

# FC Portugal 2005 Team: Coordination, Action Selection and Basic Skills for the 3D simulator

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## 1. Introduction

FC Portugal 2005 3D team is built upon the structure of FC Portugal 2004 3D, which came 8<sup>th</sup> in RoboCup 2004 in Lisbon. Our research focus is the adaptation of previously developed methodologies from our 2D soccer teams [1, 2, 3] to the new 3D environment. In our 2D teams, which participated in RoboCup since 2000 with very good results, we have introduced several concepts and algorithms covering a broad spectrum of the soccer simulation research challenges. From coordination techniques such as Tactics, Formations, Dynamic Positioning and Role Exchange, Situation Based Strategic Positioning and Intelligent Perception to Optimization based low-level skills, Visual Debugging and Coaching, the number of research aspects FC Portugal has been working on is quite extensive [1, 3]. The research-oriented development of our team has been pushing it to be one of the most competitive over the years (World champion in 2000 and Coach champion in 2002, European champion in 2000 and 2001, Coach 2<sup>nd</sup> place in 2003 and 2004 and always in the top six places in all major world competitions since 2000).

## 2. Current Status

FC Portugal 2004 research team is currently developing new low-level skills for our 3D soccer players. The lack of visual information and long sensing and acting delays of the new simulator introduce several control problems that are currently being tackled in our team. FC Portugal 3D 2004 used a simple physical model and an empirically tuned PID controller to manage most of its low-level skills. For our 2005 team we are pursuing an analytical approach for the development of new low-level skills. Our approach consists in the following steps: first a precise physical model is inferred from controlled experiments then the model is used to predict the effect of each action and select the most appropriate action at each cycle.

Unfortunately, although the structure of the high level decision modules was ready to be used in 2004, it could not be exploited to its full potential due to poor low-level capabilities of our agents. For RoboCup 2005 3D soccer simulation competition we expect that the decisive factor (like in the 2D competition) may be the high-level reasoning capacities of the players and not their low-level skills.

### 2.1 Agent Behavior

FC Portugal agent's individual behavior is composed by four main low-level skills:

- *Move\_to\_Point*( $P, v$ ) – Agent moves to point  $P$  arriving there at velocity  $v$ ;
- *Kick\_to\_Point*( $P, v$ ) – Agent kicks the ball to point  $P$ , ball arrives at  $P$  with a velocity  $v$ ;
- *Intercept*() – Agent intercepts the ball in the least possible time;
- *Dribble*( $v$ ) – Agent dribbles the ball using velocity  $v$ .

All of these low-level skills are currently under development improving similar low-level skills developed for our 2004 3D team. From these low-level skills, several other higher-level skills may be constructed like passing, forwarding and shooting to the goal.

## 2.2 Team Behavior

Flexible Tactics has always been one of the major assets of FC Portugal teams. FC Portugal 2005 3D is capable of using several different formations and for each formation players may be instantiated with different player types. The management of formations and player types is based on SBSP – Situation Based Strategic Positioning algorithm [1, 4]. Player's abandon their strategic positioning when they enter a critical behavior: Ball Possession or Ball Recovery. This enables the team to move in a quite smooth manner, keeping the field completely covered.

## 3. Projected Developments

We plan to adapt our previous researched methodologies to the new 3D environment:

- Strategy for a Competition with a Team with Opposite Goals [1, 3, 4];
- Concepts of Tactics, Formations and Player Types [1, 3, 4];
- Distinction between Active and Strategic Situations [1, 4];
- Situation Based Strategic Positioning (SBSP) [1, 4];
- Dynamic Positioning and Role Exchange (DPRE) [1, 4];
- Visual Debugging and Analysis Tools [1, 3];
- Optimization based Low-Level Skills [1, 3].

Depending on the server development and competition rules, the following methodologies may also be used in our 2004 3D team:

- Intelligent Coaching based on Opponent Modeling and High Level Statistics [2, 3];
- COACH UNILANG – A Standard Language to Coach a (Robo)Soccer Team [2, 3];
- ADVCOM – Intelligent Communication using a Communicated World State [1, 3];
- Intelligent Perception using a Strategic Looking Mechanism (SLM) [1].

## 4. Conclusions

We believe that most of our research on high-level flexible coordination methodologies may be applied directly to the new 3D league. The first results of our team were quite encouraging. Using more robust low-level skills we deem that the coordination methodologies previously developed and adapted to the new environment will enable a highly competitive 3D team.

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