Introduction of Academic Areas

National University Corporation
Japan Advanced Institute of Science and Technology

CONTENTS

Human Life Design

Designing a high Quality of Life (QoL) with harmonious collaboration between human and machine by fusing human information processing and knowledge science

Overview:

Human life design area aims to create a gentle, attractive and harmonious "way of life" and "society".
Toward this goal, we

(1) Acquire the fundamental knowledge about the biological characteristics such as mental, cognitive and physical of human on the basis of the study such as psychology, physiology, brain science, cognitive science, and so on.

(2) Research and develop elemental and applied technologies to support and extend the various activities of individuals and groups, based on the knowledge about the biological characteristics of human, and also considering sociality of a human being.

(3) Design a new ways of life and scene of social system (human life) under the complex relationships and interactions between human-human or human-object, by fusing those findings and technologies.

Through these three research activities, we realize an innovation for QoL improvement, and pursue materialization of a rich and fulfilling human society and knowledge creation.

Keywords:

Perceptual information processing, Interaction, Cognition/Psychology/Behavior, Human Interface, Social Psychology, Interactive Systems, Creativity Support, Groupware, Design Thinking, Media Art, Human life and science, Social Infrastructure, Care support, Network science and service, Innovation Design

Education policy:

This area is a fusion area whose professors have been promoting the study of human in Knowledge Science and Information Science.

In this area, we implement comprehensive and interdisciplinary education and research, from a primitive level, such as brain function, perception, and cognition, to a higher level, such as creation and social activities, by handling the activities of human as intelligent life, and also considering demonstration of technologies and the ideas in social life.

We hope our student to be a leader to open up the future of society, by focusing on one of the levels of research but without remaining only in that level, having interests not only in technologies but also in human activities as a design engineer, and deepening their insight by reflecting a variety of perspectives.

Faculty:

Vice-President: NAGAI Yukari
Professor: UNOKI Masashi, NISHIMOTO Kazushi, HAYASHI Yukio, FUJINAMI Tsutomu, MIYATA Kazunori
Associate Professor: KANAI Hideaki, KIM Eunyoung, SATO Toshiki, HIDAKA Shohei, YUIZONO Takaya, YOSHITAKA Atsuo

Examples of research activities in Human Life Design Area

Knowledge Management

Interdisciplinary educational and research area for innovation design based on Knowledge Science

Overview:

Human knowledge, distinct from money, lands, or natural resources, is the most precious managerial resource in the global society, where people and machines are connected rapidly and seamlessly by the IoT (Internet of Things). JAIST initiated the establishment of the field of "Knowledge Science" in the world, preceding the coming of a "knowledge society". We are studying knowledge creation in the extent of individuals, organizations, and societies, by combining humanities and sciences. Our fundamental questions are "What is knowledge?", "How is knowledge created?", and "How should knowledge be utilized?" We are fostering young students and working professionals who will be able to contribute to social development by solving social problems through technological/regional innovations.

Keywords:

Service science, System science, Data mining, Explainable artificial intelligence, Ethnography, Marketing, Decision-making, Social simulation, Complex systems, Language and Communication, Experimental philosophy Learning science, Knowledge management, Management of Technology, Regional management, Consulting, Tourism, Medical care, Nursing care, Education

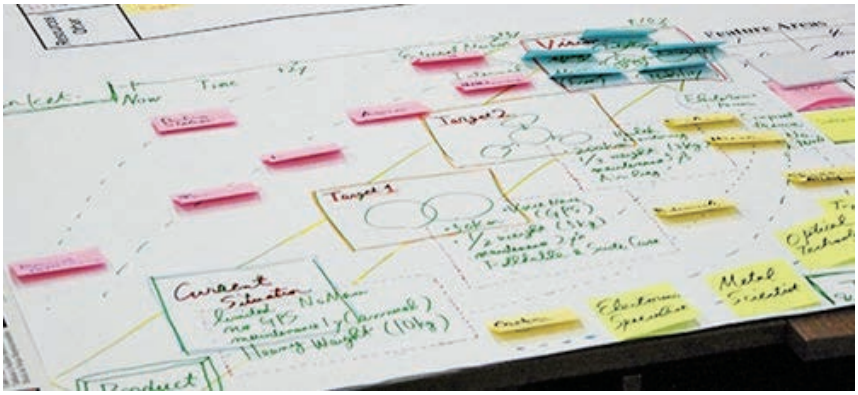
Education policy:

Our research area is conducting cutting edge research on (1) knowledge creation methodology to analyze social problems, (2) system design methodology to design effective service systems to solve the problems, and (3) business methodology to implement the systems. We are fostering young students for the knowledge society who have the basic skills of the three methodologies. We are also in charge of the education of working professionals who are seeking for solutions of practical issues in their workplace.

