AY2025 Admission Guide

Department of Mechano-Informatics

Graduate School of Information Science and Technology
The University of Tokyo

Master's Program

Doctoral Program

Contact [Department Administration Office]
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Under "Prospective Students" on
https://www.i.u-tokyo.ac.jp/index_e.shtml
click on "Admissions" →"Departments and Faculty"
→"Mechano-Informatics" → "Admissions"

In addition to this brochure, be sure to refer to "Admission Guide: Graduate School of Information Science and Technology, The University of Tokyo."

(I) Master's Program

(1) Applicants should refer to the "AY2025 Admission Guide: Master's Program, Graduate School of Information Science and Technology, The University of Tokyo".

(2) Preference Card and supervising professor

In the "Preference Card (for Master's Program)", indicate your preferences for the field of interest and research plan, etc., and submit the card together with your other application documents. Check "Faculty and Labs in Department of Mechano-informatics" at the end of this booklet and enter your first to 10th choices of supervising professors in the field "Your selection of Lab" of the Web application system. If the professor of your choice cannot be assigned, any other professor available may be assigned.

(3) Expertise Assessment Card

Submit two-pages document to assess your expertise regarding research activities, creative activities in a university lecture or practicum, and extracurricular activities.

(4) Examination Schedules

a. Document screening

Document screening will be conducted based on the submitted documents. Regarding the notification of the screening, refer to the "AY2025 Admission Guide: Master's Program, Graduate School of Information Science and Technology, The University of Tokyo".

b. General education subjects

Mathematics examination is conducted. Refer to the "AY2025 Admission Guide: Master's Program, Graduate School of Information Science and Technology, The University of Tokyo" for detail.

c. Foreign language (English)

TOEFL scores will be used to evaluate the applicants' English skills. For details, refer to "Guidelines for Submission of TOEFL Scores (for AY2025 Entrance Examinations)."

d. Specialized subjects and oral examination

The examination will be conducted only for applicants who have passed the document screening, taken the general education subject (mathematics) examination, and whose TOEFL score submitted has been considered valid. The oral examination will be held online.

Examination date	Examination times	Examination subjects	Examination content	Notes:
August 19 (Monday), 2024 – August 23 (Friday), 2024	Between 9:00 a.m. and 6:00 p.m.	Mechano-Informatics	English presentation of expertise, field of study and research plan (7 minutes) and oral examination. Topics related to mechanics-related fields (mechanical dynamics, control, mechatronics, robotics, etc.) and information-related fields (fundamentals of information science, digital circuits, computers, software, etc.) might be asked during examination.	The URL of online examination will be announced by August 16 (Friday), 2024.

(5) Notes

a. Applicant must prepare a Windows PC or Mac with an external web camera and connect to the Zoom for the online oral examination.

b. Applicant must prepare slides for the presentation in advance and share the screen during the oral examination.

c. For other notes, carefully read the “Notes for Specialized subjects and oral examination” section of this guide.

Please be sure to check the department webpage, where more detailed information may be posted whenever necessary.

(II) Doctoral Program

(1) Applicants should refer to the "AY2025 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo", and must receive guidance from their prospective thesis advisor before submitting their applications.

(2) Preference Card and prospective supervisor

After consulting with your prospective supervisor, indicate your preferences for the field of interest and research plan, etc., on the "Preference Card (Doctoral Program)", and submit the card together with your other application documents. Enter the name of your prospective supervisor in the filed of "Supervising professor of your choice" of the Web application system.

(3) Application Period

Note that different application periods are scheduled for Summer and Winter Examinations. For details on the application periods, refer to the "AY2025 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo".

(4) Examination Schedules

a. Summer Examinations

1) Primary Examinations

The oral examination will be held online.

Examination date	Examination times	Examination subjects	Examination content	Notes:
August 19 (Monday), 2024 – August 23 (Friday), 2024	Between 9:00 a.m. and 6:00 p.m.	Mechano-Informatics	Mechano-Informatics (Oral Examination) Topics related to mechanics-related fields (mechanical dynamics, control, mechatronics, robotics, etc.) and information-related fields (fundamentals of information science, digital circuits, computers, software, etc.) might be asked during examination.	The URL of online examination will be announced by August 16 (Friday), 2024.

Notes:

a) Oral Examinations will focus on the content and progress of the applicant's Master's thesis or an equivalent research project, as well as concepts and plans for the prospective doctoral research theme, and related knowledge in the Mechano-Informatics field. Applicants must prepare slides for the presentation in advance and share the screen during the oral examination, and will be required to answer questions.

b) Oral Examinations for applicants who are expected to complete a Master's or Professional degree program by September 30, 2024 will simultaneously serve as the secondary examinations. Refer to "Notes" on Secondary Examinations below.

As an examination of foreign language skills, English proficiency will be evaluated based on submitted TOEFL

scores. For details of how to submit TOEFL scores, refer to the “AY2025 Admission Guide: Doctoral Program, Graduate School of Information Science and Technology, The University of Tokyo”.

Applicants who have completed (or are expected to complete) a Master's program at the University of Tokyo are not required to submit TOEFL scores.

Supplementary information may be provided on the following web page. Be sure to check:

https://www.i.u-tokyo.ac.jp/edu/course/m-i/admission_e.shtml

2) Secondary Examinations

The secondary examination is conducted by oral examination. The secondary examinations will be conducted for those who pass the primary examinations, on the completed Master’s theses or equivalent research projects.

