Support System for Understanding How Teammates Grasp Game Situations

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Abstract: In team sports, each player's move is affected by their mental state. A successful tactic in team sports is to understand the mindset of teammates. The current situation of the game can provide clues for determining a player's mindset. For instance, if the teammate thinks his team has the advantage, he feels encouraged and can move actively and confidently. Therefore, determining how teammates grasp the game situation is important for tactical success. This study develops a support system for understanding how teammates grasp the game situation. This system consists of two subsystems; the perceived game situation input system is used by individual members to input the perceived game situations of past games and the game situation sharing system shows the current perceived game situation of all team members. By visualizing the perceived game situation in two ways, members are able to recognize the trigger events of grasping negative situations easily.
Keywords: game situation, team sports, visualization, mental situation

1. Introduction

In team sports such as soccer and rugby, the players' actions and movements are planned carefully and tactically. However, no matter how successful they are in practice, these plans sometimes fail during actual play. One reason is that the members' movements are not always the same and can change depending on the player's mental situation (Campo et al., 2018) ; e.g., if they are depressed or nervous, they may not perform as they did in practice. If members are aware of their teammates' mental state, they are able to support each other.

Mental states change depending on how the game flow is perceived (Schmidt et al., 2020), which we call subjective flow. Subjective flow can be determined by the perceived current situation and the prediction of future situations. For example, if the current situation is advantageous and the future is disadvantageous, the subjective flow might be negative, and the player's mindset becomes depressed. The perception of the current situation and prediction of future events are determined by the subjective criteria of players and differ between players. If the trigger events of determining the perceived current situation and the prediction of the future situation can be understood, it is possible to infer the mental states of members during the game.

The types of trigger events for the members may be the same, so it is effective to consider the trigger events of past games. As a first step toward grasping the mental situation, we propose a system for collecting the perceived current situation of past games and sharing them with the members. During such activities, it is important to determine how to share the perceived current situation from the viewpoint of understanding the subjective criteria. There are several systems that aim to visualize the knowledge of group members for collaborative learning. Many focus only on sharing current knowledge (Janz et al., 2009) and do not address the trigger for acquiring such knowledge. Our system visualizes the perceived current situation with the game events that trigger the perception.

2. Overall Framework of System

2.1 Mental State and Trigger of Perceiving Game Situation

To grasp the mental states of teammates, we first propose a model representing how mental states are determined. Figure 1 shows the model for identifying the mental situation from game events. The players use the events in the game to perceive the current situation. They also predict future situations from current game events. The difference between the current and future situations establishes the subjective flow of the game and this flow determines the mental situation.

For example, based on the event of losing points and falling behind, a player considers the current situation to be a "disadvantage." Since he is pessimistic and believes his team is going to lose more points in the future, he considers the future situation to be "more disadvantageous." By comparing the current and future situations, the flow appears negative, so his mental state is depressed.

In this process, how the player perceives current and future situations differs for each player based on their personal criteria. Determining the trigger of how the situation is perceived makes it possible for the player to infer the mental states of the other members.

Figure 1. Model for Identifying the Mental Situation by Game Events

2.2 System Overview

This study supports recognizing the triggers of the advantage/disadvantage perception of the current situation. Grasping the future situation, flow, and mental situation remains as our future work.

Since triggers are established depending on the players' criteria and might be common for all games, finding triggers based on past games is effective. This study proposes a support system for understanding how teammates grasp the current game situation by sharing the perceived situation of past games based on game events.

Figure 2 is the overall framework of our system. It consists of two subsystems: the perceived game situation input system and the game situation sharing system. The perceived game situation input system is used by individual members to input the perceived game situation of a past game. The system displays the game's video on each player's interface. The players input the perceived situation, such as whether it is considered an advantage or disadvantage, at each point in time. The input data is saved as perceived situation data. The game situation sharing system shows the perceived game situation of all team members. It arranges the distribution of the perceived data so as to find the players' trigger events or tendencies of teammates easily.
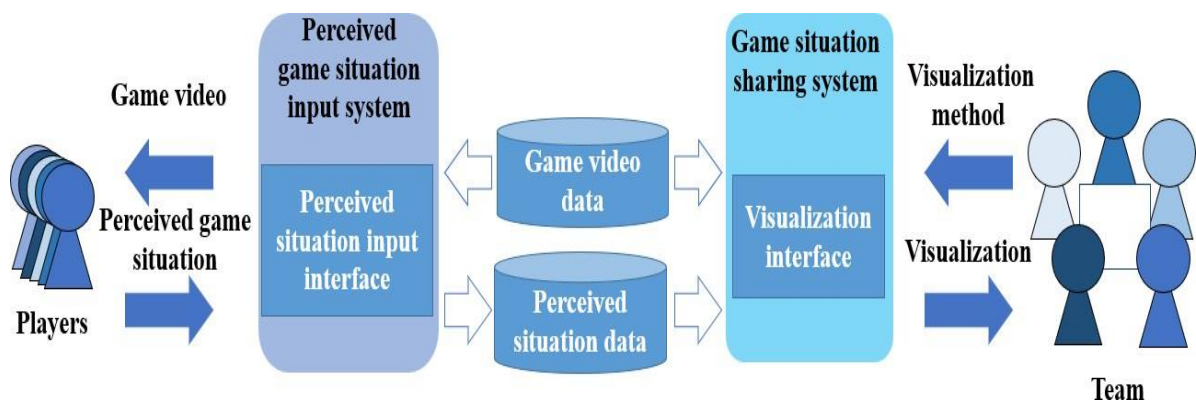
Figure 2. Overview of the System.

