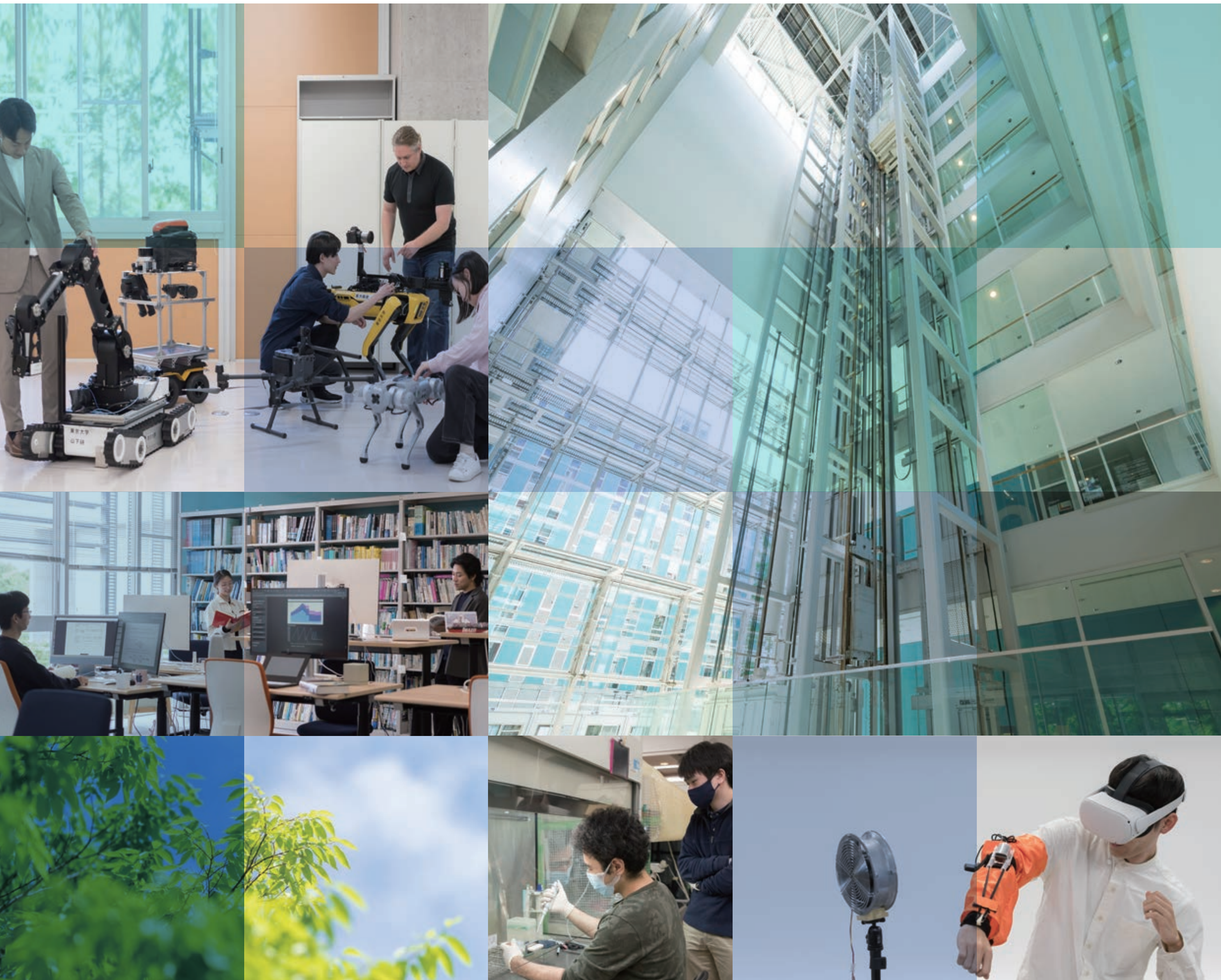
UTokyo

DEPARTMENT OF

HUMAN AND ENGINEERED ENVIRONMENTAL STUDIES

Graduate School of Frontier Sciences, The University of Tokyo

2025–2026



New Horizon for Bright Future

Department of Human and Engineered Environmental Studies, envisioning the future beyond the horizon.

Using engineering and informatics as fundamental technologies, along with an understanding of human characteristics, this department conducts research that contributes to human activities by developing novel elemental technologies and system designs. Our research targets focus primarily on the engineered devices and man-made systems that make up our societal and living environment. Among the research themes considered are the development of assistive technologies that will enable people to live their lives in a secure manner, the realization of services that will ensure the safety of the social infrastructure that surrounds us, and the realization of a carbon neutral future for the global environment.
Our mission is to create frameworks that will lead to the realization of a safe and secure society under the motto of *"understanding people, supporting people, and connecting people."*

INDEX

Engineering and informatics have made significant contributions to technology, from social infrastructure to entertainment, and have enriched and improved people's lives. On the other hand, some people believe that our society has entered a mature phase after a period of continuous growth. Issues of diversity and inclusion have been raised, including the considerations of individual characteristics and the sustainability such as environmental sustainability on a global scale and the safety of social infrastructure, as represented by carbon neutrality. To solve these issues, we believe that technologies, systems, goods, and services are required that are based on concepts different from those of conventional growth processes. To accomplish this, it is essential to have the ability to integrate other disciplines, and to create new fields based on fundamental knowledge of engineering and informatics, as well as a deep understanding of people, with an eye to the future.

Our department conducts research in various fields, including energy engineering, systems design, ergonomics and bioengineering, robotics and mechatronics, sensing, and computational engineering. Our education program also offers lectures and exercises in the aforementioned specialized fields, as well as in basic engineering and informatics. In addition to research in your field of expertise, you can expand your knowledge by attending lectures on different fields and stimulate your intellectual curiosity through discussions with your peers and faculty members.

