

RoboCup 2006 Official Rules for the Coach Competition

Revision 0.0

The RoboCup 2006 Simulation League Organizing Committee

January 23, 2006

1. Introduction

This document contains official rules of the coach competition at RoboCup 2006. While we will try to cover all cases, if unexpected events do occur, the organizing committee will seek input from the participants and then makes a decision. However, once the committee has made a decision, that decision is final and will not be open to further discussion. More information about this competition can be found at:

<http://www.robocup2006.org/>

Any changes, comments, clarifications, and/or discussions will be put on the above web site and announced on the coach mailing list:

robocup-coach-l@cc.gatech.edu

2. Simulation Environment

- Machines: Teams can only use Linux operating system. The Linux distribution will be announced close to the competition.
- Simulator: The latest rcssserver official release will be used. You can get the latest version from:
<http://sserver.sourceforge.net/>
- Coachable Players: You can get the latest version of the standard coachable players from:
<http://www.sourceforge.net/projects/rcsscoachable>

3. Tournament Structure

In this section, an overall structure of the coach competition is described. Before going to the following sections, the definition of some phrases is presented.

- Play Pattern: The term play pattern is used to describe a *simple behavior* that a team performs which is *predictable* and *exploitable* for the coaches. For example, suppose that the goalkeeper goes out of the penalty box when the ball passes mid-field line approaching his goal line. In this document, we use the term pattern as a contraction of play pattern.
- Base Strategy: The general strategy of the test team regardless of the pattern in it.

3.1. Overall Competition Structure

1. A set of strategies to be used as the base strategies of the patterns will be created. Then the patterns will be added to these base strategies, and some sample matches will be played.
2. Participants will be provided with the .rcg log-file of each pattern. It means that only one pattern is activated in a log-file.
3. The no-pattern .rcg log-file of the base strategy will be provided for the coaches. The coaches should be looking for the qualitative differences between the pattern log file and the corresponding no-pattern log file to recognize the pattern correctly.
4. Patterns and base strategies will be defined by Clang rules or created by a real 2D team. Of course, if the pattern is defined by Clang rules, these rules will not be available for coaches.
5. Coaches will coach the standard coachable team in a full 6000-cycle match in front of the fixed-opponent. The strategy of the fixed-opponent is composed of one or more patterns in each game.
6. The coaches should detect the play pattern(s) of the fixed-opponent in each game and report it (them). Therefore, coaches have to detect activated pattern(s) in a 6000 cycle match and report it (them) during the game.
7. The strategy of the opponent is not necessarily the same as the base strategies used to create corresponding .rcg log files of patterns.

8. To avoid random reporting, we will only accept the first N reports from the coach where N is the number of activated patterns in the game.
9. A penalty will be assigned to each wrongly reported pattern.
10. Coaches can advise their team in the online detection game by sending Clang rules to the standard coachables to facilitate the detection process.
11. The only inputs of the coaches are pattern and no-pattern .rcg logs and nothing else.

3.2. Organizational Points

- a. The patterns and base strategies should be created by participants. However, the organizing committee has the right to create some other patterns to use during the competition.
- b. Each team must create three patterns for each round. At least two of the patterns should be created using the standard coachable players and Clang rules, and the other one can be created by real 2D teams. Note that, the log files of patterns should not necessarily contain a full 6000-cycle test game i.e. duration of the logs can be less or more than 6000 cycles.
- c. Submitted patterns must be different from the patterns that are published before the competition also teams cannot submit a pattern more than once. The patterns that do not satisfy the mentioned criteria will be rejected.
- d. The organizing committee will reject those patterns that are not predictable and exploitable.
- e. The patterns used in the competition will include submitted patterns by teams and several others.
- f. Participants must submit their coach binary and three patterns with their corresponding no-pattern logs 24 hours before starting of each round.
- g. If a team fails to submit its binary and/or three patterns, that team will miss the competition. In very exceptional situations, the organizing committee will decide about the matter.
- h. After receiving all the materials from the participants, the organizers will decide on the patterns used and a set of log-files will be provided for the coaches. The set of patterns used in a round might be different from those used in the other rounds.
- i. There would be no guarantee about using all the submitted patterns, or for example, activating a pattern of each team in a game. The organizing committee will finally decide on the patterns that will be used.
- j. Just after receiving all materials, the set of patterns will be available to all participants.
- k. The name of a log-file denotes the name of the pattern activated in it and the name of the base strategy used to create that game. i.e. The name of the log-file in which somepattern is activated is somepattern-somestrategy.rcg. It also means that somestrategy has been used as a base strategy to create this log-file.
- l. We will consider an average of 5 minutes for processing time of a pattern. For example, if we use 60 log-files in a round, coaches are given a total of 5 * 60 minutes to analyze all the log-files. The restriction will be enforced just on the total processing time not the mentioned 5 minutes.
- m. To report a detected play pattern, a coach should send a free-form message in the following form:

(pattern-detected <CLangStr>)

Where CLangStr is the name of the pattern (same as somepattern as stated in 3.2.k).

- n. In each game one or more patterns will be activated (The number will be given to the coach as an argument). Coaches must report less than or equal the number of activated patterns. More reports will be ignored.
- o. The cycle number of receiving the above message in the simulator's .rcg log-file will be assumed as the detection time of that pattern.
- p. The *whole* process will be done automatically. Participants must provide an automatic offline analyzer and online coach program(s). i.e. participants have to provide automatic program(s) to perform these tasks: Analyze log-files of the patterns, detect the activated patterns of the opponent in the online detection game and report activated patterns during the game. Participants can separate offline analysis from online detection by submitting two separate binaries.
- q. Coaches can create some files to record specifications of play patterns during analysis process and use them in the next steps.
- r. You can either modify your code or submit new code between rounds.

- s. Your coach binary will be executed by different users in your user group. Your binary and other related files have to be given at least group read and executable permissions.
- t. If your coach does not work, we will not fix it. For more information on Agent Failures, look at section 4.1.
- u. The latest official release of standard coachables will be used in the competition.

3.3. Scoring

To calculate the performance of a given coach the following formulas will be used:

$$\text{score} = \alpha \times \text{Correct report reward} - \text{Incorrect report penalty}$$

$$\text{Correct report reward} = 3000 \times N_c + \sum_{i=1}^{N_c} (6000 - tc_i)$$

$$\text{Incorrect report penalty} = 3000 \times N_i + \sum_{j=1}^{N_i} (6000 - ti_j)$$

Where:

$$\alpha = \frac{\text{Total number of flaws} - \text{Number of activated flaws}}{\text{Number of activated flaws}}$$

$$N_c = \text{Number of correct reports}$$

$$tc_i = \text{Time of the } i^{\text{th}} \text{ correct report}$$

$$N_i = \text{Number of incorrect reports}$$

$$ti_j = \text{Time of the } j^{\text{th}} \text{ incorrect report}$$

Note the following points about the formula:

- i. A given coach will be rewarded if he reports an activated pattern correctly. The sooner he detects the pattern, the more score he will get.
- ii. Penalty will be imposed to any incorrect report.
- iii. The Mathematical Expectation of the formula is zero. This means that random reporting won't be worthwhile.
- iv. The incorrect report penalty depends on the time of incorrect detection. This is just to ensure that the Mathematical Expectation of the formula be zero. It means that, at any given time, if a coach wants to report a pattern randomly, the probability of getting reward is equal to the probability of losing score due to incorrect report.
- v. The constant value 3000 is multiplied to both N_c and N_i to make difference between a coach who does not say anything during games and the other ones. If a coach detects just one pattern correctly, he will get at least 3001 points (when he reports detected pattern in the cycle 5999!).

