AY2022 Plans of Creative Factory Seminar
2022年度創造工房セミナーについて

Code	Theme	Instructors (main instructor)
CFS01	Human Activity Analysis and Recognition using Machine Learning Techniques	SHIN, J.
CFS02	Sensor Fusion: Treasure hunting by rover! センサーフュージョン：ローバーで宝探し！	OHTAKE, M., DEMURA, H., YAMADA, R., OGAWA, Y., HONDA, C., KITAZATO, K. HIRATA, N.
CFS03	Multimodality Medical Data Analysis for the Diagnosis of Heart Diseases	ZHU, X., PEI, Y. LYU, Guo-Wei
CFS04	Sign Language Recognition with Small Data	JING, L. LI, X.
CFS05	Methods, Tools, & Devices to Design and Produce 3D Objects: Haptic Modeling and Rapid Prototyping (“3D Printing”) 立体形状デザインと造形のための手法と技術: 触覚モデリングとラピッドプロトタイピング	COHEN, M., YOSHIOKA, R
CFS06	Challenge to develop a UAS for disaster response	YAGUCHI, Y.
CFS07	Performance Improvement of an Application Using an FPGA Board	SAITO, H., KOHIRA, Y., TOMIOKA, Y.
CFS08	Developing a Data Warehouse to Store Fukushima Traffic Congestion Data	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16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 16 (Fri).

Grades will be determined after the Poster Session in October.

CFS 1	Human Activity Analysis and Recognition using Machine Learning Techniques
Instructors	SHIN, J.
Course Schedule	June 9 – September 16 * Production creation: June 9 – September 16
Abstract	In recent years, human activity 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 activity analysis and recognition using machine learning techniques. The applications of human activity 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 activity analysis and recognition system. In the case of applications, we will mainly focus on human neurological disorder identification and gesture recognition. The basic procedure of a system is as following: 1. Human activity data collection (video based or sensor based) 2. Feature extraction and selection 4. Build the classification or matching or clustering or regression model 5. Take the unknown person data 6. Test and evaluate the model Through this course, we can learn the fundamental knowledge of data analysis, pattern matching, and pattern recognition in the area of human activity analysis and recognition.

CFS 2	**Sensor Fusion: Treasure hunting by rover!** **センサーフュージョン：ローバーで宝探し！**
Instructors	OHTAKE, M., DEMURA, H., YAMADA, R., OGAWA, Y., HONDA, C., KITAZATO, K., HIRATA, N.
Course Schedule	June 13 – August 1 * Production creation (Details are to be informed by course instructor.)
Abstract	Students will have experience of sensor fusion based on SLAM in an extreme environment on rough terrain for lunar development activities. The outputs are a set of established analysis procedures and supporting tools, etc. The following tasks are set: 1) To search for a location with specified geometric conditions based on SLAM measurements by LIDAR, 2) To search for a specified material by multi-band camera, and 3) To search for a safe path by determining a starting point and an ending point based on their searched positions on the simulated lunar surface. Participant will be devided to teams to create the required tools and models, as well as the procedures to realize these tasks. The teams will work together to achieve the goal and present the results. Data acquired at the RTF and data from the lunar explorer KAGUYA will be used to simulate the lunar environment. One day experiment will be held at the Robot Test Field Fukushima using the developed hardware and software in Q2. 月面開発活動を念頭においた不整地極限環境における SLAM ならびにセンサフュージョンを体験する。成果物は、確立した解析手順とその支援ツール等一式である。1) LIDAR による SLAM 計測結果に基づいて指定された幾何条件の場所を探索する、2) マルチバンドカメラのデータから指定された物質を探索する、3) それらの位置情報を踏まえて始点と終点を決めて安全な模擬月面経路探索をする、といったタスクを設定する。チームに分かれてそれらを実現する手順と必要なツールやモデルを作成し、解析結果と共に成果発表する。月面模擬環境として、ロボットテストフィールド福島での取得データや月周回衛星かぐやのデータなどを使用する。 Q2 期末試験予備日に日帰りでロボットテストフィールド福島での実証試験を予定。

