## AY2021 Plans of Creative Factory Seminar
## 2021年度創造工房セミナーについて

| Code | Theme | Instructors (main instructor) |
|---|---|---|
| CFS01 | Human Action Analysis and Recognition using Machine Learning Techniques | SHIN, J. |
| CFS02 | Robotics, Control, and VR with Dog-like robots on rough terrains e.g. Disaster Site and the Moon "Let's go around UoA with pupper!"<br>災害現場や月面等を想定した不整地でのロボット制御とVR（四つ足ロボットで大学を一周してみよう！） | OHTAKE, M.,<br>DEMURA, H.,<br>YAMADA, R.,<br>OGAWA, Y.,<br>HONDA, C.,<br>KITAZATO, K. |
| CFS03 | UoA Team in COVID-19 Open Research Dataset Challenge | ZHU, X.,<br>PEI, Y. |
| CFS04 | Methods, tools, and devices to design and produce 3D objects<br>立体形状デザインと造形のための手法と技術 | COHEN, M.,<br>YOSHIOKA, R |
| CFS05 | Performance Improvement of an Application using an FPGA Board | SAITO, H.,<br>KOHIRA, Y.,<br>TOMIOKA, Y. |
| CFS06 | Development of Autonomous Driving Algorithms on Embedded Systems | OKUYAMA, Y.,<br>SUZUKI, T.,<br>ASAI, N.,<br>BEN, A |
| CFS07 | Wireless Control of Five Finger Robot Hand with Digital Gloves | JING, L. |
| CFS08 | Developing a Big Data Analytical Framework to Extract Spatiotemporal Trends in Very Large Air Pollution Databases | RAGE, U. K. |

セミナーの成果を発表する「ポスターセッション（9月17日（金）開催予定）」への参加が必須です。

成績はポスターセッション終了後に決定されます（確定は10月）。

Students are required to participate in Poster Session scheduled on September 17 (Fri).

Grades will be determined after the Poster Session in October.

| CFS 1 | **Human Action Analysis and Recognition using Machine Learning Techniques** |
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| Instructors | SHIN, J. |
| Course Schedule | June 9 – September 17<br>* Production creation: June 9 – September 17 |
| Abstract | In recent years, human action analysis and recognition based on video analysis or sensor data analysis has attracted considerable attention in research and industrial community. This course aims the human action analysis and recognition using machine learning techniques. The applications of human action analysis and recognition are spreading in various fields, such as detecting suspicious behavior in public areas, healthcare, elderly people monitoring, fitness tracking, working activity monitoring, human computer interaction, intelligent video surveillance, human-robot interaction, human disorder identification and so on. The purpose of this course is to study feature extraction, selection and machine learning algorithms and use those algorithms to develop human action analysis and recognition system. In the case of applications, we will mainly focus on human neurological disorder identification and gesture recognition.<br>The basic procedure of a system is as following:<br>1. Human action data collection (video based or sensor based)<br>2. Feature extraction and selection<br>4. Build the classification or matching or clustering or regression model<br>5. Take the unknown person data<br>6. Test and evaluate the model<br>Through this course, we can learn the fundamental knowledge of data analysis, pattern matching, and pattern recognition in the area of human action analysis and recognition.<br>. |

| CFS 2 | Robotics, Control, and VR with Dog-like robots on rough terrains e.g. Disaster Site and the Moon "Let's go around UoA with pupper!"<br>災害現場や月面等を想定した不整地でのロボット制御と VR（四つ足ロボットで大学を一周してみよう！） |
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| Instructors | OHTAKE, M., DEMURA, H., YAMADA, R., OGAWA, Y., HONDA, C., KITAZATO, K. |
| Course Schedule | June 9 – July 6<br>* Production creation: June 9 – September 17 |
| Abstract | Tasks of this PBL are Assemblation of two dog-like robots derived from Stanford University, Controling them,making VR by 360-cameras,testing SLAM, and Practising Machine Learning as a base of the control. This course handles two puppers as a minimum swarm robots, and tries to experience a self-positioning. Outputs of this course are defined as assembled robots and VR-space of UoA generated by on-board 360° cameras. If students can establish procedures of self-positioning, this is also included as an extra-output.<br><br>本 PBL では Stanford 大学モデルの四つ足ロボットを組み立てて、姿勢制御、VR、自己位置同定、それらの基礎となっている機械学習といったトピックを体験する。2 台の四つ足ロボットを最小の群として扱って、自己位置同定の練習を行う。組み立てたロボット、360 度カメラを用いた大学 VR 空間を最小限の成果物と定義する。2 台の四つ足ロボット同士の相対的位置同定を光学で行うことなどにも挑戦し、自己位置同定手順が確立できればそれもエキストラの成果とする。 |

