Dynamical Systems in Soccer: Analyzing Possession Outcomes and Player Movement

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My project is in the area of sports analytics and it aims to understand soccer movement. I use two data sets. One is a public data set of professional soccer possessions that contains time series of position vectors of the players and ball, and the other is a repository I created for high school games. I first study statistical differences between goal-scoring and non-goal-scoring possessions. I show that faster, longer possessions with more passing are more successful, and I also discuss whether statistical evidence supports common tactics like long balls and switches. In the second result, I use regression analysis to demonstrate that, in this dynamical system, the ball attracts players whereas players tend to repel each other. Since STATS-like student data are unavailable, in the third result I show how I created a student repository. From the video clips of my school games, I first use projective geometry to transform coordinates in the video into coordinates on the field. I prove that 4 anchors are necessary and sufficient to determine the projection. I then compare student statistics against those from the pro sequences. I show that high school players are more likely to lose the ball to the opponent. They are also more likely to run towards the ball rather than in the direction the ball is moving. The findings of my project are useful in several directions. Comparisons between successful and unsuccessful possessions, and between pro and student players can help teams at all levels improve. My approach to modeling soccer as a dynamical system can be applied to collaborative team efforts. This project also provides a general method for extracting player coordinates from iPhone videos.

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