

A STUDY ON QUANTITATIVE EVALUATION FOR SOCCER TACTICS USING DEFENSE STRENGTH MAP

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Introduction

In recent years, it has become possible to get player's coordinate in games by using multi-camera system. This paper proposes a "Defense Strength Map" based on player's coordinate to evaluate soccer tactics quantitatively.

Methods

"Defense Strength" is defined as the strength that defenders impose on an attacker. The strength is quantified by the mathematic model below.

$$S_{defense} = \sum_{i=1}^n (P_{pressure} \times P_{direction} \times P_{zone}) \quad (n: \text{the number of defenders within 10 meters})$$

In the mathematic model, $P_{pressure}$ indicates the pressure that imposed on an attacker from a defender, and it is calculated by the distance-decay function below.

$$P_{pressure} = \begin{cases} M \times e^{-\alpha(x-1)} & (x \geq 1\text{m}) \\ M & (0 < x < 1\text{m}) \end{cases}$$

In the function, M , α , and x are the maximum value of $P_{pressure}$, an attenuation coefficient of pressure and the distance between an attacker and a defender. Then, $P_{direction}$ is a coefficient based on the relative position between an attacker and a defender, and P_{zone} is a coefficient based on an attacker's position in a soccer field.

Results & Discussion

Figure 1 is an example of Defense Strength Map, the darker color indicates the stronger defense. It can be used to evaluate balance and combination of defense organization quantitatively and visually. Also, it can be used to evaluate offense tactics quantitatively, such as pass-quality and receiver's positioning. As a case analysis, we evaluated the "triangle's center" attacking tactics, which Shoji [1] pointed out that a tactic specific to team Spain and Barcelona.

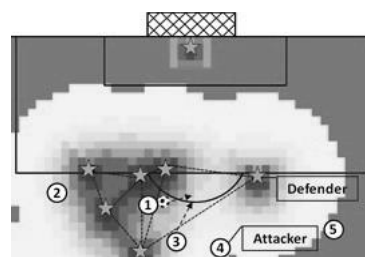


Figure 1. Defense Strength Map

Conclusion

The case analysis demonstrated strong feasibility of evaluating soccer tactics quantitatively by Defense Strength Map.

References

1. Kizaki, S. et al. (2010). *Soccer Critique Magazine*, ISSUE 46: pp.38-50.