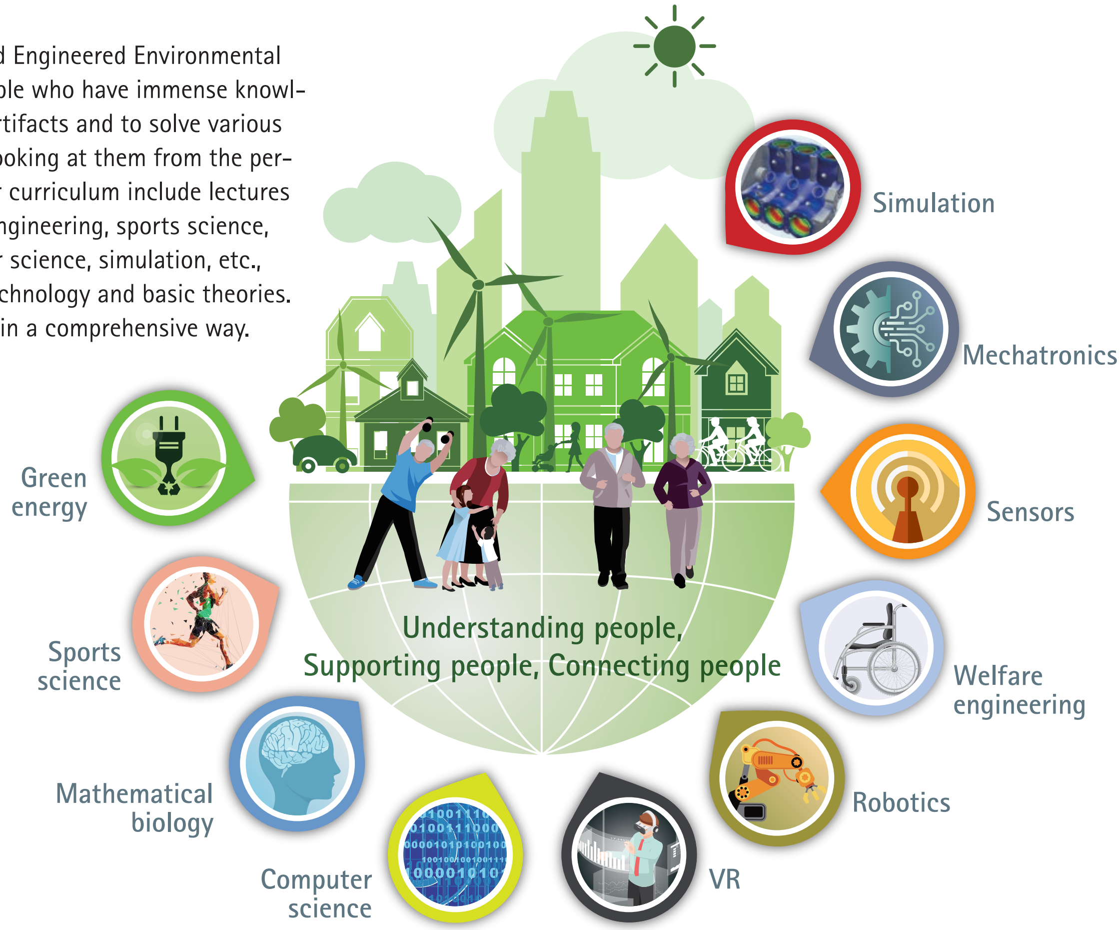
Let's discuss how people and technology, and people and the environment should coexist. Then, let's create new technologies, a new society, and a new era together.

YAMASAKI Yudai
Professor, Head of the Department of
Human and Engineered Environmental Studies,
Graduate School of Frontier Sciences, the University of Tokyo

CURRICULUM

Various lectures lead to innovation. The fusion of different disciplines opens the door to the future.

In the Department of Human and Engineered Environmental Studies, we aim to cultivate people who have immense knowledge about human beings and artifacts and to solve various problems in the community by looking at them from the perspective of the environment. Our curriculum include lectures on energy engineering, system engineering, sports science, mechatronics, sensing, computer science, simulation, etc., which are based on elemental technology and basic theories. These lectures can be combined in a comprehensive way.



LECTURE LIST

Special Lecture on Human and Engineered Environment I and II
Knowledge Information Processing
Human and Environmental Information Wearable Sensing*
Environmental Simulation I and II
Actuation Technologies
Nanoprocessing and Nanometrology
Special Lecture on Human Factors
Modeling and Analysis of Complex Systems*
Robot Informatics
Theory of measurement and analysis of biomedical signals
Neuroengineering
Special Lecture on Decommissioning and Dismantling*
Concept Rapid Prototyping
Teaching Development in Higher Education

Special Lectures on Human and Engineered Environmental Studies
Special Lecture on i-Construction Systems for Infrastructure Projects*
Special Seminar on i-Construction Systems for Infrastructure Projects*
Dynamics and Control Seminar
Human and Engineered Environmental Studies (Basic I, IIA, IIB and Advanced)
Exercises in Human Environmental Design M and D
Special Exercises in Human and Engineered Environment I–V
Stress Management
Proactive Research Commons
System Architecture
Case Study: Social Design and Management*
Seminar in Aging Control Design

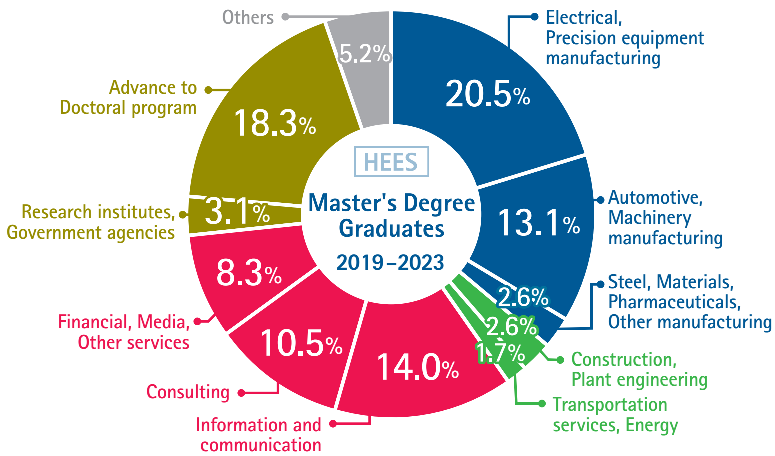
* =Lectures conducted in English

CAREER PATH AFTER GRADUATION

Our graduates have leading positions in major companies and research institutes.

Annually, about 50 students complete the master's course and about 10 complete the doctoral course. About 20% of master's course graduates advance to the doctoral course, while others find employment with institutions and companies in a wide range of industries.

Job Placement and Advancement



Example of Employers

Electrical, Precision equipment manufacturing	Sony / Canon / KEYENCE / Panasonic / Denso / Hitachi / OMRON / Fujitsu / Seiko Epson / etc.
Automotive, Machinery manufacturing	Toyota Motor / Honda R&D / Nissan Motor / Komatsu / BOSCH / etc.
Steel, Materials, Pharmaceuticals, Other manufacturing	Nippon Steel / JFE Steel / Dai Nippon Printing / etc.
Construction, Plant engineering	JGC Japan / Obayashi / Chiyoda / etc.
Transportation services, Energy	JR Central / Chugoku Electric Power / INPEX / etc.
Information and communication	NTT / NTT Data / NTT Docomo / Softbank / Yahoo Japan / DeNA / IBM Japan / NS Solutions / Amazon Web Services Japan / etc.
Consulting	Nomura Research Institute / Daiwa Institute of Research / Accenture / McKinsey & Company / KPMG Consulting / etc.
Financial, Media, Other services	Rakuten / Amazon Japan / NHK / Mizuho Bank / SUMITOMO MITSUI BANKING / Nomura Securities / Daiwa Securities / SMBC Nikko Securities / Recruit Holdings / etc.
Research institutes, Government agencies	Ministry of Economy, Trade and Industry / Tokyo Metropolitan Government / National Institute of Advanced Industrial Science and Technology / Japan Aerospace Exploration Agency / etc.

MESSAGES FROM OUR ALUMNI

*Affiliations are as of the time of the interview.

More messages are on our webpage >>>
https://www.h.k.u-tokyo.ac.jp/message/index_e.html

Academic studies nurtured my entrepreneurship

WANG Yen Po

Co-founder & CTO, INOPASE Inc.

Graduated from Universidad Autonoma de Ciudad Juarez (2018). Master's degree (2020) and Doctoral degree (2024) in Human and Engineered Environmental Studies, GSFS, UTokyo.

I work as CTO of INOPASE Inc., a medical startup I established as a graduate student.

