

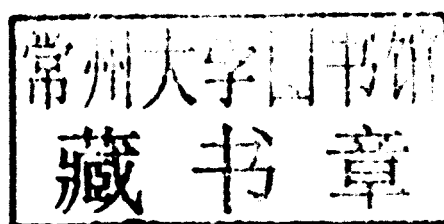
ICAROB 2014

THE PROCEEDINGS OF INTERNATIONAL CONFERENCE ON ARTIFICIAL LIFE AND ROBOTICS

January 11-13, 2014
Compal Hall, Oita, JAPAN
International Meeting Series

Editor-in-Chief
Masanori Sugisaka
Editors: Takao Ito, Ju-Jang Lee, Yingmin Jia
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The Proceedings of the International Conference on
ARTIFICIAL LIFE AND ROBOTICS
(ICAROB 2014)



January 11-13, 2014
Compal Hall Oita, Japan

Editor-in-Chief: Masanori Sugisaka
Editors: Takao Ito, Ju-Jang Lee, Yingmin Jia

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ORGANIZED

International Steering Committee of International Conference on Artificial Life and Robotics (ICAROB) and ALife Robotics Corporation Ltd.

CO-ORGANIZED BY

IEEE Fukuoka Section (IEEE Robotics and Automation Society, Fukuoka Section, Japan)
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University of Malaysia-Peris, Malaysia)
Takao Ito (Ube National College of Technology)

HISTORY

This symposium was founded in 1996 by the support of Science and International Affairs Bureau, Ministry of Education, Culture, Sports, Science and Technology, Japanese Government. Since then, this symposium has been held every year at B-Con Plaza, Beppu, Oita, Japan except in Oita, Japan (AROB 5th '00) and in Tokyo, Japan (AROB 6th '01). We changed this symposium name as The International Conference on Artificial Life and Robotics newly. This conference invites you all.

OBJECTIVE

The objective of this conference is the development of new technologies for artificial life and robotics which have been recently born in Japan and are expected to be applied in various fields. This conference will discuss new results in the field of artificial life and robotics.

GENERAL SESSION TOPICS

- | | |
|---|--|
| GS1 Artificial intelligence & Complexity | GS2 Reinforcement Learning System and genetic programming |
| GS3 Human-machine cooperative systems & Human welfare robotics | GS4 Neural Networks |
| GS5 Pattern recognition | GS6 Robotics I |
| GS7 Robotics II | |

ORGANIZED SESSION TOPICS

- | | |
|---|--|
| OS1 Intelligent Control | OS2 Environment Navigation and Localization |
| OS3 Facial Expression Analysis, Music Recommendation and Augmented Reality | OS4 Applications in Kansei Engineering |
| OS5 Analysis of Randomized Algorithms Intelligence in Biological Systems | OS6 Empirical research on Network and MOT |
| OS7 Intelligence in Biological Systems | OS8 Software Development Support Method |
| OS9 Foundation of computation and its application | |

COPYRIGHTS

Accepted papers will be published in the proceeding of ICAROB and some of high quality papers in the proceeding will be requested to re-submit their papers for the consideration of publication in an international journal ARTIFICIAL LIFE, COMPLEXITY AND ROBOTICS under negotiation. All correspondence related to the conference should be addressed to ICAROB Office.

ICAROB Office

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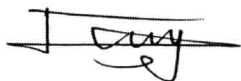
MESSAGES

Yingmin Jia

General Chair of ICAROB



Yingmin Jia
General Chair
(Professor,
Beihang University,
R .P. China)

A handwritten signature in black ink, appearing to read 'Jia' followed by a stylized flourish.

It is my great pleasure to invite you to the International Conference on Artificial Life and Robotics (ICAROB), in Oita City, Oita, Japan from Jan. 11th to 13th, 2014.

ICAROB 2014 develops from the AROB that was created in 1996 by Prof. Masanori Sugisaka and celebrated her birthday of eighteen years old in 2013. Doubtless, new mission and big challenges in the field of artificial life and robotics will promote ICAROB to start a new stage and attract wide interests among scientist, researchers, and engineers around the world.

