CS 4200 Project Proposal: Predicting NFL Player Performance in Developing Optimal Fantasy Football Teams

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Introduction

The inspiration behind Fantasy Football AI was many things which culminated together. The first of which was the NFL Season had just started so, my mind was already occupied with football on at least three out of the seven days in the week (Sunday, Monday, and Thursday). The second reason was because fantasy football is something I partake in on a yearly basis. The final leg was that I realized while playing fantasy football that statistics, conditions, teams, and many other data sets would lead you to a better prediction for what you can expect a player to do during the game.

All these data sets lead me to think of a way a computer, AI, could decode this raw data and present a simple solution to the fantasy football player on who he/she should be starting or benching on a given week. This project aims to use artificial intelligence concepts along with big data management to smartly select the correct player to choose given the circumstances they are playing under.

This project is not unique at all, there have been more intelligent people with years of AI experience take different and better approaches to the domain at hand. However, what we want to accomplish is something of a smaller scale given the constraints of this project. We still would like to add some unique features to the AI that the other developers could not or did not want to. Creating an AI for Fantasy Football is not an easy task at all, and there are some components to the AI that could be subjective based on the developer and his team. All these choices could lead to a better or worse AI depending on how deep the developers fantasy football knowledge is. We will try to only add objective components that are easy to assess however, subjective statistics will eventually creep into our design at latter stages because thats just how fantasy football is.

Related Work

There have been numerous attempts in trying to develop AI's that try to build the best possible teams in Fantasy Football. In traditional Fantasy Football, participants have access to various amounts of information, which include player statistics, predictions, expert rankings, and peer recommendations (Lutz 2015). Participants then take this data and try to formulate, to the best of their abilities and with the current data, the most efficient teams they can week after week. This is what Fantasy Football AI's have attempted to also do in the past; look at player data and create teams that are efficient and have optimal players to win weekly Fantasy Football matches. Some of the AI methods and techniques that have been used to solve the Fantasy Football puzzle include Bayesian Reinforcement Learning (Matthews), Markov Decision Process (Matthews, Ramchurn, and Chalkiadakis 2012), rule-based reasoning (Lutz 2015), classification methods (Lutz 2015), linear Support Vector Machines (Lutz 2015), and neural networks (Lutz 2015). Additionally, IBM's Watson has been helping Fantasy Football participants make better decisions by applying machine learning to articles about players and their statistics in Fantasy Football (Baughman 2018). In turn, Watson develops statistics for players so that participants can make the correct drafting decisions for their teams (Baughman 2018). In this section, the works of Roman Lutz from the University of Massachusetts Amherst and Tim Matthews, Sarvapali Ramchurn from the University of Southampton in collaboration with Georgio Chalkiadakis from Technical University of Crete and the techniques they used to implement their Fantasy Football AI's will be briefly discussed.

In Roman Lutz's work in Fantasy Football AI, Support Vector Regression and neural networks were applied to the Fantasy Football problem domain to achieve an AI that could predict scores of NFL players. In order to achieve this, data from the last 6 NFL seasons were used and passed through Support Vector Regression and neural networks so that only the data that mattered was pulled from the raw data. Support Vector Regression does this by creating a linear regression model for the data and it is particularly good at predicting winners of sports matches from a structured data set using this method. However, if the structure of the data is unknown, that is where neural networks come into play, as they are successful at adapting to almost any data set by learning the characteristics of that data set. The results from the neural network calculations are then converted to a "linear output layer" so that they can be compared with the results from the Support Vector Regression to see which AI method is better suited for predicting NFL player scores in Fantasy Football.

Tim Matthews, Sarvapali Ramchurn, and Georgios

Chalkiadakis used the Bayesian reinforcement learning model in order to develop an AI Fantasy Football "manager" that optimizes the selection of NFL players in the formation of its teams. As explained by the authors, this is a computationally difficult task as there are more than 500 possible NFL players to draft from, they are selectable in over 10^{25} ways, and participants must repeatedly make these decisions week after week for 38 weeks. Problems that have a similar problem domain have used different Bayesian reinforcement learning techniques. Essentially, these techniques employ Bayesian agents that keep track of the state of their world and explore them in an optimal way. With this, these agents are able to formulate optimal formations of their problem domain over time. The authors of this paper use a similar approach. This is done by creating an automated Fantasy Football manager in which its ability to handle decisions is implemented as a "belief-state Markov decision process" which allows for the optimal selection and formation of NFL Fantasy Football players into teams over the period of 38 weeks.