During the master's and doctor's programs, I was able to attend international academic meetings, which not only promoted my academic growth but also helped me improve communication skills and extend my global network. With various scholarships granted, I took advantage of academic programs and patent acquisition support to build my business foundation. I was also given the honor of being listed in the Forbes 30 Under 30 Asia-Pacific in healthcare.

If you look to study in this department, I hope you will try to develop your potential to the fullest. With resources, mentorship and global opportunities available there, your potential is limitless. Whatever career you choose after graduation, I believe you can achieve great results, even greater that I have. Take on challenges, dream big and do your utmost so you can achieve your goals.

Wide experience encouraged my growth as a researcher

SUN Jingyu

Senior Research Scientist, NTT Computer and Data Science Laboratories

Graduated from Beihang University (2008). Master's degree (2013) and Doctoral degree (2016) in Human and Engineered Environmental Studies, GSFS, UTokyo.

I work on IoT-related research at NTT Network Innovation Laboratories. I'm engaged in my daily work, aiming to enhance the value of information through new sensing technologies, AI and big data processing.

As a graduate student, I was involved in the measurement and evaluation of huge manufacturing components with complex 3D shapes and the examination of their processing method. For ship builders, I developed a method for evaluating 3D-shaped curved shell plates and also devised a system for generating the curved shell plates processing method. I was also given the opportunity to study at *l'Université de Jean Monnet* in France for six months as a researcher.

Here's my message to current and would-be students of this department: The experiences you gain there will prove to be important for your future career. I hope you will focus on research activities to seize the opportunities for your growth.

Research-based thinking serves as a foundation of my life

YOSHIDA Lui

Associate Professor, Graduate School of Engineering, UTokyo

Graduated from the Dept. of Systems Innovation, UTokyo (2008). Master's degree (2012) and Doctoral degree (2015) in Human and Engineered Environmental Studies, GSFS, UTokyo.

I'm engaged in research and other activities related to educational technology, aspiring to improve education. I'm particularly interested in online education and active learning. I work on the development of online education tools and programs for teachers to create better lessons. As more people pay attention to my research field in recent years, I'm having a busy life but feel satisfied with my job.

As a graduate student, I majored in biomedical engineering. It's apparently unrelated to education technology, but through my studies, I was able to acquire a habit of creative and logical thinking for creating originality from earlier studies and applying logic to insist on my originality. I also learned the importance of trying again and again with flexibility and tenacity even if I failed. These skills proved helpful even after I changed my field of expertise. I hope students of this department spend good times in their studies. Your learnings will work as a foundation of your life!

We aim to accumulate and evaluate social experiments and show our solutions to society.

CASE 1 ● Going carbon neutral after CO_2 reduction phase

Diversity-aware optimization and control of vehicles and energy systems

Sustainable Power and Energy Systems Lab.

YAMASAKI Yudai, Professor

Various efforts are being made to achieve carbon neutrality by 2050. Reducing CO_2 emissions from the automotive sector is of great significance, as it currently accounts for approximately 16% of the world's emissions. To reduce CO_2 emissions from the automotive sector, in addition to electrification, the use of e-fuel, which is a fuel obtained by synthesizing green hydrogen and CO_2, is also being considered. To consider using electricity for electrification and green hydrogen production for e-fuel, we must consider the automotive field but also the energy system simultaneously.

Thus, achieving a sustainable global environment and society requires improving not only the performance of individual automobiles and energy devices, as has been done in the past, but also coordinating and cooperating with them. In addition, design and control with consideration for the various characteristics of their users will lead to further reductions in CO_2 emissions and produce highly convenient devices and systems.

Our group focuses on elucidating energy conversion phenomena and developing physics- and/or AI-based models to optimize and control systems ranging from automotive powertrains to energy systems. We accomplish this by using models and information while taking human behavior into account. (Figure 1). Some examples of our research are explained below.

Since e-fuel is synthesized, its composition can be controlled at the manufacturing stage compared to conventional fuels by distillation. In addition, whereas combustion improvements have been made with fixed fuels, in the future, improvements in both fuel composition and combustion technology will be possible and farther improvements in engine performance are expected. On the other hand, the production volume of e-fuels is not expected to be as large as that of conventional petroleum fuels, and e-fuel is used by blending with carbon-free bio-derived fuel and/or conventional fuels is a realistic approach. Then, the systems that use such fuels must have fuel diversity and robustness. To realize them, we must understand the influences of fuel composition on ignition and combustion, and real-time sensing methods to detect the fuel characteristics and control technology are also needed. Figure 2 shows an experimental system and some results of both experiment and calculation to clarify the ignition and combustion characteristics of various fuels. This experimental system can be conducted with a small amount of fuel, and it is very useful for testing new and/or expensive fuels. Ion current measurement has a potential to understand even chemical reaction under ignition and combustion process in real time.

CO_2 emission and energy consumption in the real world are affected by driver's characteristics, which are influenced by traffic situations. Prediction of driver's behavior, such as the drive does not accelerate when a traffic signal is about to change from green to red, can enable a powertrain control to prevent the engine of a hybrid vehicle from starting. Additionally, the vehicle can reduce CO_2 emissions and energy consumption by secretly reducing the degree of acceleration, even when the driver wants to accelerate. On the other hand, driver comfort may be compromised if the driver feels that the expected acceleration is not achieved. Figure 3 shows photos from an experiment to collect data for developing a prediction model of driver behavior and its emotions. We intend to correlate biometric signals with driving maneuvers, and derive the driver's emotions from the driving maneuvers, and utilize this information for powertrain control while considering characteristics of each driver.

We are conducting our research with a focus on what is necessary to achieve carbon neutrality while maintaining convenience and affluence without imposing inconvenience on humans.

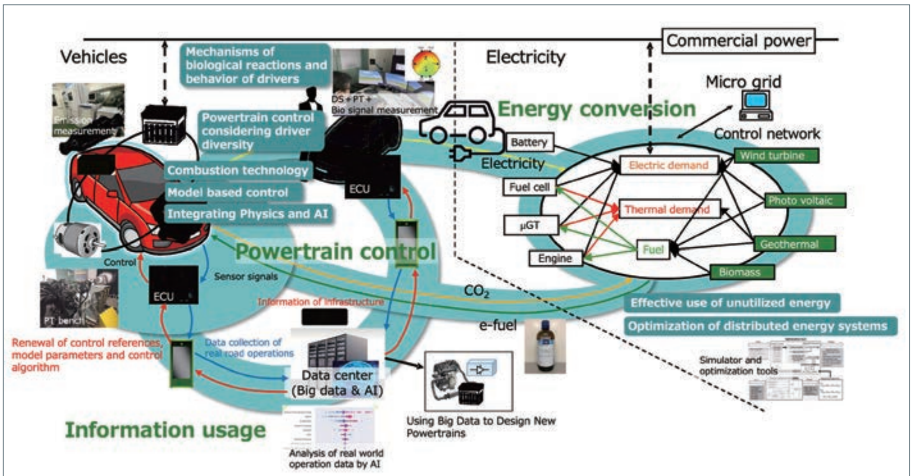


Figure 1: Cooperative coordination and optimization of vehicles and energy systems

