AKATSUKI
Soccer 2D Simulation Team
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Abstract. Most of effort of the member of these based on improving the UVA base and correcting some method of this base and we have trying to give some new and awesome algorithm and method with artificial intelligent rule. We now explain our researches in soccer simulation field in separated sections.

1   Introduction

AKATSUKI team researches begun in 2008 with the name DesertEagle. We have success in some competition such as 4th in Khwarizmi student competition 2008, 3rd in RaadCup in Isfahan (Called Rexxar), 1st in seventh competition through student in Tehran . This team started in September 2008, at the first we study some basic knowledge about artificial intelligent and some basic training of programming that must be set to UVA base. The agent of team connected to each other by some method (you have been known in downs) and do the tactic of team, this system called multi agent system (MAS). Our Source Written by C++ and based on UVA Trilearn base 2003.AKATSUKI has two main system ; Offensive system , Defensive system. In ever system we have two skill; with ball skills (when ball kickable) and without skills (when not kickable). Now some advanced skill will explain.

2   UVA Trilearn Base

Sources of Desert Eagle are based on UVA Trilearn base. Code of UVA base is based on three levels: low level, intermediate level, high level. There are some elementary methods in the first level (low level) that you can improve base by these functions or make a new and useful function. The other one is intermediate level that include some functions, these function act as actor like shooting or passing and something like that. The last one is high level modes that take in some advance function.

3   Main Board

Figure 1, 1 is the main board of team and shows us how agent makes decision. This board has three general packages and some secondary packs. These general packs contain by: at the first advanced skill of the agent that include by some skill like with ball mode or without ball mode (shoot, dribble, pass)-pack of agent information (being in multi system (offensive, defensive and …) and type of agent (attacker, defender and …) – pack of information of game general from base and world model that contain by hearing and vision and positioning information. there are some sideway pocks Between these packages like arranging team that change with first package and strategic package is at the same and these packages will update by updatable pack that is in second package in each cycle and get the new information from game. There is agent from head of these packs and connected with these packs and choose the best decision that set with the game information.
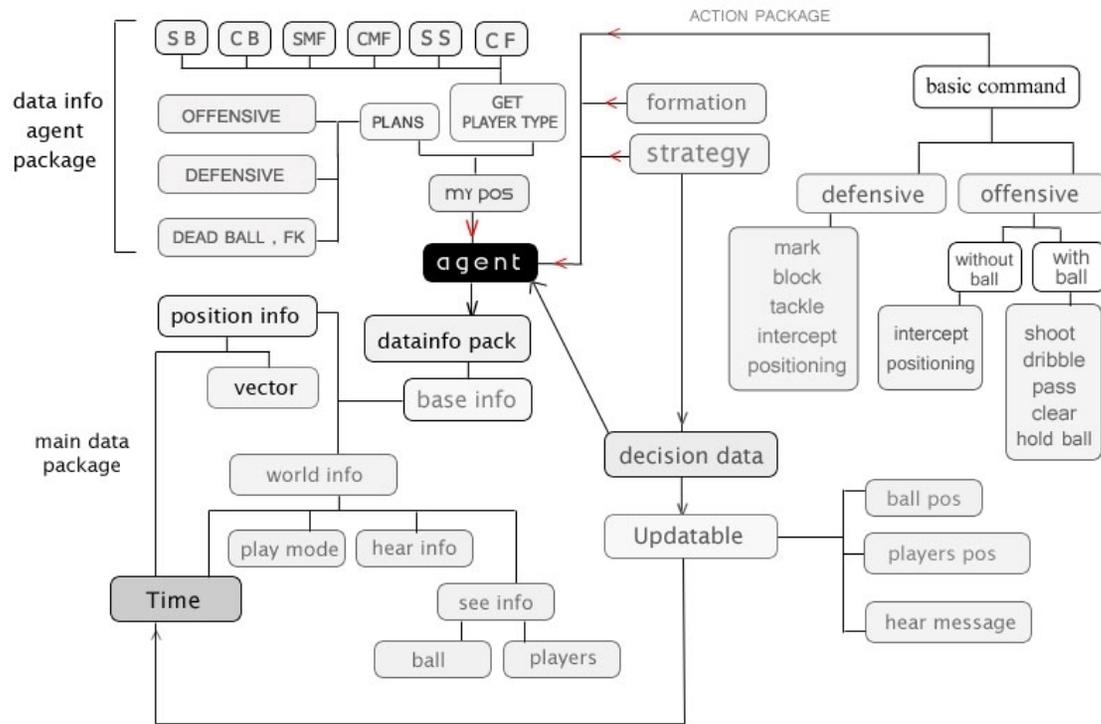
Fig.1

