JoiTech-SPL Team Description 2015

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Abstract. In this paper we describe the strategy of our RoboCup team "JoiTech-SPL" for the RoboCup 2015 Standard Platform League competition. We consider that RoboCup competition is an ideal scenario to challenge our expertise and applying our findings in robotics, and consequently we commit to participate in Standard Platform League. In particular, our interest is to enhance our understanding of human development and to contribute in the development of algorithms based on those findings. From our past experience participating as "JoiTech" in the RoboCup Humanoid Adult Size League, when we won the first place in RoboCup 2013 Eindhoven and were chosen as the laureate of the Louis Vuitton Best Humanoid Award, we believe that our software and hardware experience will make a substantial difference in our performance in the competition of Standard Platform League.

1 Team Background

Team JoiTech-SPL is originally derived from RoboCup team JEAP, which participated in competitions of Humanoid KidSize League since 2006. Team JEAP is composed of master and doctoral students at Emergent Robotics Laboratory, Osaka university. Team "JoiTech" is a derivative of team JEAP, it was started up as a new team in cooperation with students at Osaka Institute of Technology in RoboCup Japan Open 2010. The team name, JoiTech, is an acronym for "JEAP and Osaka Institute of Technology", and it also means "joint team with Institute of Technology" and "enjoy technology". The team JoiTech had focused on Humanoid League Adult Size for several years.In RoboCup 2013 Eindhoven, it took the 1st place in Humanoid League Adult Size and also was awarded the Louis Vuitton Best Humanoid Award [3]. The main goal of our lab is to understand the cognitive developmental process of humans based on synthetic approaches with humanoids, which contains robot-robot communication and machine learning. For the upcoming year of RoboCup, we believe that the participation of Standard Platform League may enhance our understanding on our original approaches. Consequently, the team shift its focus to Standard Platform League by adding "SPL" to the original team name "JoiTech".

1.1 Team Name

The team name "**JoiTech-SPL**" is an acronym for "**J**EAP and **O**saka **I**nstitute of **Tech**nology for **S**tandard **P**latform **L**eague", and it also means "joint team with Osaka Institute of Technology" and "enjoy technology".

1.2 Team Members

The philosophy of our team is promoting cooperation between members coming from diverse fields of knowledge. Currently our team is comprised by graduate students and researchers, whose areas of work include vision processing, machine learning, cognition development and robot control.

Minoru Asada (*Professor*)
Endo Nobutsuna (*Professor*)
Jorge Luis Copete Vasco (*Master Student, Team leader*)
Junichi Suzuki (*Master Student*)
Tomohiro Kojima (*Master Student*)
Yoshihiro Nakata (*Master Student*)
Quan Wei (*Master Student*)
Ryo Iwaki (*Master Student*)
Ruben Paul Alvarado Martinez (*Master Student*)
Nobuyuki Ota (*Master Student*)
Hirofumi Kawachi (*Master Student*)
Ryosuke Yokoo (*Master Student*)
Tomoki Kojima (*Master Student*)

1.3 Robots

Our team currently has five H25 NAO v4s robots for the RoboCup competition.

2 Participation in RoboCup 2015

We are participating in the drop-in player and the technical challenge competitions of RoboCup 2015.

2.1 Acknowledge of Team Code

We acknowledge the usage of the code release of other team. In 2014 we adopted the code release of B-Human team to participate in Japan Open 2014. Until now we have been employing the code release of B-Human team and for participating at RoboCup 2015 we use B-Human's code as the base code. We added functions to detect white goals and non-orange balls. We modified the walking engine and the selection of player roles.

2.2 Impact of the team's participation in RoboCup

Regarding the impact of our participation in SPL league, we have first to remark that the main objective of our laboratory is to understand the development of human cognitive mechanisms. For that purpose we carry out research using infant development as a basis to get robots develop intelligence through environmental interaction. Then, for RoboCup we aim to find out the necessary factors in cognition development through implementing optimal actions in NAO which involve body and environment recognition, and we expect this work will contribute to the progress of multi robot cooperation. We consider that playing soccer has many interesting challenges due to the complex environmental changes generated by the interaction of multiples factors like ball, soccer field, and players of both teams. Regarding the impact for our university, we consider that participating at RoboCup 2015 is a great opportunity to stimulate the interest in robotics of Osaka University students. In our laboratory we aim to build a cooperation scheme with students in different research fields related to robotics. On the other hand, we consider that receiving recognition of outstanding achievements in an international competition would be an excellent way to let to know to the general public about the research activities that Osaka University is carrying out in the robotics field. This recognition helps Osaka University to get more support in its research activities, and as a consequence will contribute to consolidate Osaka University as a leading institution in robotics fields.

