

Automatic feature selection for a case-based reasoning AI system

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Abstract

The purpose of this study is to demonstrate the possibility to perform an automated search for the optimal attribute configuration of the AI system. First, optimality means to perform the most performance for AI system setting. Our AI system is based on machine learning. Second, the attribute is feature which commonly shared among things. Our AI system has attributes. What we are using AI system is a soccer game AI system. We are striving for ball possession, and we are seeking the configuration that yields the highest ball possession. Ball possession is a criterion for judging whether it is optimal attribute configuration or not in our AI system.

1 Introduction

Now, we are working on a case-based reasoning AI system for simple soccer game. A simple soccer game that divides into red and blue points and shoots the ball to each other's goals in two dimensions. Figure 2 is playing simple soccer game. Case-based reasoning is a method to solve a new problem by analogy based on a solution of the past similar problem. In an article, the optimal solution for finding an attribute set that gives the best classification result to a specific classifier is the wrapper method [1]. Wrapper method is a method of selecting only meaningful subsets of attribute sets.

The selection of attributes is crucial for this system. Currently, the selection is done by hand, which is not reliable. So we propose an automated way to select the attributes. We want to improve the existing result.

2 Method

We test different settings of the AI engine to find the optimal combination. We set soccer game AI is the standard of selecting attribute composition. It is based on some attributes that can be turned ON and OFF.

We run a simple soccer game to judge whether the performance will improve or worsen. The AI plays the game automatically for 5 minutes. Figure 1 shows the match played soccer game operated by AI. The AI

plays the game based on the data we played the game in advance. We count time to hold a ball in left of center line. We divide the measured time by total time. The value is obtained by dividing is the standard for measuring the performance.

And currently these attributes are identified manually. We tried to change it automatically. For the first time, The setting is all true. We made a program change the attribute one by one for each group. The attribute is about soccer ball game setting. For example, one attribute group is from Enable_PlayerX0 to Enable_PlayerX3.

We explain it with pseudo code. Here on is true and off is false.

```
Initially all attributes are on
FOR GROUP attribute AI
  FOR EACH attribute AI
    SET A FLAG TO TRUE
    SWITCH OFF AI
    CHECK IF PERFORMANCE HAS IMPROVED
    IF PERFORMANCE HAS IMPROVED
      [Figure3]
      SWITCH OFF NEXT attribute AI
    ELSE IF PERFORMANCE HAS WORSENEDED
      [Figure4]
      BACK SWITCH ON
      SET A FLAG TO FALSE
    END IF
  END LOOP
END LOOP
```

Figure 1 Pseudo code

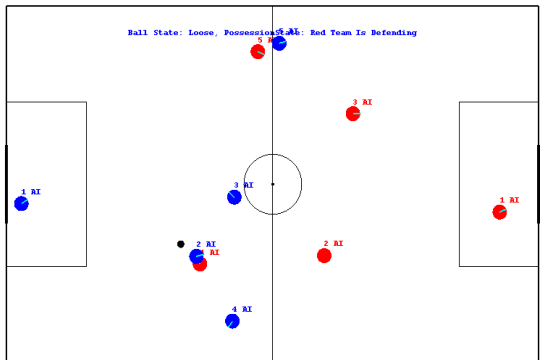


Figure 2 Game Screen

3 Results

3.1 The table description

We will explain table1. Classifier Change to false is setting change from ON to OFF.

When change to false is the ball possession name of changing from ON to OFF. Enable_PlayerX3 is changed classifier name from ON to OFF. Except the all_ture. The all_true is all ON.

Update best Possession is the highest ball possession in the experiment. If When change to false is higher than Update best Possession. Program change the value from Update best Possession to When change to false.

3.2 The experimental result

Table1 show result of test1. At the point Enable_PlayerNumber3, ball possession change greatly from 66.00% to 80.00%. After that When change to false do not exceeded 80.00%.