4 Decision Making (DM)

Make decision by agent is general part of the main board and it could be one of the most important packages and skill in a awesome team that in each opponent team change with their tactic . In this team that is stronger in defender mode, defensive mode design better for agent that will be change by tactic of opponent. For example if the closest defender to ball, this defender blocks the ball and other agents will marking, positioning or pressing that the main decision tree has shown in down.
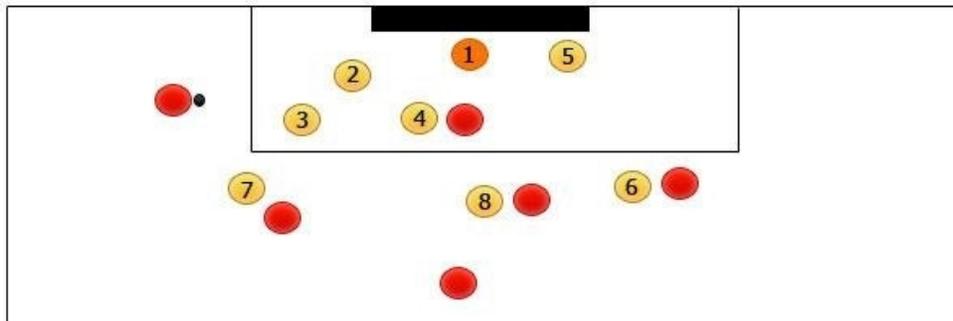

Figure 2 : generally this picture shows us the defensive behavior of agents. Player number 3 goes to block position, corner players goes to line of gate (mark goalline) and the other players mark the opponent offenders.

However there were some problem to design these algorithms on UVA base but we solved these problems by experimental trick. You can see the decision tree of defensive mode in figure 3 (below)
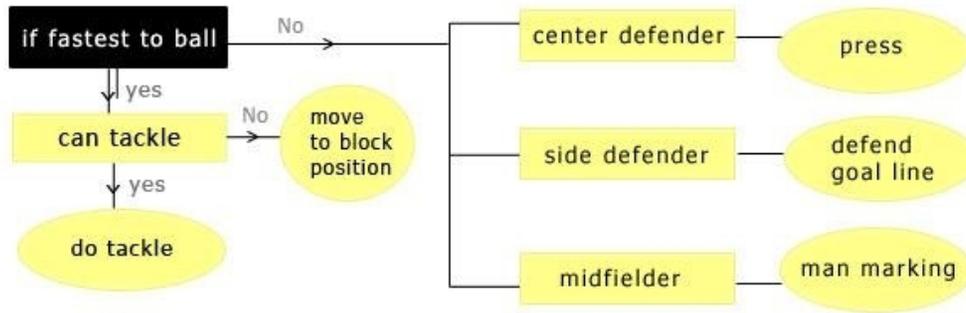

Figure.3 (decision tree of defensive mode)

5   Agent Skills

The agent skill of player cleave In two type that one of those is skill with ball and another is skills without ball , each skill have some low level agent skill that change by type and position of agent. We explain some of these actions below. But these two type of agent skills cleave to: Offensive system and Defensive system.