2.3 Importance of participating in RoboCup

Participating in RoboCup is important for achieving the research and educational goals of our team. The main research goal of our team is designing and developing robots capable of interacting smartly in real environments. In line with this, participating in an international high level competition as RoboCup will allow us to deal with the most advanced problems and then to get feedback from the performance of our approach. The opportunity to play matches against other teams with similar goals in their research work will also allow us to learn from their technical approaches and strategies. On the other hand, the educational goal of our team is preparing competent, qualified people in robotics and artificial intelligence who will contribute to the development of the field in coming years. Therefore, we consider that participating in the RoboCup competition is harmonious with our educational objectives, and stands as an excellent opportunity to challenge our philosophy and enriching experience for the members of our team.

3 Team's participation in RoboCup Open SPL competitions

May 2015, Japan Open 2015, Result: Second place (Highest score in the qualifying tournament)
May 2014, Japan Open 2014, Result: Fourth place

4 Research and Activities

In our laboratory, in order to understand the development of human cognitive mechanisms we carry out research using infant development as a basis to get robots develop intelligence through environmental interaction. With RoboCup competitions we are verifying the learning of abilities and robots cooperation in real environments.

4.1 Research

We carried out research on estimation of actions of soccer players in an environment with multiple agents and dynamical conditions. In our experiment we employed data from the RoboCup 2D Soccer Simulation League and showed the potential of our model based on deep learning [1]. Our previous research work [2] regarding motor learning is another significant achievement of our team to be implemented for SPL.

4.2 Team strategies for playing soccer

Self-position estimation A common issue in soccer competitions that requires special attention is the degradation of the estimation of the self-position after robots have moved or rotated during a certain period of time. For preventing from that, we made improvements so that in case the certainty parameter in self-position estimation goes below a chosen threshold, NAO rotates and turns around its neck slowly, which increases the certainty parameter and makes the estimation accurate enough.

Entering ReadyState An important requirement for current SPL competitions is the abillity of robots to look for their initial positions when they are still outside the field and then moving toward there without manual assistance. We programmed our team so once the formation is decided, each NAO moves to its initial position in accordance with its correspondent role. First, when GameController is set to ReadyState, each player looks around the surroundings to roughly determine its self-position. Then, by continuously correcting self-position, each player goes towards its initial position.

Color Calibration One of the most severe problems we faced when starting to work with NAO was the loss of visual recognition accuracy when confronted to changed lighting conditions in the environment. Currently we are able to set hue, saturation and brightness for each of 4 designated colors (Orange, green, white and yellow), and as a result, even if the environment lightning conditions change, we obtain adequate visual recognition from NAO.

Role selection Each of 5 NAOs has been assigned a role as attacker, defender or goalkeeper. Basically, the attacker chases the ball and kicks it towards the goal line. In case of the defenders, when the ball crosses the center line, they kick the ball to return it to the opponent's side of the field. Finally, the goalkeeper's role consists of following the ball parallel to the direction which it is moving to prevent the opponent from reaching the goal line.

Ball Passing For our next step we consider to focus in getting robots pass the ball mutually, and devising strategies for playing soccer based on NAO's body structure. By combining different techniques to solve issues of current technology, we aim to develop strategies that let robots surpass humans in playing soccer.

4.3 Related Activities

Practice Matches and Workshop, October 2014.
We arranged a match with "Camellia Dragons" at October 2014 in Aichi Prefectural University, Japan. The purpose of the match was testing the latest changes to improve the code of both teams. Among our results, we fixed the code for robots to estimate their self-location and the color calibration when lighting conditions change. We also organized a workshop session in order to share experiences regarding strategies and capabilities of both teams.

5 Conclusion

Based on our experience and achievements in RoboCup competitions and our recent but enriching experience acquired in SPL league competitions and activities, we believe the evolved team "JoiTech-SPL" will be a new highly competitive participant in the RoboCup Standard Platform League.

References

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