

Simulation Strategic Positioning for Mobile Robot Roccer Wheels

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ABSTRACT

Soccer robot is a combination of sports, robotics technology and multi agent system. The achieve goals in playing the ball, requires individual intelligence, and the ability of cooperation for individual skills. The success of a soccer robot team is influenced by the success of the robot player to enter the ball into the opponent's goal. In entering the ball into the opponent's goal needed an appropriate position and strategic. This research makes the design in finding a strategic position at the time of attack. The design divides the field into several small areas or the main grid, where each region gives different action. The position is said to be strategic if the robot passing success and has a fairly wide perspective against the goal. The strategic position is gained from the greatest opportunity of some of the decisive conditions. The calculation used is to use the Probability Naïve Bayes Classifier by taking the maximum value that serve as a strategic position. So this research resulted in a design in finding strategic position.

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I. INTRODUCTION

In a soccer robot match aims to develop intelligence research on robotics by solving problems in a wide scope related to the existing problems. The soccer robot match is KRSBI (Indonesian Football Robot Contest) and FIRA (Federation of International Robot-soccer Association) organized by RoboCup International level. In the soccer robot itself, a lot of research is done, one of which research attacks in a game. The game relies on the location of the spherical coordinates that will produce a centralized game pattern and one direction only (Egly et al., 2005). This strategy ignores the middle position where the offensive is based only in the pursuit of the ball and the defense strategy only rests around the penalty box.

In this study, focused on finding a strategic position on the robot soccer when attacked. The strategic position of players in the field is the placement of the robot is not in possession of the ball. With this, the core issue to be addressed is where the player must go to a certain position, depending on the various factors involving the ball position, the distribution of other agents, the point of view against the goal and the opposing player. In seeking a strategic position in this study using conditional opportunities. Conditional probability is used to determine the greatest opportunity in the best position that will be the position of each robot. To find a strategic position also required knowledge of the position of the

opponent's robot and point of view to the goal. So as to minimize the occurrence of errors in the feed to another agent robot.

II. STRATEGIC POSITION SELECTION

Strategic positioning is the creation of unique and valuable positions gained by conducting a series of activities. Strategic itself is done by an organization or group to determine the strategy or direction, and make decisions to allocate resources in obtaining the desired results. It also deals with strategic planning in which a management tool is used to manage current conditions to project future conditions. Before determining a strategic position, the initial process is to divide the field into small grids that will find the highest opportunity value in a strategic position based on several major factors.

A. Grid Created

The grid is formed throughout the field, each grid point used as a reference in finding a strategic position. The grid is made statically, because the process of finding the best point does not need to re-check. Grid is formed in the initial process before entering on the calculation algorithm and skill individual robot. Here is an overview of the grid making on the field.

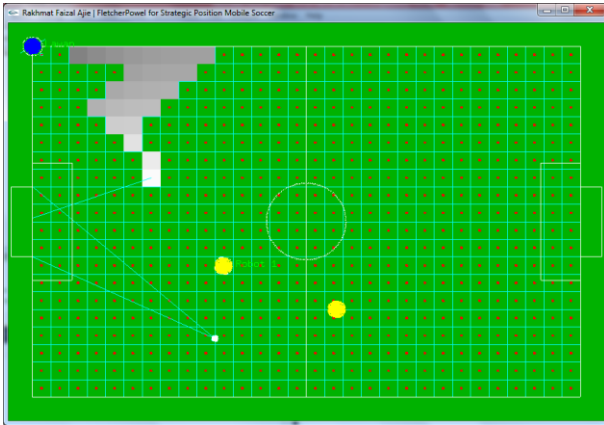


Fig 1. Grid for Simulation

Each grid point of the robot is used, because it simplifies and speeds up the process of performance on the system.

B. Passing Success

Passing on a soccer robot can be done successfully if there are no obstacles that interfere with the process. Assumed variable R1 is a robot that will receive the ball successfully at position x. In order for R1 to receive the ball feed successfully, all c requirements need to be true, and $P(c|x)$ is an approximation to the probability that c will be a given reality at location x. Terms c is a frequent factor in passing, the condition c which is considered is:

- 1) c1: No opponent can reach the position of x faster than the counterpart R. In this factor, the speed of each robot is said to be equal, $P(c1|x) \sim 0$ when the opponent can reach the location of x faster than R and $P(c1|x) \sim 1$ if otherwise, like the visualization below.

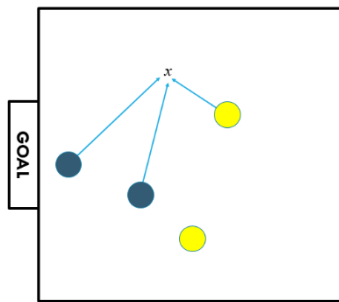


Fig 2. The robot (yellow) can get to the point faster than the opponent's robot (blue).

- 2) c2: No opponents are facing in position x. So $P(c2|x) \sim 0$ when the opponent confronts the point along the line between x the origin position to the destination x and $P(c2|x) \sim 1$ otherwise.