For a successful meeting, many people have contributed their great efforts to ICAROB. Here, I would like to express my special thanks to all authors and speakers, and the meeting organizing team for their excellent works.

Looking forward to meeting you at ICAROB in Oita City and wishing you enjoy your stay in Japan.



Takao Ito
General Chair
(Professor of Ube National
College of Technology
, Japan)

A handwritten signature in black ink that reads "Takao Ito". The signature is fluid and cursive, with the first name "Takao" and the last name "Ito" clearly distinguishable.

Takao Ito

General Chair of ICAROB

It is my great honor to invite you all to The International Conference on Artificial Life and Robotics (ICAROB 2014). This Conference is changed as the old symposium from the first (1996) to the Eighteenth I am pleased to welcome you to the 2013 International Conference on Artificial Life and Robotics (ICAROB) in the wonderful city of Oita, Japan

The ICAROB has long history. The former organization of the ICAROB was developed under the strong leadership of the President, Professor. Masanori Sugisaka, the father of AROB. We gathered many researchers, faculty members, graduate students from all over the world, and published numerous high-quality proceedings and journals every year.

Over the years, dramatic improvements have been made in the field of artificial life and its applications. The ICAROB has becoming the unifying the exchange of scientific information on the study of man-made systems that exhibit the behavioral characteristic of natural living systems including software, hardware and/or wetware. Our conference shapes the development of artificial life, extending our empirical research beyond the territory circumscribed by life-as-we-know-it and into the domain of life-as-it-could-be. It will provide us a good place to present our new research results, good ideas, and valuable information about artificial intelligence, complex systems theories, robotics, management of technology, etc.

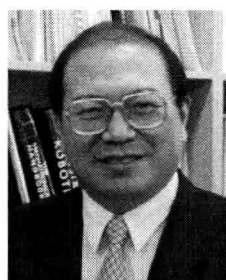
In order to provide an outstanding technical level for the presentations at the conference, we have invited more than 60 distinguished experts in the field of artificial life in the organizing committee and program committee. We will have 23 sessions during 3 days of conference, including 3 invited sessions.

The conference site is the Compal Hall, one of the finest congress centers in Oita. It is situated near the center of the city. You can find many fantastic scenic spots and splendid hot-springs. Enjoy your stay and take your time to visit the city of Oita.

I am looking forward to meeting you in Oita during 2013 ICAROB and to sharing a most pleasant, interesting and fruitful conference

Ju-Jang Lee

General Chair of ICAROB



Ju-Jang Lee
General Chair
(Professor, KAIST)

A handwritten signature of Ju-Jang Lee in cursive script.

The First International Conference on Artificial Life and Robotics (ICAROB) will be held in Oita City, Oita, Japan from Jan. 11th to 13th, 2014. This year's Conference will be held amidst the high expectation of the increasingly important role of the new interdisciplinary paradigm of science and engineering represented by the field of artificial life and robotics that continuously attracts wide interests among scientist, researchers, and engineers around the globe.

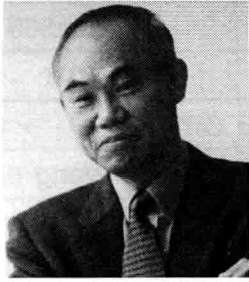
Distinguished researchers and technologists from around the world are looking forward to attending and meeting at ICAROB. ICAROB is becoming the annual excellent forum that represents a unique opportunity for the academic and industrial communities to meet and assess the latest developments in this fast growing artificial life and robotics field. ICAROB enables them to address new challenges, share solutions, discuss research directions for the future, exchange views and ideas, view the results of applied research, present and discuss the latest development of new technologies and relevant applications.

In addition, ICAROB offers the opportunity of hearing the opinions of well-known leading experts in the field through the keynote sessions, provides the bases for regional and international collaborative research, and enables to foresee the future evolution of new scientific paradigms and theories contributed by the field of artificial life and robotics and associated research area. The twenty-first century will become the century of artificial life and intelligent machines in support of humankind and ICAROB is contributing through wide technical topics of interest that support this direction.

