

B-Human

Playing Soccer on a Field without Unique Goals

Motivation and Contribution

The Standard Platform League environment strongly relies on a fixed color assignment to simplify object detection and localization. In recent years, some field elements, such as certain colored goal parts and all beacons, have been removed, providing a more “natural” appearance of the soccer pitch. In our opinion, the next reasonable step would be to remove one goal color.

The contribution of B-Human’s Open Challenge demonstration is to show that playing soccer in such an environment is already possible given the league’s current state of the art.

Implementation

Removing one goal color facilitates color calibration but poses a state estimation problem as no unique elements that allow a direct unambiguous computation of the robot’s pose are left on the field.

For self-localization, B-Human uses a combination of a particle filter and a Kalman filter. The former computes a global position estimate; the latter performs local tracking for refining the global estimate. Having a known start position, no robot kidnappings, and no sequences of false positives, a tracking component would be sufficient even when having no unique goals anymore. However, this is not the case for the Standard Platform League. During the course of play, unique features are needed to recover a global position estimate during soccer play.

The B-Human software includes a tracking of visually perceived robots as well as a team-wide consistent ball model. Both features – the ball as well as teammates – have been integrated into the particle filter’s measurement update step. Thereby, these movable objects become new features that can contribute to overcoming the field’s ambiguities.

The Kalman filter’s local refinement does not have to handle any robot kidnapping and thus does not incorporate these new features but has been adapted to tolerate non-unique goals.

For this challenge contribution, no changes to the vision system, such as memorizing unique elements outside the field by using certain descriptors, have been made. Of course, this state estimation-based approach relies on having at least one active teammate.

Demonstration

B-Human’s Open Challenge demonstration will be a short match that has a realistic course of play. That means that the team will consist of four robots that are able to correctly position in the READY state, score (no own) goals while PLAYING and recover from kidnapping after having been PENALIZED. During the match, the referees should not be from team B-Human but be selected by the Technical Committee. The two non-unique goals will be either two of the official yellow goals or the challenge field’s original goals, covered by sheets.

