The 1st Univ. Carthage – Hosei International Joint Webinar with honorable support by the Embassy of the Republic of Tunisia in Japan

Recent Issues in, Intelligent Robotics, Machine Learning and Distributed System

March 17th (Wed), 2021

This webinar introduces advanced research projects on intelligent robotics, Machine Learning and Distributed System under the joint auspices of the engineering faculties of University of Carthage and Hosei University, IIST: Institute of Integrated Science and Technology, to promote international research and educational collaboration among their affiliated schools.

Agenda

ZOOM ID
https://hosei-ac-jp.zoom.us/j/86357937413?pwd=c3NITXFEUVRKSHFqeHZvdGVxa0dOUT09
Meeting ID: 863 5793 7413
Pass Code: carthage&h

OPENING REMARKS
2021/3/17, 08:00-08:15(UTC),09:00-09:15 (CET), 17:00-17:15 (JST)
Mr. Fethi JELASSI, Counsellor, Embassy of the Republic of Tunisia in Japan
Dr. Mongi BESBES, Vice-President, University of Carthage.
Dr. Kazuo YANA, Director of IIST, Hosei University,

SESSION 1 (Presentation, 20min, Q&A 10min. all together)
University of Cartage RESARCH PROJECTS
08:15-9:25 (UTC), 09:15-10:25 (CET), 17:15-18:25 (JST)

1-1 Syrine Ben Yehia, Neila Bedioui,*"PID Haptic Robot Control For Teleportation*"
1-2 Eya Labidi, Zied Tmar,*" Suitable Observer-based Control of Omnidirectional Mobile Robots*"
1-3 Neila Bedioui, Mongi Besbes," *Adaptative Control of VTOL*"
Q&A

INTERMISSION (20 min.)
Coffee Break with Demonstration of INSTM(Carthage) and IIST(Hosei)
09:25 – 09:45 (UTC), 10:25-10:45 (CET), 18:25-18:45 (JST)

SESSION 2 (Presentation, 20min, Q&A 10min. all together)
IIST RESEARCH PROJECTS
09:45 – 10:55(UTC), 10:45-11:55 (CET), 18:45-19:55 (JST)

2-1 Akihiro Fujii, "*Discussion about an anonymous and trusted communication environment*"
2-2 Xiang Kun, Akihiro Fujii,"*Reputation Analysis Based on Weakly-Supervised Bi-LSTM-Attention Network*"
2-3 Shunsuke Kitada, Hitoshi Iyatomi," *Practical and Interpretable Deep Learning Techniques in our Iyatomi's Lab"*
Q&A

CONCLUDING REMARKS
10:55-11:00 (UTC), 11:55-12:00 (CET), 19:55-20:00 (JST)
Dr. Jinjia Zhou, Assoicate Professor of Applied Informatics, Hosei University

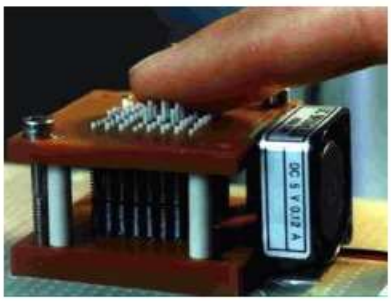
Proceedings(draft)

1-1 PID Haptic Robot Control for Teleportation

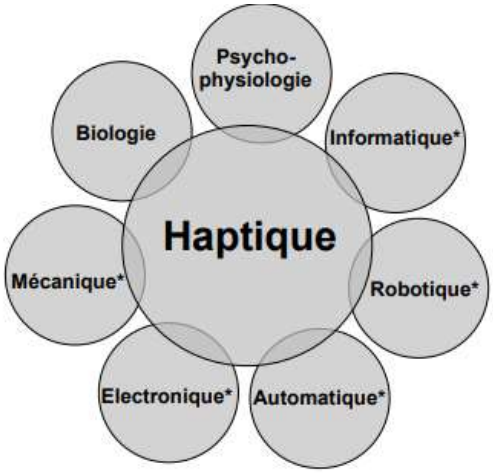
In the past few years, a new scenario for robot-based applications has emerged. Service and mobile robots have opened new market niches. Also, new frameworks for shop-floor robot applications have been developed. In all these contexts, robots are requested to perform tasks within open-ended conditions, possibly dynamically varying. These new requirements ask also for a change of paradigm in the design of robots: on-line and safe feedback motion control becomes the core of modern robot systems. Future robots will learn autonomously, interact safely and possess qualities like self-maintenance. Attaining these features would have been relatively easy if a complete model of the environment was available, and if the robot actuators could execute motion commands perfectly relative to this model. Unfortunately, a complete world model is not available, and robots have to plan and execute the tasks in the presence of environmental uncertainties which makes sensing an important component of new generation robots. For this reason, today's new generation robots are equipped with more and more sensing components, and consequently they are ready to actively deal with the high complexity of the real world. Complex sensorimotor tasks such as exploration require coordination