Faculty:

Professor: IKEDA Mitsuru, UCHIHIRA Naoshi, KOHDA Youji, SATO Osamu, SHIKIDA Asami, HASHIMOTO Takashi, HUYNH Nam Van, HIRAISHI Kunihiro

Associate Professor: ITO Yasunobu, KANG Rihyei, GOKON Hideomi, SHIRAHADA Kunio, DAM Hieu Chi, MIZUMOTO Masaharu



Roadmapping: a Methodology in Knowledge Science

Security and Networks

The basic technology education and research of ICT systems that support the development of advanced information society and science and technology

Overview:

Computer systems and networks have become increasingly important to our modern life. These information and communications technologies, or ICT, are the foundation that enables apps on our smartphones, that provide information security, that allow our mobile devices to connect wirelessly to the cloud. In the future, this trend is clearly increasing as "smart technologies" combine to form the Internet of Things. In addition, ICT investment has a close relationship to corporate performance, and has become a key driver of national growth strategy. The Security and Networks Research Area at JAIST performs research and graduate education on the fundamentals of ICT systems, to make wide-ranging contributions to industry, standardization activities and governmental policy making.

Keywords:

smart city, cyber security, Internet of Things, the Internet, information systems, embedded systems, software engineering, next generation wireless communications, integrated circuits and systems, information theory

Education policy:

The fundamentals of engineering from the areas of computer science, networking and information security, as well as mathematics, are integral to education within the Security and Networks Research Area at JAIST. Courses are designed to develop students' ability to understand essential theories, technologies and methods. This provides skills that will serve students throughout their career, as they develop the next generation of ICT systems. In addition, our practical seminars including project-based learning are effective in fostering practical skills needed in the workplace.

Faculty:

Professor: AOKI Toshiaki, INOGUCHI Yasushi, KANEKO Mineo, KURKOSKI Brian M., SHINODA Yoichi, TAN Yasuo, FUJISAKI Eiichiro
Associate Professor: ISHII Daisuke, SUZUKI Masato, TANAKA Kiyofumi, LIM Yuto
Research Associate Professor: CHINEN Ken-ichi, BEURAN Razvan Florin
Senior Lecturer: TOMITA Takashi

VLSI and embedded systems, network devices, servers, and smart house experimental environment

Intelligent Robotics

The interdisciplinary study of perception-action robot and logically intelligent agent

Overview:

The humanoid robot is one of the ultimate goals of computer science. The robots are expected to support our daily lives, including disaster relief and care for aged people, where they are supposed to behave with enough intelligence as well as mechanically smooth body movement. This area covers these two aspects of intelligence and robotics, that is, we aim at building an autonomous cognitive agent with independent knowledge and inference mechanism based on advanced software engineering, as well as on mechanical/control engineering. The area includes the study of robot as a unit of perception/action cycle, mathematical logic as a foundation of inference, distributive/parallel system, software verification, and techniques for agent communication. Thus, we contribute through our interdisciplinary efforts to the further development of our society.

Keywords:

artificial intelligence, mechanical engineering, control engineering, mathematical logic, software engineering, distributive system

Education policy:

