



Japan Society for Fuzzy Theory and Intelligent Informatics

日本知能情報ファジィ学会

日本知能情報ファジィ学会は、知とあいまいさをソフトに考える学会です。

**The 19th
Intelligent System Symposium (FAN 2009)
and
The 1st International Workshop on
Aware Computing (IWAC 2009)**



第19回インテリジェント・システム・シンポジウム

Fuzzy, Artificial Intelligence, Neural Networks and
Computational Intelligence (FAN 2009)

and

The 1st International Workshop on Aware Computing
(IWAC2009)



2009年9月17日(木)、18日(金)

会津大学

主催：日本知能情報ファジィ学会

協催：会津大学

協賛：計測自動制御学会，電気学会，システム制御情報学会，電子情報通信学会，人工知能学会，情報処理学会，日本神経回路学会，日本ロボット学会，日本機械学会，日本生体医工学会，日本AEM学会，IEEE SMC 日本支部；

Program

The 19th Intelligent System Symposium
(Fuzzy, Artificial Intelligence, Neural Networks and
Computational Intelligence: FAN2009)

and

The 1st International Workshop on Aware Computing
(IWAC2009)



September 17-18, 2009

The University of Aizu

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Message from FAN2009 Organizing Committee Chairs

Dear Participants of FAN2009 and IWAC2009,

It is our great pleasure to welcome you to attend the 19th Intelligent System Symposium (FAN2009) and the 1st International Workshop on Aware Computing (IWAC2009). This year, the symposium/workshop are sponsored by Japan Society for Fuzzy Theory and Intelligent Informatics (SOFT), and supported by the Society of Instrument and Control Engineers (SICE); the Institute of Electrical Engineers of Japan (IEEJ); the Institute of Systems, Control and Information Engineers (ISCIE); the Institute of Electronics, Information and Communication Engineers (IEICE); the Japanese Society for Artificial Intelligence (JSAI); Information Processing Society of Japan (IPSJ); Japanese Neural Network Society (JNNS); the Robotics Society of Japan (RSJ); the Japan Society of Mechanical Engineers (JSME); Japanese Society for Medical and Biological Engineering (JSMBE); the Japan Society of Applied Electromagnetic and Mechanics (JSAEM); and Society of Signal Processing Applications and Technology of Japan (SSPATJ).

We would like to thank our host, the University of Aizu, who has fully supported us in providing the meeting rooms and necessary budget for inviting top-level keynote speaker; our authors for submitting their newest results; the organizing committee members for preparing everything for the event; the program committee members for spending their precious time in reviewing the papers; the organizers for organizing the special/invited sessions; and all people involved in this event.

For participants from Japan, Aizu is actually a well-known place. Most Japanese people know the “Byakkotai” (white-tiger corps), the treasure Mount Bandai, the beautiful Inawashiro Lake, and so on. In fact, Aizu is a very unique area in Japan. This is partly because of its abundant nature, and partly because of the profound culture made by Aizu people in the past centuries. The basic thinking of Aizu people is “Jingi” (love and righteous). Unfortunately, this thinking was not the main stream in the Meiji Restoration period. People at that time were seeking eagerly for a way to become rich and strong. Now, Japan is rich and strong, and what we do need is nothing but “Jingi”.

We hope you can enjoy your stay in Aizu during and after the event. Please try to see the nature, to talk with the local people, and to feel Aizu cultural. We believe that you will love Aizu, because this is a place containing the true beauty of Japan.

Have a nice time!

FAN2009 Organizing Committee Chairs:
Qiangfu Zhao, Hiroaki Kaminaga, Junji Kitamichi, and Keitaro Naruse

Message from the Program Committee Chairs of IWAC2009

Dear IWAC 2009 Attendees,

On behalf of the IWAC 2009 Program Committee, we are happy to welcome you to the 1st International Workshop on Aware Computing (IWAC 2009)! This workshop provides a forum for engineers, researchers, and scientists to exchange the latest results in an emerging new field of aware computing.