between the motor system and the sensory feedback. For robot control purposes, sensory feedback should be adequately organized in terms of relevant features and the associated data representation.
There is a compelling case for using principles of human haptic perception—active touch—to inspire the development of robot haptic systems. Human haptic exploration is efficient, robust to noise, yet adapts rapidly to changing conditions. Moreover, human hand control is the archetypal general-purpose sensorimotor system. It uses biological mechanisms to achieve a remarkable degree of functional flexibility, across huge variations in conditions, that remains elusive in "intelligent machines." Key to this capability (over-and-above the hand's anatomy) are the neural control processes underlying hand function. It is valuable therefore to consider the approaches taken to robot haptics, and the main challenges, in light of these "organizational principles" of human hand control.
Haptics provides useful information under a wider set of circumstances than is sometimes appreciated. First, and most obviously, haptics can be the only available signal, such as in poorly lit environments, or when reaching into a bag. Second, even when other senses are available, haptics provides direct information about properties of objects that are poorly (or at least very indirectly) specified by other senses. This is because haptics, uniquely among human senses, involves physical interaction with objects, allowing properties such as friction and compliance to be sensed. Third, haptics contributes to sensorimotor processing even when it provides redundant information to other senses.

The active nature of haptics presents key challenges to haptic-sensing robots. It is necessary to determine not only what the properties of the sensors should be, but also what information is required in a given situation, and which actions should be performed to elicit it. Gibson (1950) described active perception in the context of vision, noting that optic flow signals to observer motion and the structure of the environment are acquired by an observer who moves, and therefore directly influences the acquired information.

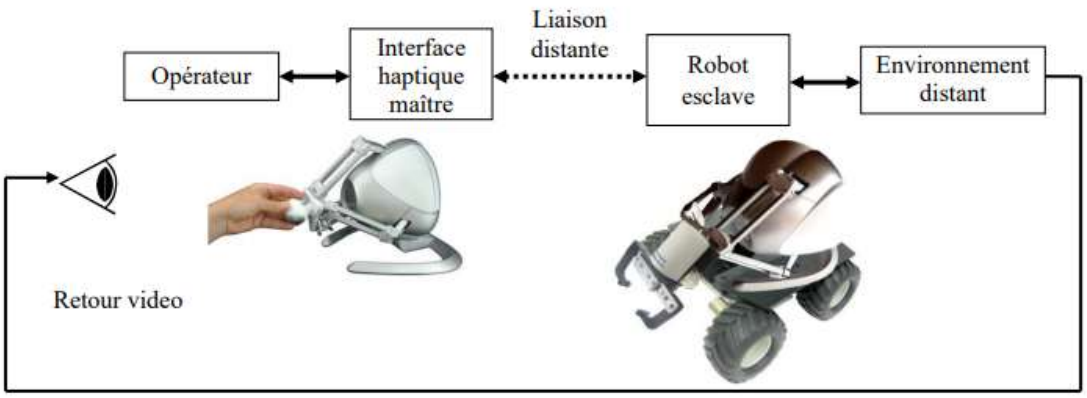


the realization and the implementation haptic systems, either in "virtual reality" or in remote handling, mobilize skills strongly multidisciplinary, disciplines summarized in the diagram opposite (note that the technological disciplines opposite (*) are not isolated from each other but behave well obviously transversal skills to varying degrees). More and more users of haptics numerous and for more and more uses diversified: PC gaming, simulators (aeronautics, military, surgical, dentistry, etc.), telerobotics (dangerous environment, medicine, ...)



ROBOT HAPTIQUE SET

The haptic robot proposed by SET can be used as a haptic interface but we can also create a remote manipulator, by associating two remote robots, one as master and one as slave. The design of this haptic robot is of the "delta robot" type, that is to say with a parallel structure with 3 chains identical closed kinematics connecting the base to the removable terminal organ (effector), offering 3 degrees of freedom in translation. Each kinematic chain has a motor and an incremental encoder.



