MarliK 2016 Team Description Paper

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Abstract. MarliK is a 2D soccer simulation team with members active in the field since 2005 and participating in RoboCup competitions since 2008. Since then we've achieved some success including two 3rd places in the RoboCup competitions, which is more than any other team from our country has ever done. After being absent for a few years, we are now back again hoping to restore our team to its former glory.

Keywords: Team Description Paper, MarliK, Multi-agent Systems, 2D Soccer Simulation

1 Introduction

MarliK 2016 is a soccer 2D simulation team which is programmed in C++ language and uses Agent2D as its base code. The team is formed as the result of an attempt to continue previous works done by the team members in soccer simulation field. Among our members, some have been active in the soccer simulation field since 2005, researching as a member of LEAKIN'DROPS, MarliK, and FC-Perspolis teams, or acting as supervisors to other teams. We've been honored to be able to achieve 3rd place in RoboCup 2011 and 2012, 1st place in IranOpen 2012 and 2013, 2nd place in IranOpen 2011, 1st place in DutchOpen 2012, and many other international and national awards. Sadly we have recently experienced an era of inactivity in the past few years; mainly because some members graduated and had to move to different cities and universities. However, now we have formed MarliK once more and are working with the aim of returning the team to its previous glory by making it one of the most formidable teams in the world again.

We've started by identifying and fixing bugs and situations which would sometimes cause runtime errors in our previous teams, and also generally optimized and trimmed the code. We also have implemented a new through pass system with the aim of breaching into the opponents penalty box from the middle of the field. Currently we are working to develop a new passing system based on the ant colony algorithm, which can potentially result in dynamically finding and exploiting weaknesses in the opponents' formations.

In the rest of this paper, we'll describe some of the ideas and algorithms that we are implementing on our team.

2 Breaching Through Pass

This new algorithm is developed with the with the intention of creating goal scoring opportunities from the middle of the field by sending a breaching through passes into the free space behind the opponents' defenders.

At first, a few pre-defined points are selected inside the opponents' penalty box and virtual pass routes to those areas are constructed. Then the ball owner optimizes those virtual routes to find a better route. Afterwards, that route can potentially be a breaching through pass route once it is found and its safety is confirmed,

The route optimization is done by finding a breaching point between two of the closest opponents' defenders to the original virtual route; one on either side of the route. Then the route is changed to maximize the distance between itself and those defenders. The process is described in the pseudo-code below:

```
For Each Predefined Virtual Route V_Route
{
  Iterate Through Opponent Defenders
  Set Closest Defender North Of V_Route As N_Defender
  Set Closest Defender South Of V_Route As S_Defender
  Maximize Dist Of V_Route From N_Defender And S_Defender

  Iterate Through Different Pass Speeds
  {
    Prepare Virtual Pass
    If (Ensure Virtual Pass Safety By:
        Simulating Future Cycles After Passing The Ball
        Checking If Teammate Gets Ball Before Opponents)
    {
      Commit Through Pass Via V_Route
      End
    }
  }
}
```

This algorithm is especially effective against teams that have their defensive line higher up the field, leaving a lot of free space between them and the goal. Our mid-fielders and playmakers can exploit that space by playing the ball through it for the forwards and hopefully creating one-on-one opportunities for them.

3 Passing system inspired from ant colony algorithms

Sometimes, agents manages to create scoring opportunities with a few amazing passes. But those situations may only happen a few times during a match. With the aim of developing a passing system that can memorize such situations in order to create more similar situations in the remaining cycles of the game, we have arrived at the idea of using an algorithm inspired from ant colony algorithms.

Similar to how ants lay down pheromone trails down when finding food in natural world, soccer agents can also set flags upon finding a good pass. These flags can then subsequently increase the likelihood of those good passes happening again by affecting the agent's pass rating systems and positioning algorithms. This can result in agents learning and repeatedly exploiting any weakness that is found in the opponent's defensive or positioning systems and hopefully produce eventual goal-scoring opportunities for the team.

It must be noted that this system doesn't completely override and normal passing system and instead only adds some more value to the passes similar to previous successful valuable passes when deciding which pass to make. Therefore an adequate normal passing system is required before this new algorithm could be appended. Otherwise, there will be no opportunity to try to recreate.

For this algorithm to work correctly, the outcome of every pass done must be carefully evaluated and we need to be able to differ between good passes, normal passes, and bad passes. At the moment we are only using a simple function for this. It assigns the bad flag to any pass that doesn't reach its intended receiver, and the good flag to any pass made some cycle before we scored a goal. Improving this function to be more intelligent may dramatically increase the quality of our new passing system's output.