The drawback to this formula is that a given coach may get higher rank than the other one just for one cycle earlier report! We would like to consider two coaches that report within a few cycles as identical. Technically speaking, reporting a pattern only 10 cycles or so earlier causes no preference. There needs to be some minimum difference in the total score for one coach to be considered better than the other. We use another formula to calculate score' which is the score that a given coach would have received, if he reported all of its correct patterns 25 cycles (i.e. identity-period) earlier and all of its incorrect patterns 25 cycles later.

$$\text{score}' = \alpha \times \text{Correct report reward}' - \text{Incorrect report penalty}'$$

$$\text{Correct report reward}' = 3000 \times N_c + \sum_{i=1}^{N_c} (6000 - (tc_i - \text{identity period}))$$

$$\text{Incorrect report penalty}' = 3000 \times N_i + \sum_{j=1}^{N_i} (6000 - (ti_j + \text{identity period}))$$

The identity-period is the number of cycles by which the difference in the reporting time yields a tie (which is by default 25 cycles). It can be concluded that for a given coach score' is always higher than score ($\text{score}' > \text{score}$).

The following relations will be used to rank two coaches A and B:

1. Coach A will be ranked higher if and only if
 - $\text{score}(A) > \text{score}(B)$ and $\text{score}(A) > \text{score}'(B)$
2. Coach A and Coach B will be considered as tie if and only if
 - $\text{score}(A) = \text{score}(B)$ or
 - $\text{score}(A) > \text{score}(B)$ but $\text{score}(A) \leq \text{score}'(B)$

Note that this relation is transitive. It means that if Coaches A and B are tied and Coaches B and C are tied, Coaches A and C are also tied.

To make the ranking procedure clear, suppose that in some round, 20 patterns have been introduced to the coaches C1, C2 and C3, and 5 out of them have been activated in the match. We define U as the set of patterns and A as the set of activated patterns as follows:

$$U = \{pattern_1, pattern_2, \dots, pattern_{20}\}$$

$$A = \{pattern_1, pattern_2, pattern_3, pattern_5, pattern_7\}$$

It can be concluded that:

$$\alpha = \frac{20 - 5}{5} = 3$$

Assume C1, C2 and C3 report the patterns as follows (each pair denotes the name of the pattern and the reporting time, respectively):

$$C1 \text{ reported flaws} = \{(pattern_2, 500), (pattern_9, 4305), (pattern_5, 5999)\}$$

$$C2 \text{ reported flaws} = \{(pattern_1, 480), (pattern_6, 4320), (pattern_2, 5990)\}$$

$$C3 \text{ reported flaws} = \{(pattern_3, 480), (pattern_7, 5990)\}$$

Therefore, C1 and C2 report two correct patterns and one incorrect; and C3 detects 2 patterns correctly. C1 will get the following scores.

$$\text{Correct report reward} = 3000 \times 2 + ((6000 - 500) + (6000 - 5999)) = 11501$$

$$\text{Incorrect report penalty} = 3000 \times 1 + (6000 - 4305) = 4695$$

The final score would be equal to:

$$\text{score}(C1) = 3 \times 11501 - 4695 = 29808$$

And

$$\text{Correct report reward}' = 3000 \times 2 + ((6000 - (500 - 25)) + (6000 - (5999 - 25))) = 11551$$

$$\text{Incorrect report penalty}' = 3000 \times 1 + (6000 - (4305 + 25)) = 4670$$

$$\text{score}'(C1) = 3 \times 11551 - 4670 = 29983$$

Going through this way, we can calculate scores of C2 and C3. The final results are:

$$\text{score}(C2) = 3 \times 11530 - 4680 = 29910 \quad \text{And} \quad \text{score}'(C2) = 3 \times 11580 - 4655 = 30085$$

$$\text{score}(C3) = 3 \times 11530 - 0 = 34590 \quad \text{And} \quad \text{score}'(C3) = 3 \times 11580 - 0 = 34740$$

By using the mentioned ranking procedure, C3 will rank first because:

$$\text{score}(C3) > \text{score}(C2) > \text{score}(C1) \quad \text{And} \quad \text{score}'(C3) > \text{score}'(C2) > \text{score}'(C1)$$

C2 and C1 will be considered as tie since:

$$\text{score}(C2) > \text{score}(C1) \quad \text{But} \quad \text{score}'(C2) \leq \text{score}'(C1)$$