| CFS 3 | UOA Team in COVID-19 Open Research Dataset Challenge |
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| Instructors | ZHU, X., PEI, Y. |
| Course Schedule | June 1 – September 30<br>*Product Creation Period: June 1 – September 30 |
| Abstract | With the development of imaging technology and deep learning, physicians and radiologists have realized the necessary of medical data using deep learning. Our research lab is performing collaboration research with Fukushima Medical University, Toho University, and Huazhong University of Science and Technology in the automatic interpretation of endoscopy images, CT/MRI images, and ultrasonic images.<br>In order to improve the efficiency of interpreting medical data with the aid of medical information, we expect to develop a computer-aided diagnosis and analysis system based on deep learning, medical images, and medical information. Recently, pneumonia has aroused the concerns of society and is a research target. In this creative factory seminar, students will learn how to build a medical image and information database using open database and clinical database, learn the knowledge of machine learning and deep learning, and implement AI technology to clinical medicine. A seminar will be given by a guest lecturer to introduce the basic knowledge and technology of deep learning.<br>COVID-19 Open Research Dataset Challenge provides a 33 GB database for 17 tasks. These real data can help our students master the skills for data analysis on medical data, and also enable our students to make contributions to win the war with COVID-19. |

| CFS 4 | **Methods, tools, and devices to design and produce 3D objects; 立体形状デザインと造形のための手法と技術** |
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| Instructors | COHEN, M., YOSHIOKA, R. |
| Course Schedule | September 8 – September 10<br>* Production creation:　September 13 – September 22 |
| Abstract | この講義ではハプティックモデリングについて学ぶとともに、Geomagic Phantom Omni 触覚デバイスとモデリングソフト Freeform / Claytools による 3 次元触覚モデリング、constructive solid geometry などについて学びます。大部分をしめる演習では受講者が実際に上記ツールでモデリングを行い、技術への理解を深めると共にこれら技術の特徴を生かした造形物の創造プロセスを体験します。この技術で作成される造形物には多様な用途があり、印鑑、フォント、彫刻、様々な装飾や土産物などへの応用がこれまでに試みられています。また、モデリングソフトで作成したモデルは、ラピッドプロトタイピング用3D プリンター（Ultimaker2+または Ultimaker3）を利用して造形を行います。<br><br>he lectures will include a review of haptic modeling, including CAD authoring tool "Freeform / Claytools"　for Geomagic Phantom Omni force-display interface, and suggestions for advanced techniques, including constructive solid geometry (CSG). There will also be "hands-on" sessions, in which each participant uses the described software to make their own creation. These objects can be applicable in many applications as new hankos, fonts, sculptures, decorations, and souvenirs. Models created by tparticipants will be printed using a 3D printer (Ultimaker2+ or Ultimaker3) for rapid prototyping.<br><br>Relevant links:<br><br>Administration:<br>http://www.u-aizu.ac.jp/en/graduate/curriculum/guide/seminar-cis.html#CFS<br>http://www.u-aizu.ac.jp/graduate/curriculum/guide/seminar-cis.html#CFS<br><br>Rapid prototyping:<br>http://en.wikipedia.org/wiki/Rapid_prototyping<br>http://ja.wikipedia.org/wiki/ラピッドプロトタイピング<br><br>Home page of publisher of main CAD software:<br>https://www.3dsystems.com/software/geomagic-freeform<br>https://ja.3dsystems.com/software/geomagic-freeform |

| CFS 5 | **Performance Improvement of an Application using an FPGA Board** |
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| Instructors | SAITO, H., KOHIRA, Y., TOMIOKA, Y. |
| Course Schedule | June 14 – September 24<br>* Production creation: July 1 – September 17 |
| Abstract | Objective:<br>The main objective of this seminar is to accelerate an application using a field programmable gate array (FPGA) board. Through this seminar, students learn circuit design, performance improvement, or power optimization. Moreover, students learn how to use a tool such as Electronic Design Automation (EDA) tool for their development.<br><br>Through the seminar, students study<br>1. how to model an application using a language<br>2. how to use a tool<br>3. how a synthesized circuit or a program code works on an FPGA board<br>4. evaluation of the developed circuit or code<br><br>Method:<br>1. Selection of an application such as an image processing<br>2. Modeling of the application using a language<br>3. Synthesis of an integrated circuit using Altera Quartus Prime or Xilinx Vivado<br>4. Simulation of the synthesized circuit or the program code using a simulator<br>5. Execution of the synthesized circuit or the program code |