Notes:

a) The secondary examinations will be scheduled between late January and early February of 2025; applicants will be notified of the details later. For applicants who wish to enter the graduate school in October 2024, and those who wish to enter in April 2025 but have completed or are expected to complete a Master's or Professional degree program by September 30, 2024, the secondary examinations will be conducted during the period of the primary examinations.

b) Applicant must submit a copy of one’s Master's thesis or an equivalent document and slides for the presentation according to a later notice. Share the slides on the screen during the oral examination to make a presentation on the content of research within a specified time limit, and answer questions.

b. Winter Examinations

Primary Examinations and Secondary Examinations will be held between late January and early February, 2025 to accept a few applicants.

Details on examination methods, schedules, and locations will be posted on the following web page in October:

https://www.i.u-tokyo.ac.jp/edu/course/m-i/admission_e.shtml

(5) Applicants for the Special Selection for Professionals（社会人特別選抜） must contact the Department Administration Office before submitting their applications. These applicants must include in the “Application Documents” specified in “AY2025 Admission Guide: Doctoral Program [Special Selection for Professionals], Graduate School of Information Science and Technology, The University of Tokyo” the following seven types of materials describing their research and achievements in the field of mechano-informatics. Applicants might be exempted from the written examination by the contents of “Application Documents”. No specific form is provided.

i. The list of research achievements (written in Japanese or English)

Provide a list of academic papers, patents, products, and other evidences of the applicant's achievements accomplished as a part of her/his profession. In the case of collaborative achievements

with several persons, clearly indicate the applicant's contributions.

ii. The abstract of those major achievements (written in Japanese or English)
Select up to three major achievements from the list above, and provide the outlines of these achievements in approximately five A4-sized pages.

iii. The research plan for the doctoral program (written in Japanese or English) in approximately two A4-sized pages.

iv. Recommendation letters from two persons who are familiar with the applicant's research achievements of the applicant (including Master's supervisor) (written in Japanese or English).
*Refer to the admission webpage of the Graduate School for submission instructions and submit it separately.

v. A copy of a Master's thesis or an equivalent research report.

vi. The abstract of v. (written in Japanese or English)

vii. The originals of any other documents which are useful to evaluate the applicant's ability (e.g. copies of published papers, patent specifications or brochures of products by the applicant).

(6) Notes

a. Applicant must prepare a Windows PC or Mac with an external web camera and connect to the Zoom for the online oral examination.

b. Applicant must prepare slides for the presentation in advance and share the screen during the oral examination.

c. For other notes, carefully read the "Notes for Specialized subjects and oral examination" section of this guide.

Please be sure to check the department webpage, where more detailed information may be posted whenever necessary.

AY2024 Notes for Specialized subjects and oral examination of Department of Mechano-Informatics (Master's and Doctoral Programs) Graduate School of Information Science and Technology, The University of Tokyo

1. **Examination dates and times**

Please refer to the "Examination schedules" listed in this Guide.

2. **Examination locations**

The oral examination will be held online.

The URL for the online system that should be accessed by each person will be notified later.

3. **What to prepare**

(1) Examination admission card. (Print it out.)
(2) Prepare a Windows or Mac with camera for the online oral examination.
(3) Prepare slides (ex. PowerPoint) for the presentation in advance and share the screen during the oral examination.
(4) Prepare an internet line of sufficient quality. Prepare an environment where no people around and stillness is maintained.
(5) Prepare notebooks of A4 size or larger, sketchbooks or a whiteboard, which is required to show the answer in front of the camera and read it remotely, and a thick pen that can be viewed remotely.
(6) Follow the instructions of the Graduate School for the 'what to bring' for the general education subject (Mathematics).

4. **Items to keep in mind during examinations**

(1) Online examination is always being recorded.
(2) Examinees will not be allowed to leave the examination room until the end of the scheduled examination time. Temporary leaves during the examination are also prohibited in principle. If you start to feel sick and/or need to use the bathroom, notify the examination supervisor.
(3) Be alone in a closed room during the online examination. Do not use headphones or earphones.
(4) Turn on the camera during the online examination and do not use the virtual background.
(5) Presentation tools and paper scripts during the presentation are acceptable, but do not refer to it in a question and answer session.
(6) Reference text books and the Internet etc. are not allowed without permission.
(7) The presentation time is managed in the examination room. However, a clock without any of the following functions can be used: dictionary function, calculator function, or Internet/PC connection function.
(8) Print out examination admission card beforehand and place on top of your desk during the examination.
(9) Only the following items can be placed on the desk: examination admission card, PC, Web camera, monitor, keyboard, mouse, A4 or above notes, sketchbooks or a whiteboard, and a thick pen.
(10) If there is a bookshelf in front of or beside the desk, cover it with a curtain or sheet.
(11) Before and during the test, you will need to move the camera to show the proctor your desk and the entire room where you will be taking the test (360degrees). Any privacy concerns should be dealt with in advance.
(12) Do not record the test details. Also, do not tell anything about the test.
(13) In the unlikely event that misconduct is discovered, the test will be invalidated retroactively.
(14) After the oral examination, leave the online examination room according to the instructions from the examiner.

Follow the instructions and location information of the Graduate School for the written examination for the general education subject (Mathematics).

