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Vicenç Torra

Institut d'Investigació en Intel·ligència Artificial
Consejo Superior de Investigaciones Científicas
Campus U.A.B., 08193 Bellaterra, Catalonia, Spain
E-mail: vtorra@iii.csic.es

Yasuo Narukawa

Toho Gakuen

3-1-10, Naka, Kunitachi, Tokyo 186-0004, Japan

E-mail: narukawa@d4.dion.ne.jp

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Preface

This volume contains the papers selected for presentation at the 1st Conference on Modeling Decisions for Artificial Intelligence (MDAI 2004), held in Barcelona, Catalonia, August 2–4, 2004.

The aim of this conference was to provide a forum for researchers to discuss models for information fusion (aggregation operators) and decision, to examine computational methods and criteria for model selection and determination, and to stimulate their application in new contexts.

Fifty-three papers were submitted to the conference, from 19 different countries. Each submitted paper was reviewed by at least two experts on the basis of technical soundness, originality, significance and clarity. Based on the review reports, 26 papers were accepted for publication in this volume. Additionally, this volume contains the plenary talks given at the conference.

We would like to express our gratitude to the members of the program committee as well as to all reviewers for their work. We thank Alfred Hofmann, from Springer-Verlag, who supported the publication of these proceedings in the LNAI series.

The conference was supported by the Catalan Association for Artificial Intelligence (ACIA), the European Society for Fuzzy Logic and Technology (EUSFLAT), the Japan Society for Fuzzy Theory and Intelligent Informatics (SOFT), the IEEE Spanish Chapter, the Spanish Council for Scientific Research (CSIC) and the Generalitat de Catalunya (AGAUR 2002XT 00111).

May 2004

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Introduction to RoboCup Research in Japan

Yoichiro Maeda

Department of Human and Artificial Intelligent Systems
Faculty of Engineering, Fukui University
3-9-1 Bunkyo, Fukui 910-8507 Japan
maeda@ir.his.fukui-u.ac.jp

What is RoboCup ?

RoboCup (Robot World Cup Initiative) is the most famous soccer robot competition in the world. However, RoboCup was originally established as an international joint project to promote AI, robotics, and related field. To go toward this aim, the soccer game is selected as a primary domain in RoboCup and soccer game competitions and international conferences have been organized at different places of the world every year since 1997 [1]-[6]. Currently, about 35 countries and 3,000 researchers are participating in the RoboCup project. The final goal of the RoboCup project is to develop a team of fully autonomous humanoid robot soccer players, according to the official rule of the FIFA, that can win against the human World Cup champion team until 2050.

The first idea of soccer robots was proposed by prof. Alan Mackworth (University of British Columbia, Canada) in his paper "On Seeing Robots" in 1992 [7]. The Dynamo robot soccer project was established by his group. Also in Japan, Japanese researchers organized a Workshop on Grand Challenges in Artificial Intelligence in October 1992, discussing possible grand challenge problems. Furthermore, a group of researchers including Minoru Asada, Yasuo Kuniyoshi, and Hiroaki Kitano, decided to launch a robotic competition, tentatively named the Robot J-League in June 1993. After that, they renamed the project as the Robot World Cup Initiative "RoboCup".

Competitions and Conferences

The first official RoboCup competition and conference was held in IJCAI-97, Nagoya in 1997. Over 40 teams participated, and over 5,000 spectators attended. Since 1997, RoboCup has been held in several places in different countries as shown in Table 1. RoboCup competitions and conferences marked in Table 1 was held at the same time of FIFA WorldCup.

In this year, RoboCup2004 was held in Lisbon, Portugal. In the future, RoboCup2005 will be held in Osaka, Japan and RoboCup2006 in Germany synchronizing with FIFA WorldCup 2006. Regional competitions and workshops related to RoboCup (See Table 2) have been also held in various countries actively. In Japan, RoboCup pre-competition (Called Japan Open) has been held every year since 1998.

Table 1. World Championship Competitions and Conferences

	Venue	Participants
RoboCup 97	Nagoya (Japan)	10 Countries / 40 Teams
RoboCup 98 *	Paris (France)	20 Countries / 63 Teams
RoboCup 99	Stockholm (Sweden)	35 Countries / 120 Teams
RoboCup 2000	Melbourne (Australia)	19 Countries / 110 Teams
RoboCup 2001	Seattle (U.S.A.)	22 Countries / 119 Teams
RoboCup 2002 *	Fukuoka (Japan) / Busan (Korea)	29 Countries / 188 Teams
RoboCup 2003	Padua (Italy)	34 Countries / 277 Teams
RoboCup 2004	Lisbon (Portugal)	30 Countries / 265 Teams
RoboCup 2005	Osaka (Japan)	(Planned Schedule)
RoboCup 2006 *	Germany	(Planned Schedule)