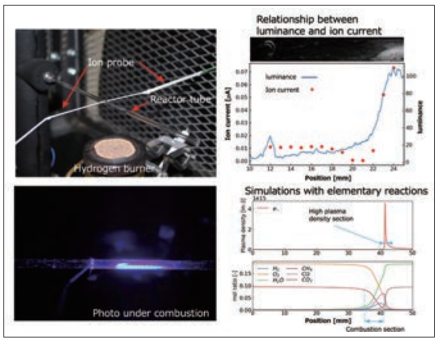


Figure 2: Combustion experiment and ion current measurement using micro-flow reactor

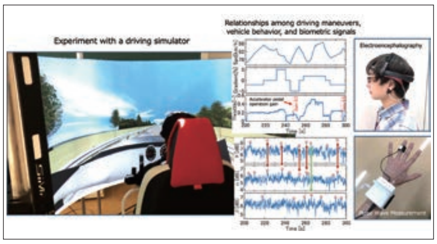


Figure 3: Relationship between driving operation, vehicle behavior, and biometric signals

CASE 2 ● Exploring life's complexity through measurement and mathematics

Expanding the boundaries of life science with multiscale analysis

Mathematical Biology and Bioengineering Lab.

KOTANI Kiyoshi, Professor × **SHIMBA Kenta**, Associate Professor

Biological systems exhibit complex hierarchical structures—from molecules and cells to organs and entire organisms—each level contributing to a wide range of essential functions. Yet, many of these mechanisms remain a mystery. To uncover the secrets of life, it is crucial to collect information from multiple biological layers using advanced technologies such as nanotechnology and multimodal measurement. Equally important is the integration of data across these layers. To bridge differences in scale and modality, we employ mathematical modeling approaches that extract the core essence of biological phenomena.

At the Mathematical Biology and Bioengineering Lab, we are dedicated to deciphering the fundamental principles of life by integrating multimodal and inter-hierarchical data through mathematical analysis and modeling, all underpinned by our expertise in measurement technologies and mathematical analysis. To achieve this, we harness a diverse range of biological and mathematical tools, including engineering methods such as microfabrication and signal processing techniques, as well as optogenetics, stem cell biology, statistical mechanics, and nonlinear dynamics (Figure 1).

To study human brain function, non-invasive techniques are essential. However, non-invasive measurements often suffer from a low signal-to-noise ratio, making advanced mathematical methods necessary to extract meaningful brain activity. We develop and refine techniques using electrical signals (EEG), magnetoencephalography (MEG), magnetic resonance imaging (MRI), and near-infrared spectroscopy (NIRS) to obtain useful insights into brain function. Our particular focus is on high-precision analysis of brain activity using EEG and MEG, where we estimate neural activity in the cerebral cortex—the source of cognitive processing—and investigate how the brain interprets and responds to the world.

As an application of brain measurement research, we are also working to enhance brain-computer interfaces (BCIs). BCIs interpret brain signals in real time and translate them into commands for external devices, enabling direct interaction with the environment. We are especially focused on developing a novel BCI for wheelchair control that utilizes augmented reality (AR) and camera-based spatial recognition (Figure 2). This system detects obstacles and navigable paths using a camera, presents options to the user through AR goggles, and reads the user's visual attention to allow intuitive control of the wheelchair.

To further understand human brain function, we also take a bottom-up approach from its fundamental building blocks: neurons. Cultured neuronal networks offer a simplified yet powerful model of brain functionality. Unlike in human studies, invasive stimulation and measurement are possible, making them ideal for experimental validation of mathematical models. Using high-density microelectrode array chips with over 20,000 electrodes, we investigate the properties of diverse cells in the network and work toward reconstructing neural systems similar to those found in the body (Figure 3).

Our goal is to understand biological phenomena spanning a vast range of spatial scales—from micrometer-scale cells (10^{-6} m) to the human body (1 m)—and temporal scales—from millisecond-level cellular activity (10^{-3} s) to years-long processes like rehabilitation and disease (10^{9} s). By advancing both measurement and mathematical modeling technologies, we hope to contribute to solving real-world problems—from uncovering the principles of life to supporting human health and wellbeing.

Figure 2: Wheelchair operation using AR-BCI

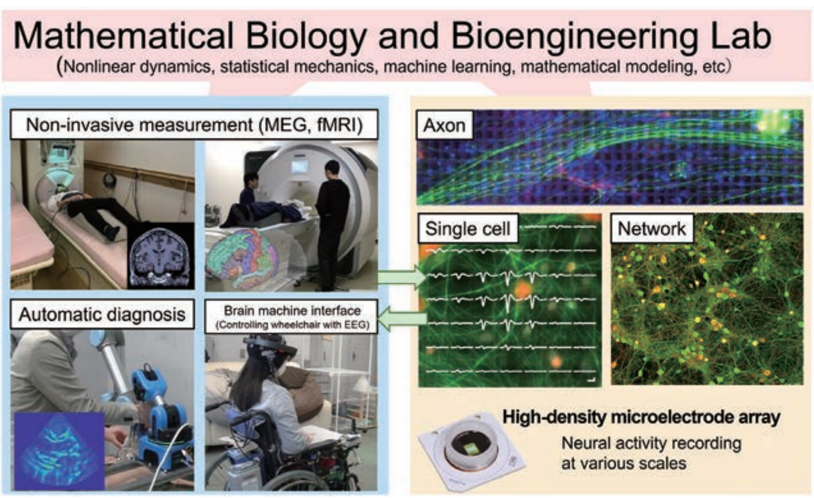


Figure 1: Overview of laboratory research areas

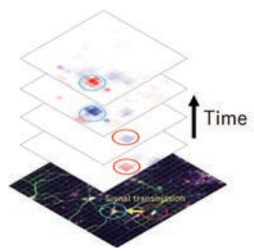


Figure 3: Neural activity recording from cultured neural

LABORATORY INTRODUCTION

The laboratories of the Department of Human and Engineered Environmental Studies are accepting visits and questions. If you are interested in the details of individual research content, please refer to the laboratory home page and feel free to contact faculty members.

ORGANIZATION

Graduate School of Frontier Sciences (GSFS)

- Division of Transdisciplinary Sciences
  - Department of Advanced Materials Science
  - Department of Advanced Energy
  - Department of Complexity Science and Engineering
- Division of Biosciences
  - Department of Integrated Biosciences
  - Department of Computational Biology and Medical Sciences
- **Division of Environmental Studies**
  - Department of Natural Environmental Studies
  - Department of Ocean Technology, Policy, and Environment
  - Department of Environment Systems
  - **Department of Human and Engineered Environmental Studies**
  - Department of Socio-Cultural Environmental Studies
  - Department of International Studies
- Facilities
  - Life Science Data Research Center
  - Sustainable Society Design Center

Ambient Mechatronics

Lab website https://www.aml.t.u-tokyo.ac.jp/

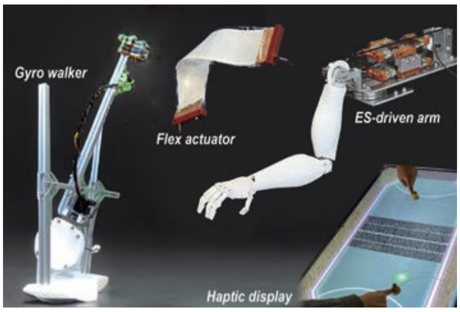
To create innovative human-environment interaction technologies

YAMAMOTO Akio
Professor

Our research group is working on novel actuators and sensors for future robotics and CHI (computer-human interaction) systems. In the area of actuators, a wide range of research topics are covered, with a particular emphasis on electrostatic actuation. For sensors, we are working on built-in sensing for integration with actuators and human-related sensing targeting CHI applications.

