

Diversity as a Game Changer for Successful Teams in RoboCup

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The international RoboCup competition has, in the past, been described as “a treasure trove of rich diversity for research issues and interdisciplinary connections” [1]. This description is often credited to the facets of the federation itself, which hosts a variety of challenges for rescue robots, robots for service at home and in industrial environments, and, most prominently, robots that play soccer, in different sizes and formats, be they simulated, wheeled, or legged.

A particular team with constant outstanding performance is the B-Human team of the Department of Mathematics and Computer Science, University of Bremen, and the German Research Center for Artificial Intelligence (DFKI) research area Cyber-Physical Systems. The team is considered one of the best in the soccer RoboCup Standard Platform League (SPL) (see Figure 1), winning the world championship nine times. This “Women in Engineering” column covers the dimensions of diversity that contribute to this success story and the potential of the dimensions yet unexplored.

SENIORITY

Robot soccer is a team sport just like human soccer, meant to invite everyone regardless of their background. “More than 200 students start their studies in computer science each year at the University of Bremen” says Tim Laue (Figure 2), one of the team leaders of

B-Human and a postdoctoral researcher and lecturer in the Department of Mathematics and Computer Science. “Students can choose a semester project evaluated with 18 ECTS for eight months in the bachelor program and 24 ECTS for 12 months in the master program.” One of the offered projects is participation in the B-Human team. Often, the students continue with a

bachelor’s thesis or master’s thesis afterward. In fact, continuity is a major key for the success of the team. “I have been with B-Human for 20 years by now,” says Thomas Röfer (Figure 2), the second team leader working at DFKI in Bremen. “You get the chance to travel the world for a championship. Students want to experience this again and again, so they stay!” In the previous



FIGURE 1. The diversity of the human and robot participants of the 2022 SPL competition is clear at a glance. (Source: Thomas Reinhardt; license: CC BY-SA 4.0)

project period, only one student did not continue to work for B-Human after the official project ended. This is very beneficial for the team, as the learning curve to use the robots and contribute software is quite high. As a result, the team is composed of members of all seniority levels, including bachelor's students, master's students, Ph.D. students, and even postdoctoral researchers.

GENDER

“To motivate new students to join the project, we showcase the work of previous semesters,” says Röfer. One particularly famous team member of B-Human was (and still is, to some extent) Judith “Judy” Müller. Her kicking algorithm was literally a game changer when she introduced it with her diploma thesis, in 2010 [2]. It is, by now, the standard kick in the league, used by a huge number of teams worldwide (see Figure 3). Müller is considered a true role model to inspire the next generation of female students. Given the example she has set, it is thus no wonder that, while slowly, the RoboCup project in Bremen has attracted more women recently. “I wanted to join because I found both the robots and the competitive idea very appealing. With some friends joining as well, it was very promising to become a very fun experience,” says Ayleen Lührsens (Figure 2), who joined the team in 2021 and worked on the 2022 visual referee challenge, where the robot has to react to human instructions. Lührsens is one of three female students on the current roster of 14 team members. She says, “While soccer and robotics may not be the driving factor for women to join the RoboCup, the surrounding activities are very exciting and inspiring. We are visiting fairs to showcase our work, which is a great experience.” And of course, there is the chance to participate in and maybe even win the world championship.

GEOGRAPHY

Recently, RoboCup has paid special attention to the support of diversity in gender, ethnicity, and geography through the RoboCup Visiting Fellows

Program, established in 2019. While the pandemic did not allow for extended research visits, this program is something that B-Human aims to explore in the future. “We had international students, but that is actually rare. This is probably the case, as the bachelor courses are usually held in German, but we would switch to English if the need arises due to international students joining in the future,” says Röfer.

CONCLUSION

There is truly a place for everyone in RoboCup. “We can leverage from an established system. So, everyone is free

to add new components, either to the robots directly or to the infrastructure of the team,” says Jo Lienhoop (Figure 2), who is another student in the 2021 class. “I am developing an advanced passing strategy—this is highly visible on the field—but there are also others that, for example, implement Discord bots to support the team in the back. Therefore, everyone can find something that appeals to his or her interests and abilities.” This fusion of robotics and artificial intelligence is very much in line with the initial idea to join the communities of the IEEE Robotics and Automation Society and the Association



FIGURE 2. The B-Human team of 2022–2023. Time Laue is in the back row, second from the left; Thomas Röfer is in the back row, third from the right; Ayleen Lührsens is in the front row, first from the right; and Jo Lienhoop is in the back row, second from the right. (Source: Christian Mandel; license: CC BY-SA 4.0.)



FIGURE 3. A B-Human robot performs a strong shot toward the opponent's goal. (Source: Tim Laue; license: CC BY-SA 4.0.)

for the Advancement of Artificial Intelligence to beat the world champion in soccer by 2050 [3].

To achieve this ambitious goal, B-Human (<https://b-human.de>), like any other team, will welcome with open arms anyone who brings motivation and skills to its team. The willingness to improve, enthusiasm, and discipline are the keys to success, not race and gender. Literally anyone who is interested is encouraged to participate, perhaps becoming a role

model for currently underrepresented groups and sparking in them an interest in the whole topic of robotics. This is true even if their background may not have fostered that interest so far, which could be for many reasons, such as a nonacademic background in the family and certain expectations due to gender. So basically, everyone has the chance to become a role model and get others excited about this topic through RoboCup, and this chance should be taken!

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FROM THE GUEST EDITORS (continued from page 7)

platform engages the user and performs automated evaluation of arm and hand function and their evolution over time.

The article by Sun et al. [A6] aims to realize a walking-training robot in response to the shortage of rehabilitation physiotherapists. The proposed rehabilitation gait-training robot caters to the characteristics of human omnidirectional walking and allows passive and active training to be directly and gently switched during walking. A control algorithm is realized to accurately follow the exercise programs prescribed by physical therapists and achieve satisfactory practice results.

Finally, Infarinato et al. [A7] developed an augmented and extended a home rehabilitation system that provides neurorehabilitation exercises and assessments to chronic stroke patients with aphasia. Their work analyzes the feasibility, satisfaction, and motivation of patients and the clinical effect of the intervention using their system, which allows the administration of speech and language home therapy.

By presenting the achievements and future opportunities in this multidisciplinary research area, which crosscuts robotics, automation, AI, and health care, we hope this special issue can inform and inspire the researchers in this exciting and important area of robotics and automation. More importantly, we look forward to new research efforts to further robotic technologies for homecare.

APPENDIX: RELATED ARTICLES

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