

# RoboCup 2012 SPL Open Challenge

## Localization Ambiguity around the Center of the Field

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### I. MOTIVATION

Localization is essential for a soccer robot to determine the kicking direction. However, one of the key challenges of SPL this year is that both of the goal posts are in yellow, which makes the field symmetric. Localization using map features could often generate two feasible solutions. This problem is especially critical when the robot is around the center of the field as the locations of the two symmetric solutions are close to each other in which the state-of-the-art localization approaches such as particle filtering could still fail. For instance, if a robot were unwarily turned 180 degrees around the center circle due to the collision with the other robots, it would be very challenging for the robot to select the correct localization solution from the two ambiguous ones using the map features only.

While the map features are symmetric, it is unlikely that the positions of all robots in the field are symmetric. Based on this assumption, we proposed to utilize the estimates of the robots on the field to figure out the correct location hypothesis by enhancing our previous multi-robot Simultaneous Localization and Tracking (SLAT) algorithm [1] with Multiple Hypothesis Tracking (MHT) [2].

### II. DEMONSTRATION

For the demonstration, several robots will be on the field and one striker will walk toward and kick the ball. Fig. 1 shows the initial condition in which the striker has a good location estimate and plans to kick the ball toward the opponent's goal. For demonstrating the proposed multi-robot SLAT with MHT algorithm, we manually move the robot to the symmetric pose while it is approaching the ball as shown in Fig. 2. It is very likely that the robot will incorrectly kick the ball toward its own goal in this case. With the use of the proposed approach, the striker will realize that it is actually in the symmetric pose and thus turn and kick the ball correctly toward the opponent's goal as illustrated in Fig. 3.



Fig. 1. The initial condition is that the striker has a good location estimate and plans to kick the ball toward the opponent's goal.



Fig. 2. The striker is manually placed to the symmetric pose and the striker will have an incorrect location estimate. It is very likely that the robot will incorrectly kick the ball toward its own goal.



Fig. 3. Based on the proposed approach, the striker can and will detect that it is actually in the symmetric pose and will turn and kick correctly toward the opponent's goal.

### REFERENCES

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- [2] S. Blackman. Multiple hypothesis tracking for multiple target tracking. *IEEE Aerospace and Electronic Systems Magazine*, 19(1):5-18, Jan. 2004.