We are also working on the development of new robotic systems using our expertise on novel actuators and sensors, such like the thermal walking mechanisms that are actuated by a thermal actuation principle. Development of novel CHI systems is another aspect of our research activities. Especially, we have been working on haptic and tactile systems to realize intuitive CHI.

We welcome new students who are interested in these research fields with a solid background on mechatronics.



Novel robotic and mechatronic devices for enhanced interaction.

Sustainable Power and Energy Systems

Lab website https://www.s-energy.k.u-tokyo.ac.jp/

Realization of carbon-neutral and convenient energy systems

YAMASAKI Yudai
Professor

To realize a sustainable global environment and society, not only the optimization of individual vehicles and energy devices, but also their organic coordination and cooperation are required. In addition, the design and control of these devices must consider the various characteristics of users, which will lead to the realization of more energy-efficient and convenient devices and systems.

In the field of Sustainable Power and Energy Systems, we are working on automotive powertrains and distributed energy systems. Our research objective is to analyze and synthesize them. The followings are the main topics: 1) the elucidation of phenomena related to energy conversion, 2) modeling using physics and AI, 3) systemization and control using models and information, and 4) the optimization of energy systems considering human behavior.

Model based control of engines considering driver's characteristics

Real World Robot Informatics

Lab website https://www.robot.t.u-tokyo.ac.jp/

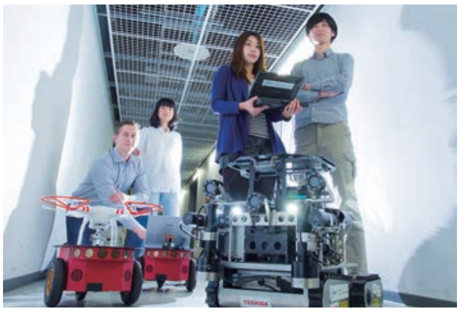
Understanding environment and human by robot and sensing technologies

YAMASHITA Atsushi

Professor

Our laboratory focuses on real world robotics based on image processing, computer vision, sensor information processing, and artificial intelligence. We are developing innovative technologies for humans and robots to understand real environments by advanced sensing and information presentation technologies. We are also interested in understanding human and assistive technologies for human.

We are working on a wide range of research topics from fundamental theory to practical applications.



Real world robots

AN Qi

Associate Professor

Japan's elderly population has exceeded 25%, and it becomes a hyper-aged society. As people age, they are more likely to have movement disorders, which increases social security costs and the burden on caregivers, physical therapists, and other professionals. Our laboratory aims to develop technologies to assist people with movement disorders and rehabilitation system for motor learning. In order to assist human motion and provide rehabilitation effectively, it is important to understand the mechanism by which humans achieve movement as fundamental research and utilize this finding in support system.

Our laboratory conducts a wide range of research, from fundamental research to elucidate the mechanism of human motor control to applied research to develop assistive technologies.

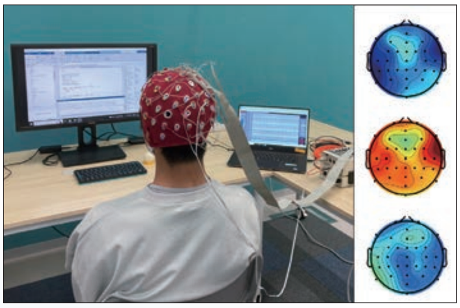
Understanding mechanism of motor control and assistive technology

HAMADA Hiroyuki

Project Lecturer

The human brain enables adaptation to various environments and facilitates a range of actions by the body. Therefore, suffering from a brain injury makes it difficult to adapt to environments, affecting daily life activities. In order to provide effective approaches to support those in need of such rehabilitation, it is necessary to understand the mechanisms of human adaptation based on neuroscience and cognitive science. In our laboratory, we strive to comprehend these mechanisms through the study of neural activity and cognitive characteristics.

Our research spans from fundamental research to clinical research involving patients with neurological disorders.



Visualization of neural activities by EEG analysis

Mathematical Biology and Bioengineering

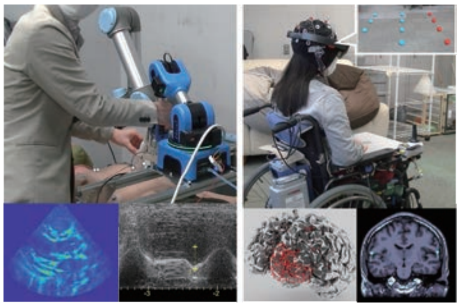
Lab website https://neuron.t.u-tokyo.ac.jp/mbb/

Elucidating the operating principles of complex biological systems by integrating multiscale information

KOTANI Kiyoshi
Professor

Recent advances in experimental and analytical techniques have revealed that biological systems are organized more precisely than ever imagined to perform various functions. We have been developing measurement methods and theories for dynamical systems to elucidate the underlying mechanisms of complex biological phenomena. We also applied the fundamental biological findings to a wide range of fields such as diagnosis and human interfaces.

Specifically, we have conducted studies on: (a) developing theoretical methods for nonlinear and time-delayed stochastic systems on complex networks, (b) understanding working memory and other cognitive functions using multi-scale brain models and noninvasive brain measurements, and (c) high-speed brain-machine interfaces using virtual reality.

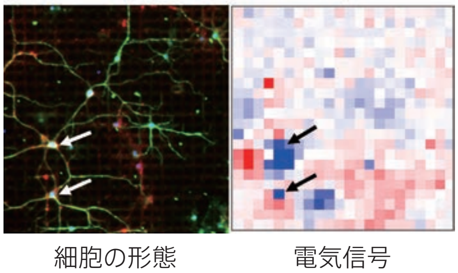


Non-invasive measurement and mathematical analysis of human heart (left) and brain (right)

SHIMBA Kenta
Associate Professor

Biological systems express their functions with hierarchical structures at various scales, such as molecule-cell-tissue. We aim to experimentally elucidate biological phenomena from the microscopic level and to develop experiment-based mathematical models toward understanding macroscopic biological systems. We are mainly working on cultured neuronal networks and sliced brain tissues using multi-site electrical recording of neural activity and microfabrication techniques.

Specifically, we have been (a) developing measurement techniques to evaluate neuronal functions, types, and structures in an integrated manner, (b) constructing experimental models that mimic biological functions such as pain transmission, (c) devising analysis methods to integrate acquired multi-scale data, and (d) elucidating the pathogenic mechanisms of neurological diseases using human iPS cells.