Table1
Ball Possession1

Classifiers Change to false	When change to false	Update best Possession
all_true	66.00%	66.00%
PlayerX3	65.00%	66.00%
PlayerY3	64.00%	66.00%
PlayerNumber3	80.00%	80.00%
PlayerNumber2	57.00%	80.00%
BallState2	66.00%	80.00%
DangerMoveFoward0	59.00%	80.00%
MovementDirection2	62.00%	80.00%
ClosestThreatDistance2	74.00%	80.00%
ClosestThreatDirection2	63.00%	80.00%
IsPWB3	63.00%	80.00%
PdeFromPwb2	72.00%	80.00%
Enable_Player4X2	69.00%	80.00%
Enable_Player5X2	71.00%	80.00%

3.3 Total nineteen experimental results

We repeated that experiment nineteen times. Table 3 and table 4 show results of nineteen. By experimenting with ON/OFF switches, ball possession increased from 64.75% to 76.52%. The average ball possession increase approximately 11.77%.

Table 2 show result of changed classifiers number in total nineteen experiments. Enable_PlayerX3 is changing most frequently.

4 Discussion

As shown in the table 3 and table 4. The average ball possession of the team has increased from 64.75% to 76.52% thanks to our algorithm. The average ball possession increase approximately 11.77%.

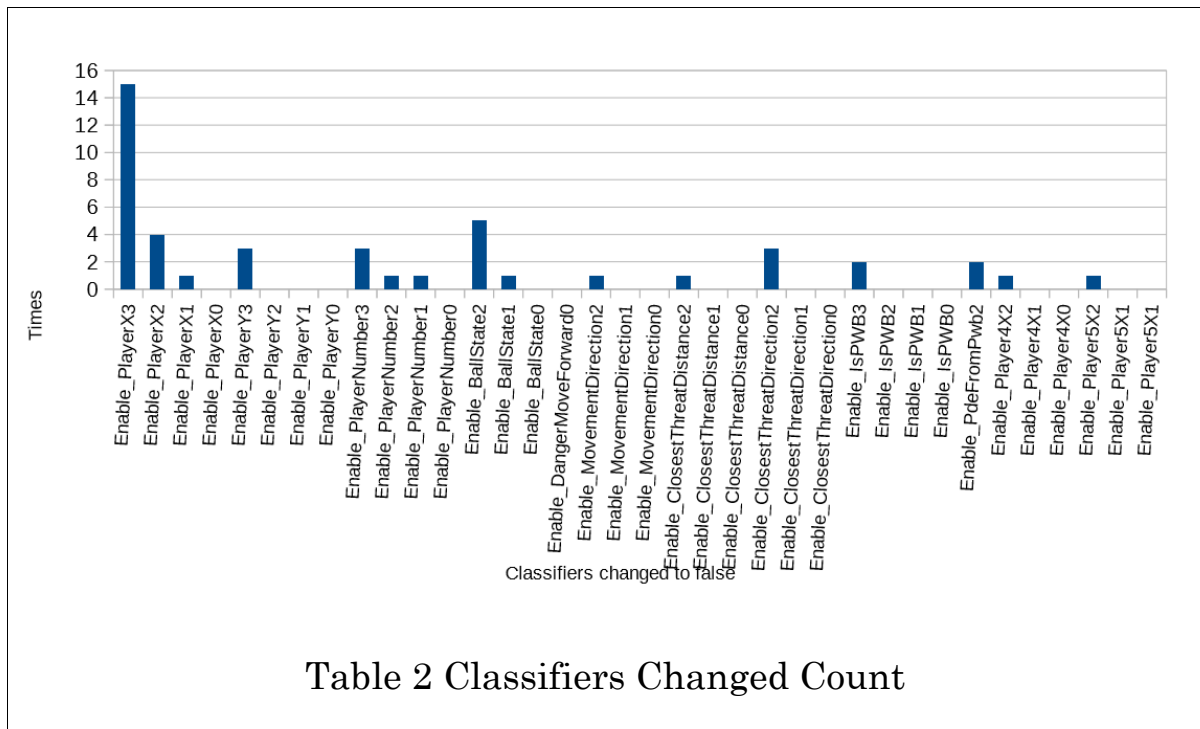
This is evidence that performance has increased. It can be said our algorithm worked correctly.