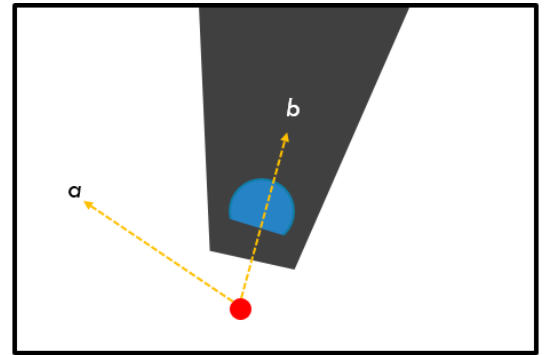


Fig 3. Visualization for intercepted (a not intercepted) and (b intercepted)

- 3) c3: Passing long enough for R to receive the ball, where $P(c3|x) \sim 0$ when the location x is smaller than the maximum distance from the robot area of the feed and $P(c3|x) \sim 1$ otherwise where the distance between x0 the starting position to the x position is far enough to receive the ball.
- 4) c4: Passing is short enough to be done accurately. $P(c4|x) \sim 0$ when the initial position x0 to position x is greater than the maximum distance and $P(c4|x) \sim 1$ otherwise.

C. Goal Position

Considering that R1 has successfully received the ball, then c 'needs to approach it to be true so $P(goal|receive, x)$ with some conditions is:

- 1) c'1: Shots of x that the shooter is close enough to the goal to beat the goalkeeper (Not too close, not too far). $P(c'1|x) \sim 0$ if the firing time is smaller and the distance is greater than the maximum distance that makes the opposing goalkeeper can block at the point of destination, and $P(c'1|x) \sim 1$ otherwise.
- 2) c'2: R has a fairly open angle from location x to the opponent's goal. $P(c'2|x) \sim 0$ the resulting corner is too small, $P(c'2|x) \sim 1$ otherwise. On the determination of open angel against the goal also made some knowledge of the opponent's position or kipper position. If on the go there is no opponent or kipper that blocked, then R can make a shot to the goal from the position anywhere like the Fig 4.

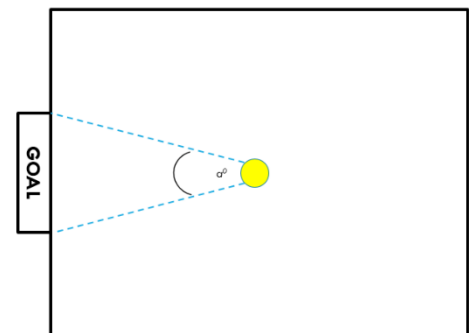


Fig 4. Open angel close enough in the position (yellow)

- 3) $c'3$: R will have enough time to take a shot before the opponent steals the ball by considering the distance R with the opponent. $P(c'3 | x) \sim 0$ if distance R close to the opponent and $P(c'3 | x) \sim 1$ otherwise.
- 4) $c'4$: R is in their defense area. $P(c'4 | x) \sim 0$ if R is in its own region and $P(c'4 | x) \sim 1$ otherwise.

The last thing to do is to multiply every point that is selected with open angel against the goal to get the greatest opportunity as a strategic position.

D. Coordination of Robot Pass

Coordination in the direction of movement of robots is done so that each robot can go to the position of each goal - each. After a strategic position is obtained, the distance between the positions of the two robots with the ball position is done by comparison. If the distance of the R1 robot on the ball is closer than the distance R2 with the ball, then R1 is conditioned to go to the ball position and R2 to the strategic position and vice versa. The distance of the robot closest to the ball is conditioned towards the ball position so that the robot can be faster in retrieving the ball from the opponent. The algorithm created below illustrates a detailed coordination process.

Robot Direction Coordination Algorithm, considering the ratio of the distance of each robot with the ball position.

```

DistanceA ← R1 distance with the ball
DistanceB ← R2 distance with ball
If DistanceA ≥ DistanceB then
    R2 starts moving to ball position
    R1 starts moving to strategic position
Else if DistanceA ≤ DistanceB then
    R1 starts moving to ball position
    R2 starts moving to strategic position
End if

```

This algorithm makes the direction of the goal on each robot can be well controlled.

E. Calculation of Robot Distance with Ball

Distance of robot with ball is used to determine the movement of a robot. The distance of the robot closest to the ball will be conditioned to get to the ball position, while the other robot to the strategic position that has been generated. To determine the distance of the robot to the ball, use the phytagoras calculation, where the ball positions with the robot as the C line, the x-axis of the robot with the x-axis of the sphere as point A, and the y-axis of the robot with the y-axis of the sphere as line B.

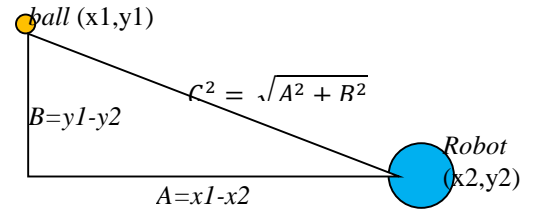


Fig 5. Visualizing the calculation of the distance of the robot (blue) with the ball (green).