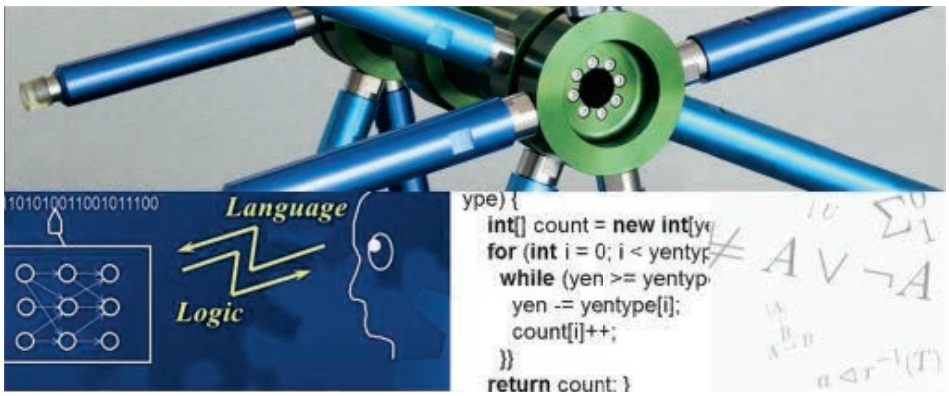
This area aims at fostering students as global leaders of future society or excellent scientists, who are equipped with (a) discussion/writing skills based on sufficient knowledge of mathematics and technical terms in English, (b) planning methodology as to short-term/long-term milestones, and (c) knowledge of the process from detailed survey to the completion of novel academic contribution.

Faculty:

Professor: ISHIHARA Hajime, OGATA Kazuhiro, OGAWA Mizuhito, NGUYEN Minh Le, CHONG Nak-Young, TOJO Satoshi

Associate Professor: ASANO Fumihiko, OKADA Shogo, SCHWARTZMAN Gregory, JI Yonghoon, HIROKAWA Nao, HO Anh-Van

Senior Lecturer: YOKOYAMA Keita



The axial part of walking robot (upper half), and AI, software, and logic (lower half)

Entertainment Technology

Establishment of well-developed society where people can enjoy delightful learning and living by applying a wide variety of information technology/AI technology

Overview:

Information technology is essential for convenient and trustworthy society. To further develop the society for people to enjoy delightful learning and living, this area aims at establishing a better relationship between people and computer by making the most use of a wide variety of technology of artificial intelligence and human information processing. Its research interests include game AI for entertainment, system or game AI that can support human's learning, standard criterion to measure pleasure or difficulty of a game or puzzle, sophisticated natural language processing and image processing for interaction with human. Thus, we contribute our interdisciplinary efforts to the development of a delightful society.

Keywords:

artificial intelligence, game AI, machine learning, natural language processing, learning support system, gamification, algorithm, computational geometry, image information science, computer vision

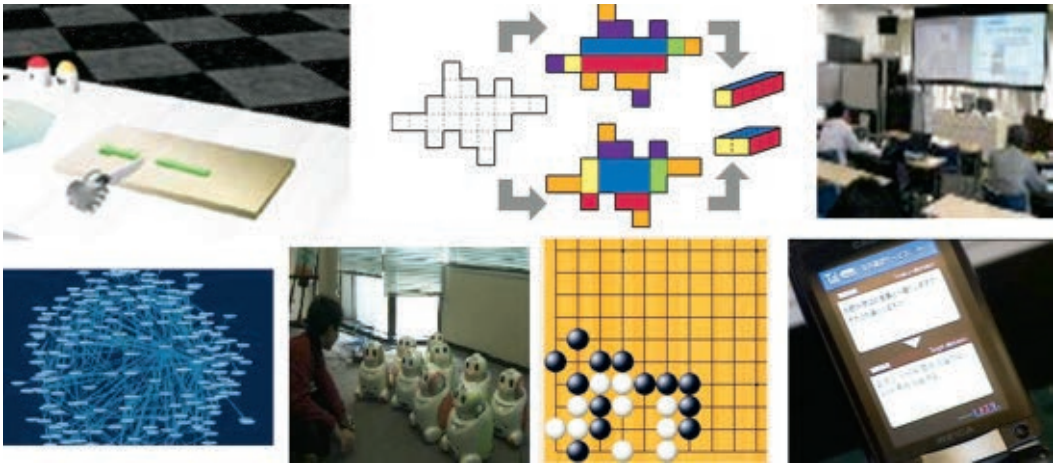
Education policy:

This area explores entertainment for a happy life by integrating fundamental techniques such as game, machine learning, learning support, natural language processing, artificial intelligence and computer vision, as well as by combining deep analysis and modeling of human's perception, recognition, thought and sentiment.