5 Conclusion

In this research, We succeed in raising the performance of AI. It was demonstrated the possibility to perform an automated search for the optimal attribute configuration in the AI system.

Reference

- [1] Improving Classification Performance by Merging Distinct Feature Sets of Similar Quality Generated by Multiple Initializations of mRMR <http://ieeexplore.ieee.org/document/7376629/>



```
;  
; ***** CLASSIFIERS (factors) *****  
; *****  
Enable_PlayerX0 true  
PlayerX0Step 18  
;  
Enable_PlayerY0 true  
PlayerY0Step 10  
;  
Enable_PlayerX1 true  
PlayerX1Step 18  
;  
Enable_PlayerY1 true  
PlayerY1Step 10  
;  
Enable_PlayerX2 true  
PlayerX2Step 18  
;  
Enable_PlayerY2 true  
PlayerY2Step 10  
;  
Enable_PlayerX3 false |  
PlayerX3Step 9  
;  
Enable_PlayerY3 true  
PlayerY3Step 5  
;  
;  
;  
; ***** CLASSIFIERS (factors) *****  
; *****  
Enable_PlayerX0 true  
PlayerX0Step 18  
;  
Enable_PlayerY0 true  
PlayerY0Step 10  
;  
Enable_PlayerX1 true  
PlayerX1Step 18  
;  
Enable_PlayerY1 true  
PlayerY1Step 10  
;  
Enable_PlayerX2 false |  
PlayerX2Step 18  
;  
Enable_PlayerY2 true  
PlayerY2Step 10  
;  
Enable_PlayerX3 false  
PlayerX3Step 9  
;  
Enable_PlayerY3 true  
PlayerY3Step 5  
;  
;
```

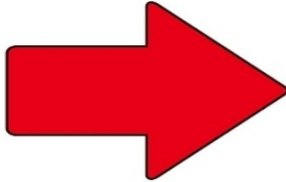


Figure 3 AI System Screen

```
;  
; ***** CLASSIFIERS (factors) *****  
; *****  
Enable_PlayerX0 true  
PlayerX0Step 18  
;  
Enable_PlayerY0 true  
PlayerY0Step 10  
;  
Enable_PlayerX1 true  
PlayerX1Step 18  
;  
Enable_PlayerY1 true  
PlayerY1Step 10  
;  
Enable_PlayerX2 true  
PlayerX2Step 18  
;  
Enable_PlayerY2 true  
PlayerY2Step 10  
;  
Enable_PlayerX3 false |  
PlayerX3Step 9  
;  
Enable_PlayerY3 true  
PlayerY3Step 5  
;  
;  
;  
; ***** CLASSIFIERS (factors) *****  
; *****  
Enable_PlayerX0 true  
PlayerX0Step 18  
;  
Enable_PlayerY0 true  
PlayerY0Step 10  
;  
Enable_PlayerX1 true  
PlayerX1Step 18  
;  
Enable_PlayerY1 true  
PlayerY1Step 10  
;  
Enable_PlayerX2 true  
PlayerX2Step 18  
;  
Enable_PlayerY2 true  
PlayerY2Step 10  
;  
Enable_PlayerX3 true  
PlayerX3Step 9  
;  
Enable_PlayerY3 false  
PlayerY3Step 5  
;  
;
```

