REPRESENTATION AND ANALYSIS OF SOCCER PLAYERS' TRAJECTORIES

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INTRODUCTION

The increasing interest in quantifying variables related to the athlete's performance has been stimulated the development of systems to collect data. In [1], we proposed an automatic method of tracking soccer players from video sequences. This kind of method provides a great amount of data to be summarised and interpreted. In this paper, we propose and evaluate two ways of representation and analysis of players' trajectories.

METHODS

A first division Brazilian championship game was recorded using four stationary digital video cameras. Applying [1], the 90 minutes players' positions were obtained (sampled at 7.5 Hz). To each player's position data set, linear regression of the covered distance in function of time was performed and the slope of the best fit regression line (α) was determined. This parameter was used to characterise the physical performance of each player. Principal components analysis (PCA) was performed to model the regions more visited by the players. In the Figure 1, the ellipses are centred in the player's median position. The ellipse's major axis has his direction driven by the eigenvector associated to the largest eigenvalue. The lengths of the axes are one standard deviation long symmetrically to the origin. The slope of the major axis related to the longitudinal axis of the field was also calculated (θ). To evaluate the stability of the proposed variables, the variations of slopes ($\Delta\alpha$) and ($\Delta\theta$) were analysed increasing the time of sampling from 2 to 90 minutes (2 minutes step). In this evaluation, the trajectories of just 14 players were considered, excluding therefore the goalkeepers and the players replaced during the game.

RESULTS AND DISCUSSION

An individual analysis of the PCA can be used to distinguish the players' characteristics of moving, as shown in the Figure 1. Considering that the PCA is obtained *a posteriori*, the representation can be associated to the tactical organization of the team. The Figure 2 exemplifies the players' covered distances at any time interval for 8 players. Furthermore, it is remarkable that the curves seem to be characteristic to each player. The Figure 3 shows the tendency of stabilization of the mean value and standard deviation of ($\Delta\alpha$) and ($\Delta\theta$) for the 14 players with the increment of the time interval used to determine the variables. This result suggests that it is not necessary to analyse the full time game to determine, at a given error level, the variables proposed. In conclusion, the proposed variables showed to be useful to represent and analyse important aspects of the soccer players' performance.

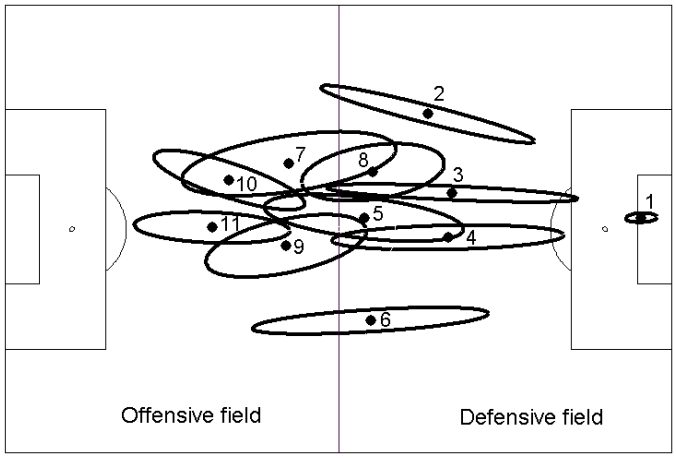

Figure 1: Representation of the players' region of moving using Principal Components Analysis (PCA).

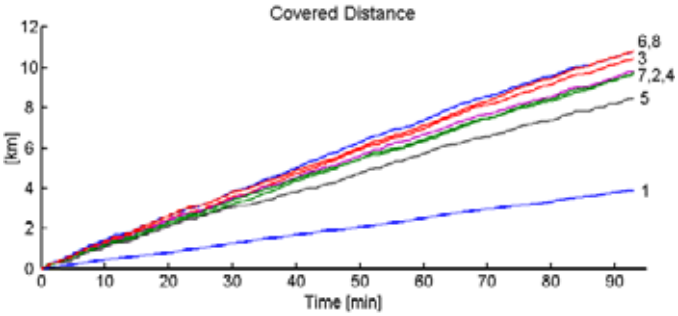

Figure 2: Example of covered distance of 8 players in function of the time

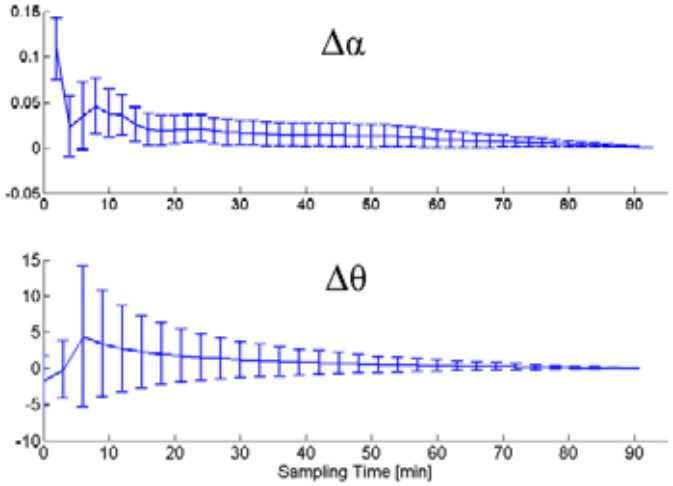

Figure 3: Mean value (n=14) and SD of the variation of slope of ($\Delta\alpha$) and ($\Delta\theta$) with the increment of the time interval used to determine the variable.

ACKNOWLEDGEMENTS

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REFERENCES

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