The ultimate goal of aware computing is to create a computing machine/system that is able to be aware. An aware system may not be as intelligent as a human, but it will certainly be more autonomous and more human-like than conventional systems. Application examples of aware computing include context awareness, situation/background awareness, power awareness, location/position awareness, weakness/risk/danger awareness, safety/security awareness, chance/opportunity awareness, etc.

IWAC 2009 is co-located with the 19th Intelligent System Symposium (FAN 2009). Besides regular sessions, 6 keynote speeches are scheduled in the two-day program. One-day tour has been arranged by the Organizing Committee of FAN 2009 who would like to pay all expense for the tour (except for lunch). Please join the tour and enjoy the beauty and richness of Aizu, which speaks for itself.

We are extremely grateful to the sponsors, the University of Aizu and the Japan Society for Fuzzy Theory and Intelligent Informatics. We would like to thank warmly other 11 supporting societies, including IEEE SMC Japan Chapter; the Society of Instrument and Control Engineers (SICE); the Institute of Electrical Engineers of Japan (IEEJ); the Institute of Systems, Control and Information Engineers (ISCIE); the Institute of Electronics, Information and Communication Engineers (IEICE); the Japanese Society for Artificial Intelligence (JSAI); Japanese Neural Network Society (JNNS); the Robotics Society of Japan (RSJ); the Japan Society of Mechanical Engineers (JSME); Japanese Society for Medical and Biological Engineering (JSMBE); and the Japan Society of Applied Electromagnetic and Mechanics (JSAEM). We would also like to thank the authors for submitting their research work, as well as the Program Committee members for their enthusiasm, time, and expertise.

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Tadahiko Murata, Shuxue Ding, and Yong Liu