[Preference card (for Master's Program and Doctoral Program)]

Department of Mechano-Informatics, Graduate School of Information Science and Technology,
The University of Tokyo

Examinee's name	
Field of interest and research plan (Please describe in as much detail as possible)	

- Submit this form along with your application.
- Use a computer to prepare this card.
- Do not extend to the next page. The font size should be 12pt or larger.
- For doctoral program applicants, note that different application periods are scheduled for the Summer and Winter Examinations. Application documents received outside of the respective application periods shall be deemed invalid.

[Expertise Assessment Card (for Master's Program)]

Department of Mechano-Informatics,
Graduate School of Information Science and Technology, The University of Tokyo

Examinee's name :

- ◆ Write down the examinee's name.
- ◆ Use this two A4 pages to write your expertise. No additional pages are allowed.
- ◆ Use a computer to prepare this card.
- ◆ The font size should be more than 12 pt. Images and diagrams can also be used.

Department-specific Conditions on Submitted Documents (Mechano-Informatics)

For other conditions on submitted documents common to all the departments, check the Admission Guide of the Graduate School.

List of Department-specific Documents

	Summer Examination		Winter Examination	
	Documents to be Submitted	Who to Submit	Documents to be Submitted	Who to Submit
Master's Course	Preference Card	All Applicants		
	Expertise Assessment Card	All Applicants		
Doctoral Couse	Preference Card	All Applicants	Preference Card	All Applicants
			(1)A list of research achievement (written in Japanese or English) (2)The abstract of the major achievements (written in Japanese or English, approximately 5 pages in A4-size) (3)Research plan in the doctoral program (written in Japanese or English, approximately 2 pages in A4-size) (4)Recommendation letters (from 2 persons, written in Japanese or English)*Refer to the admission webpage of the Graduate School for submission instructions and submit it separately. (5)A copy of a master's thesis or an equivalent research report (6)The abstract of (5) (written in Japanese or English, 2 pages in A4-size) (7)Other documents (e.g. published papers, patent specifications or brochures of products by the applicant)	All Applicants *Those who are expected to complete a master's program should bring (5) with them at the time of the second round exam, not at the application.
Doctoral Course (Special Selection for Professionals)（社会人特別選抜）	Preference Card (for Doctoral Program)	All Applicants	Preference Card (for Doctoral Program)	All Applicants
	(1)A list of research achievement (written in Japanese or English) (2)The abstract of the major achievements (written in Japanese or English,approximately 5 pages in A4-size) (3)Research plan in the doctoral program (written in Japanese or English, approximately 2 pages in A4-size) (4)Recommendation letters (from 2 persons, written in Japanese or English)*Refer to the admission webpage of the Graduate School for submission instructions and submit it separately. (5)A copy of a master's thesis or an equivalent research report (6)The abstract of (5) (written in Japanese or English, 2 pages in A4-size) (7)Other documents (e.g. published papers, patent specifications or brochures of products by the applicant)	All Applicants	(1)A list of research achievement (written in Japanese or English) (2)The abstract of the major achievements (written in Japanese or English,approximately 5 pages in A4-size) (3)Research plan in the doctoral program (written in Japanese or English, approximately 2 pages in A4-size) (4)Recommendation letters (from 2 persons, written in Japanese or English)*Refer to the admission webpage of the Graduate School for submission instructions and submit it separately. (5)A copy of a master's thesis or an equivalent research report (6)The abstract of (5) (written in Japanese or English, 2 pages in A4-size) (7)Other documents (e.g. published papers, patent specifications or brochures of products by the applicant)	All Applicants

Department-specific Conditions on TOEFL Scores

	Summer Examination	Winter Examination
Master's Course	All participants	
Doctroral Course	All applicants except those who have completed (or are expected to complete) a Master's program at the University of Tokyo	All applicants except those who have completed (or are expected to complete) a Master's program at the University of Tokyo
Doctoral Course (Spetial Selection for Professionals)	All applicants except those who have completed a Master's program at the University of Tokyo	All applicants except those who have completed a Master's program at the University of Tokyo

Faculty and Laboratories of Department of Mechano-Informatics

※: Professors denoted by this symbol do not accept new graduate students for the applicable academic year.

[RCAST]

denotes the professors of Research Center for Advanced Science and Technology holding adjunct professorship at School of Information Science and Technology.

[AI center]

denotes the professors of AI Center (*1) holding adjunct professorship at School of Information Science and Technology.

*1 Next Generation Artificial Intelligence Research Division, Center for Education and Research in Information Science and Technology (CERIST), and Next Generation Artificial Intelligence Research Center, The University of Tokyo.

[SICT Center]

denotes the professors of SICT Center (*2) holding adjunct professorship at School of Information Science and Technology.

*2 Social ICT Research Center and Center for Creation of Intelligent World, The University of Tokyo.

