Fantasy Football AI: Predictive Modeling and Squad Optimization

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1. Introduction

Fantasy football allows millions of users to build virtual teams made up of real-world football players, earning points based on their real-life performances. The challenge lies in choosing a team that maximizes points while respecting multiple constraints such as budget, formation, and player positions.

This project focuses on creating a data-driven solution for creating an optimal team. By predicting fantasy points of the players using machine learning models and selecting an ideal combination of players via mathematical optimization, our goal is to strengthen overall team performance satisfying our constraints.

2. Objectives

- Predict fantasy points for each player using machine learning models trained on historical data.
- Use these predictions to create a 15-player fantasy team that maximizes projected performance.
- Ensure the selected team satisfies constraints related to budget, player positions, club limits, and valid formation structures.
- Identify an ideal starting eleven that further boosts gameweek performance.

3. Methodology

3.1 Data Collection

We utilize publicly available datasets from the Fantasy Premier League API and GitHub sources such as [1], which include:

- Player statistics (goals, assists, expected goals (xG), expected assists (xA), minutes played)
- Gameweek-wise match results
- Fixture difficulty ratings
- Player prices, club affiliations, and positions

3.2 Fantasy Point Prediction Models

We implement multiple regression models to predict fantasy points:

- Linear Regression
- Random Forest Regressor
- XGBoost Regressor

Model evaluation is based on standard regression metrics:

Mean Absolute Error (MAE):

$$\text{MAE} = \frac{1}{n}\sum_{i=1}^{n}|y_i - \hat{y}_i|$$

Root Mean Square Error (RMSE):

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}$$

Where y_i and $\hat{y}_i$ denote the actual and predicted fantasy points for player i. These predictions are then used to drive the team optimization stage.

We might not only rely on these standard metrics but also look into additional methods and variations to achieve better prediction accuracy.

4. Team Optimization Strategy

After calculating predicted points, we construct the best possible team that adheres to our constraints while maximizing overall team strength.

4.1 Optimization Objective

We formulate the team selection as an integer linear programming (ILP) problem:

$$\max \sum_{i=1}^{n} p_i x_i$$

Where:

- p_i is the predicted fantasy points for player i
- $x_i \in \{0, 1\}$ indicates whether player i is selected

The goal is to find the optimal set of players that collectively yield the highest total points for the team.

4.2 Constraints

To ensure realism and validity within the system, the following constraints are applied:

- **Squad Size**: 15 players must be selected.
- **Budget**: Total player costs must not exceed a preset value.
- **Positional Requirements**:
  - 2 Goalkeepers
  - 5 Defenders
  - 5 Midfielders
  - 3 Forwards
- **Formation Rules**: A valid starting eleven must comply with acceptable formations (e.g., 4-3-3, 4-4-2).

The output of this process is not merely a list of high-performing individuals but an optimally structured and cohesive squad tailored to maximize fantasy returns within a constrained setting.

5. Expected Outcomes

- A CSV file containing predicted fantasy points for all active players.
- An optimized 15-player team meeting all our constraints.
- A selected starting eleven based on formation compatibility.
- Total expected points for the optimized team.

References

[1] Vaastav Anand. Fantasy premier league data repository. https://github.com/vaastav/Fantasy-Premier-League, 2024. Accessed: 2025-06-13.

[2] Malhar Bangdiwala, Rutvik Choudhari, Adwait Hegde, and Abhijeet Salunke. Using ml models to predict points in fantasy premier league. In *2022 2nd Asian Conference on Innovation in Technology (ASIANCON)*, pages 1–6. IEEE, 2022.

[3] IBM. Ibm watson fantasy football. https://www.ibm.com/thought-leadership/fantasy-football/index.html, 2024. Accessed: 2025-06-13.

[4] Prof. Dr. S. N. Sarda, Rishikesh Sahu, Atharva Ingole, Aditi Patil, and Akansha Tarpe. Fantasy football team prediction using ml. https://www.doi.org/10.56726/IRJMETS54188, 2024. Accessed: 2025-06-13.