3rd Symposium on AI Center

November 23, 2019 9:30 to 16:30

Place：UBIC 3D-Theater, The University of Aizu
Entry fee：free

＜Morning session＞Chairperson: Jiro IWASE, Regent, Director of UBIC, UoA

【Opening】 9:30- 9:40 Ryuichi OKA, President, Chairperson of the Board of Executives, UoA

【Lecture 1】 9:40-10:30

『Deep Learning Based On-Road Risk Detection』

Qiangfu ZHAO, Professor, System Intelligence Laboratory, UoA

【Lecture 2】 10:40-11:30

『Physics of Mental Space』

Ihor LUBASHEVSKY, Professor, Complex Systems Modeling Laboratory, UoA

【Lecture 3】 11:40-12:30

『From Finger Tracking and Gesture Interpretation to Motion Understanding』

Timothy K. SHIH, Distinguished Professor, Vice Dean of College of EECS,
Director of Innovative AI Research Center of National Central University, Taiwan

【Lunch break】 12:30-13:30

＜Afternoon session＞Chairperson: Qiangfu ZHAO, Professor, System Intelligence Laboratory, UoA

【Lecture 4：Keynote Speech】 13:30-14:30

『A multi-FPGA system for AI application』

Guest speaker: Hideharu AMANO, Professor,
Department of Information and Computer Science, Keio University

【Lecture 5】 14:40-15:30

『Energy Management System based on High-speed, Low-power AI-Chip,and Electrical Vehicles (EVs)』

Ben Abdallah ABDERAZEK, Professor, Adaptive Systems Laboratory, UoA

【Lecture 6】 15:40-16:30

『AI and Creativity – Symbols and Knowledge Formats for Creativity Development』

Rentaro YOSHIOKA, Senior Associate Professor, Active Knowledge Engineering Laboratory, UoA

＊ Lectures will be in English. There will be no interpretation.
＊ 40 minutes presentation + 10 minutes Q&A. Keynote Speech (Lecture 4) is 45 minutes presentation + 15 minutes Q&A.

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【Lecture 1 】

Title: **『Deep Learning Based On-Road Risk Detection』**

Abstract: In this talk, I report on the application of deep learning for on-road risk detection. In the proposed system, a USB-camera is mounted on a mobility scooter to provide video data in real-time, and a convolutional neural network (CNN) is used to detect possible risks. Each frame is classified to 11 categories, including normal, left/right attention, left/right warning, etc. A bottleneck problem in deep learning is the collection of labeled data. During the initial experiment, we collected video data containing more than 130,000 frames to train the CNN. A great number of data will be needed in the process of commercializing the system. To solve this problem, we propose a novel method that enables us to assign labels efficiently. Using this proposed method, we found experimentally that we can obtain labels of all data by labeling manually less than 10% of all the data. In addition, the CNN obtained via transfer learning, based on the well-known AlexNet, performs very well. The average performance of several runs is about 95.83% for testing data. Considering that 30 frames are captured in each second, this accuracy means that three consecutive mistakes are almost impossible, if we use the CNN for real-time risk detection.

One weak point of RGB image-based risk detection is that the performance usually depends on the lighting condition. That is, the performance can be very poor in dark environments. To solve the problem, we investigate the possibility of depth image-based approach for full-time indoor patrolling. As the first step, we consider a 3-class problem. Each depth image is classified to “danger” if some obstacle is very close, to “notice” if the obstacle is close, and to “normal” if there is no obstacle around. The label of each depth image is defined based on the RGB image captured at the same time, and an AlexNet, which is a well-trained convolutional neural network, is retrained via transfer learning, and used for classification. In our primary experiment, we collected 102,776 image data in the Research Quadrangle of the University of Aizu. Testing results show that the performance of the depth image-based approach is good regardless day or night, and in most cases is better than the RGB image-based approach. This result can provide new insights for us to designing more practical full-time patrol robots.

【Lecture2】

Title: **『Physics of Mental Space』**

Abstract: The purpose of my talk is to introduce the notion of mental space whose elements are the images of perceived objects or physical stimuli. These images possess their own properties reflecting the properties of the corresponding physical sources but are not reduced to them. Moreover, after emergence mental images no longer need their sources to be present. Therefore these mental images are considered to be individual entities existing on their own in the mental space.