3. Perceived Game Situation Input System

The perceived game situation input system allows individual players to input their perceived game situation along with the game flow. Figure 3 shows the interface. The video display area shows the game, allowing the player to watch the video using the start and stop buttons. The perceived situation can be inputted by stopping the timing in the video where the player recognizes the situation, selecting the type of situation using the perceived situation input area, and pushing the input button. At the beginning of the game video, the system recognizes that the player thinks the situation is "neither (advantage /disadvantage)" and, until the perceived situation changes to advantage or disadvantage, it recognizes that the player perceives the same situation. The input situation display area designates the inputted situations along with the time by color. Its horizontal axis corresponds to the time sequence of the game video and the time periods are colored by the perceived situation of the player; that is, blue for "advantage," yellow for "neither," and red for "disadvantage." When the save button is pressed, the input situation is stored as the perceived situation data.

Figure 3. Perceived Situation Input Interface

4. Game Situation Sharing System

The game situation sharing system displays the perceived situation of all members to support them in determining the trigger game events of perceiving the situation. Currently, the system assumes that players tend to grasp two events; one is the trigger event for individual players who perceive situations differently than others and the other is where most of the members perceive the situation as negative. To help members recognize such events easily, this system provides two visualization modes: *whole team mode* and *each player mode*.

Figures 4 and 5 show the interface of the two visualization modes. In whole team mode, the number of players who perceive each situation is counted and indicated as the height of each color, with blue for "advantage," yellow for "neither," and red for "disadvantage." In each player mode, each player is assigned to each line, as shown in Figure 5. In both modes, the horizontal axis represents the time axis and, by clicking the point on the axis, events that occur at that time are highlighted in the list of events area. Table 1 shows the elements of the list of events prepared for a rugby game.
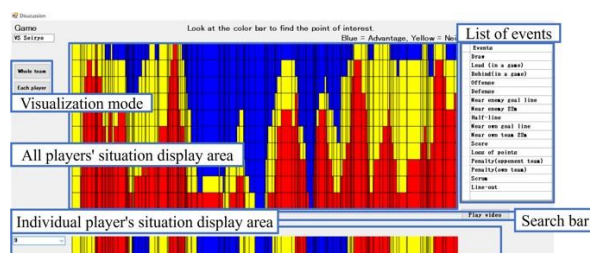

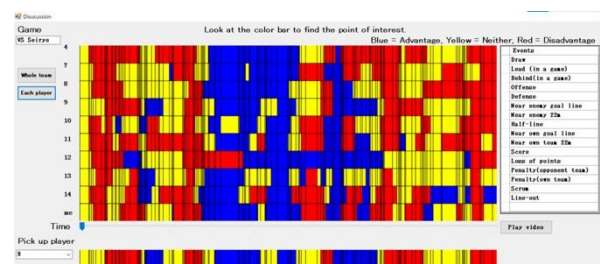*Figure 4.* Visualization Interface
(Whole Team Mode).

Figure 5. Visualization Interface
(Each Player Mode).

Table 1. List of events

Scores: draw, lead, behind
Side: offense, defense
Position: near enemy goal line, near enemy 22 m, half-line, near own goal line, near own team 22 m
Events: score, loss of points, penalty (opponent team), penalty, (own team), scrum, line-out

5. Conclusion

In this paper, we proposed a method for estimating the teammates' mental situations based on perceived current and future situations. In addition, we described the development of a system for grasping the trigger events of perceiving the current situation as advantage/disadvantage using the experience of past games. The system proposes an environment that enables members to express their perception of situations during the game. It also visualizes the distribution of the grasped game situations of the team members for understanding the triggers for determining the situation.

In our future work, we will evaluate the effectiveness of our visualization interface for grasping the trigger events of the current situations of teammates. In addition, we will develop a support method for grasping future situations and mental states.

References

Campo, M., Martinent, G., Pellet, J., Boulanger, J., Louvet, B., & Nicolas, M. (2018). Emotion–performance relationships in team sport: The role of personal and social identities. International Journal of Sports Science & Coaching, 13(5), 629-635.

Janz, B. D., & Prasarnphanich, P. (2009). Freedom to cooperate: Gaining clarity into knowledge integration in information systems development teams. IEEE Transactions on Engineering Management, 56(4), 621-635.

Schmidt, S. C., Gnam, J. P., Kopf, M., Rathgeber, T., & Woll, A. (2020). The influence of cortisol, flow, and anxiety on performance in E-sports: A field study. BioMed research international, 2020.