To achieve it, students learn fundamental techniques and theories of information science as well as advanced knowledge of sub-fields. They also cultivate abilities necessary to become advanced scientists or engineers, such as problem finding, modeling, substantiation, implementation, evaluation, presentation skill, communication skill and scheduling.

Faculty:

Vice-President: IIDA Hiroyuki
Professor: UEHARA Ryuhei, KOTANI Kazunori
Associate Professor: IKEDA Kokolo, SHIRAI Kiyoaki, HASEGAWA Shinobu



In the upper row, from the left, animation generation from cooking recipe, a common development of two different boxes, a distance lecture
In the lower row, from the left, entertainment on network, a communication robot, tsumego generation, machine translation on mobile phone

Energy and Environment

Learning and putting state-of-the-art sciences/technologies into practice to contribute to solving energy and environmental issues and realizing sustainable future societies

Overview:

We tackle global energy and environmental issues and contribute to realizing sustainable and symbiotic societies in the future by using four primary areas of our scientific/technological expertise integrated with state-of-the-art technology in knowledge sciences: 1) Creation of new materials for renewable energy to be used in innovative methods such as a liquid process and researches of renewable energy material-device technologies applied for solar cells and thermoelectric conversion devices, 2) Elemental chemistry- & biofunction-based technology for the establishment of sustainable society focusing on development of high thermomechanical performance plastics, 3) Advanced environmental sensors based on nano-electro-mechanical (NEM) devices and zero-power & functional system integration technology, and 4) Materials-Informatics based on Data Mining and Quantum Simulations.

Keywords:

Green technologies, Nano-liquid process, Renewable polymers, Thermoelectronics, Solar cells, Ab initio electronic structure calculations, Nano-electro-mechanical (NEM) devices, Materials Informatics

Education policy:

This area features its multidisciplinary and advanced natures realized by hybridizing the diverse faculty members' research expertise in energy and environment. We provide comprehensive education and research programs by covering a wide range of sciences and technologies to build sustainable societies. Those include atoms/molecules based fundamental sciences, state-of-the-art material integration nanotechnologies for bioplastics, energy-conversion devices and zero-power integrated functional systems, and material informatics based on computational sciences. The students enrolled in this area are expected not only to acquire profound knowledge founded on the study and research in the individual areas but also to master the new methodologies to expand their research expertise into new domains with a full awareness of social contributions. The students will eventually become capable of making substantial contributions to the sustainability with the leading-edge technologies.

Faculty:

Professor: OHDAIRA Keisuke, KANEKO Tatsuo, KOYANO Mikio, MAEZONO Ryo, MIZUTA Hiroshi
Associate Professor: OKEYOSHI Kosuke, HONGO Kenta
Senior Lecturer: CHAMMINGKWAN Patchanee, MASUDA Takashi, MURUGANATHAN Manoharan

Our quest for breakthrough in the Energy and Environment research

Materials Chemistry

Contributing to the creation of novel functional materials based on designing the basic structure from the perspective of chemistry

Overview:

This area focuses on the design of novel functional and high-performance materials through basic and applied chemistry with the aid of advanced characterization facilities. We contribute to society by proposing innovative chemical products and fabrication processes to industries, necessary for the enriched sustainable society. Moreover, we aim to foster future researchers and technical experts who have the ability to develop new materials on the basis of design at the atomic and molecular levels with advanced knowledge of chemistry.

Keywords:

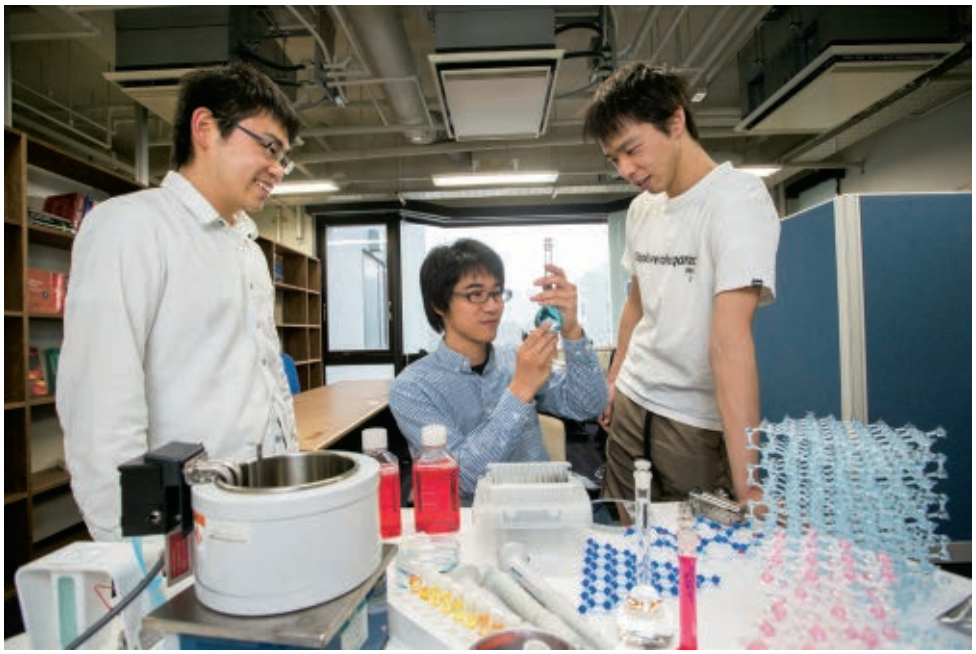
Nanomaterials chemistry, Polymer chemistry, Green chemistry, Energy-related materials, Biocompatible materials, Catalyst chemistry, Analytical chemistry

Education policy:

This is a new area organized mainly by faculty staff in the area of chemistry. We aim for students to obtain not only the skill of advanced characterization for composition and structure of materials but also the ability to design basic structure of materials with new functions. In addition, we aim to nurture students to understand the technology and materials which are required in industries and contribute to society by the technological development and creation of new materials from the perspective of chemistry.

Faculty:

Professor: MAENOSONO Shinya, MATSUMI Noriyoshi, YAMAGUCHI Masayuki
Associate Professor: SHINOHARA Ken-ichi, TANIIKE Toshiaki, NAGAO Yuki, NISHIMURA Shun, MATSUMURA Kazuaki, MIYAKO Eijiro, YAMAMOTO Yuko S.



Applied Physics

Opening up the future of materials science by approaches of applied physics and engineering by exploring and making full use of nanoscience and nanotechnology

Overview:

Our mission is to develop nanotechnology based on the science of atoms and molecules by seeking and acquiring the wisdom and skill in applied physics. We explore unprecedented technologies towards realization of ubiquitous devices, quantum devices, micro- and nano-machines, atom and molecule manipulators, and so on, which will provide rapid progress in building infrastructures for the future society. We contribute to solving the environmental and energy issues and supporting the safe, reliable and sustainable human society, by using the innovative technologies. Offering rich experience in cutting-edge nanoscience and nanotechnology, we educate our students to become challenging materials scientists capable of figuring out the essential cores of various issues through their ability to think from the perspective of physics.

Keywords:

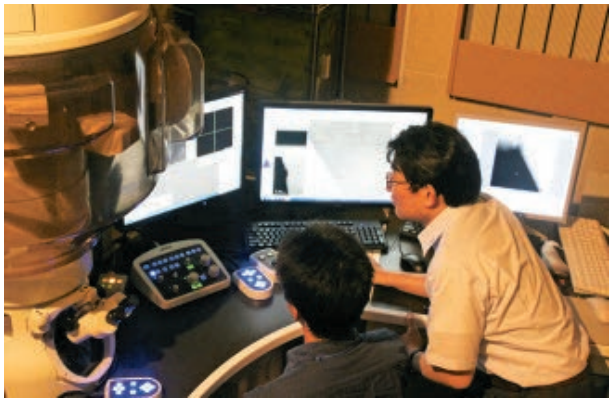
Nano-materials, Nano-devices, Nano-imaging and measurements, Micro- and Nano-fabrication, Hybrid organic/inorganic materials, Electronics, Spintronics, Photonics

Education policy:

We foster students to be excellent scientists and experts by providing chances to enhance their intellectual and distinguished power to lead the next generation; they can explicate with physical perspectives the essence of the issues and stride seamlessly across various fields. The frame of physics is very tough. Physics has evolved in principled and inductively intellectual struggles to understand the phenomena in nature. Learning physics and depicting our future are the same as "standing on the shoulders of giants". In addition, the objectives in applied physics spread widely and openly, leading the students to be active globally beyond any boundaries, whereas their expertise in physics is being reinforced. We aim at realization of dream futures with the students by solving the issues and difficulties faced by human beings, using the wisdom and skills which were established by respected scholars and experts in the fields of physics and applied physics.