Note that, the maximum and minimum scores in this scenario are:

$$\text{MAX}(\text{score}) = 3 \times 44995 - 0 = 134985$$

$$\text{MAX}(\text{score}') = 3 \times 45120 - 0 = 135360$$

$$\text{MIN}(\text{score}) = 0 - 44995 = -44995$$

$$\text{MIN}(\text{score}') = 0 - 44870 = -44870$$

3.4. Ranking Coaches

Unlike the previous year of the competition, we will rank coaches in a given round in a different way. Last year, we simply summed the score of a given coach in multiple iterations and then ranked the coaches according to their respective scores.

Just like before, we will run multiple games with different activated patterns in each round and the score of a coach for each game will be calculated using formula given in the section 3.3. After each iteration, coaches will be ranked. Obviously, tied teams will get the same rank. For example, if three first ranked teams are tied, all the three teams are ranked first, and the next ranked team would be ranked fourth. The sum of individual **rank**s in each iteration represents the final score of a given coach for that round. Finally, coaches will be ranked according to their final scores. This procedure is the same as the procedure used in Rescue Simulation league.

3.5. Tournament Procedure

The tournament procedure will be as follows:

- a. The competition will consist of three rounds.
- b. All the teams in each round will be placed in only one group.
- c. In the first round the first 8 top teams proceed to the second round.
- d. In the second round the first 4 teams proceed to the final round.
- e. The rank of the coaches in the final round determines the final ranking.
- f. If teams are tied and it is the case that some team(s) in the tie will advance to the next round and some team(s) will not, the tiebreaking procedure described in section 3.6 will be applied.

3.6. Tiebreakers

Tiebreakers between $N \geq 2$ teams will apply in the following priorities:

1. An extra match will be used to rank the tied teams. The higher-ranked team(s) will proceed to the next round. If still there is a tie, the tied teams will continue this procedure.
2. Step 1 will be repeated for at most 3 times.
3. Random selection (e.g. coin toss)

4. Failures

4.1. Coach Failure

In case of coach failure due to any programmatic problems related to the agent itself, you will have only 5 minutes to fix the problem. If the problem still exists, in very exceptional situations, the organizing committee will decide what to do; otherwise, you will miss the competition.

4.2. Server and Coachable Players Failure

In case of any failure in simulator and/or coachable players, the human referee will decide on continuation of the game by consulting the organizing committee. If the committee decides on stopping the game, the match will be restarted from the beginning.

5. Fair Play

The aim of RoboCup is to promote scientific and technical progress in the fields of Robotics and Artificial Intelligence. According to common sense understanding of fair play commitments, we are very strict with teams who violate the fair play commitments during all phases of the competition. Violation of the fair play commitments includes for example:

- Using other teams' binaries in your team!
- Having coaches that do not say anything in the hope that other teams are bad enough which leads to a situation that teams with zero score will advance to the next rounds!

Any of these is strictly forbidden.

Other strategies might be found violating the fair play commitment, after consultation with the organizing committee. However, we expect it to be pretty clear what a fair team should look like. If you are in doubt of using a certain method, please ask the organizing committee before the tournament starts. If a team is found to use unfair programming methods during the tournament, it will be immediately disqualified. If a team is under suspicion of violating the fair-play agreement, the committee has the right to ask for source code inspection.

6. Remote Participation

General Remark: *Remote participation is only possible in extreme cases.*

We will not have resources to search for problems in remote participants' startup procedure, so, in their own interest, remote participants are asked to make sure that a 3rd party (i.e. we) can start up their code easily and smoothly on a platform that might be different from their development platform. We unfortunately are not able to guarantee the remote participation of a coach if we do not succeed in getting the code quickly and smoothly to run.

7. After Competition

The coaches' binaries should be published after the competition. In case a team fails to provide a working executable, we will publish the complete home directory of that team. Also, it may cause disqualification in RoboCup 2007 competitions. Although releasing source codes is not mandatory, the organizing committee encourages publishing sources strongly.