6   Offensive System

The main part of offensive system is breaking the opponent defensive line with offensive action and some skills. The offensive skill contains by kick and move actions. And we divide the opponent field with ball position. The main target of attackers is make score. *AKATSUKI* offensive plan is wing attackers move with ball to opponent goal area with dribble then score ball with shoot or pass to other attacker. In our tea m the power of offensive method is offensive positioning and dribble.

6.1   Offensive Positioning

In *AKATSUKI*, we have made the method to do positioning in specific situation To Improve the Offensive Power and Strategy. In this positioning we want improve the receive pass and more than through pass. We need some method for design this algorithm. These methods return when ball is in our position and agent not fastest to ball and ball is not over the offside line. First of all Agent must understand when do positioning. For this method agent check the positioning terms. For check positioning terms we set three parameters, x_min , y_min and y_max to each attacker agents. This parameters are the distance of x or y direction from the ball. We set about 20.0m to them .after this calculate first we make positioning box (fig.5) the divide the box to four area. Its shown in fig.4 .
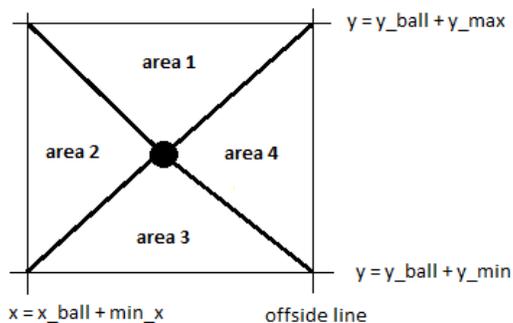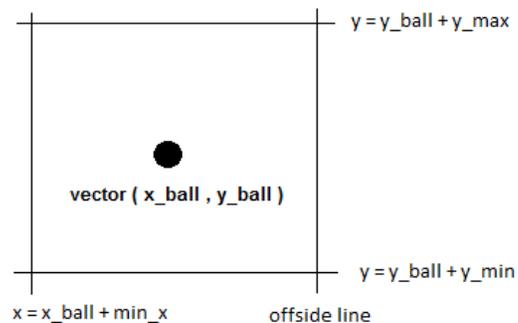

Fig.4. Example of making box

Fig.5. Example of division into four box

In this phase we must calculate the direction of widest angle at all area. The widest angle means the direction having largest angle between the opponents. The ever area has two direction , max_angle and min_angle. we use the world model class method in UVA base for got direction of widest angle. This method get some info and for this positioning we have some information as ball and angles. We give ball start position , max_angle , min_angle , distance to this method. Usually distance set about 15.0m to them. Now we got the widest angle. The widest angles shown in fig.6.
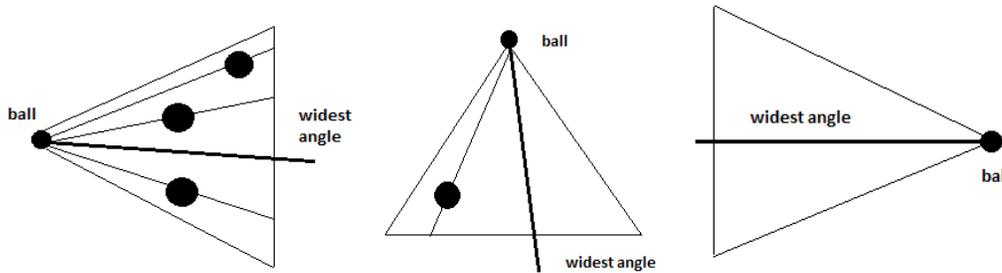

Fig.6. Example of widest angle in areas (in right fig show widest angle with no opponent)