It is a great for me as a General Chair of the 1st ICAROB 2014 to welcome everyone to this important event. Also, I would like to extend my special thanks to all authors and speakers for contributing their research works, the participants, and the organizing team of the 1st ICAROB.

I'm looking forward to meeting you at the 1st ICAROB in Oita City and wishing you all the best.

Masanori Sugisaka



Masanori Sugisaka

Honorary General Chair

**(Professors,
University of Sultan Zainal
Abidin(UniSZA), Malaysia,
University of Malaysia
-Perlis and President,
ALife Robotics Co., Ltd. ,
Japan)**

Masanori Sugisaka

Honorary General Chair of ICAROB

It is my great honor to invite you all to The International Conference on Artificial Life and Robotics (ICAROB 2014).

This Conference is changed as the old symposium from the first (1996) to the Eighteenth(2013) annually which were organized by Oita University, Nippon Bunri University(NBU), and ALife Robotics Corporation Ltd. under the sponsorship of the Science and Technology Policy Bureau, the Ministry of Education, Science, Sports, and Culture (Monbusho), presently, the Ministry of Education, Culture, Sports, Science, and Technology (monkasho), Japanese Government, Japan Society for the Promotion of Science (JSPS), The Commemorative Organization for the Japan World Exposition ('70), Air Force Office of Scientific Research, Asian Office of Aerospace Research and Development (AFOSR/AOARD), USA. I would like to express my sincere thanks to not only Monkasho (annually fund support from 1996 to 2013) but also JSPS, the Commemorative Organization for the Japan World Exposition ('70), Japanese companies for their repeated support.

The old symposium was organized by International Organizing Committee of AROB and was co-operated by the Santa Fe Institute (USA), RSJ, IEEEJ, ICASE (Now ICROS) (Korea), CAAI (P. R. China), ISCIE, IEICE, IEEE (Japan Council), JARA, and SICE. The old AROB symposium was growing up by absorbing many new knowledge and technologies into it.

This history and character are inherited also from now. From now on, ALife Robotics Corporation Ltd. is in charge of management. The future of The ICAROB 2014 is brilliant from a point of view of yielding new technologies to human society in 21st century.

I hope that fruitful discussions and exchange of ideas between researchers during Coferenence (ICAROB 2014) will yield new merged technologies for happiness of human beings and, hence, will facilitate the establishment of an international joint research institute on Artificial Life and Robotics in future.

TIME TABLE (1/11)

1/11	Room301	Room304	Room305
9:30~	Registration		
10:00-11:20		GS3 (4) Chair M. Rizon	GS7 (4) Chair J. Wang
11:20-11:40	Coffee break		
11:40-12:00	Opening Ceremony (room300)		
12:00-13:00	Lunch		
13:00-14:00	IS (room300) Chair J. M. Lee		
14:00-14:20	Coffee break		
14:20-16:00		GS1(5) Chair M. Kubo	GS4(4) Chair A. Selamata (will be end at 15:40)
16:00-16:20	Coffee break		
16:20-18:00		GS5(5) Chair S. Ishikawa	GS 2(5) Chair K. Kobayashi

GS1 Artificial intelligence & Complexity
GS2 Reinforcement learning system &
Genetic programing
GS3 Human-machine cooperative systems
& Human welfare robotic
GS4 Neural Networks
GS5 Pattern recognition I
GS6 Robotics I
GS7 Robotics II

OS1 Intelligent Control
OS2 Environment Navigation and
Localization
OS3 Facial Expression Analysis, Music
Recommendation and Augmented
Reality
OS4 Applications in Kansei Engineering
OS5 Analysis of Randomized Algorithms
OS6 Empirical research on Network and MOT
OS7 Intelligence in Biological Systems
OS8 Software Development Support Method
OS9 Foundation of computation and its
Application

TIME TEBLE (1/12)