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Lecturer
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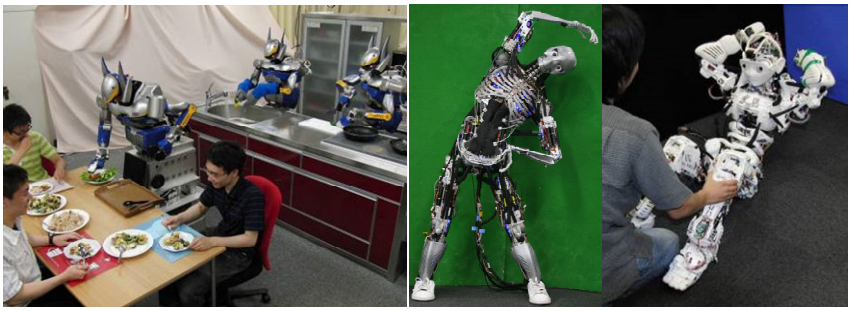
JSK Robotics Laboratory
(Jouhou System Kougaku Laboratory)

URL: http://www.jsk.t.u-tokyo.ac.jp/

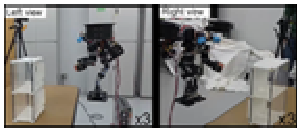
Research in this laboratory is focusing on the fundamental functions and systems necessary for future intelligent robots that will live and work in the daily life field and human society. The members are challenging something new through their own integrated robot systems and learning how to build sustainable systems for the future with each other.

(1) Daily life support humanoid platform : recognition of situations in human life environments, using tools, dishes, tablewares, and appliances, learning from humans, conversation with humans, etc.
(2) Musculoskeletal tendon-driven humanoid : humanlike musculoskeletal body with very many joints and numerous redundant sensors aiming at powerful and supple motions like human, design principle of humanoid body structure, autonomous development of complex sensory-motor system, etc.
(3) Dynamics whole body control humanoid : integrating high-torque, high-speed motor drive circuit, high-speed 3D recognition system, dynamics whole-body.
(4) Transform robotics devices: embedded CPU for transform robots, integrated intelligent, IMU sensors, onbody communication LAN system, power system. etc.
(5) IRT (Information and Robot Technology) to support human and aging society: through fusing IT and RT systems, personal mobility robots, affectionate watching appliance are conducted for supporting the future life society
(6) Robot Open Software System : design and development of open-source type intelligent robot for mobile manipulation robot.



Daily Assisteive HRP2-JSK humanoids

Musculoskeletal humanoids



Flying Transform Robots

IRT Robots

Robot-social interaction

Dynamic whole-body control humanoid

Open software robot : PR2

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Laboratory for Intelligent Systems and Informatics (ISI)

http://www.isi.imi.i.u-tokyo.ac.jp/

Breakthroughs Towards Truly Intelligent Systems in the Real World:

Towards truly intelligent behavior in the complex and uncertain real world, we reveal the principles of human intelligence and develop next generation AI, with applications to real world tasks.

1. Next Generation AI & Robotics Intelligence

Deep reinforcement imitation learning, multi-agent collaborative learning, dynamical systems/chaos/reservoir computing, spiking neural networks, free energy principle/predictive coding, dual-arm robotic manipulation, behvior emergence/immediate adaptation, autonomus systems, intention understanding, AI ethics

2. Elucidating/Modeling Human Intelligence, Origin of Intelligence

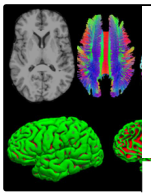
Whole brain simulation, Embodied cognition/behavior, Emotion/Feeling Model, Fetus/neonate embodied brain development simulation, Acquisition of concepts/language, Self-other/social cognition, Emergence of consciousness, Brain science and modeling of moral/value/intention/motivation/creativity/aesthetic/music

3. Bio-inspired Robots & Adaptive/Learning Control

Musculo-skeletal robots, Soft robots, Dynamic motor skills, “Knacks & Focuses”, Thin&flexible tactile sensors, Adaptive/learning control, Physical reservoir computing, Next gen. neuromorphic devices

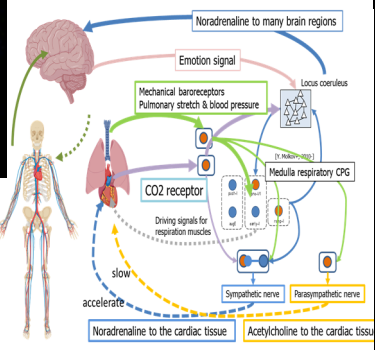
4. AI Tech for Medical/Welfare/Handicapped & Global Issues

Monitoring & risk prediction of behavior/health, Clinical applications, Interactive elderly care robots, Understanding developmental disorders and alleviative technology for their sufferings, Agile-legal tech.

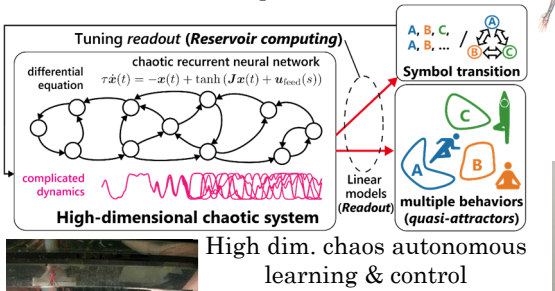


Brain sim.