Simultaneous evaluation of structure and function

Intelligent Systems Design

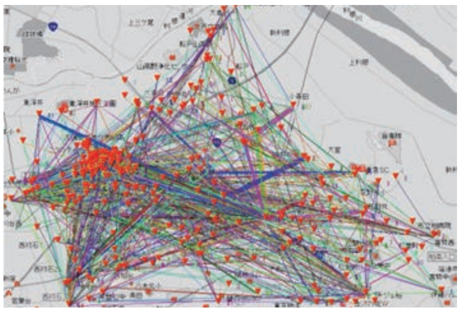
Lab website https://is.edu.k.u-tokyo.ac.jp/

Transformation of Industry and Society

HIEKATA Kazuo
Professor

Large complex systems are systems, which consist of various elements and have emerged functions. In modern days, we are facing with many significant problems caused by large complex systems. To solve these problems, perspectives from several academic disciplines, such as engineering, information technology, economics, business administration and domain specific knowledge, are necessary to be integrated. We work on following items. 1) Development of methodology for designing systems by systems approach, which identify objectives, functions, behavior and dependency of system elements. 2) Development of methodology for communication and collaboration of teamwork to integrate multidisciplinary experts by mutual understanding on the bases of systems approach.

Our lab applies, we apply systems approach to marine transportation system, shipbuilding industry and information system integration industry to create structures of industries by utilizing advanced technologies.



On-demand bus in the demonstration experiment at Kashiwa

Human and Environment Informatics

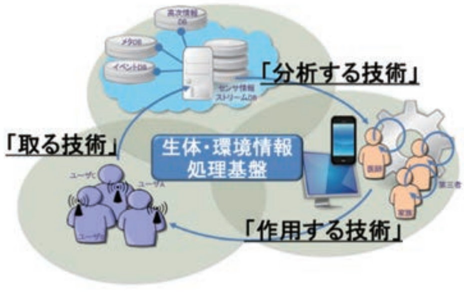
Lab website https://www.lhei.k.u-tokyo.ac.jp/

Make human society comfortable, safe and secure by sensing and robot technologies

WARISAWA Shin'ichi
Professor

In order to realize a safe, secure and comfortable living environment, we are promoting research on sensing technology for various information emitted by humans, higher-order information processing technology that extracts body and mental state, behavior change and intervention technology. Specifically, based on stress and emotion sensing technology, we are conducting research on methods for evaluating and predicting intellectual productivity, how to realize high-quality breaks and sleep with a real feeling, and intervention methods to improve personal comfort, productivity and group communication.

Through these researches, we will build a human environment model that contributes to promotion of mental and physical health, and show our society the creation of new lifestyles from both physical and psychological environments.



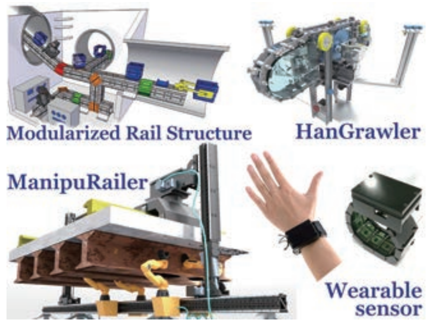
System platform promoting mental/physical health

FUKUI Rui
Associate Professor

Our research group is studying various autonomous systems using ROBOT technologies. Especially we focus on distributed and integrated robot systems with unprecedented shapes, mechanisms, and strategies. When you see our robot, you might say "Is this really a robot !?"

Each robot is not only a machine, but also has various forms such as sensors, electronic circuits, and artificial intelligence (AI). Sometimes our robots get into the environment as if they were an original part of the environment. This approach is called environmental structuring technology that helps humans live comfortably and other robots work efficiently.

Please Imagine a world where "robots" that do not look like robots cooperate with each other, execute great work to help people, and make people happy. We are looking forward to studying with students who are interested in innovation with technologies.

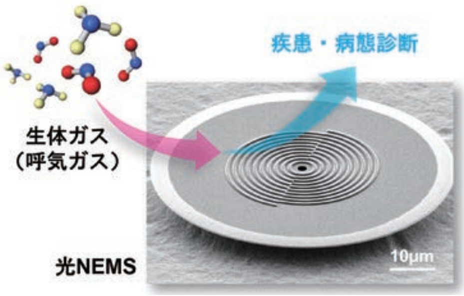


Environmentally distributed/integrated robot systems and sensing devices for human behavior monitoring

KOMETANI Reo
Associate Professor

As represented by the advancement of IoT devices, mobile/wearable devices, automobiles, healthcare devices, and so on, people's life, society, and industry are supported by various sensor technologies and sensor information networks. Aiming to enrich the living environment in the future, we are researching on sensor devices and sensing technology, which are core technologies for this purpose. Specifically, in order to create technologies that closely related to support our daily lives, such as advanced healthcare technology (breath diagnosis technology, etc.) and large-capacity optical communication technology, we are developing sensing nanodevices based on new detection principles by using NEMS (Nanoelectromechanical systems) technology, semiconductor technology, nanofabrication, device measurement technology, and information technology. We combine device technologies with information technology in order to create new sensing devices and technologies.

We value the sense of feeling "Interesting!", and we are challenging to create new technologies.

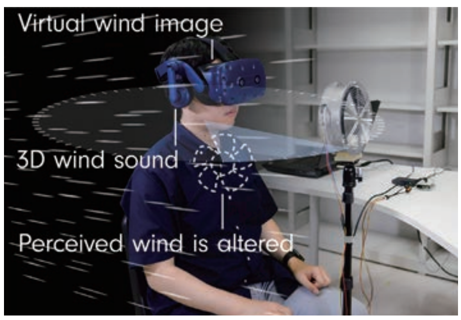


System platform promoting mental/physical health

BAN Yuki
Project Associate Professor

We are researching on elucidation of human perception and cognition, and development of control methods of them to realize innovative experiences and comfortable lifes. In particular, we have been focusing on the cross-modal effect, in which several different senses, such as vision and haptics, influence each other's senses, and have been discovering new effects and developing sensory display technologies using them. Specifically, we have researched on the presentation of sensory information such as virtual objects, wind, and water by using the cross-modal effect, and on the enhancement of human abilities such as the work efficiency by using illusions.

We are also working on a display that induces people's emotional states by combining sensory feedback and biometric measurement. We aim to create innovative sensory display technologies that utilize human perception and cognitive characteristics based on the technology of XR, AI, biometric measurement, and the knowledge of human interface and cognitive psychology.



Cross-modal Wind Display:
Modifying Perceived Directions of Wind Using Visuo-audio-haptic Interaction

Simulation of Complex Environmental Systems

MSLab website https://www.multi.k.u-tokyo.ac.jp/ CSLab website http://www.scslab.k.u-tokyo.ac.jp/

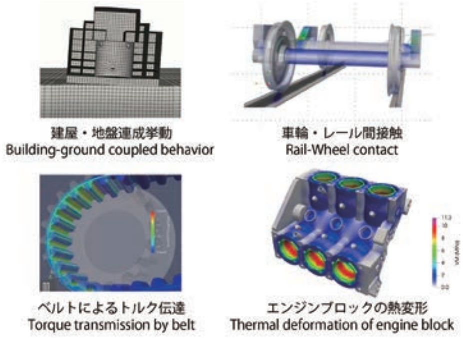
The Multi-Scenario Simulator & Simulation Complex Systems

OKUDA Hiroshi
Professor

Based on the mathematics of solid mechanics using the parallel finite element method and the technology of using supercomputers, cloud, and network, we will create practical industrial simulation and green innovation that are useful in a wide range of fields such as machinery, architecture, civil engineering, electronic and electricity. Aiming for this, we are conducting the following research.