III. REFERENCES EXPERIMENTS AND RESULT

A. One Kipper Robot and One Robot Survive

The first test is with 2 opponent robots where 1 robot becomes kipper and 1 robot in a defensive position. This test is conducted to determine the response to one of the robots who seek a strategic position by meeting several predetermined factors. In the picture below shows an overview of the first test where the robot has succeeded in determining the strategic position.

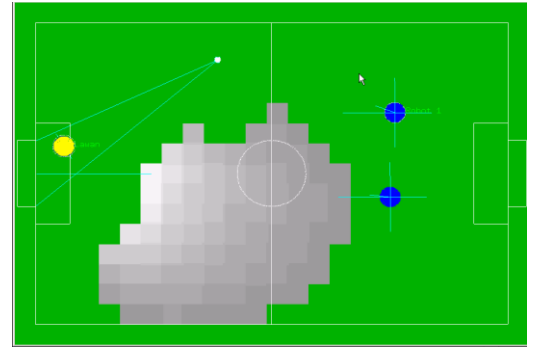


Fig 6. First test for One Kipper Robot and One Robot Survive

There are several positions generated, the position is visualized in the form of grids with different colors. The brightest color represents the greatest chance of scoring a goal in a strategic position. Opportunity value is shown in the table below:

TABLE 1. VALUE OF PROBABILITY STRATEGIC POSITION TEST (WITH KIPPER)

No	P(receive x)	P(goal receive, x, y)	P(Open Angel)	Prob. Strategic Position
1	0.08334	0.0625	0.683	77.52 %
2	0.08334	0.0625	0.605	74.92 %
3	0.08334	0.0625	0.542	72.84 %
4	0.08334	0.0625	0.492	71.15 %
5	0.08334	0.0625	0.449	69.74 %
6	0.08334	0.0625	0.414	68.56 %
7	0.08334	0.0625	0.383	67.54 %
8	0.08334	0.0625	0.357	66.67 %

No	P(receive x)	P(goal receive , x , y)	P(Open Angel)	Prob. Strategic Position
9	0.08334	0.0625	0.998	88.03 %
10	0.08334	0.0625	0.851	83.13 %
11	0.08334	0.0625	0.741	79.47 %
12	0.08334	0.0625	0.65	76.43 %
13	0.08334	0.0625	0.578	74.02 %
14	0.08334	0.0625	0.52	72.09 %
15	0.08334	0.0625	0.472	70.51 %

B. Two The Robot Blocked

The second test is with two opponent robots blocking one of the robots that will pass to his colleagues. This test is conducted to determine whether the algorithm used can produce a point position where the position is a strategic position. Although the position of the opposing robot is done randomly. In the picture below shows that the algorithm used can determine the best position.

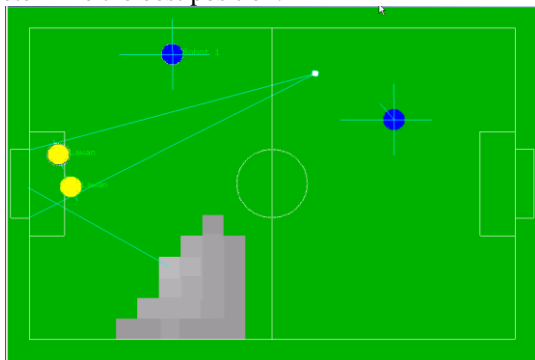


Fig 7. Visualization test for two the robot blocked

From the result position, the greatest opportunity value is the best position in the print goal and the position to receive the feed, shown in the table below:

TABLE 2. VALUE OF PROBABILITY STRATEGIC POSITION TEST (ROBOT BLOCKED)

No	P(receive x)	P(goal receive , x , y)	P(Open Angel)	Prob. Strategic Position
1	0.08334	0.0625	0.506	71.63 %
2	0.08334	0.0625	0.432	69.16 %
3	0.08334	0.0625	0.375	67.28 %
4	0.08334	0.0625	0.331	65.80 %

No	P(receive x)	P(goal receive , x , y)	P(Open Angel)	Prob. Strategic Position
5	0.08334	0.0625	0.296	64.62 %
6	0.08334	0.0625	0.267	63.66 %
7	0.08334	0.0625	0.243	62.87 %
8	0.08334	0.0625	0.223	62.19 %
9	0.08334	0.0625	0.607	74.99 %
10	0.08334	0.0625	0.517	72.00 %
11	0.08334	0.0625	0.447	69.66 %
12	0.08334	0.0625	0.391	67.81 %
13	0.08334	0.0625	0.347	66.32 %
14	0.08334	0.0625	0.31	65.11 %
15	0.08334	0.0625	0.28	64.11 %

IV. CONCLUSION

Strategic position is very important in a football game, where the need for knowledge of the opponent's position at that time. Calculation using the Naïve Bayes Classifier method in this study is very useful, which can generate the greatest opportunity from any point of location to score goals. The Naïve Bayes Classifier method can generate an opportunity value from each position point for passing and goal with some terms as a reference. So that under any circumstances, the algorithm can generate point locations with the specified conditions.

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