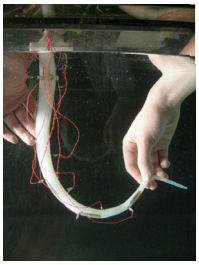
Fetus embodied development simulation



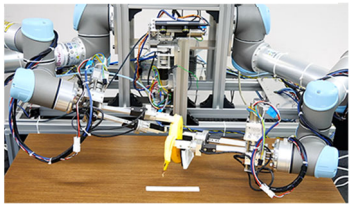
Embodied Emotion-Cognition Model



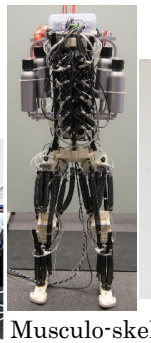
High dim. chaos autonomous learning & control



Octopus robot



Deep learning of human skills



Musculo-skeletal robot

Baby Robot

Kuzuoka-Narumi Laboratory

http://www.cyber.t.u-tokyo.ac.jp

Research on Cybernetic Interface aims to study interfaces that unite human and computer seamlessly. Our particular interest is in exploring Cybernetic Interface on the basis of Virtual Reality (VR) and Computer Supported Cooperative Work (CSCW) technologies. We focus not only on system development, but also on exploring innovative contents in application areas, and studying the impact of human-computer interaction on psychological and social science research. Specifically, we are conducting research on multi-modal/cross-modal interfaces including tactile, olfactory, and gustatory senses, human augmentation technologies to enhance human physical and cognitive abilities, social robots, and educational systems using virtual and augmented reality.

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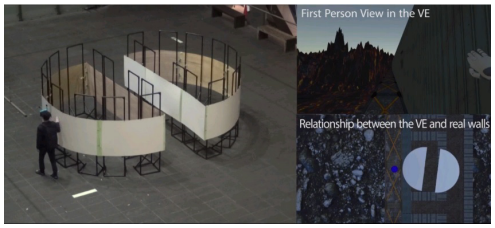
Virtual Reality / Mixed Reality

Multi-modal and Cross-modal Interfaces
Redirected Walking / Redirected Hand Interaction Techniques
Human Augmentation with Virtual and Augmented Reality
Ghost Engineering (Augmenting Perception/Cognition with Embodied Avatars)

Multi-modal / Cross-modal interfaces

Haptic display and Human Augmentation

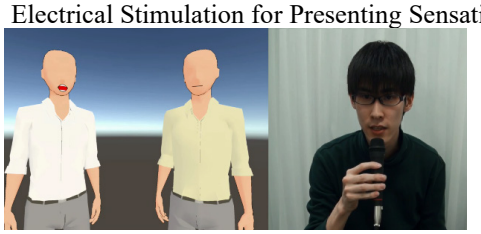


Redirected walking using visuo-haptic interaction

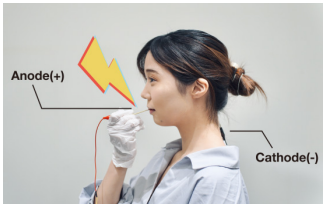
Manipulation of weight perception through body transformation with avatars

Computer Supported Cooperative Work (CSCW) / Human-Computer Interaction

Telepresence Systems for Enhancing Remote Communication
Behavior Elicitation & Emotion Evacuation Interfaces
Virtual Reality-Based Education, Rehabilitation, Consultation
Social Robot, Human-Robot Interaction, and social media
Electrical Stimulation for Presenting Sensations

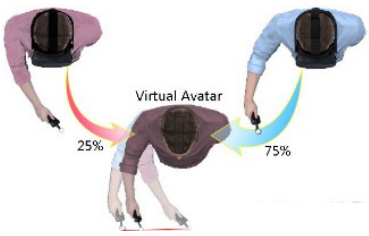


“Cloning” technique for mediated group work



Presenting spiciness through electrical stimulation

Social robots in museum



Co-embodiment for skill transfer

Dynamics and Control Systems Laboratory

http://www.ynl.t.u-tokyo.ac.jp/

(1) Highly Robust Autonomous Driving Systems of Cars and Trucks
(2) AI-based Autonomous Harvest/Transport Systems for Vegetables and Fruits
(3) Dynamics & Control Theory of Humanoid, Human Musculo-skeleton, Human Flow & Soft Robot
(4) Development of Hydraulic Actuators & Hydraulically-driven Soft Robotics
(5) Advanced Optical Sensing and Image Understanding

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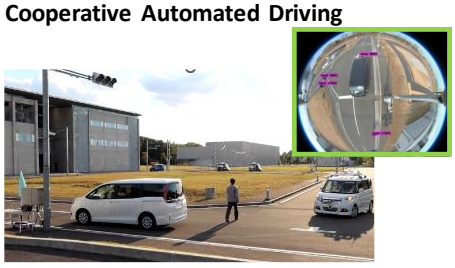
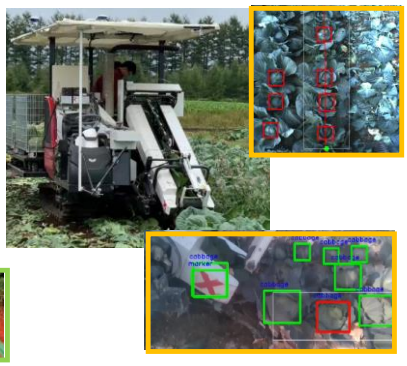
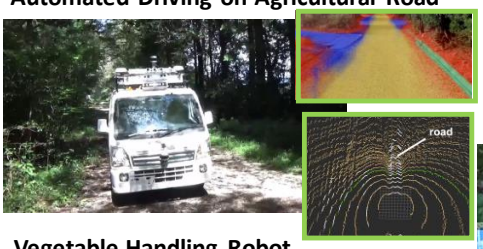
Cooperative Automated Driving