So , now its final phase. In this phase we should choose a target point for positioning. For calculate the target point first at all we make line from the ball with widest angle. Second we get the closest point to agent (should do positioning) on widest line. And now we calculate the target point. Third we set the target for attackers. Examples if center forward is agent should do positioning don't move to behind the x_ball. Or sometimes the target point is nearest the teammate has ball. In this terms we set the y_target by good distance to ball. The sample example of target point shown in fig.7.
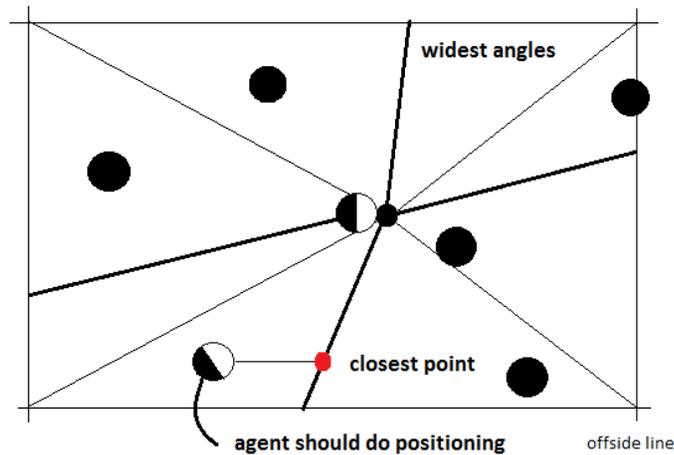

Fig.7 (the sample example target point in offensive positioning)

6 Defensive System

level so There is some advanced skill to protect the own gate, for an example marking in this team is in high that if an attacker of opponent want to break our defensive line must have some professional skill . There are some defender sides that protect sides of gate so by this action we increasing the security of team. The fastest agent to ball will move to block position , for a modal I can say when opponent attacker is on side of the ground

the nearest agent (#2 & #5) blocking them and other player mark the other attacker. The other defensive skill is marking that doesn't let the attacker go inside of own penalty area. And about pressing when the second closest of players to ball was agent there are some function will execute. These functions depend on the situation can change, in *Desert Eagle 2010* all defensive function (block, mark and …) for second closest add to his duty. In continue we explain the two main defensive skill; Positioning, Block.

6.1 Defensive Positioning

This is the main part of defensive system skills in our team. Before do positioning our coach set the defensive formation with sample analyse of opponent team. After move to strategic positions defenders check the ball position and with this do positioning. In danger positions If defender isn't fastest or second fastest to ball will do positioning with mark opponents and goal with three parameters; object target, mark distance and mark types. Our team has two mark type :

1. MARK_BISECTOR : when is ball isn't in danger position example ball isn't in own penalty area or ball is in opponents field this mark type use. marking the opponent by standing at a distance away from him on the bisector of the ball-opponent-goal angle. This type of marking enables the agent to intercept both a direct and a leading pass to the opponent.

2. MARK_BALL : marking the opponent by standing at a distance away from him on the line between him and the ball. This type of marking will make it difficult for the opponent to receive a pass. But this type use in own penalty area because help to beak the opponent attack.

After calculate the mark distance and choose mark types and object target defenders move to marking position. The most of decision mark in our team is when the ball is in our position defender mark opponent with MARK_BALL type. It can help to break opponent attack so soon.

6.2 Block

Block is the most of action in our team for defender when fastest to ball. For block we have some phase. First phase is calculate the real fastest to ball. Then for block action we have some parameters. One parameter is the block angle. For reach ball we will move to block position with block angle. Example when agent has long distance from opponents the block angle more than when agent has short distance to opponents. The final phase is calculate the block position by block angle. we check the ever position in block angle and after calculate the best position with prediction function agent should move to block position with maximum dash power.

7 Future Plans

First we want improve the power of defensive System. Now our team sometimes in defense use defenders and midfielders. This plan help to better defend but it make low stamina for midfielders. In future we want use defenders only in defensive system with improve all defensive skills especially defensive positioning.
 Second we want design the new stamina manager system. If we design it good can use midfielder in defensive system and with this project we want improve the defense and save stamina.
Third we should design new intercept method with Newton algorithm. This algorithm project started in team at September 2010 and added some function. We want complete this very soon.

8 Summaries

In this paper, we expressed our work in the field soccer 2D simulation in Desert Eagle team. Our focus was on developing the UVA base and makes some method to get good score, our team strategies, and recently developed ideas especially in defensive marking.

9 References

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