fitness values and sorted according to their fitness in descending order. The top fifty chromosomes choose again and consider being the best and discarding the other chromosomes. A new generation will be created, which consists of these best chromosomes, and similarly, the above procedure will be repeated 100 times. At the final stage the evolved chromosomes were considered to be the best, and they have the best rules for providing entertainment. Evolutionary techniques are used for evolving the game contents, so the procedure will be very slow. We evolve the rules, and then the final evolved chromosome passes through the game generator, and that game is presented to the human player for conducting the survey.