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.

[VR center]
denotes the professors of VR Center (*2) holding adjunct professorship at School of Information Science and Technology.

*2 Virtual Reality Educational Research Division, Center for Education and Research in Information Science and Technology (CERIST), and Virtual Reality Educational Research Center, The University of Tokyo.
## Kuzuoka-Amemiya-Narumi Laboratory

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.

### Virtual Reality / Mixed Reality

- Redirected Walking techniques
- Multi-modal and Cross-modal Interfaces
- Human Augmentation with Virtual and Augmented reality
- Ghost Engineering
  - (Embodyment toward Avatars and Its Effect on Perception/Cognition)
- Virtual and Augmented Reality-Based Education

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

- Telepresence Systems for Enhancing Remote Communication
- Human-Robot Interaction and Social Robot
- Behavior Elicitation & Emotion Evacuation Interfaces
- Lifelog Visualization and Analysis, and Lifelog-based Future Prediction

### Special Areas

- **3D World Reconstruction from 2D Images**
- **Territorial Virtual Time Machine**
- **Redirected Walking using Visuo-haptic Interaction**
- **Ownership toward Augmented Body**
- **Social robots in museum**
- **Gustatory / Olfactory displays**
- **“Cloning” technique for mediated group work**
- **Emotion evocation via pseudo-bodily reactions**

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Dynamics and Control Systems Laboratory [http://www.ynl.t.u-tokyo.ac.jp/](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) Biomechanics: Video MoCap, Musculo-skeletal Model, Sports Analysis
(4) Humanoid Robotics: Hydraulic Actuators, Motion Control and Soft Robotics

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Kanzaki & Takahashi Lab

**Research field:** The aim of our research is to clarify the basic neural mechanisms for generating adaptive behaviors (or intelligence) using interdisciplinary approaches combining informatics, engineering and biology. As model systems, we use cultured neurons, insect brains and rat brains. Our research deals with investigating bio-machine hybrid systems, and also establishes basic technologies for controlling behavior by external commands to brain functions.

**Kanzaki Group (RCAST, Komaba Research Campus)**
http://www.brain.rcast.u-tokyo.ac.jp/

1. **Understanding elementary intelligence of insect brains**

2. **Odorant sensors based on insect odorant receptors**

3. **Physical reservoir computing with neuronal tissues**

4. **Neural consciousness of consciousness and learning based on functional imaging**
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, tableware, 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) **Embedded robotics devices**: soft flesh or deformable tactile sensor devices, integrated IMU sensors, perception devices, embedded CPU for flying robots, onbody communication LAN system, power system for intelligent robots, etc.

(4) **Dynamics whole body control humanoid**: integrating high-torque, high-speed motor drive circuit, high-speed 3D recognition system, dynamics whole-body.

(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.
Laboratory for Intelligent Systems and Informatics (ISI)

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

A Breakthrough Towards Truly Intelligent Systems in the Real World:
Towards truly effective and human beneficial intelligent systems in the complex and uncertain real world, we are trying to develop next generation AI methods based on new understanding of the principles of human intelligence, with application to real world tasks.

1. Origin of Intelligence: Constructive Study of Emergence and Development of Embodied Cognition and Behavior

2. Elucidating/Modeling Human Intelligence, Next Generation AI

3. Musculo-Skeletal Bodies and Motor Skills
Artificial Muscles, Human/Animal Type Musculo-Skeletal Robots, Thin & Flexible Tactile Sensors, Biomechanics, Jumping & Running, Sport Motion, “Knacks” and “Focuses”, Motor Learning

4. Soft Robotics

5. Science & Technology of Monitoring / Nursing, Elderly Care,
Assistive Technology for Peple with Developmental Disorders
Our goal is to invent advanced intelligent systems for real-world recognition, contents generation and knowledge discovery by combining useful but infinite information in the physical space with a massive amount of data and powerful computational resources in cyberspace. To tackle this challenging problem, we utilize all resources in the area of computer science, including the mathematical basis and robotics.

1. Mathematical Basis
   - Information theory, machine learning, deep learning, data mining, pattern recognition, stochastic/statistical theory, time series analysis, causality analysis, learning theory, feature extraction

2. Recognition, Understanding and Thinking
   - Computer vision, image recognition and retrieval, 3D vision, behavior recognition, multimodal recognition, emotion understanding, natural language processing, speech and music information processing, medical information processing, big data

3. Contents Creation
   - Sentence generation and summarization of image and video, image generation from sentences, dialog system, automatic article generation system

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**Harada Laboratory**

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

**Machine Intelligence**

Advanced Intelligent System for

Recognition in Real-world, Contents Generation and Knowledge Discovery

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**Image feature extraction based on information theory and machine learning**

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**Integration of computer vision, computer graphics, and machine learning**

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**Automatic sentence generation system**

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**Automatic realistic image generation of unseen object**
Our group focuses on creating bio-hybrid systems that combine bio-functional materials with micro/nano devices. As one example, biohybrid robots powered with skeletal muscle tissues allow to engineer dynamic systems of living organisms. As another example, biohybrid sensors with recombinant cells can detect target materials with high sensitivity and selectivity. We aim to realize such hybrid systems by combining various disciplines, such as mechanics, informatics, biophysics, cell biology, and material sciences. Personnel interested in multidisciplinary research, with any of these abovementioned backgrounds, are warmly welcomed to join us.