Application for Robocup 2012 by Hamburg Bit-Bots

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Abstract. *Hamburg Bit-Bots* is a highly motivated team especially interested in humanoid robotics. Over the last year we have developed our own software for the RoboCup tournament and gathered much experience. Our goal is not only scoring, but to share this knowledge with like-minded people from all over the world.

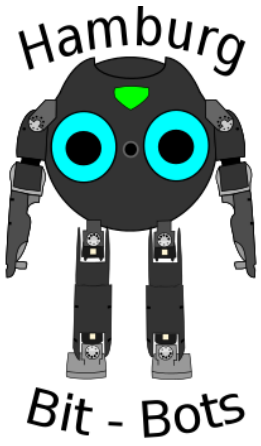

Fig. 1. Our Logo

1 The Team

The team *Hamburg Bit-Bots* consists of a group of students from the department of informatics at the University of Hamburg, Germany. There are no ties to the official robotics projects at our department as we are a student group.

Roughly 20 undergraduate and graduate students studied and worked in our group during the last year. Because of that we gathered experience in many different fields of study. We don't settle for finding one way to the aim but trying to find more methods, comparing them and discuss the best one for our team.

As we start from the very scratch each individual has a thorough understanding of every part of the code. A detailed documentation helps new comers to get along: http://bitbots.mercarion-online.de/html/index.html

2 Research

2.1 Research until now

We will give a short draft of the published work by some of our group members. Due to the fact that our team consists only of students, the published work so far are mostly bachelor thesis.

Estimation of optical-flow fields in multispectral images (2010) is a finished bachelor thesis written by Oliver Bestmann in the field of cognitive science. The developed algorithm is able to estimate robustly the optical-flow in an image sequence using additional information provided by color gradients. It can be used for better tracking the ball once it is located.

Ball verification (2011) The group members Lasse Einig and Anja Richter wrote an article about the ball verification they developed for the object recognition tool for the NAO robot in the Standard Platform League 2011.

Ball recognition based on probability distribution of shapes (2011) Sandra Schröder developed a process to determine whether a given shape would match the soccer ball or not. She uses an elaborate edge detection algorithm in combination with the probability distribution of the position of edgels to calculate the possibility of a given shape in the presented image.

Sound source localization on a humanoid robot (2011) This work shows sound source localization in horizontal plane by using cross correlation and neural networks. Robert Keßler made a contribution not only to the localisation of service robots but also to the localisation of team members during robot soccer. This concludes that this thesis is ahead of the times because it deals with the problem of communication on the field without using the wireless network.

Behaviour based coordination of a multi robot scenario realized by BDI-agents Group member Anja Richter is currently writing her Bachelor thesis on the modelling of a behaviour for a logistic scenario. The behaviour is realized by software agents according to the believe-intention-desire model and then transfered to a multi robot system.

Furthermore Timon Giese is writing his bachelor thesis on detection of team members and adversary.

2.2 Actual fields of research

As our team consists only of students working in their free time, we are not highly specialized in certain parts of human robotics. In fact every team member has his or her own area of expertise which is mostly determined by his interests. Futhermore some of our team members contribute experience gained in official student projects to the group. This mostly comprises of knowledge in the field of image processing, object recognition and experience in self localization using particle filters.

We have students doing research in behavior, image recognition, walking engine, technical challenges and communication on the field by now:

Behavior The team studying the behavior of the robotos are discussing the cooperation of the robots on the field. How can a robot decide whether he should go to the ball himself or wait for another robot to take the ball. The simple behavior of just one robot on the field is already implementated. Moreover the behavior of the goalie needs to be changed for the better.

Image recognition In Addition to the bachelor thesis of Sandra Schröder other team members try to recognise the form of the ball and the goal by the contrast on the picture.

Walking Engine The robots are already able to walk and turn. However they need to balance unevenness in the ground solider. We are still working on the adjusment of the parameters.

Technical Challenge We have some problems with the throw-in challenge at the moment as our robots are not able to keep the ball above their head. In contrast dribbling around cylinders is still implementated and we are engaged in the double-pass challenge.

Communication on the field Sound source localisation of other robots during the match is just one field of study in our team. Comunication via the network is still more trustworthy. However we are still trying to find more methods of comunication on the field due to possible future restrictions in network communication.

Friendly games with other teams are an important part of our study because the test conditions with just have of the field in our lab are inadequate.

3 Prior performance in RoboCup

The *Hamburg Bit-Bots* team was founded in 2011 as a reaction to our experience while participating in the *RoboCup German Open 2011*, where one third of the current team take part in the standard platform league.

Cooperation with the former, but still existent team *RFC St. Ellingen*, is limited to sharing the laboratory. The current team was explicitly founded for

the participation in the humanoid league and thus started from the beginning with new robots and a newly developed codebase.

We are using the *Darwin OP* robots produced by *Robotics and Mechanisms Laboratory*. All team members are currently studying computer science and are working on their bachelor's or master's degrees. This explains our lack of experiences in the humanoid league but provides us with referees in the SPL.

Our first competition will be the *RoboCup German Open 2012* in Magdeburg.

In addition we participate in friendly matches with other team, for example two of our team members will take part in the RoBOW'12.1 in Berlin in February.

4 Code from other Teams

Right now most of our codebase is written from scratch with the exception of the image-processing module. We are currently using some code written by the *RFC St. Ellingen*, which is used in the standard plattform league. This code furthermore contains little pieces written by the current world champion *BHuman*.

We are activly working on our own image-processing software, because we are keen to try out other ways of processing the raw data to extract the desired information we need. We hope to finish the main work in this area to replace the borrowed code with our own in time for the RoboCup tournament.

5 Statements

5.1 Participate

We assure to participate in the RoboCup 2012 Humanoid League.

5.2 Referee

We assure that we have a person with sufficient knowledge of the rules. We assure that this person will be available as referee during the competition.

6 Conclusion

Our team is still a beginner in this field, but our team members are highly motivated and interested in robotics. We are looking forward to get in contact with more people in the RoboCup community.

We see the *RoboCup World Championships* as an opportunity to exchange our experiences with other students and researchers from all over the world and to improve and communicate our knowledge.

We sincerely hope to get the chance to be part of this great event.