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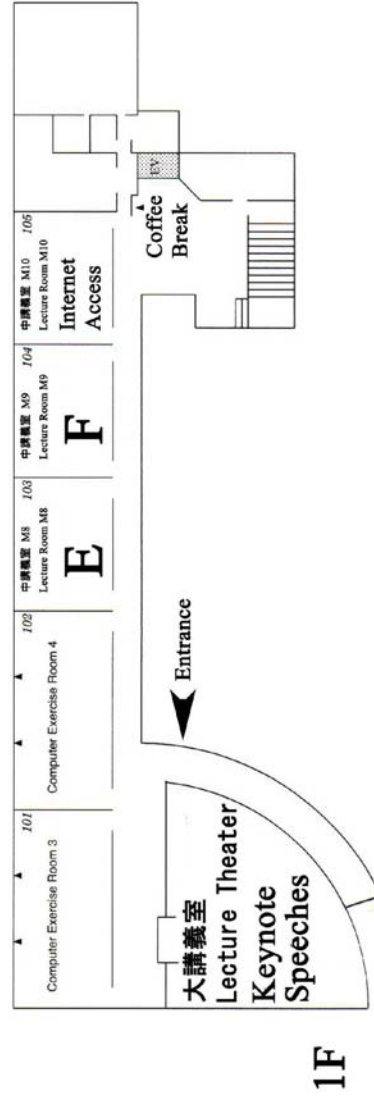
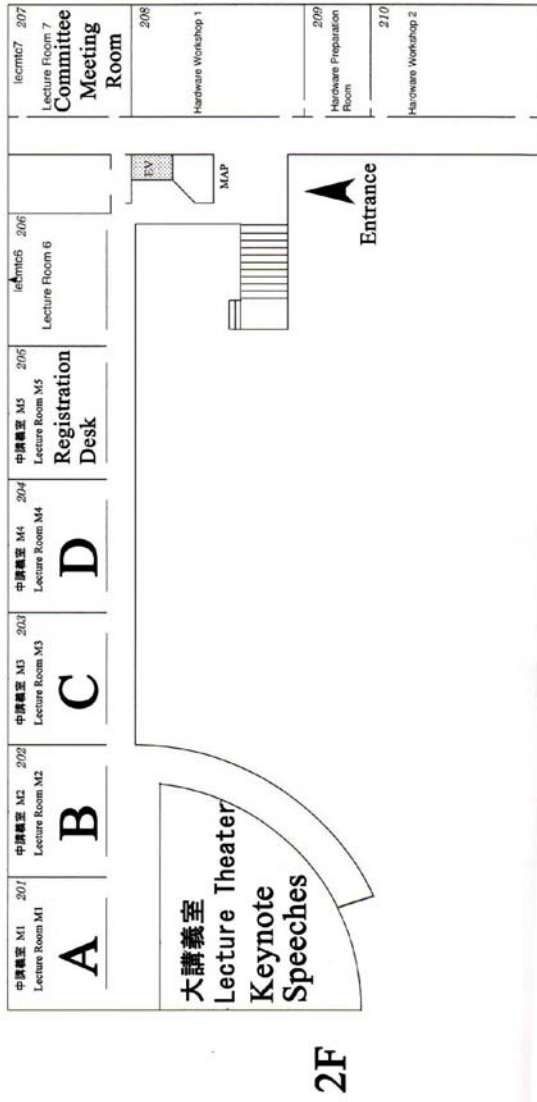
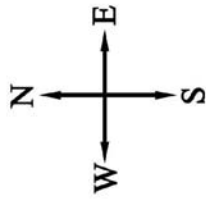
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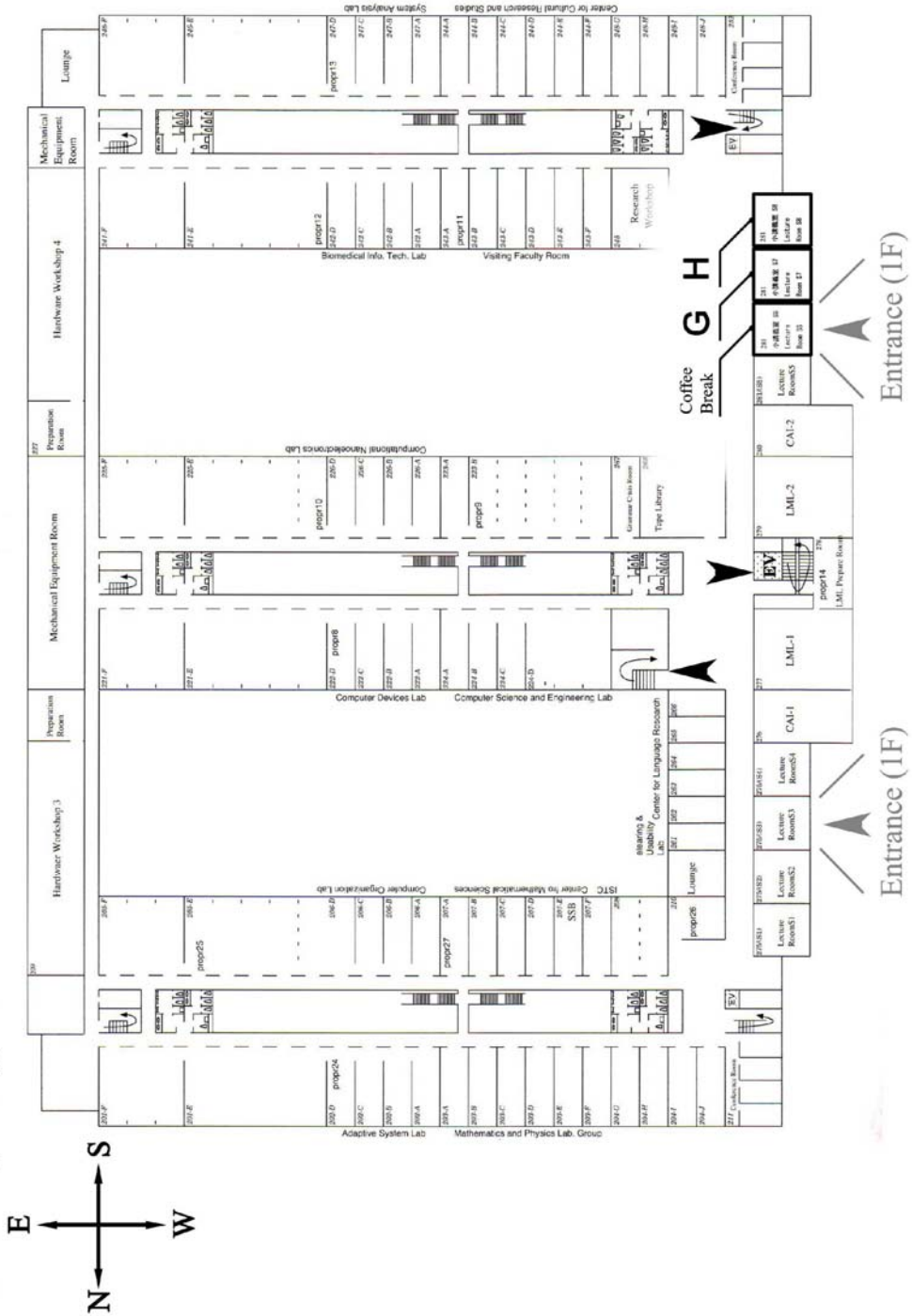
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会場案内 (Meeting Rooms)