CFS 3	Multimodality Medical Data Analysis for the Diagnosis of Heart Diseases
Instructors	ZHU, X., PEI, Y., LYU Guo-Wei
Course Schedule	June-July: Learn basic knowledge about heart murmur and related medical knowledge, confirm tasks to be performed, get a database from The George B. Moody PhysioNet Challenge 2022, and learn basic knowledge and skills of deep learning. Some knowledge about pneumonia and an open database will be introduced. July-August: Build a data analysis system using deep learning frameworks such as Torch, Tensoflow, and etc. for medical information and image analysis based on an open database. August-September: Evaluate the system, and prepare the poster and document for the final presentation.
Abstract	Background: COVID-19 pandemic brings difficulties in the clinical evaluation of patients by delaying important patient-doctor visiting, and significantly reducing screening and monitoring activities for diseases. Congenital heart diseases affect many patients, representing an important morbidity and mortality factor for several severe conditions, including advanced heart failure. Heart sound, also named phonocardiogram (PSG), is an important noninvasive tool for the diagnosis of heart diseases. However, heart sound alone is usually not enough for the accurate diagnosis of heart diseases. Electronic health data such as age, sex, height, and weight may provide additional information for screening heart diseases. Goal: 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 medical signals and information, especially for the diagnosis of heart diseases. 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. Heart Murmur Detection from Phonocardiogram Recordings: The George B. Moody PhysioNet Challenge 2022 provides data for the detection of heart murmur. 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 clinical medicine.

CFS 4	Sign Language Recognition with Small Data
Instructors	JING, L., LI, X.
Course Schedule	July 1 – September 13 * Production creation (Details are to be informed by course instructor.)
Abstract	Sign language is an important means of communication for people with speech or hearing impairments. On the other hand, it is difficult for normal people to understand sign language. Therefore, Sign Language Recognition (SLR) is important to facilitate communication between people with speech or hearing impairments and normal people. In this project, we are planning to develop a SLR system with small data set. Therefore, the students can expect to learn the following knowledge and skills: - skeleton calculation method from the video data - data aumentation methods like GAN - classification methods like GCN - some fundamental Japanese Sign Language Seminar Schedule: stage 1 (Jul. 1~15) : Project understanding, definition of the system, task assignment, make the development plan. stage 2 (Jul. 16~Aug.31) : system development and evaluation stage 3 (Sep.1~Sep.13) : summary on the project and prepare the presentation

CFS 5	**Methods, Tools, & Devices to Design and Produce 3D Objects: Haptic Modeling and Rapid Prototyping (“3D Printing”); 立体形状デザインと造形のための手法と技術: 触覚モデリングとラピッドプロトタイピング**
Instructors	COHEN, M., YOSHIOKA, R.
Course Schedule	August 30 – August 31 * Production creation: September 1 – September 15
Abstract	The lecture will consist of an introductory-level lecture and hands-on exercise on haptic modeling using Geomagic FreeForm software and Phantom Omni haptic device. The students will understand the basic concepts and techniques of haptic modeling necessary for getting started in modeling their own designs. The students will also understand features of modeling that will influence the 3D printing process so that they may effectively model 3D print-ready models. Additional workstations will be provided by Data Design Inc. for the lecture to supplement the two workstations installed at UoA.

CFS 6	Challenge to develop a UAS for disaster response 災害対応ドローンシステムの開発チャレンジ
Instructors	YAGUCHI, Y.
Course Schedule	June 15 – August 3 * Production creation: August 3 – September 3
Abstract	Objective - UAS development is emergently topic of new industrial revolution on the sky. This is very useful but if we start to develop such system, we need so many considerations for application utilizing UAV. Especially, UAV is moving and make crash easily. - This seminar, we consider how to solve the application development for disaster response using small UAV (sUAV). Through the real competition like RoboCup Flying Robot Challenge, we can learn 1. 6/15 9:00-12:30『Why do we need UAS for disaster response?』 - [Lecture] State of arts of UAS development (1~1.5h) - [Hands On] First trial: UAV indoor flight training with Ryze Tello 2. 6/22 9:00-12:30『Theory of UAS control and navigation』 - [Lecture] Physical background (1h) - [Hands On] Tello drone control hands on using Python 3. 6/29 9:00-12:30『Why UAV is danger?』 - [Lecture] Case study of failure (1h) - [Hands On] UAV Outdoor flight training with DJI Phantom 3 / DJI Mavic Pro / 3DR SOLO 4. 7/6 9:00-12:30『Consideration of disaster response』 - [Lecture] Introduction to RoboCup Flying Robot Challenge (0.5 ~ 1h) - [Hands On] UAV indoor flight training and consideration with Tello / Parrot Bebop2 / Parrot Anafi work 5. 7/13 9:00-12:30『Image Processing for Disaster Response』 - [Lecture] Focusing Image Features on Recognition (1h) - [Hands On] OpenCV Hands-on 6. 7/20 9:00-12:30『ROS Integration』 - [Lecture] Introduction to ROS (1h) - [Hands On] ROS-UAV Hands-on with Tello / Anafi work