Method

Fantasy Football AI, at the time of this writing, is planned to use a reinforced learning and/or rule-based reasoning in order to predict the amount of fantasy points a player will get in his next game. To give a simple prediction we can simply average the points of previous games and/or previous seasons; however, our hopes is that with the help of AI and by detecting trends, statistics, conditions, teams and other data sets the AI can formulate a better prediction.

We currently do not have a specific API in mind; however, we plan to use reinforced learning and/or rule-based reasoning to implement Fantasy Football AI. For reinforcement learning, we can determine whether an opposing team and/or certain weather conditions affect the prediction. For example, if player A is in team X and team X played poorly against team Y with a certain amount of games, then it reinforces that team Y can hinder the predication of player A. Or if a weather condition reinforces that player A gets a lower amount of fantasy points if every X amount of times the weather condition occurs, then through reinforcement learning we can determine a better prediction if the next game is with that certain weather condition.

Our hopes in a rule-based reasoning, is that through reinforcement learning the AI can establish rules for certain conditions. As previously mention a rule can include that if a certain weather condition is given the the rule might be that player A might not play as well, thus lowering is predication if that weather condition occurred in his next game.Furthermore, rules can help establish the trajectory of the player's fantasy points. An example of this is a rule that if ever the points a player receives after a game is detected as an outlier than perhaps the AI does not include it in the trajectory.

A major and vital component of Fantasy Football AI will be the data set that it will be working with. The data that is required by Fantasy Football AI will either be acquired from a database or through web crawling. Data Sets such as player's statistics, previous games/seasons performance, etc. will help formulate trends and create a point trajectory for the player. The data will be acquired from either a database or from web crawling. It should be noted that not data sets will might not be available to us due to the pricing.

- https://www.armchairanalysis.com/data.php
- https://github.com/BurntSushi/nfldb
- https://www.kaggle.com/kendallgillies/nflstatistics

We are going to evaluate Fantasy Football AI by comparing the predictions that our AI gave with how many points actually accrued. Our expectations are not to see the predictions to always, or even sometimes, to be exact of that actually accrued; however, our expectation is to see the prediction to be in a reasonable range of what the actual points were. Perhaps we can even implement a percent error in which can help alleviate inconsistencies; for example, if player A does not have a consistent record with playing a team Y, then the percent error can possibly increase when predicting player A's next game with team Y.

Timeline (tentative)

Robert and Ramon will focus on gathering the required data, processing it, and categorizing it into the correct data structures. Mohammed will focus on developing and testing the algorithms for generating the predictions based on the data. However, we will all reeevaluate our progress every week and refocus our efforts on lagging areas.

- Week 5 - Submit proposal
- Week 6/7 - Research NFL Stats data pulling from database or web crawler
- Week 7 - Attempt to pull the NFL stats from the previously researched venue
- Week 8 - Attempt to use the statistics data pulled in a simple print statement
- Week 9 - Be able to place the statistics of a player into a data structure or control structure
- Week 10/11 - Research ways to use the data structure of statistics to build a good AI
- Week 11/12 - Start the creation of the Fantasy Football AI
- Week 13/14 - Finalize the production
- Week 15 - Testing / Debugging

(Lutz 2015) (Matthews, Ramchurn, and Chalkiadakis 2012) (Baughman 2018)

References

Baughman, A. 2018. Watson's artificial intelligence helps millions of espn fantasy football owners make better decisions.

Lutz, R. 2015. Fantasy football prediction. *arXiv preprint arXiv:1505.06918*.

Matthews, T.; Ramchurn, S. D.; and Chalkiadakis, G. 2012. Competing with humans at fantasy football: Team formation in large partially-observable domains. In *AAAI*.