* held at the same time of FIFA WorldCup

Table 2. Regional Competitions and Workshops

[1998]	
RoboCup Pacific Rim Series 98 Singapore	Singapore
RoboCup-98 IROS Series at Victoria	Canada
VISION RoboCup 98 at Germany	Germany
RoboCup Japan Open 98 Tokyo	Japan
RoboCup Simulator League Exhibition at Autonomous Agent 98	U.S.A.
AAAI-98 Mobile Robot Competition and Exhibition	U.S.A.
[1999]	
RoboCup Japan Open 99 Nagoya	Japan
[2000]	
RoboCup Euro 2000 Amsterdam	Netherlands
RoboCup Japan Open 2000 Hakodate	Japan
[2001]	
RoboCup German Open 2001	Germany
RoboCup Japan Open 2001 Fukuoka	Japan
[2002]	
RoboCup German Open 2002	Germany
RoboCup Japan Spring Games 2002 Tokyo	Japan
[2003]	
RoboCup Japan Open 2003 Niigata	Japan
RoboCup American Open 2003	U.S.A
RoboCup German Open 2003	Germany
RoboCup Australian Open 2003	Australia
[2004]	
RoboCup Japan Open 2004 Osaka	Japan
RoboCup American Open 2004	U.S.A
RoboCup German Open 2004	Germany

Main Domains

In the RoboCup, the project is mainly organized in three domains. The RoboCup International Symposium is also held in conjunction with the soccer competitions as the core meeting for the presentation of scientific contributions in areas of relevance to RoboCup.

- RoboCupSoccer: International Robot World Cup Initiative of Soccer Game Competition by Computer Simulation and Real Robots
 - Simulation League
 - Small Size Robot League (f-180)
 - Middle Size Robot League (f-2000)
 - Four-Legged Robot League (Supported by Sony)
 - Humanoid League (Since 2002)
- RoboCupRescue: Rescue Application in Large Scale Disasters by Technologies Developed through RoboCup Soccer
 - Rescue Simulation League
 - Rescue Robot League
- RoboCupJunior: Project-Oriented Educational Initiative of Regional and International Robotic Events for Young Students
 - Soccer Challenge
 - Dance Challenge
 - Rescue Challenge

Research Subjects

RoboCup is a landmark project to bring up AI and intelligent robotics research. Technologies generated in RoboCup are able to be applied for socially significant problems and industries. For example, to realize an actual soccer robot, it is necessary for various technologies including the following research elements. So, RoboCup is a very attractive research area for AI and robotics researchers.

- High performance locomotive mechanism
- Adaptive behavior selection in dynamic environment
- Real-time reasoning and learning
- Strategy acquisition for team play
- Cooperative behavior in multi-agent robot
- Design methodology of autonomous agents
- Object recognition by sensor-fusion
- Self-localization method from sensing information
- Communication between agents by wireless-LAN system etc.

However, I regret that some researchers blame for the soccer robot research because they think it seems to be only a game. I think they don't understand the academic significance and various research subjects in RoboCup. I would like many AI and robotics researchers to understand the efficiency of RoboCup research.

RoboCup Research in Japan

Finally, I will briefly introduce the latest Japan Open held in this year. 22 teams in Simulation League, 10 teams in Small Size Robot League, 8 teams in Middle Size Robot League, 9 teams in Four-Legged Robot League, 9 teams in Humanoid League, 3 teams in Rescue Simulation League, 10 teams Rescue Robot League, 38 teams in Soccer Challenge, 6 teams in Dance Challenge and 9 teams in Rescue Challenge participated in Japan Open 2004. Three days preliminary match and one day final match was held in Osaka (See Fig.1).

In Japan, Humanoid League robots are actively developed recently because this league has just started at RoboCup2002 in Fukuoka. Many Japanese teams in every RoboCup league are continue to perform ambitious researches for a new robot mechanism, an intelligent control method, an adaptive decision making, a high-speed vision system and so on. For example, in the Middle Size Robot League, soft computing methods like as fuzzy reasoning, neural networks, genetic algorithms and reinforcement learning are also gradually increasing to be used in the real robot as shown in the following researches.

Team EIGEN (Keio Univ.)

- Motion control based on fuzzy potential method with omni-directional vision system [8]
- Neural network controller with weighted values tuned by genetic algorithms [9]

Team Trackies (Osaka Univ.)