	7. 7/27 9:00-12:30『3D Mapping』 - [Lecture] Introduction to SLAM (1h) - [Hands On] ORB SLAM 2 Hands-on (ROS) 8. 8/3 9:00-12:30『Flying Robot Challenge Setup』 - Team building - Rule consideration - Development plan discussion <Assignment Term: 8/4 – 9/3> - Mockup field construction until 8/12 (close: 9/12) - Team work for building disaster response UAS (each other) - UAV will rent from REL (Tello, Anafi work) 9. 9/9-11『Flying Robot Challenge』< Open recruitment for external teams (Assumed participation: Daido Univ., Tamagawa Univ., Tokushima Univ., Nagaoka UT., Nihon Univ., Fukushima Univ.) Remote Participation is OK (Tello / Anafi Work with Redis Platform) 9/9 10:00 – 11:00 Invited talk from Prof. Hashiguchi or Prof. Okada 11:00 – 12:00 Race briefing – Regulation check and Q&A session 13:00 – 18:00 Start challenge (25 mins in each slot) 9/10 9:00 – 9:30 Race briefing – Regulation check and Q&A session 9:30 – 12:00 Challenge time 13:00 – 14:00 Middle-time Break (Team Introduction and Q&A for teams) 14:00 – 18:00 Challenge time 9/11 9:00 – 9:30 Race briefing – Regulation check and Q&A session 9:30 – 11:00 Championship Trial – 3rd, 2nd, and 1st team trial 11:00 – 12:00 Lightning talk session for challenge impression 12:00 – 12:30 Award ceremony and closing 10. 9/16『Poster session』 Grading Policy: - Report in hands-on: 30 - Intra-Inter team mutual evaluation: 30 (max 50 pts.) - Challenge achievement score: 30 (max 50 pts.) - Poster evaluation: 10 Total 100 pts. (but max 140 pts.) Learning Target: - Understand how to control, navigate, and program UAV motion using Python and ROS - Understand specific topic of UAV application and UAS consideration such as safety, integrity, and availability

	- Understand what we can and cannot do the UAV or Robot control with sensing in real situation - Development actual UAS in real field and understand convenience and danger of UAV Learning Item (Technology) - sUAV operation - sUAV API usage - ROS - Visual SLAM - Image Processing - Teamwork for robotics challenge - Functional Safety

CFS 7	Performance Improvement of an Application using an FPGA Board
Instructors	SAITO, H., KOHIRA, Y., TOMIOKA, Y.
Course Schedule	June 20 – September 14 * Production creation: July 20 – September 14
Abstract	Objective: 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. Through the seminar, students study 1. how to model an application using a language 2. how to use a tool 3. how a synthesized circuit or a program code works on an FPGA board 4. evaluation of the developed circuit or code Method: 1. Selection of an application such as an image processing 2. Modeling of the application using a language 3. Synthesis of an integrated circuit using Intel Quartus Prime or Xilinx Vitis 4. Simulation of the synthesized circuit or the program code using a simulator 5. Execution of the synthesized circuit or the program code

CFS 8	Developing a Data Warehouse to Store Fukushima Traffic Congestion Data
Instructors	RAGE, U. K.
Course Schedule	June 15 – September 15 * Production creation: July 1 – September 15
Abstract	JApan Road Transportation and Information Center (JARTIC) has set up a nationwide sensor network to monitor traffic congestion. This network generates traffic congestion data at 5-minute intervals (in some cases at 1-minute intervals). The generated data represents noisy and irregular spatiotemporal big data. We have purchased traffic congestion data for the entire Fukushima prefecture for the time duration April-2019 to March-2020. Analyzing the data of this time is important because it covers the key events constituting of Typhoon Hagibis and Covid emergence. Data warehouse is a key component in Big Data analytics (or deep learning). It is because the success any analytical technique depends on how the data is being stored, cleaned, and extracted for analytical purposes. In this Creative Factory Seminar, students will first develop a Big Data Warehouse using Hadoop, HBase, and Spark system. Next, students will develop ETL (Extraction, Transformation, and Load) technologies to store the traffic congestion data. Finally, students will analyze and evaluate the performance of the data warehouse.