Disturbance Observer-based Robust Control

Robust motion control (e.g., position, force and compliance control) has been one of the most popular application areas of DOb since 1980s. The 2-DoF robust controller was applied to the motion control problem of many different engineering systems, spanning from industrial robots, hard-disk drives, automobiles and Hubble Space Telescope to today's cutting edge robotic systems such as compliant exoskeletons, surgery robots and unmanned aerial vehicles . It was shown that a DOb can be used not only to achieve the robustness of a motion control system but also to estimate contact force/torque as a force sensor. This specific application of DOb is known as Reaction Force Observer (RFOb) in the

literature, and it has been verified in many different engineering applications, e.g., in rehabilitation robotics, electric commuter trains and automotive. As a robust motion control tool, DOb has been rapidly matured in the last three decades. Today, DOb-based motion control products are commercially available in the market, and new motion control products keep being developed. In addition to motion control, DOb has been applied to several applications in different research fields. For example, robotic eye-hand calibration, robust control of mineral grinding process, time delay estimation and compensation of network control systems partial synchronization of neurons , sensorless measurement of pulsatile flow rate [103], temperature control of a superheated steam, and feedback linearization control of a nuclear reactor. Since plant dynamics are more complicated than servo systems, nonlinear nominal plant models and advanced performance controllers, such as nonlinear and iterative learning controllers, have been generally employed in the design of the robust controllers. Although the performance controller and DOb can be independently synthesized thanks to the flexible structure of the 2-DoF control method, the analysis and synthesis of the advanced robust controllers are generally complicated. In the last three decades, DOb-based robust control has inspired many researchers. Several linear and nonlinear observer-based robust controllers have been independently developed in the literature. For example, the robust controllers based on: Perturbation Observer (PO), Equivalent Input Disturbance (EID) estimator, Uncertainty and Disturbance Estimator (UDE), Generalized Proportional Integral Observer (GPIO), Extended State Observer (ESO) and Extended High Gain Observer (EHGO). In these robust control systems, the fundamental idea behind the controller synthesis is same as the DOb-based robust control system: estimating the internal and external disturbances by using the known dynamics and measurable states of a system (i.e., disturbance observer synthesis), feedbacking the estimations of disturbances so as to intuitively achieve the robustness of the control system (i.e., disturbance cancellation/suppression) and tuning the performance controller by considering the nominal plant model (i.e., 2-DoF control).

Dr Neila Bedioui

PhD on Electrical engineering at ENIT, Master Degree on Automation and signal treatment at ENIT, Engineering degree on Electrical Engineering at ENIT, Director of study and internships at ISTIC (since December 2020), Director of industrial computer department at ISTIC (2016-2020), Research Fields: Robust control, observer design, LMI, Embedded system, PSOC,VHDL,

Mrs Cyrine Ben Yahya,

2018:Research master's degree in Robotics, Computer and Communication Systems (M1), 2014: Fundamental Licenses in Electronics Electrotechnical and Automatic, End-of-studies project: Realization of a stand-alone single-phase inverter with PWM control ,2014: Summer internship: Industrial practical at TRADETEK, 2013: Summer internship : Office tasks in a maintenance department

1-2 Suitable Observer-based Control of Omnidirectional Mobile Robots"

In field of mobile robots, the class of omnidirectional mobile robots (OMRs) can perform both translational and rotational motion simultaneously and independently permitting them to have an arbitrary motion in an arbitrary orientation without changing the direction of wheels. High maneuverability and flexibility promote the wide applications of OMRs. Compared with non-holonomic mobile robots, OMRs are particularly adapted to little working spaces, like warehouses, some factories and hospitals.

The trajectory tracking control of OMRs plays an important role in robot applications, it consists to control the robot in real time to track a reference trajectory, an accurate track is always one of the important objectives fixed by researchers. In the literature, there have been a lot of works on the trajectory tracking control of OMRs, such as trajectory linearization, adaptive sliding-mode, model-predictive, switching-parameter-varying, active disturbance rejection, extended and state observer.

However, in real applications, the control design has several problems. For example, one worrying problem in the observer-based methods is the initial peaking phenomenon. This is due to the large initial estimation error of the observer. It will considerably decrease the control performances and may cause the damage of motors or mechanisms. Furthermore, in practical applications, affected by complex and changeable operating conditions and environmental parameters, it's usually difficult to meet the high performance control requirements using a traditional control.