Faculty:

Professor: OSHIMA Yoshifumi, SUZUKI Toshi-kazu, YAMADA-TAKAMURA Yukiko, TOKUMITSU Eisuke, TOMITORI Masahiko, HORITA Susumu, MIZUTANI Goro, MURATA Hideyuki
Associate Professor: AKABORI Masashi, AN Toshu
Senior Lecturer: FLEURENCE Antoine



Spanning wisdoms using essences of cutting-edge science and technology
—The untrodden world of nano-materials being challenged using a scanning transmission electron microscope (STEM) with atomic resolution—

Bioscience and Biotechnology

Exploration and application of biological functions through analysis, engineering, and organization of biomolecules

Overview:

Living organisms exhibit a variety of biological functions derived from various biomolecules such as proteins, nucleic acids, lipid membranes, and sugar chains. In this area, we investigate biological functions of these biomolecules in molecular and cellular levels and design and synthesis of novel artificial biomolecules and biomolecular systems through utilization of unique biotechnologies that have been developed in JAIST. We also contribute to society with collaboration with industry in medical and environmental fields by applying our innovative biotechnologies including biodevice and biosensing technologies.

Keywords:

Bio-related chemistry, Biotechnology, Chemical biology, Synthetic biology, Biomolecular design, Biodevices, Biosensing, Advanced medicine

Education policy:

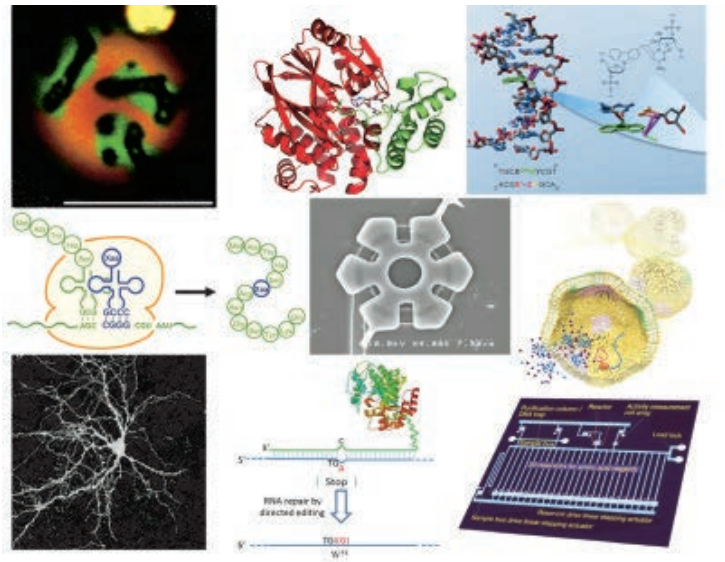
This area aims to understand, explore, and design biological functions. Students belonging to this area will study basics and applications of biology and its related subjects including chemistry and physics, and explore advanced and challenging research topics under the excellent research environment equipped with the latest research instruments. Through these activities, they will learn scientific knowledge, experimental skills, and abilities required of researchers in this area. After graduation, they will work as scientists and experts who can contribute to solution of various problems in society from a view point of bioscience and biotechnology.

Faculty:

Professor: OHKI Shinya, TAKAGI Masahiro, TAKAMURA Yuzuru, TSUKAHARA Toshifumi, FUJIMOTO Kenzo, HOHSAKA Takahiro

Associate Professor: TSUTSUI Hidekazu, HAMADA Tsutomu, HIRATSUKA Yuichi, YAMAGUCHI Takumi

Senior Lecturer: SHIMOKAWA Naofumi, NAGAI Ken, WATANABE Takayoshi



Images of research topics for each faculty member

National University Corporation
Japan Advanced Institute of Science and Technology

1-1 Asahidai, Nomi, Ishikawa, 923-1292, Japan
https://www.jaist.ac.jp/english/