講義棟 Lecture Hall



研究棟 2階
Research Quadrangles 2F



Note: FAN2009 will mainly use the lecture rooms in the lecture hall. However, on the second day, FAN2009 will also use one of the seminar rooms in the research quadrangle. As for IWAC2009, all meeting rooms are located in the research quadrangle, but the keynote speeches will be in the lecture theater. Please be careful. The registration desk will be same for both FAN2009 and IWAC2009.

セッション一覧

Program Outline

2009/9/17

	A (M1)	B (M2)	C (M3)	D (M4)	E (M8)	F (M9)	G (S7)	H (S8)
8:30	The registration desk will be open from 8:30 to 17:30							
8:50-9:00	Opening speech by President Tsunoyama: Chair: Prof. Jie Huang; Place: Lecture theater							
9:00-10:00	Keynote speech 1: Prof. Jianhua Ma; Chair: Prof. Jie Huang; Place: Lecture theater							
10:00-10:15	Coffee Break							
10:15-11:35	A1: Human Symbiotic System-I (74, 85, 103)	B1: Evolutionary Computation, Neural Networks and Control - I (79, 102, 109, 132)	C1: Intuitive Human-System Interaction (94, 114, 115, 126)	D1: Neural Networks and Self-Organization (35, 36, 61, 72)	E1: 3-D Pattern Analysis (1, 66, 67, 147)	F1: Intelligent Systems - I (17, 20, 38, 39)	G1: Context/Situation/Background Aware Computing - I (5, 7, 8, 9)	H1: Intention/Emotion/Preference Aware Computing - I (4, 10, 11)
11:35-11:50	Coffee Break							
11:50-13:10	A2: Human Symbiotic System-II (106, 107, 159)	B2: Evolutionary Computation, Neural Networks and Control - II (82, 89, 133, 134)	C2: Intelligent Image Processing based on Functions and Behaviors of Brain - I (46, 47, 56)	D2: Evolutionary Algorithms (9, 33, 40, 113)	E2: Human-Machine Interface (19, 48, 57, 70)	F2: Intelligent Systems - II (24, 43, 87)	G2: Context/Situation/Background Aware Computing - II (13, 20, 28)	H2: Intention/Emotion/Preference Aware Computing - II (3, 19, 27)
13:10-14:10	Lunch Break							
14:10-15:10	Keynote speech 2: Prof. Jaehie Kim; Chair: Prof. Shin; Place: Lecture theater							
15:10-15:25	Coffee Break							
15:25-16:45	A3: Human Symbiotic System-III (49, 73, 84, 104)	B3: Agent Networks - I (111, 112, 116, 117)	C3: Intelligent Image Processing based on Functions and Behaviors of Brain - II (81, 92, 93)	D3: Cutting-Edge Robotics (26, 52, 53, 155)	E3: Universal Creation/Distribution and Intelligent System - I (96, 97, 100, 101)	F3: Intelligent Systems - III (59, 63, 120)	G3: Context/Situation/Background Aware Computing - III (33, 34, 35, 43)	H3: Intention/Emotion/Preference Aware Computing - III (38, 40, 41)
16:45-17:00	Coffee Break							
17:00-18:00	Keynote speech 3: Prof. Toshio Fukuda; Chair: Prof. Mori; Place: Lecture theater							
18:30-20:30	Banquet; Chairs: Prof. Kitamichi and Prof. Wilson; Place: Washington Hotel							