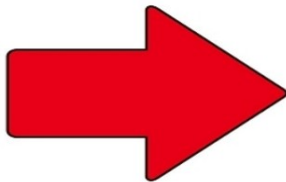


Figure 4 AI System Screen

Classifiers changed to false	Test1		Test2	Test3	Test4	Test5	Test6	Test7	Test8	Test9	Test10									
	When changed to false	Update best possession																		
alltrue	66%	66%	70%	70%	67%	67%	68%	68%	72%	72%	69%	69%	67%	67%	54%	54%	66%	66%	58%	58%
Enable_PlayerX3	65%		65%		73%	73%	68%	68%	60%		71%	71%	75%	75%	72%	72%	61%		61%	61%
Enable_PlayerX2					64%		58%				77%	77%	69%		66%				67%	67%
Enable_PlayerX1											71%								72%	72%
Enable_PlayerX0																				59%
Enable_PlayerY3	64%		68%		69%		66%		64%		75%		66%		66%		72%	72%	69%	
Enable_PlayerY2																	71%			
Enable_PlayerY1																				
Enable_PlayerY0																				
Enable_PlayerNumber3	80%	80%	66%		61%		37%		62%		63%		62%		73%	73%	63%		59%	
Enable_PlayerNumber2	57%														64%					
Enable_PlayerNumber1																				
Enable_PlayerNumber0																				
Enable_BallState2	66%		60%		71%		68%	68%	60%		63%		63%		69%		71%		68%	
Enable_BallState1							70%	70%												
Enable_BallState0							57%													
Enable_DangerMoveForward0	59%		65%		61%		50%		62%		62%		64%		71%		68%		64%	
Enable_MovementDirection2	62%		65%		60%		61%		73%	73%	64%		62%		69%		70%		48%	
Enable_MovementDirection1									72%											
Enable_MovementDirection0																				
Enable_ClosesThreatDistance2	74%		58%		46%		52%		62%		62%		70%		52%		19%		62%	
Enable_ClosesThreatDistance1																				
Enable_ClosesThreatDistance0																				
Enable_ClosesThreatDirection2	63%		64%		55%		57%		61%		69%		65%		75%	75%	54%		61%	
Enable_ClosesThreatDirection1													65%							
Enable_ClosesThreatDirection0																				
Enable_IsPWB3	63%		65%		67%		61%		71%		63%		59%		80%	80%	75%	75%	64%	
Enable_IsPWB2															59%		63%			
Enable_IsPWB1																				
Enable_IsPWB0																				
Enable_PdeFromPwb2	72%		58%		71%		70%	70%	73%	73%	73%		63%		73%		1%		58%	
Enable_Player4X2	69%		67%		72%		72%	72%	65%		67%		68%		12%		66%		65%	
Enable_Player4X1							70%													
Enable_Player4X0																				
Enable_Player5X2	71%		76%	76%	72%		64%		25%		72%		70%		59%		72%		63%	
Enable_Player5X1			66%																	
Enable_Player5X0																				
Final best possession		80%	76%		73%		72%		73%		77%		75%		80%		75%		72%	

Table 3 Ball possession2

Test11		Test12		Test13		Test14		Test15		Test16		Test17		Test18		Test19		Count better changed to false(/19 times)
When changed to false	Update best possession																	
57%	57%	64%	64%	58%	58%	64%	64%	69%	69%	68%	68%	66%	66%	64%	64%	58%	58%	
70%	70%	70%	70%	73%	73%	73%	73%	78%	78%	69%	69%	76%	76%	71%	71%	66%	66%	15
63%		76%	76%	54%		68%		66%		71%	71%	63%		65%		62%		4
		61%								66%								1
																		0
60%		61%		67%		77%	77%	80%	80%	67%		68%		68%		61%		3
						63%		70%										0
																		0
50%		69%		70%		63%		52%		57%		62%		62%		72%	72%	3
																74%	74%	1
																74%	74%	1
																1%		0
71%	71%	65%		75%	75%	73%		74%		71%	71%	55%		76%	76%	65%		5
53%				61%						62%				67%				1
																		0
67%		68%		68%		65%		60%		58%		64%		53%		63%		0
59%		66%		61%		62%		57%		67%		70%		70%		66%		1
																		0
																		0
63%		69%		88%	88%	68%		59%		60%		60%		70%		63%		1
				67%														0
																		0
60%		64%		68%		68%		75%		59%		70%		81%	81%	81%	81%	3
														71%		71%		0
																		0
66%		59%		63%		62%		74%		70%		72%		65%		77%		2
																		0
																		0
69%		58%		61%		66%		66%		65%		68%		63%		68%		2
64%		60%		78%		71%		62%		66%		73%		55%		66%		1
																		0
																		0
70%		61%		67%		68%		67%		68%		64%		64%		66%		1
																		0
																		0
	71%		76%		88%		77%		80%		71%		76%		81%		81%	

Table 4 Ball Possession3