In our case, we intend to design a nonlinear observer-based structure trajectory tracking scheme, suitable to an OMR like Robotino. Firstly, we need to establish the specific OMR state model by reviewing the existing proposed models in the previous literature works, and verify all imposed assumptions in order to take into consideration some other prospective parameters or nonlinearities. A set of possible adapted or pseudo-adapted observers developed in the literature as new and modern techniques must be tested and criticized and then an improved suitable structure for the OMR is to derive to solve the trajectory tracking problem by avoiding some famous problems like the initial peaking phenomenon, the convergence rate and the estimation accuracy. The proposed structure should demonstrate its reliability even in existing modeling errors, parameter uncertainties and external disturbances. The stability behavior of the controlled system is then analyzed.

Finally, simulations as well as experimental tests are carried out to validate the effectiveness of the designed control system.

Mrs Eya Labidi

2020-2021: Final Class in Applied Bachelor's Degree – IndustrialComputing, Embedded Systems,
2020 Summer internship : Office tasks in a maintenance department of Data, Center Integration – NOUVAMEQ, 2017-2018: Maths Bachelor's Degree, 2014-2018 : English Studies in British Council Tunisia

Dr. Zied Tmar, Associate Professor in Electrical Engineering, holder of a PhD in Electrical Engineering from the National Engineering School of Tunis (ENIT), of a Master in Automatic Control. He held several positions at Tunisian and international universities as Coordinator of end of studies projects at the Higher Institute of Technological Studies in Nabeul (1997-2003) and at the Higher Institute of Medical Technologies in Tunis (2003-2009), and director of the Electrical Engineering department at the College of Engineering of Jazan University in Saudi Arabia (2009-2016). Since 2017, he has been coordinator of research and co-constructed masters in the Higher Institute of Information Technologies and Communication (ISTIC) at the University of Carthage. His research mainly focuses on the study of nonlinear systems, their control and the detection and isolation of their faults via algebraic and geometric state observation approaches.

1-3 Adaptative Control of VTOL

The work developed in this paper treat the problems of simultaneous actuator and sensor fault estimation for an Aircraft System. The original system can often be modeled as polytopic linear parameter varying (LPV) plants for which some estimation techniques of fault and state still hard to solve. Here, we propose a new approach to design an adaptive observer based on quadratic Lyapunov approach. The solution is described as an optimization problem formulated in terms of Linear Matrix Inequalities (LMI) techniques. A simulation design shows that the new algorithm yields to reliable state estimation and simultaneous fault detection of the LPV model of Aircraft System which illustrate the validation of the proposed method.

Dr. Mongi Besbes

Vice President of University Carthage

DE, University Carthage
ME, University Carthage
BE, University Carthage

2-1 Discussion about an anonymous and trusted communication environment

Currently, common publication and communication environments are provided by large private service providers, so called “platformers”. They are basically operated based on commercial and marketing principles. In the environment, a writer is vulnerable to

unfair denial of service attacks by a group people with confronting opinions, since the opportunity for the publication is controlled by the platformer's regulations. In this paper, the possibilities of a trusted communication environment using blockchain technology is discussed. We assume several distributed managers (DMs) issuing accounts of users, which follow minimal regulation to keep anonymity and fair activities of participants. Firstly, the double issuing of accounts from a single user is prohibited and supervised by a blockchain mechanism. Secondly, activities such as publishing, evaluations, recommendation, citation and so on are operated fairly with an allocated number of points. The number of points is maintained by the blockchain mechanism as well. We discuss the realizability and feasibility of such a system from the points of view of fairness and anonymity.

Dr. Akihiro Fujii

2008-Present: Hosei University, Professor, Former Dean of graduate school of Science and Engineering, also honorary research official at National Institution for Science and Technology Policy (NISTP), Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan
2004-2008: Senior Researcher at (NISTP, MEXT), 1999-2000: Visiting Scholar, MIT U.S.A, 1997: Associate Professor at Miyagi University, 1993: PhD from Tohoku Univ. Japan

2-2 Reputation Analysis Based on Weakly-Supervised Bi-LSTM-Attention Network

Due to the emergence of blowout fast food information in Web2.0 era, a large amount of weakly labeled information (star rating, etc.) has been widespread. Weakly Supervised Deep Embedding (WDE) model is a good choice for giving a full play of this kind of data, the ratings are treated as the weakly-supervised signals for pre-training, fine-tune the whole model with small amount of manually labeled data. In this research, we proposed to change the original unidirectional transmission into bidirectional in the LSTM layer to capture the semantics in both directions, and attention mechanism is introduced, which is helpful to capture the important information in the context and improve the accuracy of sentiment classification. Finally, we use TF-IDF and LDA topic model to mine the review topics, excavate the consumers' opinions on different sentiment polarities.