2009/9/18

A (M1)	B (M2)	C (M3)	D (M4)	E (M8)	F (M9)	G (S7)	H (S8)
8:30	The registration desk will be open from 8:30 to 16:45						
9:00-10:00	Keynote speech 4: Prof. Hyungsuck Cho, Chair: Prof. Naruse; Place: Lecture theater						
10:00-10:15	Coffee Break						
10:15-11:35	A4: Intelligent Hardware Design - I - II (118, 121, 135, 136) A4: Agent Networks (58, 62, 71)	C4: Applications of Intelligent Systems in Industry - I (41, 98, 110, 122)	D4: Intelligent Robotics (75, 78, 163, 171)	E4: Universal Contents Creation/Distribution and Intelligent System - II (31, 65, 127, 169)	F4: New Trends in RoboCup Simulation - I (91, 99, 148)	G4: Location/Position Aware Computing (1, 6, 21, 32)	H4: Safety/Security Aware Computing (12, 14, 15, 22)
11:35-11:50	Coffee Break						
11:50-13:10	A5: Intelligent Hardware Design - II - III (11, 12, 13, 15)	C5: Applications of Intelligent Systems in Industry-II (69, 128, 129, 141)	D5: Mobile Intelligence (164, 166, 168, 170)	E5: Media Complex Systems - I (108, 131, 138, 142)	F5: New Trends in RoboCup Simulation - II (151, 165, 167)	G5: Machine Learning - I (27, 50, 83)	H5: Safety/Security Aware Computing - II (29, 30, 39, 42)
13:10-14:10	Lunch Break						
14:10-15:10	Keynote speech 5: Prof. Robert Kozma, Chair: Prof. Chakraborty; Place: Lecture theater						
15:10-15:25	Coffee Break						
15:25-16:45	A6: Intelligent Control (25, 32, 51, 88)	B6: Agent Networks - IV (119, 153, 179)	D6: Cutting-Edge Robotics - II (123, 124, 125, 150)	E6: Media Complex Systems - II (139, 146, 152, 154)	F6: New Trends in RoboCup Simulation - III (130, 90, 156)	G6: Machine Learning - II (21, 22, 77, 80)	H6: Power/Capability/Chance/Opportunity Aware Computing (16, 31, 36, 37)
16:45-17:00	Coffee Break						
17:00-18:00	Keynote speech 6: Prof. Takeshi Yamakawa, Chair: Prof. Ding; Place: Lecture theater						
18:05-18:50	Award ceremony, Chair: Prof. Liu; Place: Lecture theater						
18:50-19:00	Closing speech by Vice President Mirenkov; Chair: Prof. Liu; Place: Lecture theater						

Note: Numbers in the parentheses are the paper IDs assigned by the paper submission system.

The sessions G5 and G6 belong to FAN 2009.

