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Proposal for Simulation Environment to Support Understanding of Tactical Positioning

Yuki OHTSUKA[a*] & Tomko KOJIRI[b]
[a]*Graduate School of Science and Engineering, Kansai University, Japan*
[b]*Faculty of Engineering Science, Kansai University, Japan*
*k173907@kansai-u.ac.jp

Abstract: To lead tactics to success in team sports, the player needs to judge whether they should apply the tactics based on the positional relationships of their allies, opponents, and other relevant factors. Players build up successful positional relationships based on the experience, i.e. to satisfy the positions of the allies and opponents of the success experience and exclude those of the failure experiences. However, novice players, due to lack of experience, do not have appropriate successful positional relationships. In order to acquire the successful positional relationships, two steps are necessary: to experience tactics with various positional relationships and to acquire the successful positional relationships from the experiential results. This paper focuses on supporting the first step and proposes a tactic simulation system for the given tactics and positional relationships.

Keywords: positional relationship, simulation system, tactical understanding

1. Introduction

In team sports, tactics are specific methods for achieving specific objectives and typically involve the coordination of multiple players. To lead tactics to success, it is necessary to judge whether players should apply them apply them based on the position of their allies, opponents, and other relevant factors [Williams, A.H, 2006]. The player determines the success or failure of applying the tactics by comparing the current positional relationship with their understanding of successful positional relationships.

Successful positional relationships are acquired based on the past experiences. Players build up successful positional relationships by satisfying the positions of the allies and opponents of the success experience and excluding those of the failure experiences. However, novice players, due to lack of experience, do not have appropriate successful positional relationships. For these players, support is needed to make it easier for them to gain experience.

Yano et al. proposed a system to extract the positional relationships from videos in which the tactic was used [Yano et al., 2020], but it is not possible to learn to what positions the tactic is successful. Tsai et al., developed a virtual reality system to facilitate understanding of tactics [Tsai et al., 2022]. Their system allows user to participate into the game as members of preforming the tactics. However, it does not provide guidance on what positional relationships to employ specific tactics.

This study proposes a simulation system by which novice players can experience the result of success or failure of specific tactics without experiencing the real play. The system lets the players to set the positions of allies and opponents in applying the tactics and gives the results of success and failure. By making players attempt various positional relationships, the system expects players to build up the successful positional relationships.

2. Support for Understanding the Positioning of Successful Tactics

Players experience tactic with various positional relationships and grasp the successful positional relationships that satisfy the success experience and do not satisfy failure experience. Figure 1 shows an example of acquiring the successful positional relationships of a tactic called “kick and go” from the experiences. The blue circle represents allied players, the red circle represents an opponent, and the black circle indicates the point where player runs. This tactic is to break through the enemy defense, in which a player A passes a ball to ally B, runs to the position D, and gets the ball from B. If there are three success experiences and three failure experiences as shown in Figure 1, the successful positional relationships are shown as the green boundary in which the opponent C should be.

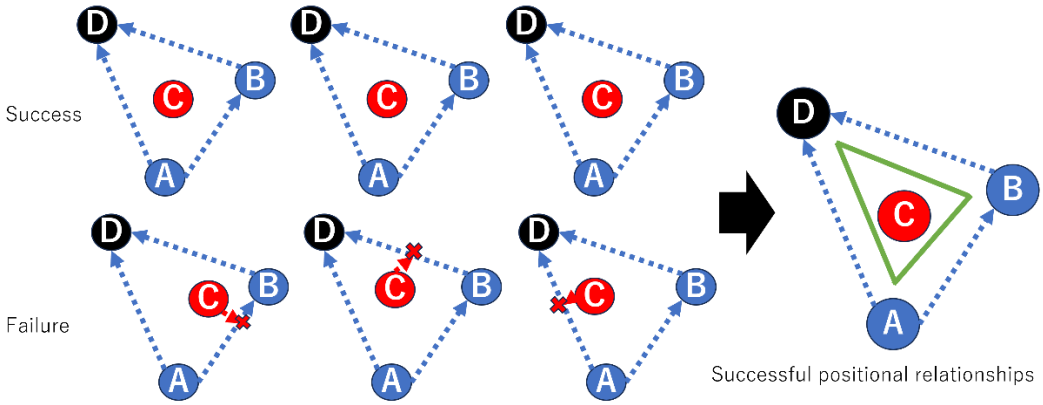

Figure 1. Example of Acquiring Successful Positional Relationships

As this example, in order to acquire the positional relationships, two steps are necessary: to experience tactics with various positional relationships and to acquire the successful positional relationships from the experiential results. Current phase of our research provides the systems for supporting the first step. That is, our research proposes a tactics simulation system for players with limited experience.