As a general goal, first, I intend to demonstrate that a number of challenging problems met in psychophysics as well as the mathematical description of mental phenomena and human behavior can be resolved turning to the concept of mental space. Second, I pose a hypothesis that the ideas underlying mental space can be useful in constructing cyber-physical space dealing with objects of virtual reality reflecting but not reduced to their real sources in properties.

As far as particular issues of my talk are concerned with, I discuss:

- The neural mechanisms governing the relationship between the mental images and their physical sources arguing for the introduction of mental space. These mechanisms are represented by predictive coding paradigm.
- The gist of Fechner' s inner psychopathic as well as related mathematical models and experimental data which actually turn to the idea of mental space.
- The concept of human temporality and the introduction of 2D-time with the space-time clouds allowing for uncertainty in human perception and qualitative evaluation of perceived objects and human actions.

Special attention is focused on:

- The notion of distance between images in the mental space. Available models and experiential data underlying the construction of image distance are discussed.
- The generalization of the available models based on the idea of mental space scale-free structure. The corresponding explanation of some known effects is presented.
- The experimental data showing that the transition between the conscious and unconscious modes of information processing are of second order, which actually challenges the corresponding explanation based on neural mechanisms.

Finally, turning to the concept of incommensurability in stimulus comparison a solution to the Fechner-Stevens dilemma is proposed.

【Lecture3】

Title: **『From Finger Tracking and Gesture Interpretation to Motion Understanding』**

Abstract: Video sensors are powerful devices which can make Human-Computer Interaction intuitive sand efficient. The fundamental techniques include tracking postures and gestures based on RGB and Depth information. With the recent development of Deep Learning models, precise finger tracking and understanding the meanings of human gestures further make HCI techniques more powerful. This talk starts from illustrating some basic features of device raw data. Feature selection and noise removal methods are discussed. A few important Deep Learning modules are then presented. These models are based on 3D CNN, GRU, and LSTM, with a few newly proposed methods. The talk demonstrates a few interesting projects such as virtual musical instruments, virtual puppet show, gesture for interactive TV, virtual keyboard, and 3D in air hand writing.

【Lecture4】

Title: **『A multi-FPGA system for AI application』**

Abstract: FiC (Flow-in-Cloud) is a multi-FPGA system using a number of mid-range cost-efficient Xilinx's Kintex Ultrascale FPGAs. Each FPGA board with an FPGA, 16MB DDR4 SDRAM x 2, and Raspberry-Pi3 daughterboard are connected with 32 10Gbps serial links. The FPGA is divided into two regions tightly coupled together with the partially reconfigurable technique: a static shell including an STDM (Static Time Division Multiplexing) switch, SERDES, and Raspberry-Pi interface, and user-defined accelerators designed in HLS (High-Level Synthesis). From the programmer, HLS accelerators are designed as if they were implemented on a virtual monolithic large FPGA.
Some implementation examples with demonstrations are shown.

【Lecture5】

Title: **『Energy Management System based on High-speed, Low-power AI-Chip,and Electrical Vehicles (EVs)』**

Abstract: This talk presents an ongoing research collaboration project between the University of Aizu and a Japanese company to develop an efficient power management systems based on a high-speed, low-power AI-chip and a grid of electrical vehicles (EVs). We will present the earlier design results of the AI-Chip hardware design and also the supporting software tools. We will also describe the prospects of the general AI-chips and their impact on future computing.

【Lecture6】

Title: **『AI and Creativity – Symbols and Knowledge Formats for Creativity Development 』**

Abstract: This talk is motivated by two questions: Will AI match humans in creativity? How can humans and AI cooperate in generating creative ideas and decisions? We will discuss existing opinions on AI creativity and attempts in expanding their creative abilities as well as the current understanding of creativity and its process. Then, an approach to develop human, and consequently AI, creativity by acquiring intention/meaning of behavior, decisions, and opinions will be introduced. The approach involves enhanced symbols and knowledge formats to enable humans to specify intention/meaning of knowledge, and companion HCI methods to support creation of quality knowledge.