Towards Intelligent Visual Perception: The State of the Art Technology and Future Perspectives of Machine Vision System

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Despite the enormous growth in vision-related hardware and software developments over several decades, machine perceptual systems in current use and development are still equipped with much less functionalities and lower level in intelligence, when compared with their biological counterparts.

This talk reviews the nature of human perception and addresses the current developments and restrictions in machine vision systems from the views of acquisition, processing and understanding of visual information. These are discussed from aspects of their hardware and software capabilities of visual perception. The first part of the talk describes the nature of human visual perception briefly and compares the information and processing flows of machine vision system with those of human system. The state of the art hardware technology and visual software algorithms are presented in order to see how high their functional levels in terms of flexibility, adaptability and cognitive capability. In the second part, high level vision is discussed by elucidating human-like visual perception to conceptualize how current vision technology is moving towards intelligent perception.

Intelligent Robotics and Automation for Human Support

Toshio FUKUDA

Center for Cooperative Research in Advanced Science and Technology

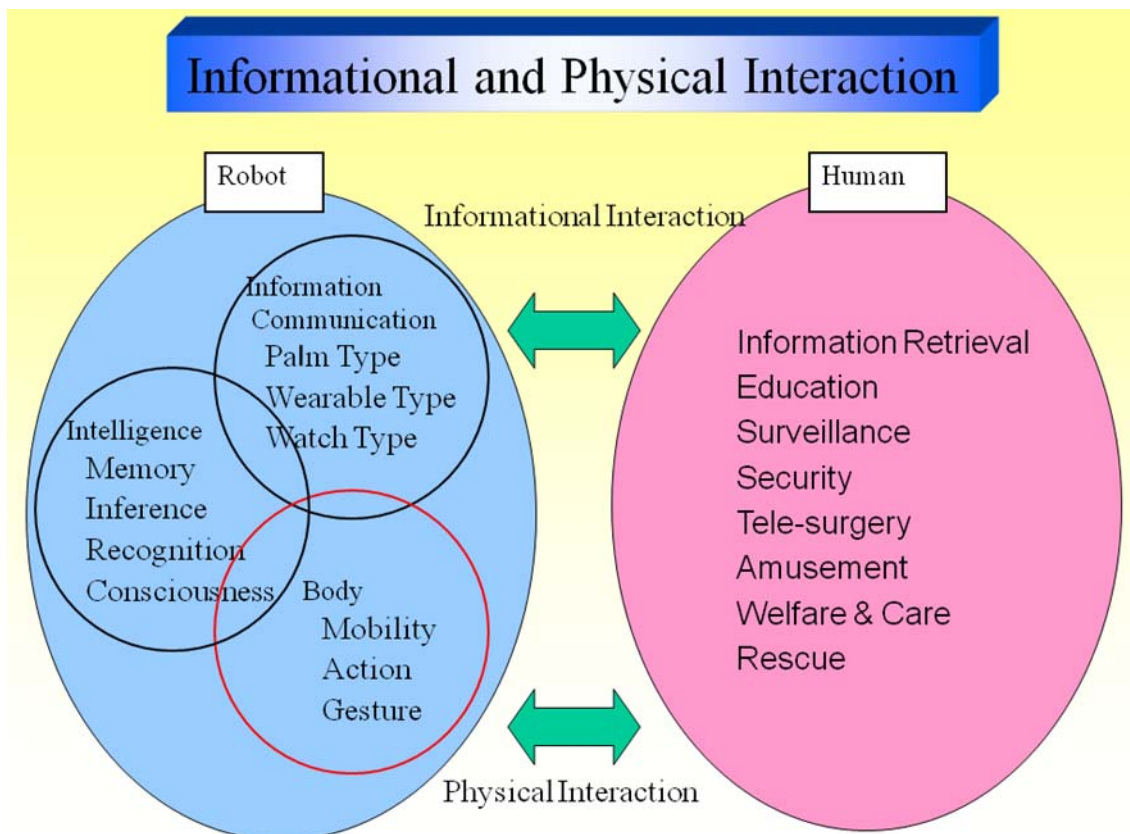
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The robotic applications growing as the robotic technology has rapidly been developing and the market is demanding in many areas, such as applications for safety and security, natural hazards, education and so on.