| CFS 6 | Development of Autonomous driving Algorithms on Embedded Systems |
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| Instructors | OKUYAMA, Y., SUZUKI, T., ASAI, N., BEN, A. |
| Course Schedule | June 9 – July 14<br>* Production creation:   July 14 – September 17 |
| Abstract | Development of Autonomous driving Algorithms on Embedded Systems Multiple companies develop vehicles capable of autonomous driving. These vehicles can run autonomously without any drivers. Currently, self-driving technologies employ some specialized devices such as GPS, maps, LiDARs, and other sensors.   The fully automated driving/piloting vehicles must be responsible for protecting humans with a general monocular camera and image recognition for multiple tolerance. However, existing embedded processor systems have difficulty with real-time image recognition due to algorithms' calculation complexity. Technological innovation by FPGAs and GPGPUs is indispensable for this realization.   In this class, we aim to develop vision-based algorithms on embedded devices required for safe autonomous driving. Participants who join this class must follow previous knowledge about Python, C language, and FPGA development. Participants will learn about data recording/playing, camera calibration, path following, and vehicle control. After that, participants will solve project-based assignments selected by the following topics.<br>1. Map generation and localization<br>2. Object detection and traffic light detection<br>3. Path generation and path planning<br>4. Neural network algorithms related with self-driving<br>Participants must implement a part of these algorithms on programmable SoC or embedded GPGPU board.<br><br>Schedule<br>June: (a) Understanding data recording/playing, camera calibration (b) Path following, and vehicle control.<br>July: (a) Practical exercise using Self-driving AI car(b) Project selection and Implementation (two times project meetings per week)<br>August: Self-working September 6th: Deadline of the project assignment.<br>September 18th: Deadline of project poster and reports. |

| CFS 7 | Wireless Control of Five Finger Robot Hand with Digital Gloves |
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| Instructors | JING, L. |
| Course Schedule | July 1 – September 13<br>* Production creation (Details are to be informed by course instructor.) |
| Abstract | Tracking the position and activities are the key issue for the active services in the fields like human computer/robot interaction. Wearable sensing technology provides a low cost, mobile, and scalable solution such applications. In this course, students will have a chance to develop a control system of the humanoid robot hand with the digital gloves.<br><br>Through the project, students are expected to learn the following knowledge and skills:<br>- processing of time-series data<br>- basic python programming<br>- fundamental machine learning method<br>- sensing knowledge<br>- fundamental mechanical/electronic knowledge<br><br>Seminar Schedule:<br>stage 1 (Jul. 1~15)<br>: Project understanding, definition of the minimal system, task assignment, make the development plan.<br>stage 2 (Jul. 16~Aug.31)<br>: minial system development<br>stage 3 (Sep.1~Sep.13)<br>: development and presentation |

| CFS 8 | **Developing a Big Data Analytical Framework to Extract Spatiotemporal Trends in Very Large Air Pollution Databases** |
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| Instructors | RAGE, U. K. |
| Course Schedule | June 15 – September 15<br>* Production creation: July 1 – September 15 |
| Abstract | Air pollution is major cause for many cardiorespiratory problems in Japan. Every year at least 60,000 Japanese are dying due to air pollution. To confront this problem, Ministry of Environment, Japan has set up a nation-wide sensor network, called SORAMAME, to record air pollution levels throughout Japan on an hourly basis. The raw data generated by this sensor network naturally exist as Spatiotemporal big data. Useful information that can empower the users (e.g., environmentalists and policy-makers) lies in this big data. The objective of this course is to develop a tool kit that can facilitate the experts to find useful information hidden in the big air pollution data.<br><br>In this Create Factory Seminar, students will first develop a Big Data Air Pollution Analytical Framework using Hadoop, HBase, and Spark system. Next, students will develop ETL (Extraction, Transformation, and Load) technologies to store the SORAMAME data into the developed big data information. Next, students will develop novel distributed pattern mining algorithms to discover patterns in the big air pollution data. Next, students will evaluate their distributed algorithms against the state-of-the-art sequential/distributed algorithms. Finally, the entire work will be submitted to a renowned computer science conference whose CORE RANK is B or more. |