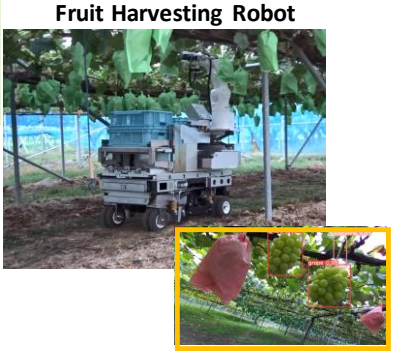
Vegetable Harvesting Robot



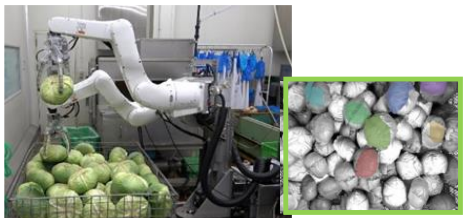
Automated Driving on Agricultural Road



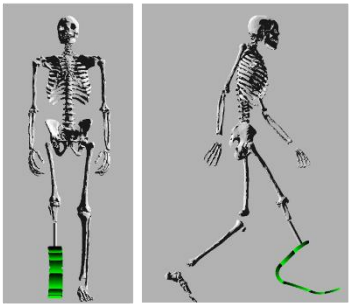
Fruit Harvesting Robot



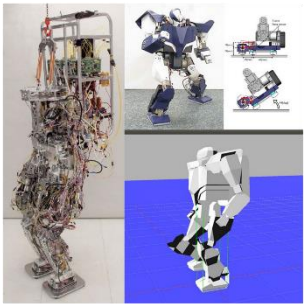
Vegetable Handling Robot



Biomechanics



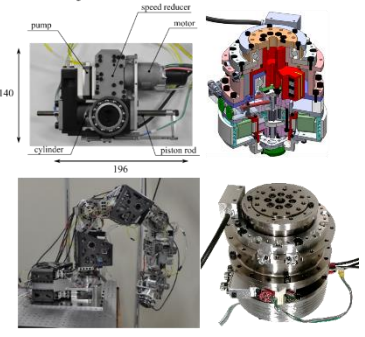
Humanoid Robotics



Human Flow

Soft Robotics

Hydraulic Actuator



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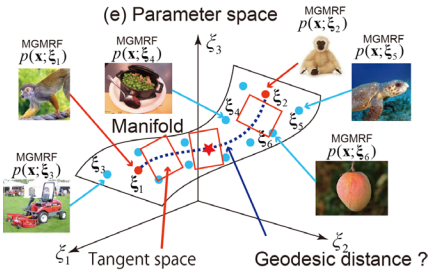
Machine Intelligence

Realizing advanced intelligent systems for understanding real world, generating content, and discovering knowledge

We aim to construct advanced intelligent systems capable of understanding the real world, generating content, and discovering knowledge by extracting valuable information from the natural environment and combining it with vast amounts of data and powerful computing resources in cyberspace. To tackle this challenge, we utilize computer science, including mathematical foundations and robotics.

1. **Mathematical foundations:** Information theory, machine learning, deep learning, data mining, pattern recognition, probability and statistics theory, time series analysis, causal analysis, learning theory, feature extraction theory.
2. **Recognition, understanding, and thinking:** Computer vision, image recognition and search, 3D information processing, behavior recognition, multimodal recognition, emotion understanding, intention estimation, natural language processing, speech and music information processing, medical information processing, big data
3. **Content generation:** Natural language description of images and videos, image generation from natural language, conversational systems capable of chatting with humans, discovery of interesting phenomena in the real world and article generation
4. **Intelligent robots:** Reinforcement learning, imitation learning, meta-learning, trajectory optimization, motion planning, task planning, continual learning, sim-to-real, fast inference, SLAM, 3D reconstruction, learning at the edge, interaction with humans



Feature extraction using
information theory and machine learning

Integration of CV, CG and ML

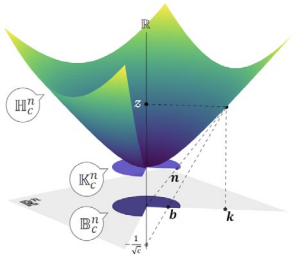
A silver car parked in a residential street.

A brown horse standing in a lush green field.

Automatic sentence generation by recognizing images

Generation of realistic novel object images

Trajectory optimization to find diverse solutions



Non-Euclidean neural network

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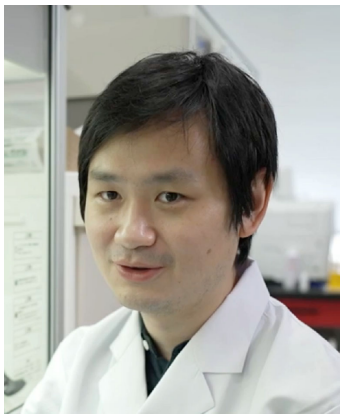
Minghao NIE
Lecturer



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Biohybrid Systems Lab.