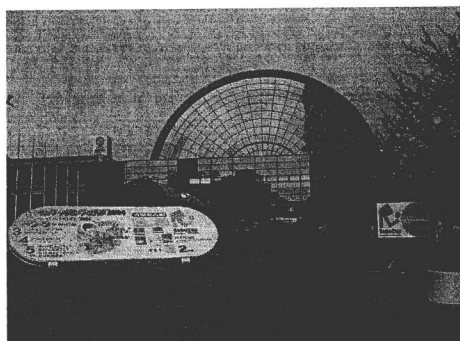
- Behavior acquisition by vision-based reinforcement learning [10]
- Multi-controller fusion in multi-layered reinforcement learning [11]
- Behavior generation for a mobile robot based on the adaptive fitness function [12]

Team KIRC (Kyushu Inst. of Tech.)

- Extended Q-learning method using self-organized state space based on behavior value function [13]

Conclusions

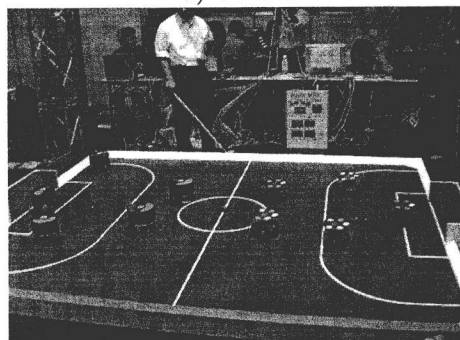
The brief summary of RoboCup competitions and conferences were introduced in earlier section of this paper and the latest RoboCup competitions in Japan were also reported in the last section. As I could not explain in detail about recent research targets for RoboCup and intelligent control methods using soft computing in this paper, some of them will be introduced in the plenary-talk of this conference. You will be able to find the detail information for RoboCup competitions and conferences at the RoboCup Official Site [14].



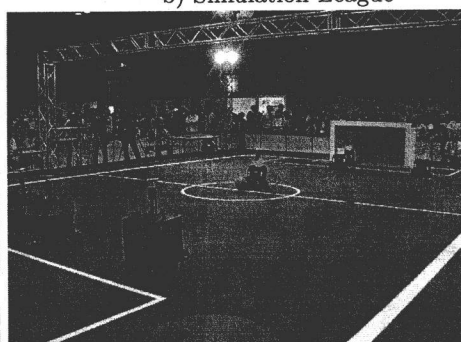
a) Conference Site



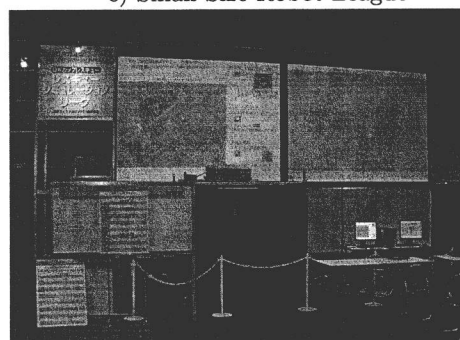
b) Simulation League



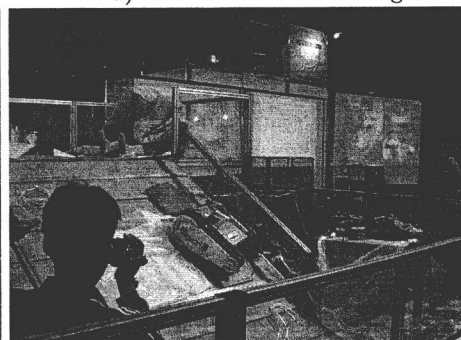
c) Small Size Robot League



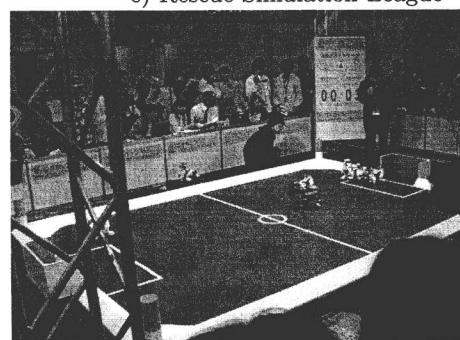
d) Middle Size Robot League



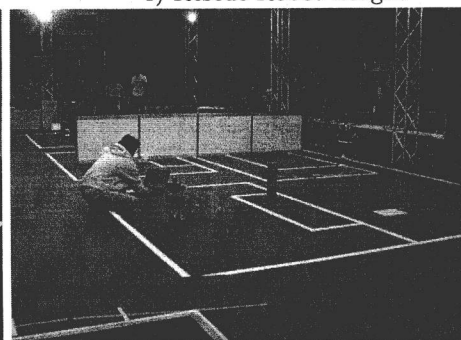
e) Rescue Simulation League



f) Rescue Robot League



g) Four-Legged Robot League



h) Humanoid League

Fig. 1. Scenery of RoboCup Japan Open 2004 in Osaka