1) Advancement of parallel finite element analysis system FrontISTR and its industrial applications, 2) Development of mathematical method for multiphysics problems including coupling with particle method, 3) Optimization for next-generation computer system, 4) Enhancement of computing efficiency by AI utilization.

https://www.multi.k.u-tokyo.ac.jp/



Parallel FEM simulations of artifacts

CHEN Yu
Professor

Research theme of CSLab is "simulation of complex systems," exploring diverse areas such as social-economics, complex fluids, and biological systems. Our four primary directions include: 1) Utilizing multi-agent cooperative evolutionary games for modeling and simulating financial markets, understanding agent decisions and their impact on market dynamics; 2) Employing discrete kinetic models to simulate complex fluids, providing microscopic-level insights into fluid dynamics; 3) Using cellular automata and heterogeneous stochastic agent models for simulating biological phenomena like cancer proliferation and aging; 4) Investigating agent-based modeling and simulations to analyze societal and technological transitions, focusing on how individual behaviors influence these significant shifts. The objective is to deepen our understanding of complex systems and devise innovative solutions for societal challenges.

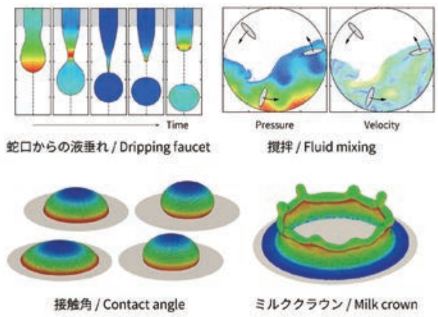
http://www.scslab.k.u-tokyo.ac.jp/

Simulations of colloidal fluids, growth of tissues, and financial crises

MATSUNAGA Takuya
Associate Professor

This laboratory carries out research on computational fluid dynamics using the particle method. The particle method is characterized by its meshfree calculation framework which enables us to numerically simulate fluid flows with complex gas-liquid interface behaviors. Since flows involving gas-liquid interfaces are ubiquitous in nature and industry, the particle method has been applied to the academic research and the industrial applications in a wide range of fields including automobiles, ships, chemical processes, and computer graphics. However, there are still many complex problems that cannot be solved with the current technology.

We challenge the frontier of computational science by developing new computational algorithms, integrating finite element methods, and using advanced HPC environments, and aim to solve the problems faced by industry and society.



Fluid simulation using a particle method

Human Augmentation

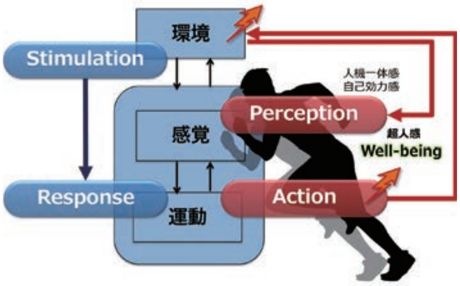
Lab website https://unit.aist.go.jp/rihsa/en/

Research on systems to be attached to human, in order to enhance and empower human functions

MOCHIMARU Masaaki
Visiting Professor

Human augmentation is a new research field for enhancement of physical and psychological functions of humans through wearable sensors, VR / AR, robots, etc. In our laboratory, elemental technologies are integrated for improving physical ability, willingness to continue, and cognitive ability based on an active model (Action-Perception) in which a person changes the environment by his / her own actions with augmented ability and perceives the change.

The Human Augmentation Laboratory has been established in the AIST Kashiwa Center at the Kashiwa II Campus, and three researchers belonging to Human Augmentation Research Center of AIST have been assigned as visiting professors. Our research interests are related to nursing care, health, and work situations. We set concrete research topic through collaboration with companies and medical institutions.

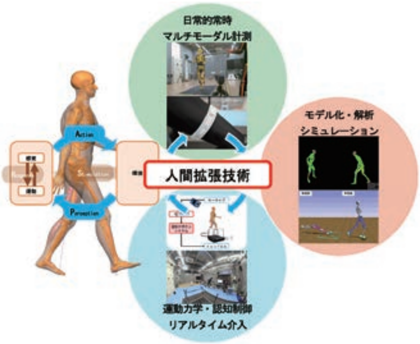


Human augmentation research based on the Action-Perception model

MURAI Akihiko
Visiting Associate Professor

Human augmentation technology augments human motor and sensory capabilities by designing their interactions. This technology consists of ①daily multimodal measurement, ②modeling, analysis, and simulation, and ③kinodynamic / cognitive control and real-time intervention.

①involves a development of human measurement technology using an image recognition by machine learning technology and wearable devices using flexible sensors, ②involves a development of musculoskeletal knodynamic analysis technology based on biomechanics and motion generation technology using deep learning technology, and ③involves a development of real-time intervention system using environmental kinodynamic / cognitive control based on robotics technology. Real-time loop of ①-②-③ would modify human behaviors and realize human augmentation technology.



Interaction Design for Human Augmentation

YOSHIE Michiko
Visiting Associate Professor

Our surrounding environment evokes different emotions, which in turn influence our voluntary actions. For example, the existence of an evaluative audience induces performance anxiety that can lead athletes or musicians to falter at a critical moment. We investigate psychophysiological mechanisms underlying the effects of emotions on voluntary actions, focusing especially on fine motor skills such as music and sport. Our research approach includes subjective measurements (e.g., questionnaires, semi-structured interviews), physiological measurements (e.g., autonomic activity, muscular activity, brain activity), and behavioral measurements (e.g., motor performance, artistic performance). Our goal is to develop human augmentation technologies that help us modulate emotional states and achieve optimal performance in our daily lives.

Enhancing human performance through emotion-environment interactions

Innovative Learning Creation Studies

Lab website https://www.ilcs.k.u-tokyo.ac.jp/index_e.html

Realizing an inclusive society by clarifying the mechanism of "Learning"

KURITA Kayoko
Professor (Concurrent)

Our main research theme is to establish innovative methodology of learning and teaching. In particular, we focus on effective teaching methods, and develop programs for instructors, such as single-lesson design, evaluation, course design, and mock classes, and verify their effectiveness. My area of expertise is the development and evaluation of faculty development (FD) programs for university faculty and pre-FD programs for graduate students.

We will also explore the characteristics in each topic and effective feedback methods from the perspectives of pedagogy and engineering. In addition, we are focusing on "reflection" as an element of educators' own quality improvement, and are conducting research on effective mentoring in the process of creating teaching portfolios and academic portfolios, on the effectiveness of reflection itself, and on dissemination and support, including renewal programs.

Development of a worksheet which facilitates one's own reflection

HACHISUKA Satori
Lecturer (Concurrent)

We are researching to establish innovative learning and teaching methods by elucidating the mechanism of human "Learning." We will systematize methods for sensing human physiological and psychological condition, effective feedback methods for learning, and multiple evaluation methods by focusing on human "Learning."