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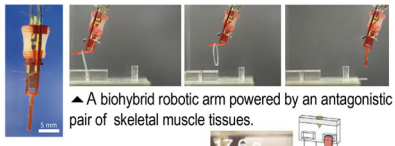
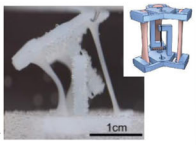
Our research group aim to develop biohybrid systems that integrate functional biomaterials with artificial devices, such as biohybrid robots powered by skeletal muscle tissues that works flexibly and quietly, covered by living skin tissue with human-like appearance and function, and enabled by sensor cells that can detect target materials with high sensitivity and selectivity. Our approach involves various disciplines, including mechanics, informatics, micro/nano technology, bioengineering, and material sciences. Personnel interested in multidisciplinary research, with any of these abovementioned backgrounds, are warmly welcomed to join us.

Cyborg technology

Blend living and artificial materials to create superior biohybrid robots.

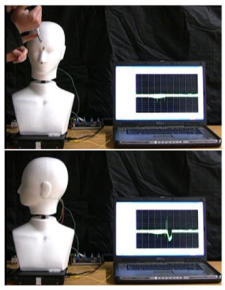


▲A biohybrid robotic arm powered by an antagonistic pair of skeletal muscle tissues.

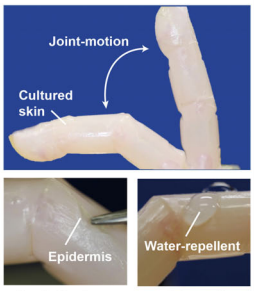


A tensegrity robot actuated by cultured skeletal muscle tissues.

◀A bipedal robot walks using a pair of biohybrid legs.



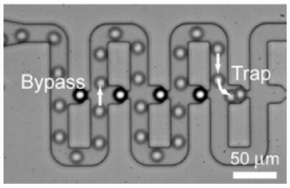
▲A robot with cell-based biosensor reacts to a smell by rotating its head.



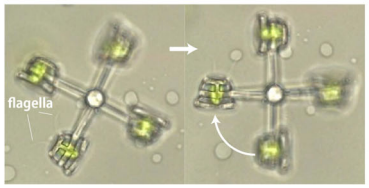
▲A robotic finger covered by cultured skin tissue with water-repellent epidermis.

MEMS (Micro-Electro-Mechanical Systems)

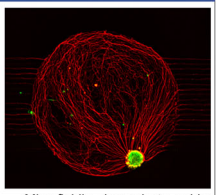
Fabricate functional microscale machines using microfabrication techniques.



▲Manipulate and arrange biomolecules or cells effectively using microfluidics.



▲A 3D printed micro gear actuated by the movement of flagellated swimming microorganisms.

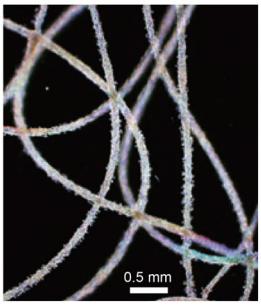


▲Microfluidic channels to guide the formation of *in vitro* sensory neuron networks.

Biofabrication

Manufacture macroscopic tissues/organs by assembling cellls and biomaterials.

▲Process living cells into micro beads, accumulate the beads to fabricate millimeter scale 3D tissues.

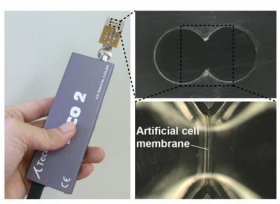


▲Cell fiber: a thin, long, fibrous tissue fabricated using microfluidic techniques.

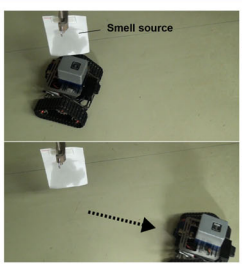
▲A mini beef steak fabricated using cells isolated from bovine muscles.

Artificial cell membranes

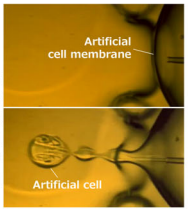
Create artificial cells as highly sensitive and selective biosensors.



▲Portable senor powered by an artificial cell membrane. The membrane consists of proteins derived from olfactory cells to detect smells.



◀A robot mounted with an artificial cell membrane based odorant sensor, which can move in response to smell.



▶Inspired by the principle of bubble guns, artificial cells can be fabricated by jetting a flow onto an artificial cell membrane.

Bio-intelligence Systems Lab.

http://www.ne.t.u-tokyo.ac.jp/index-e.html

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Research Fields： The Bio-Intelligence Systems Lab aims to understand the brain in engineers' manner and to create next-generation brain-like computation systems. Our research field is interdisciplinary, ranging between informatics, engineering, and neuroscience. To reveal how intelligence, consciousness, and fine arts emerge, we investigate neural computation at various scales, ranging from dissociate culture of neurons on a petri dish, the rodent brain, and the human brain. We develop novel experimental methods and equipment, such as high-density microelectrode arrays and behavioral assays, to obtain large-scale experimental data, and make full use of state-of-the-art machine learning and artificial intelligence to characterize and analyze our own data. Based on these experiments, we reveal the dynamics of neural activities and construct mathematical models of the brain.

