Players Displacement based on Captured Data in a VR Soccer Training Simulation

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1. Introduction

The optimal physical and mental preparation of soccer elite players is highly sought after in modern competitive professional soccer given the high performance standard demanded by modern sports. In order to achieve an extra edge in performance efficiency, there is a demand for technological tools to be employed from a sports science perspective to enhance the training and analysis of the player's performance [1] such as the one we propose.

In this work we introduce a novel way of soccer player's displacement based on real data that is captured from video so that we build a Virtual Reality training simulator in Unity 3D (our selected visualization engine), giving for the first time the chance to both coaches and players to experience firsthand the events of previous matches from a first person perspective. Furthermore, we strive for the employment of captured real displacement data in order to build new hypothetical situations that could be experienced in a real match in the future, which has proven to be important in order to allow the athletes to achieve an automatic and controlled performance in stressful situations [2].

2. Finer Displacement

Our displacement data expresses each player's position x and y in a second to second basis. It includes all the trajectories of both players and referees. What are being missed are the detailed displacement between seconds and actions they make. Unknown displacement between seconds must be inferred in order to achieve a smooth and natural movement visualization. We adopt Catmull-Rom Spline, also called Overhauster spline, a local interpolating spline developed for computer graphics having in mind the case where we have a series of positions and want a curve to smoothly interpolate (pass through) all of them from P1 to Pm-1 in a given sequence of points P0 to Pm. Its initial use was in the design of curves, and has recently been used in several applications such as Automatic Vehicles Lane Detection, where it proved to be more accurate in the estimation of the path of Lane between two known control points in comparison to straight and parabolic models [3].

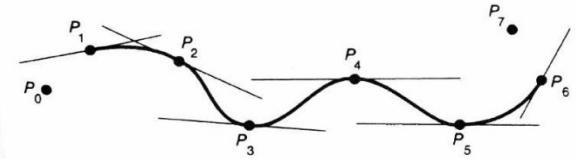

Figure. 1 Catmull-Rom spline. The points are interpolated by the spline in a direction parallel to the line between the adjacent points. The straight lines indicate the direction.

In order to apply the Catmull-Rom to the raw positional data, we need a framework that makes possible accurate movement representation. Simple Waypoint System [4] offers the functionality of assigning different types of movements and patterns to in-game objects, characters, players, and elements in general in Unity 3D, employing real stadium models scaled to fit real sized venues such as Kashima Stadium's skp (SketchUp) model [5] and imported to Unity as can be seen in Fig. 2. The waypoints are to be followed by the respective avatar of the 22 players and referees participating in a match. By employing the Simple Waypoint System and applying data cleaning, we made possible the estimation of a fine trajectory for the players while also filling the empty data gap between control points.

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Figure. 2 Player paths estimated by Catmull-Rom spline from the captured displacement data.

References

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