1/12	Room301	Room304	Room305
9:30~	Registration		
10:00-11:20	PS1(6) Chair D. Hazry	OS5(3) Chair H. Furutani (will be end at 11:00)	OS8(4) Chair T. Katayama
11:20-13:00	Lunch		
13:00-14:40	PS1(6)	OS1(5) Chair Y. Jia	OS3(5) Chair Y. Yoshitomi
14:40-15:00	Coffee break		
15:00-17:00	PS1(6)	OS2(6) Chair J. M. Lee	OS4(5) Chair: T. Hattori (will be end at 16:40)
18:00-20:00	Banquet: HOTEL HOKKE CLUB OITA		

TIME TABLE (1/13)

1/13	Room301	Room304	Room305
9:30~	Registration		
10:00-12:00		GS6(5) Chair F. Dai (will be end at 11:40)	OS7(6) Chair J. Nishii
12:00-13:00	Lunch		
13:00-14:40		OS6(5) Chair: T. Ito	OS9(4) Chair: M. Sakamoto (will be end at 14:20)

The International Conference on ARTIFICIAL LIFE AND ROBOTICS 2014 (ICAROB 2014)

January 11 (Saturday)

Room 300: 11:40-12:00

Opening Ceremony

Chair: M. Sakamoto (University of Miyazaki, Japan)

Welcome Addresses

- | | |
|---|--|
| 1. General Chairman of ICAROB | Y. M. Jia (Beihang University, China) |
| 2. General Chairman of ICAROB | T. Ito (Ube National College of Technology, Japan) |
| 3. General Chairman of ICAROB | J. J. Lee (KAIST, Korea) |
| 4. Honorary General Chairman
of ICAROB | M. Sugisaka(ALife Robotics Co., Ltd. Japan) |

January 12 (Sunday)

HOTEL HOKKE CLUB OITA

18:00-20:00

Banquet

Chair: M. Oswald (The Vienna University of Technology, Austria)

Welcome Addresses

- Y. M. Jia (Beihang University, China)
H.H.Lund(Denmark Technical University of Denmark,Denmark)
L.Pagliarini(Denmark Technical University of Denmark,Denmark)

TECHNICAL PAPER INDEX

January 11 (Saturday)

Room 300

13:00-14:00 Invited Session

Chair: J. M. Lee(Pusan National University, Korea)

IS1-1 *Playware Research – Methodological Considerations*

Henrik Hautop Lund (Centre for Playware, Technical University of Denmark, Denmark)

IS1-2 *ALife for Real and Virtual Audio-Video Performances*

Luigi Pagliarini (Centre for Playware, Technical University of Denmark, Denmark

Academy of Fine Arts of Macerata,Italy)

Henrik Hautop Lund (Centre for Playware, Technical University of Denmark, Denmark)

IS1-3 *Heart-pulse Biofeedback in Playful Exercise using a Wearable device and Modular Interactive Tiles*

Tomoya Shimokakimoto (University of Tsukuba, Japan)

Henrik H. Lund (Technical University of Denmark, Denmark),

Kenji Suzuki (University of Tsukuba/ JST, Japan)

January 11 (Saturday)

9:30- Registration

Room 304

10:00-11:20 GS3 Human-machine cooperative system & Human welfare robotics

Chair: Mohamed Rizon (Universiti Sultan Zainal Abidin (UniSZA), Malaysia)

GS3-1 *Development of Measurement System for Quantitative Evaluation of Skillfulness of Lower Extremities*

Kazunori Yamazaki, Donggun Kim, Yoshifumi Morita, Hiroyuki Ukai
(Nagoya Institute of Technology, Japan),

Kenji Kozakai, Satoru Shibata, Shigenori Onishi, Akihiro Ito, Daisuke Mizuno
(Sanyo Machine Works, Ltd., Japan),

Tatsuya Hirai, Haruna Takeda, Yuka Sugiura (Tanakakai Nishio Hospital, Japan)

GS3-2 *Glove-Based Virtual Interaction for the Rehabilitation of Hemiparesis Stroke Patient*

Khairunizam WAN, Aswad A.R, Rashidah Suhaimi, Nazrul H. ADNAN, D. Hazry,