

Using Player's Body-Orientation to Model Pass Feasibility in Soccer

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Abstract

Given a monocular video of a soccer match, this paper presents a computational model to estimate the most feasible pass at any given time. The method leverages offensive player's orientation (plus their location) and opponents' spatial configuration to compute the feasibility of pass events within players of the same team. Orientation data is gathered from body pose estimations that are properly projected onto the 2D game field; moreover, a geometrical solution is provided, through the definition of a feasibility measure, to determine which players are better oriented towards each other. Once analyzed more than 6000 pass events, results show that, by including orientation as a feasibility measure, a robust computational model can be built, reaching more than 0.7 Top-3 accuracy. Finally, the combination of the orientation feasibility measure with the recently introduced Expected Possession Value metric is studied; promising results are obtained, thus showing that existing models can be refined by using orientation as a key feature. These models could help both coaches and analysts to have a better understanding of the game and to improve the players' decision-making process.

1. Introduction

Pep Guardiola, current Manchester City's soccer coach and former Futbol Club Barcelona's, said once that elder people claim that in yesteryear soccer you had to control the ball, then look and turn around, and finally, make the pass, while in today's faster version of soccer, players need first to look (and orient correctly) before controlling and passing the ball. Therefore, getting orientation metrics may help coaches to boost the performance of a team by designing optimal tactics according to players' strengths and weaknesses. However, the concept of orientation is a complex concept without an exact definition, and during a soccer game, there are a total of up to 22 players oriented in their own way at any given time during 90 minutes. In order to avoid the so-called concept of *paralysis by analysis*, in this paper soccer events are filtered, hence including just pass

events, which are the ones in where orientation takes the most important role according to Guardiola's words. The main contribution of this research is a computational model that, for each pass event, outputs the feasibility of receiving the ball for each potential candidate of the offensive team. The proposed model combines three different types of feasibility measures, defined on the grounding assumption that, among all potential receivers, the passer will move the ball to the (a) best oriented, (b) less defended and (c) closest available player. Orientation is obtained through a Computer Vision state-of-the art method [1], which outputs an orientation value for each player by projecting the upper-torso pose parts in a 2D field. On top of these data, a novel feasibility measure is introduced to describe how good/bad the orientation fit between a passer and a potential receiver is. Given the location of all defenders, another feasibility metric is defined to establish how tough it is for the passer to move the ball to a particular player; this metric takes into account the distance of all defenders with respect to the passing line, which is defined by the relative angle in the 2D field that joins the passer and the receiver. Finally, pairwise distances among offensive players are used to construct a third feasibility measure based on the separation between players, hence assuming that players close to the ball have higher chances of receiving it than farther ones.

Results, expressed with Top-1 and Top-3 accuracy, show that the combination of all feasibility measures outperforms any of their individual performances, and that the model strongly benefits from the inclusion of the orientation feasibility measure. Moreover, existing state-of-the-art (SoA) models have been tested and compared, both before and after adding orientation as a feature to predict the outcome of passes, obtaining promising results which show that models can be confidently refined by adding these type of data.

The rest of the paper is organized as follows: in Section 2, the related research is analyzed, including the details of the methods this research stems from; the proposed computational model is described in Section 3, along with all technical details. Feasibility results, discussion and possible combinations are studied in Section 4, and finally, conclusions are drawn in Section 5.