Figure 2 shown the system configuration. It consists of the interface and the simulation execution function. The player inputs tactical information that he wants to acquire the successful positional relationships into the interface. Then, the player inputs the positional relationships such as the number of allies and opponents, their positions, and the action they take. The simulation execution function simulates the tactics based on the input positional relationships and gives the result whether the tactic can be done with the success or failure. If the tactic becomes failure, the system also indicates the action that causes the failure.

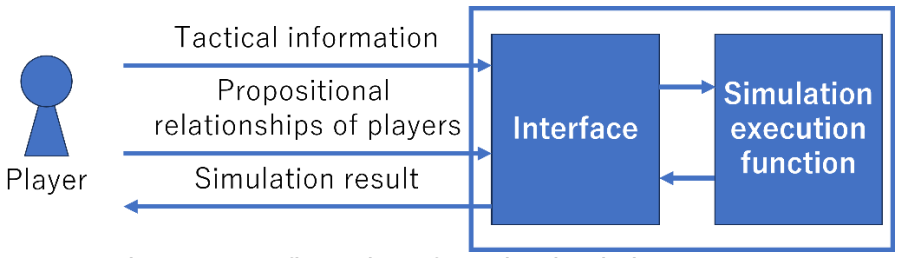

Figure 2. Configuration of Tactic Simulation System

3. Prototype System

We have implemented the prototypes system targeting the tactics of the soccer. Figure 3 shows the interface. In the Tactical situation area, the player can set the number of players and their positions related to the tactics. The player’s position can be freely adjusted by clicking the position in the Simulation area. Tactical actions can be defined in the Tactical action area. After all settings have been made and, Confirmation button is pressed, the system simulates

the tactics. Currently, simulation function set the player's running speed as 7m/s, and ball kicking strength as 350N, which is sufficient to kick a ball a speed of about 8m/s.

The result of the simulation is shown in the message window as shown in Figure 4. When the tactic was succeeded, it shows the success message as shown in Figure 4(a). In the case of failure, the result and the failed action is shown like Figure 4(b).

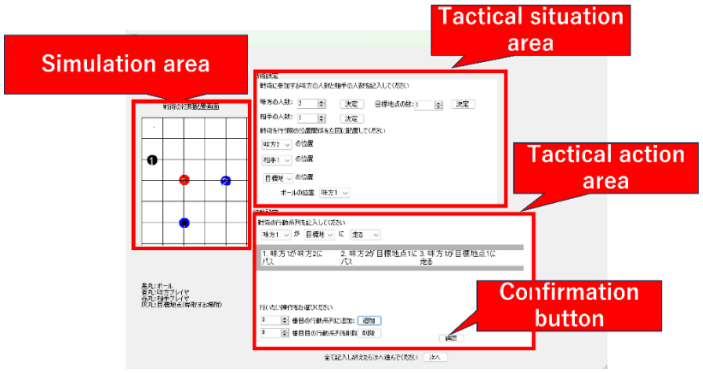

Figure 3. Simulation Interface

a) Success result b) Failure result

Figure 4. Result Message Window

4. Conclusion

In this study, we have proposed a system for providing the simulation results of the tactics in the given positional relationships. By using the system, the player is able to grasp the success or failure of the tactics with the given positional relationships. In order to acquire the successful positional relationships, the player needs to extract the characteristics of positional relationships of success and those of failure. For our future, we plan to develop a system that visualize all simulation results so as to make players to grasp the characteristics easily. Furthermore, we intend to conduct user studies to evaluate the effectiveness of the system.

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