

28th ECSS Anniversary Congress, Paris/France, 4-7 July 2023

Nearest Neighbor Clustering to Recognize Team Tactics

Schwenkreis, F.

Baden-Wuerttemberg Cooperative State University Stuttgart

INTRODUCTION:

Team tactics are coordinated moves of team members as for example in team handball or soccer. Several approaches have been published to detect team tactics automatically in streams of spatio-temporal data as they are generated by Kinexon or Catapult equipment in order to take team tactics into account when evaluating the players' performance. Particularly the representative search based on the clustering data mining technique has been identified lately as a means to solve the task. However, the used notion of distance is critical, and first approaches based on the Frechet distance and straight forward clustering techniques based on distance (and density) have shown suboptimal results.

METHODS:

A two-step approach is introduced. First, clusters of player trajectories are identified allowing to "encode" whole team moves as combinations of trajectory cluster ids. Then a variation of a co-occurrence grouping is used to find similar team moves. We need a variation because not all groups of trajectories are "significant" for a team move. Thus, we need to assign significance weights to trajectories when searching for co-occurring trajectory groups.

Usual clustering techniques are suboptimal because they need a more or less constant distance (or density) across clusters. Both, distance and density vary a lot in case of trajectories of players, depending on the played position. Thus, it will be shown that a special notion of nearest neighbor similarity outperforms direct distance or density-based approaches. To find the nearest neighbors of trajectories the dynamic time warping (DTW) distance is used instead of the Frechet distance.

RESULTS:

Focusing on a single team of the first German team handball league, 32 matches of that team in 2022 have been analyzed. 7,833 raw player trajectories of attack events have been extracted from the spatio-temporal data collected by Kinexon during the matches. 5.5 seconds of position information before an attack event (the defense trajectories have not been analyzed yet) were used to search for trajectory groups. By excluding team moves of fast breaks and penalties, the search for tactical moves was based on 732 team moves and 6,153 player trajectories.

Using the two-step approach based on the notion of the dynamic time warping distance, 56 groups of team tactical moves have been identified consisting of 35 groups of player trajectories. However, the 56 groups are partially nested meaning that one group is a special case of another group.

CONCLUSION:

Using DTW is a much better distance criterion for trajectories than the Frechet distance. Using the nearest neighbor-based similarity based on DTW rather than using the direct distance allows taking into account the differences of moving patterns of different player positions. It will be shown that the typical trajectories of specific player positions are detected and then grouped to complete tactical moves. And this done in a complete automated process without human video classification.

Topic: Statistics and Analyses

Presentation: Oral

European Database of Sport Science (EDSS)

Supported by SporTools GmbH



26861