Research Examples:

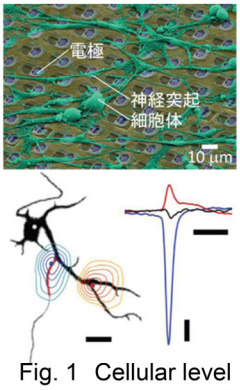


Fig. 1 Cellular level neural measurement

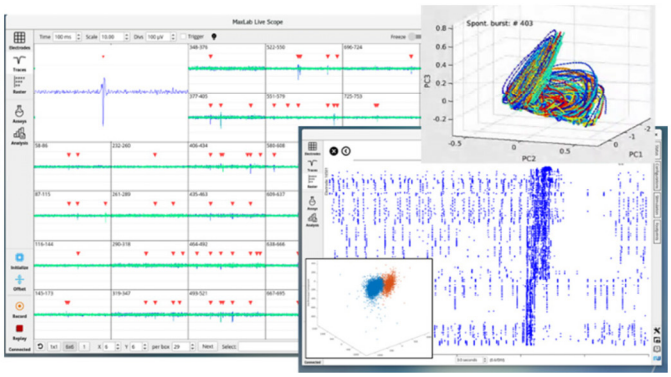


Fig. 2 Mathematical analyses and modeling of large-scale spatio-temporal neural data

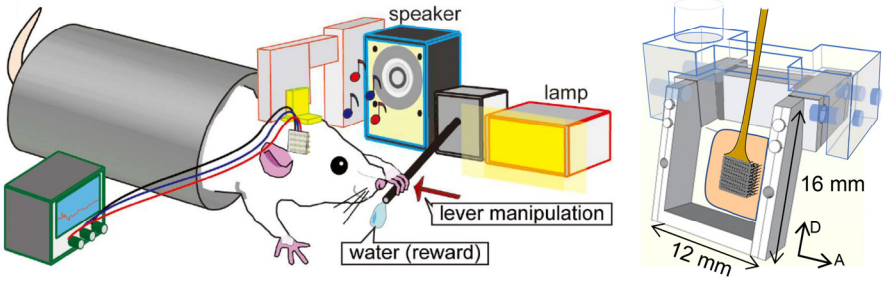


Fig. 3 Neural measurement with microelectrode array (electrophysiology)

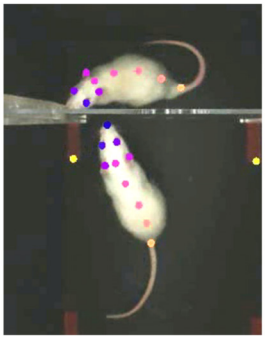


Fig. 4 Behavioral analysis with computer vision

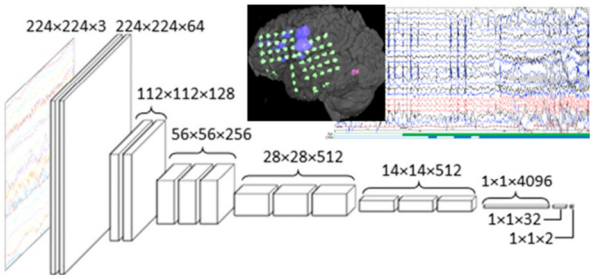


Fig. 6 Electroencephalography diagnosis system with deep learning

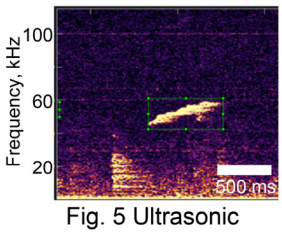


Fig. 5 Ultrasonic communication in rodents

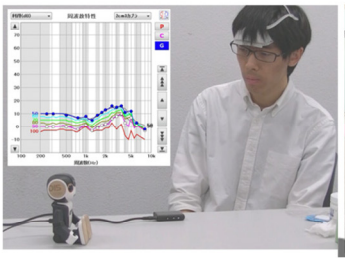
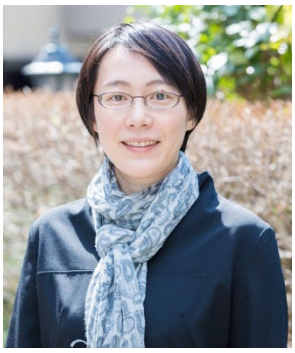


Fig. 7 Hearing aid support system with personal robot

Fig. 8 Digital medicine with VR/AR system



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Well-being Engineering Lab.

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Our laboratory examines the evolving facets of everyday human life in tandem with societal shifts, focusing on the perspective of well-being. Our approach involves synthesizing knowledge across various disciplines related to daily life and delving into the optimal state of human existence. This exploration extends to the development of novel assistive technologies and mechanical systems that support such a state.

Our research encompasses the realms of intelligent assistive technology and robot development, covering analysis, implementation, empirical evaluation, and the social integration of innovative mobility concepts. Rooted in a comprehensive understanding of human behavior, movement, cognition, physiology, and psychological characteristics, our investigations transcend the confines of university laboratories. We actively engage in field-based research and social experiments, including action research. Our overarching goal is to foster the development of systems that seamlessly connect human life, machinery, and information, translating these connections into practical applications for societal benefit.

Our research initiatives include

(1) Advancing real-life environmental measurement and behavior estimation technologies to support self-management and facilitate behavioral changes.
(2) Designing personal mobility vehicle (PMV) systems geared towards health maintenance, mobility extension, and improvement in quality of life (QOL).
(3) Pioneering digital healthcare systems and affective computing based on social assistive robots (SAR) and robot interactions.
(4) Creating accessible design robots to promote social inclusion.
(5) Undertaking the development, clinical research, and effectiveness evaluation of assistive products and rehabilitation systems.