One of the important applications is that the robotic technology assists and supports the human to live in the good quality of life. In this presentation, the human support is classified into (i) physical support, (ii) skill support, and (iii) intelligence support.

Some technology advancement and difficulties will be shown in conjunction with the computational intelligence.



Advances in Biometric Technology

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The biometrics is a field of technology to automatically identify a person using physiological or behavioral traits like the fingerprint, iris, face, hand vein, etc. It becomes a new solution to security management for its high security and convenience. In this talk, some in new biometric technology are introduced: these include the touch-less fingerprint recognition, fake fingerprint detection, iris recognition at a distance, biometrics in mobile devices, 3-dimensional face recognition, and face entertainment center. Concluding remarks are made with an expectation for the future biometric technology.

Phase Transitions in Brains and Brain Models – Neural Substrates of Higher Cognition and Awareness in Man and Machines

Robert Kozma

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Higher cognition granulates the seemingly continuous temporal sequences of perceptual experiences into meaningful and comprehensible chunks of concepts and complex behavioral schemas. They are accessed during future action selection and decisions. These activities use spatio-temporal patterns emergent over dynamic landscapes, and provide an alternative to the notorious symbol grounding problem. Mathematically, these processes have been successfully described using ODEs with distributed parameters and by PDEs derived for the cortical tissue. In an alternative approach, we introduce neuropercolation model based on random graph theory, linking pattern-based spatio-temporal encoding and generalized, non-local percolation and phase transitions in random graphs. Scale-free behavior and small-world effects in cortical tissues are important properties exhibited by neuropercolation.

Unlike phase transitions in classical physical systems, neural phase transitions have a mesoscopic character, with intermittent long-range correlations. The observed behaviors have been described as the manifestations of intentional neurodynamics with complex spatio-temporal encoding of sensory data in the context of the animal's past experiences and future actions. Noise is a driving source of the corresponding dynamics, producing random processes with apparent deterministic characteristics. Phase transitions in cognitive processing represent a new class of phenomena as a necessary substrate of awareness in animals and animats. This talk introduces the mathematical basics of phase transitions in large-scale random graphs and applies the derived mathematical tool for the interpretation of neurophysiological experiments and for building intelligent devices with higher cognitive capabilities.

Pervasive Smart u-Things and u-Intelligence: Visions and Challenges

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1. Smart u-Things and u-Intelligence

Weiser and Brown summarized the modern computing history in three waves/phases/eras/trends: the MC, the PC and the UC (Ubiquitous Computing), which correspond to three kinds of relationships between human and computers that are with different sizes/forms/users. The following table, maybe incomplete and incorrect, is my attempt to list other essential features in the three waves.

Features / Waves	1st Wave (MC)	2nd Wave (PC)	3rd Wave (UC)
Human-Comp Relation	m-to-1	1-to-1	1-to-m
Computing Element	Mainframes	Personal Computers	u-Things
Size/Form/User	Large/Stationary/Few	Small/Portable/Many	Invisible/Everywhere/All
Main Role/Objective	Calculation	Information	u-Service
Processing Content	Data	Media	Context
Main Driving Force	Fast, Precise, Reliable	Rich, Convenient, Secure	Aware, Comfort, Safe
Basic Behavior	Passive	Interactive	Active/Life-like/Smart/UI
Theory/Technology	Computer Sci./Eng.	Information Sci./Eng.	u-Sci./u-Eng.