Another important requirement is an algorithm able to identify similar situations. Again, we have used a simple algorithm for now which divides the soccer field into separate regions and declares two situations are similar when the agents that matter are located in the same regions. We believe this condition alone is not enough and are trying to define better conditions for similarity evaluation without imposing too much overhead.

An example of this passing system can be seen in Figure 1. It is shown that after player 7 created a goal-scoring opportunity for player 9 at cycle 2185 which resulted in a goal, he remembered the situation and exploited a similar weakness in the opposition's defense line and recreated a similar opportunity for player 9 again at cycle 3831 which also resulted in another goal.

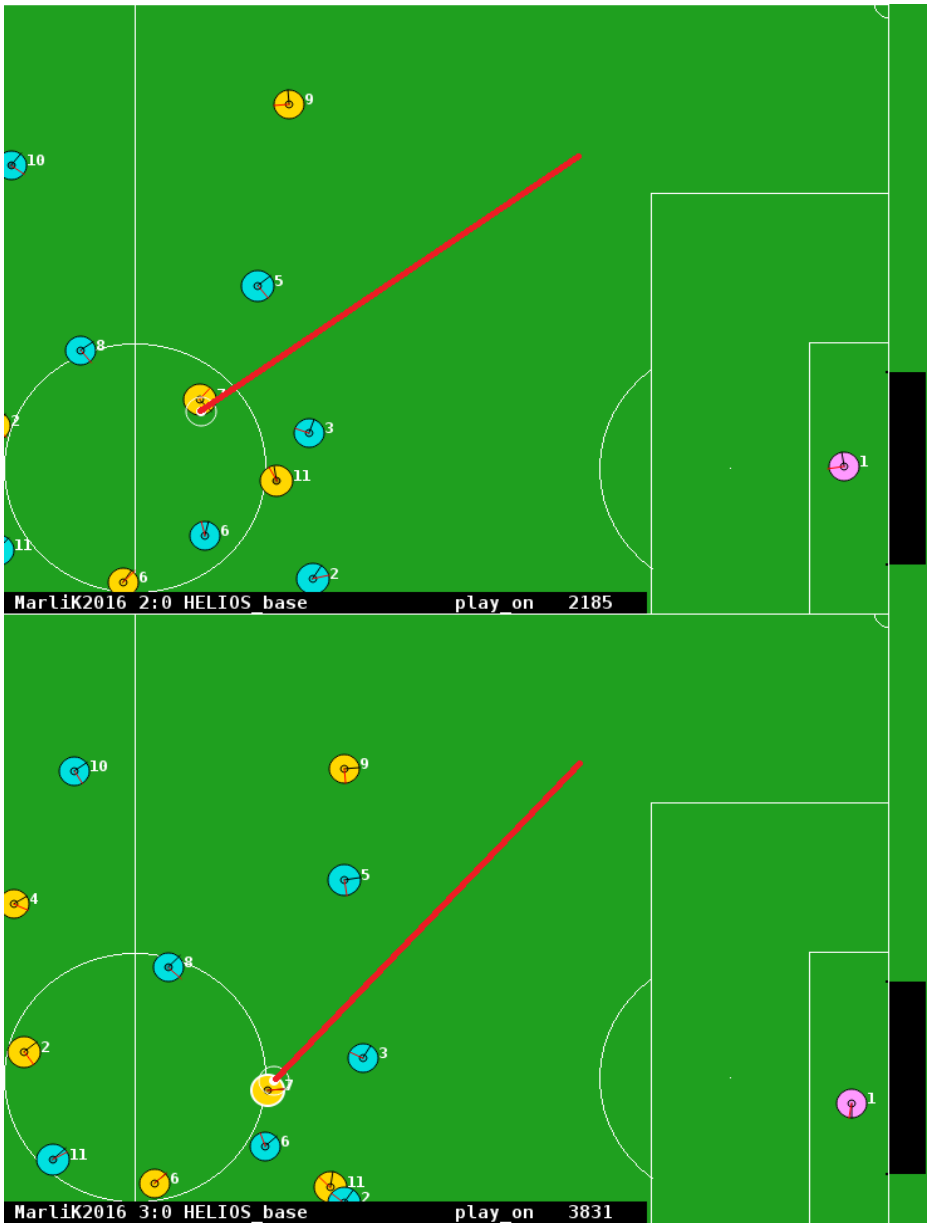

Fig. 1. Passing system inspired from ant colony algorithms

4 Conclusions and Future Work

We have recently changed some of the members and the new ones are getting more familiar with the team structure. So far we have fixed some of the bugs present in our previous codes and are working to tweak the overall quality of the team. As for new ideas, we came up with a new complementary passing system inspired by ant colony algorithms and are trying to improve it and make it fit to use regularly. We've also developed a new through pass system and implemented it in the team.

In the future, we hope to continue working on that passing system and also come up with some ideas for a more solid defense.

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