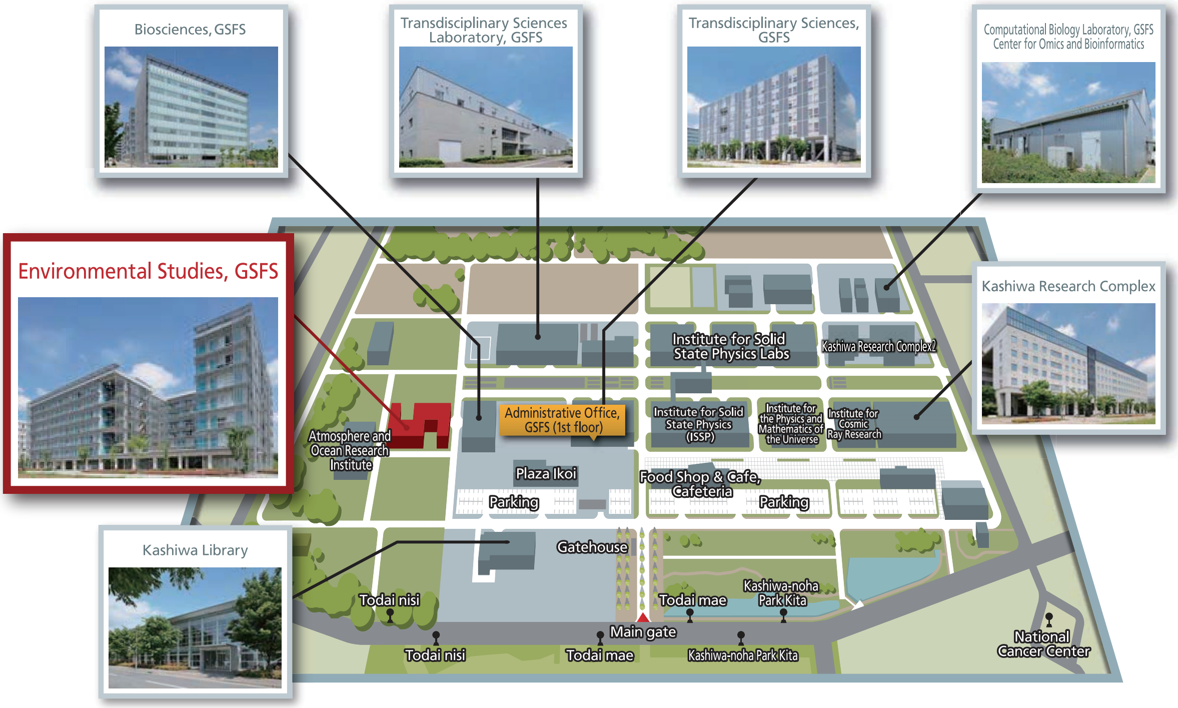
Our research areas are based on knowledge of ergonomics (human factors), human interface, pedagogics, and technologies of signal processing, AI, XR and more. Our goal is to combine those knowledge and technologies to develop human-centered learning system. Specifically, we are researching eye gaze tracking and facial expression measurement during online learning, quantification of teaching methods by teacher movement analysis, improvement of learning effect by multimodal stimuli and VR. In the future, these research results will support both the learning and the teaching sides and help the development of diverse human resources. In addition, this course features efficient and speedy research suitable for real world by cooperation with Nagase Brothers Inc.

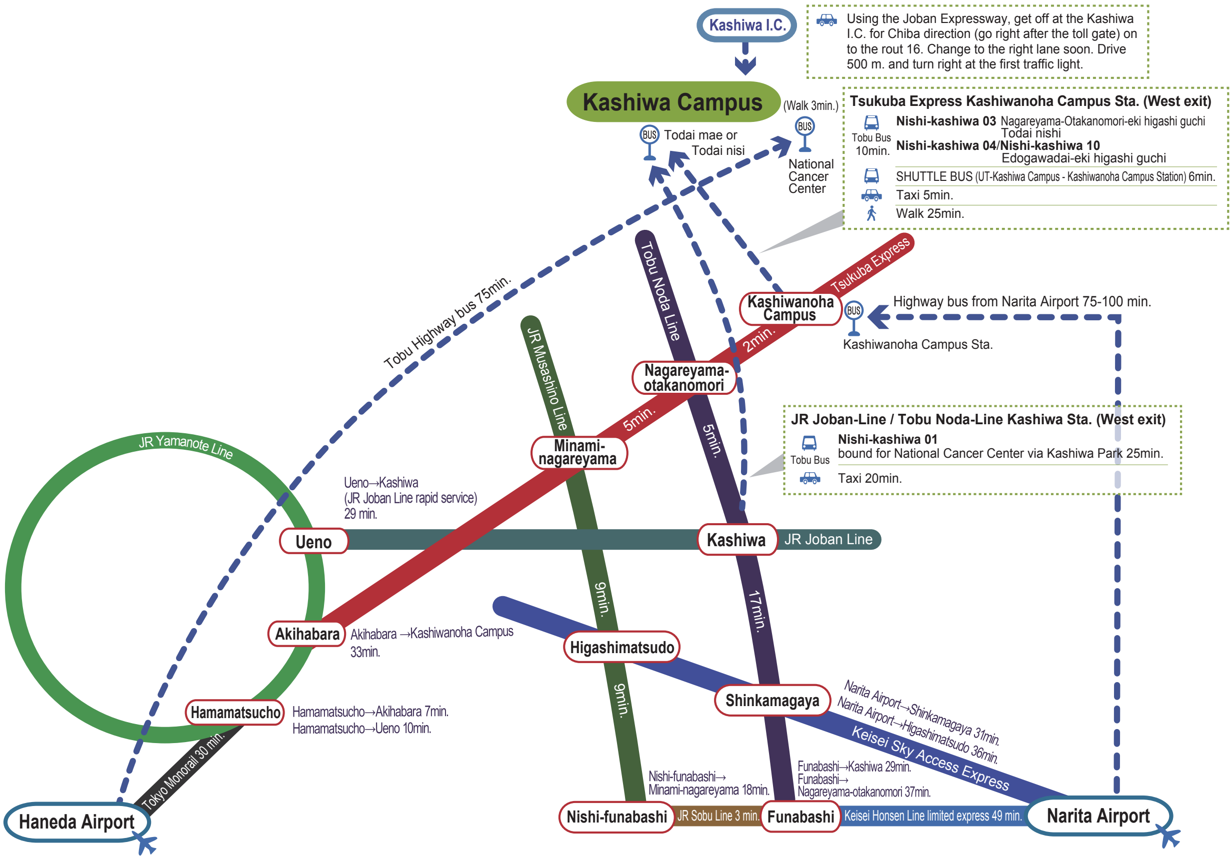
Eye gaze tracking during online learning

INQUIRIES CONCERNING THE ENTRANCE EXAMINATION

For information about the entrance examination, please refer to the graduate school application guidelines and the entrance examination guide. For details on how to obtain these documents and a detailed schedule of the entrance examination briefing session, visit the website of the *Department of Human and Engineered Environmental Studies, Graduate School of Frontier Sciences, the University of Tokyo* (https://www.h.k.u-tokyo.ac.jp/index_e.html).

For inquiries regarding admission to the Department of Human and Engineered Environmental Studies
Email: hees-admission@edu.k.u-tokyo.ac.jp





DEPARTMENT OF
HUMAN AND ENGINEERED ENVIRONMENTAL STUDIES

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