Laboratory Introduction

2024.09.13.

Bio-Robotics and Human-Mechatronics laboratory

Graduate School of Information, Production and Systems, Waseda University

https://sem-matsumaru.w.waseda.jp/

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Biographical information

Ichiro Kato
1926-1994

- 1985 B.S., Mechanical Engineering, Waseda University.
  "Development of articulated manipulator aiming at force control",
  (Supervised by late Prof. I.Kato).
- 1987 M.S., Mechanical Engineering, Waseda University.
  "Basic theory of multi d.o.f. compliance control on articulated manipulator",
  (Supervised by late Prof. I.Kato).
- 1987-99 Corporate Research & Development Center, Toshiba Corporation.
  - Research on robots for specialized operations.
  - Developing mechatronics systems using robotic technologies.

TOSHIBA

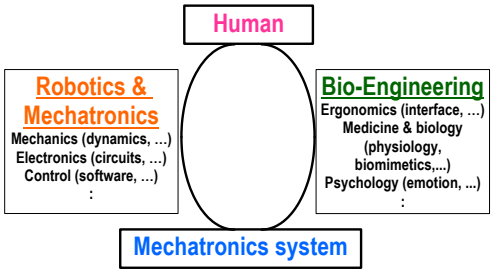
- 1998 Ph.D., Mechanical Engineering, Waseda University.
  "Research on structure and control of working robot in a narrow space",
  (supervised by Prof. S.Sugano).
- 1999-2010 Associated Professor, Shizuoka University.
  - Education and Research on Bio-Robotics and Human-Mechatronics.
  - Invited Professor (2003). LSC - CNRS, Evry France, Visiting Fellow (2002).
    Shizuoka Industrial Research Institute, Shizuoka Japan, etc.

国立大学法人 静岡大学

- 2010- Professor, Waseda University.
  - Research and Education on Bio-Robotics and Human-Mechatronics.

Bio-Robotics and Human-Mechatronics Laboratory

- Various subjects between human and mechatronics systems (robots and other systems).
- To make mechatronic systems more useful / friendly for users.
- Developing original functions and producing real-world systems.
- Integrating various knowledge and technologies into systems (selection / combination are based on engineering sense).
  → System Integrator (SIer).
- Work on elemental technologies by ourselves if necessary.



Better interaction / relationship between human and robots

https://sem-matsumaru.w.waseda.jp/d01theme.htm

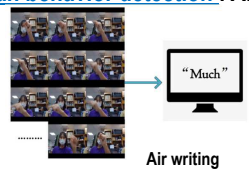
Example of recent students' topics

Image processing: Super-resolution, Fake face detection

Super-resolution

Fake face detection

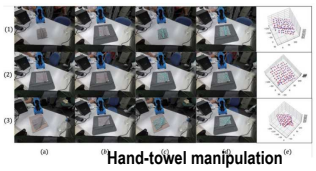
Human behavior detection : Air writing recognition, Human posture classification.



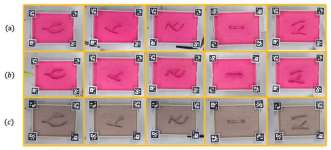
Air writing

Posture recognition 15FPS

Robotics: Reproduction of object deformation.



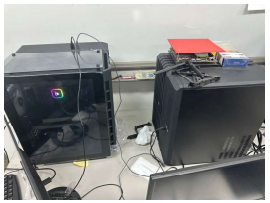
Hand-towel manipulation



Trench making

Research equipment

Deep learning machines:
A6000*2, 3090*2



Depth sensor:
Azure Kinect, Zed series……

6 DOF manipulator *3sets

Spot: Available in our cooperating lab from WUT.

Seekur Jr: Available in our cooperating lab from WUT.

WUT: Warsaw University of Technology (Poland-Europe)

Expectations for students

- What is your purpose of admission?
  - Tourism in Japan. ×
  - Earning a degree. △
  - Personal growth. ○
- Request --- Change your Mindset.
  - Passive. × Waiting, Being given, ..
  - Active. ○ Act, Acquire, ..

Graduate vs. Undergraduate

- **Graduate school**.
  - Research.
  - Unknown issues.
  - Chaotic, Trial and error.
  - Proposal.
    novelty, uniqueness,
  - Different result.
    because of you (individuality).
  - No correct answer.
    make it correct.
- **Undergraduate school**.
  - Learning.
  - Existing facts.
  - Systematized, Formulaic.
  - Memory.
    certainty, responsiveness,
  - Same result.
    no matter who does (uniform).
  - A correct answer,
    always same

Supervisor vs. Teacher

- **Supervisor**.
  - Give the guidance of research.
  - Play the role as a collaborator or platform.
  - Consider by yourself and discuss.
  - The responsibility to support student to become researcher.
- **Teacher**.
  - Teach detailed knowledge step by step.
  - Play the role as knowledge giver.
  - Just follow the teacher‘s instructions.
  - The responsibility to let everyone learn knowledge well.

