Problem Chosen	2020 MCM/ICM Summary Sheet	Team Control Number
D		2002526

Improving Team Performance During a Football Match

Summary

The interaction and cooperation between players in a football match can affect their success and score goals. To explore this and develop strategies to help Huskies perform better next season, we quantified and formalized the team's structural and dynamic characteristics, using several indicators to describe the team's performance in many aspects and making targeted strategies.

For the first problem, we used Social Network Analysis to construct the passing network, and explained the basic attributes of the Network. Furthermore, specific network characteristics are analyzed from the perspective of whole network, local networks and individual networks. The whole network: weighted proximity matrix, the centroid, weighted center dispersion and maximum radius. Local networks: identify the network patterns, including Core/Periphery Analysis to obtain the Core players and the Periphery players and their relationship, and the analysis of configurations that constructs the 3-node sub-network to obtain the types and frequencies of its motifs happened, namely the specific configurations of dyadic and triadic. The index of individual network: Degree Centrality of node. Finally, we draw the timeline to analysis the dynamics of passing over time.

In the second question, combining the social network analysis and the actual situation of football matches, we found three performance indicators: one team's total number of passes in one match, average contribution to the team and pass-possession rate, and four team level processes: aggregation, extension, tempo and connected configuration ratio. They were then combined with goal difference as the independent variable to draw the scatter plots and conduct multiple linear regression analysis. Finally, three significant variables that can effectively measure the level of team cooperation were selected and the performance model of passing network passed the test as a whole at a 95% significance level. And Root MSE equals to 1.5, which is of low level. The Huskies team is then described from three aspects: structure, configuration and dynamics.

Based on the summary of the effective indicators of winning the game, the coach is advised to strengthen the cooperation training of three-member groups, improve the passing quality according to the opponent's Control opening attack routine and pay attention to the player's physical and skill training in order to achieve a better performance in the future.

For the fourth problem, our findings are summarized from the perspective of model indicators pi1, tp2, tp3 and tp4. In the design of a generalized model the factors to be considered are frequent and close interaction, affecting all aspects of the task for division of labor, being gradual, full interaction or communication within a subgroup. Others include collective consciousness, the cores and team trust.

The model established in this paper makes full use of the obtained data of passes to describe and quantify the team cooperation level from multiple aspects. It is validated by statistical tests and can be applied to assess the level of teamwork of multiple teams and predict the outcome of matches. The indicators selected by the model can be widely used to describe other social teamwork levels.

Key words: network; indicators; social network analysis; motif;