The u-things, as opposed to digital e-things existing on computers/Web/Internet, are physical things (various real objects and spaces) with attached, embedded or blended computers and/or other devices. Smart u-things are ones that can, more or less, sense, compute, communicate, and may take some actions according to their goals, situated contexts, users' needs, etc. Ubiquitous intelligence (UI, u-intelligence) is focused on various levels/kinds of intelligence of the real smart u-things, related technologies and their pervasion in the real world in order to offer ubiquitous/pervasive services (u-services) to all people.

2. Real World Challenges

As smart u-things exist in the physical environments, i.e. the real worlds that are familiar to our human but extremely hard to deal with correctly and adaptively by these computerized everyday objects and spaces. This is mainly because of intrinsic complexity of real worlds. So, the fundamental challenges are

- To understand and model complex real world worlds including their diversity, uncertainty, unpredictability, imprecision, exception, safety as well as various social and psychological factors;
- To study related technologies to deal with these complexities and make practical

applications.

3. Key Issues to Challenge Real World Complexity

Since an ideal smart u-thing is expected to be able to act autonomously in right time, right place and right means under the complex world conditions, the following are related key research issues/topics:

- Situation Approximation & Awareness
- Knowing Users' Needs
- Complicated Things' Relations
- Knowledge Management/Growth
- Self Awareness
- Looped Self Adjustment
- Exception Handling
- UbiSafe - Safety & Satisfaction

Development of Advanced Epilepsy Treatment: Exodus from Loss of Awareness

Takeshi Yamakawa

Department of Brain Science and Engineering
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Up to 5% of people in the world may have at least one seizure in their lives and about 1% are suffered from seizures hindering their daily life. The seizures produce loss of awareness in some cases. Although the seizures can be suppressed by adequate medication for about 80% of them, the residual 20% are not affected by the drug. The effective treatment for these patients of drug-resistant epilepsy is a surgical treatment to remove the "epileptogenic focus".

The current localization accuracy of the epileptogenic focus is not good and thus the extirpation of focus with significant margin causes the removal of normal brain and leads to the severe aftereffects such as restricted vision, motor dysfunction, disorder of memory, and so on. To cope with this problem, we should develop the technology of (1) detecting the epileptogenic focus, and (2) necrotizing the epileptogenic focus excluding normal brain.

In order to identify the location of the epileptogenic focus which may be a point, definite area or disseminated form, the activated area of epilepsy should be detected by the non-invasive method, for instance, an optical topography (a kind of Near-Infrared Spectroscopy : NIRS). The location of the focus may be obtained by the transient waveform of the optical topography which is similar to the solution of an inverse problem. The candidate of the tool for solving the problem would be the SOR network developed by the author.

After identifying the location of the epileptogenic focus, almost all of the focus area should be necrotized by the way in which the narrow area can be affected with checking. The necrotizing equipment for the narrow area should be fine for not delivering damages on the healthy area of the brain. In our research two candidates of necrotizing equipments will be developed as shown in the following.

Rapid freezing and thawing of the biological tissue cause necrosis of cells and neurons in the narrow area because of destruction of sub-cellular organelle by the difference of salt concentrations. This is well-known as cryoablation in hepatoma, lung malignancy, carcinoma prostata, and so on, where the tip of the freezing probe is about several cm and not suitable for minimally invasiveness and narrow area freezing. Thus the coaxial double tube structure is employed for fine tip of the probe, where the outer diameter of the probe is less than 1 mm.

Another candidate to necrotize the focus of narrow area is a laser light focused on the target tissue. It exhibits the flexible treatment by changing the intensity, wavelength, time period of exposure, and thus a variety of usage will be expected.

The minimally invasive surgery for drug-resistant epilepsy is to be developed within three

years by the support of JSPS (Japan Society for the Promotion of Science) in which the restricted area of the brain (epileptogenic focus) is necrotized excluding the healthy part of the brain. By employing this technology and equipment brain surgeons will be able to save the lives of patients of serious epilepsy and the patients may accomplish the exodus from loss of awareness.

[Acknowledgments]

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Sept. 17, 2009

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