Research

- <Definition>
  - Reveal something unknown or new (in some sense) based not only on the person himself but also based on the accumulation of previous research.
- <Basis of judgment>
  - Critical examination of previous research and conventional technology.
- <Resources/accumulation>
  - Emphasis on facts/theories,
  - Utilization of data/theories.
- <Action/attitude>
  - Logical/critical examination,
  - Hypothesis-testing examination,
  - Logical reasoning,
  - Critical analysis.
- <External Attitude>
  - Explanation of the process,
  - Ability of expression and persuasion.
- <Research activities>
  - Cultivation of professionals with a research mindset and research methods.

Laboratory Activities

1. Regular lab meeting (once a week).
   A) Students do the reporting and discussion (volunteer).
      - Active student has more chance to get the guidance and supporting.

   B) Peer review.
      - Present and share with all members, learn from each other.
      - Normally, one-on-one individual guidance and support will not be provided.
2. Daily activities such as discussion / consultation, mutual learning, and mutual checking among lab members (persuasiveness).
   A) Students do the reporting and discussion(volunteer).
      - A training to explain to others and make them to understand and agree .
      - Activities to increase the number of consenters and supporters.

Thesis for a degree

- Master's thesis = Research paper.
  - Both research content (uniqueness/novelty and usefulness/benefit) and expressions with enough information.
  - not an activity report (a list of your actions).
  - To think items (information and grounds) by yourself, and to constantly collect and accumulate them.
- Emphasizing arguments and conclusions.
  - Visualize = Write it down. Use it to organize your thoughts.
  - Actual tasks, evidence information, structure of persuasive logic, etc. required will be different depending on the conclusion to be asserted.
- Guidance (instruction, advice, suggestion) can be given after the information on the grounds for your assertions and conclusions and your persuasive logic are presented.
  - If you think out your claims and conclusions well, you will be improved by the advice and suggestions obtained.
  - Only on the midway progress, no one can discuss to determine whether adequacy/insufficient or pass/fail.
- Ability to persuade.
  - Ability to think about the necessary ground information and collect and record it,
  - Ability to critically analyze the resulting data, etc.
- Approved by professional examination.
  - Such as acceptance at international conferences and academic journals. A peer-review experience valuable.
  - Claims for originality/novelty and usefulness/benefit must be the same both inside and outside the school.
  - Utilize experts outside the school.
- Guidance (correction of sentences, detailed comments, etc.) will not be provided for the details of your documents (including doctoral dissertations).
  - A degree is given for individual ability. A thesis is an object for judging your abilities.
  - Apply your items in the guidelines by yourself, consider them, and create your own draft answer.

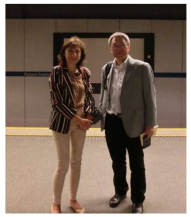
Schedule (guideline)

- 1S --- Setting your research topic.
  - Deepening the research concept, collecting information (literature survey, etc.), acquiring skills (algorithms, tools, etc.)
- 2S --- Implementation.
- 3S --- Experiment.
  - Results and analysis.
  - Writing full-length manuscript.
- 4S --- Update.
  - Additions and revisions.
  - Thesis completion.

https://sem-matsumaru.w.waseda.jp/g01event.htm

International cooperation

Warsaw University of Technology (Poland-Europe):
- Research cooperation.
- Opportunity for short time internship.

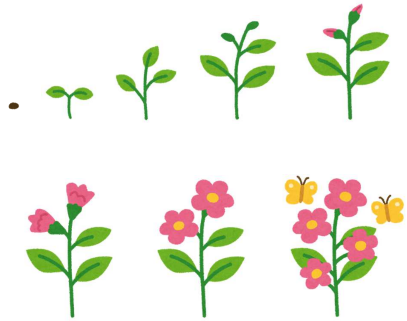




ICSSR (Indian Council of Social Science Research) - JSPS (Japan Society for the Promotion of Science) joint research: IIT Jodhpur, IIT Delhi, etc.
- Research cooperation.
- Opportunity to mutual visiting.


Message

- Let's grow up together developing a new field at the meeting ground for people who have a new way of thinking and extraordinary abilities regardless of areas or aspects.

- 領域や分野にとらわれない新しい考え方や，高い能力をもった人々が集う場で，新しい分野を開拓しながら，一緒に成長しましょう.



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