Ms. Xiang Kun

2019: Bachelor of Management in Beijing Forestry University
2017: Sessional Course in Brighton University
2021: Master of Engineering in Hosei University, majored in Applied Informatics
Main Research Field: Natural Language Processing/ Internet of Things/ Linked Open Data/ Vision Intelligence. Committed to combine informatics technology with other popular industries with practical significance.

2-3 Practical and Interpretable Deep Learning Techniques in our Iyatomi's Lab

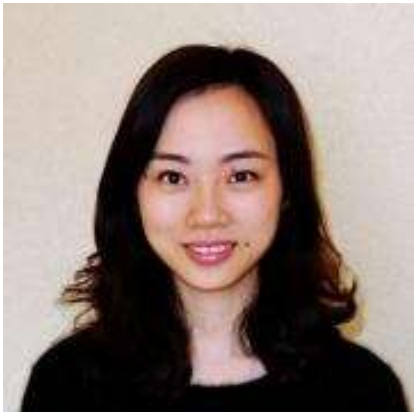
In this presentation, I will give an overview of the various works based on deep learning in our Iyatomi's lab, and especially introduce my research on natural language processing (NLP). Today, deep learning is a fundamental technology that attracts a great deal of attention and has become a keystone of Artificial Intelligence (AI). This technology has demonstrated many outstanding achievements in a variety of tasks. In our lab, for example, we have published various achievements in automatic plant disease diagnosis, cancer diagnosis, content-based image retrieval from brain MRI, cybersecurity, as well as NLP is no exception. NLP is one of a field of AI that gives the machines the ability to read, understand and derive meaning from human languages, and deep learning models have provided excellent performance in this field as well. However, the models generally become a black box that is difficult to interpret for prediction from a human perspective. This presentation will introduce some techniques and models used to interpret the model predictions I am working on, from both basic and applied research aspects.

Mr. Shunsuke Kitada

He received his B.E. degree in science and engineering and his M.S. degree in engineering from Hosei University, Tokyo, Japan, in 2018 and 2020, respectively, where he is currently working toward his Ph.D. His research interests include natural language processing, computer vision, and computational advertising. He is a Japan Society for the Promotion of Science (JSPS) research fellow DC2 at Hosei University. He was the recipient of the student honorable mention from the Information Processing Society of Japan (IPSJ) in 2019 and honorable mention from the Young Researcher Association for NLP Studies (YANS) in 2019.

Dr. Hitoshi Iyatomi

Hitoshi Iyatomi is a professor of Applied Informatics at Hosei University, Japan. He received his B.E, M.E and Ph.D (engineering) degrees from Keio University, Japan in 1998, 2000, and 2004, respectively. During 2000-2004, he worked for Hewlett-Packard Japan as a technical consultant. He joined Hosei University as a research associate in 2004. In 2011, he earned his second Ph.D degree (medical science) from Tokyo Women's Medical University. In 2016-2017, he was a visiting scholar at Johns Hopkins University. He has authored and co-authored more than 120 peer-reviewed journal and conference papers in various research areas based on machine learning such as computer vision, medical applications and natural language processing.



Dr. Jinjia Zhou

received B.E. degree from Shanghai Jiao Tong University, China, in 2007.She received M.E. and Ph.D. degrees from Waseda University, Japan, in 2010 and 2013, respectively. From 2013 to 2016, she was a junior researcher with Waseda University, Japan. Currently she is an Associate Professor with Hosei University, Tokyo, Japan.During 2017-2019, She is also a senior visiting scholarship in State Key Laboratory of ASIC & System, Fudan University, China. Dr. Zhou was selected as a research fellow by the Japan Society for the Promotion of Science during 2010-2013. She is selected as JST PRESTO researcher during 2017-2021. Her interests arein algorithms and VLSI architectures for multimedia signal processing.