先端科学技術研究科　修士論文要旨

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要旨

Background: Football has a long history and a huge popularity. So, the football world has also become a large marketplace. Football clubs are keen on signing and contracting good players at a reasonable price. However, the traditional metrics for evaluating football players often focus on specific types of actions during a game, failing to capture the overall influence of players on team performance. However, the players' salaries have to be defined based on the overall influence in the game, so a comprehensive framework is needed to address these limitations and provide a unified measure of player impact. This idea leads us to the necessity of approximating the action value function.

Objective: This study aims to improve the existing evaluation frameworks using the action value function by implementing and enhancing the model that comprehensively evaluates players' overall contributions to a game, overcoming the constraints of action-specific metrics.

Methods: We surveyed some previous studies utilizing deep reinforcement learning to establish a baseline model. The model was enhanced by introducing new features designed to improve its performance. The proposed model was applied to event data from the 2022-2023 English Premier League season, including 380 games. For the model validation, we analyzed the correlation between team-level evaluation metrics and the actual number of goals scored. Additionally, the relationship between individual player metrics and their salaries was examined to see the validity as an objective evaluation metric.

Results: The new model demonstrated a significant positive correlation between team evaluation metrics and actual goals scored, whereas the baseline model showed no significant correlation. Furthermore, player performance metrics derived from the new model exhibited a significantly higher correlation with player salaries than the baseline model. We can say the new model is better than the existing model for evaluating the teams' and players' performance.

Application and Discussion: A case study illustrates the practical utility of the proposed evaluation framework in assessing individual players. The results show potential applications in player recruitment and understanding player characteristics, offering new insights for team management. In the last chapter, we discuss the dataset's limitations and the potential improvement of the action value function method for football action evaluation.