**RIEC International Symposium**

# When AI Meets Human Science:

**The 4th Tohoku – NTU Symposium on Interdisciplinary AI and Human Studies**

Time: March 12-13, 2021

## Keynote Speech 1 (March 12, 2021)

### Quantum annealing and its application to real industry

Masayuki Ohzeki
Tohoku University

## Keynote Speech 2 (March 13, 2021)

### Human-Centered Redistricting Automation in the Age of AI

Wendy K. Tam Chou

Department of Political Science, Department of Statistics, Department of Mathematics, Department of Computer Science. Department of Asian American Studies, College of Law

Senior Research Scientist,
National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign

Important insights into the impact of governmental processes can be gained through an interdisciplinary approach that combines research in AI that is deeply grounded in the social sciences and law. We develop an Evolutionary Markov Chain Monte Carlo (EMCMC) algorithm for sampling electoral maps. Our algorithm combines the advantages of evolutionary algorithms as optimization heuristics for state space traversal and the theoretical convergence properties of Markov Chain Monte Carlo algorithms for sampling from unknown distributions. We further adapt our algorithm for high performance computing architecture. Our approach is tightly coupled with legal theories articulated by the courts.

# Session 1 (March 12, 2021)

**Langsmith: An Interactive Academic Text Revision System**

Takumi Ito[1,2], Tatsuki Kuribayashi[1,2] , Masatoshi Hidaka[3], Jun Suzuki[1,4], Kentaro Inui[1,4]
[1]Tohoku University [2]Langsmith Inc. [3]Edge Intelligence Systems Inc. [4]RIKEN

Despite the current diversity and inclusion initiatives in the academic community, researchers with a non-native command of English still face significant obstacles when writing papers in English. This paper presents the Langsmith editor, which assists inexperienced, non-native researchers to write English papers, especially in the natural language processing (NLP) field. Our system can suggest fluent, academic-style sentences to writers based on their rough, incomplete phrases or sentences. The system also encourages interaction between human writers and the computerized revision system. The experimental results demonstrated that Langsmith helps non-native English-speaker students write papers in English. The system is available at https://emnlp-demo.editor. langsmith.co.jp/.

**Neural Substrates of Communication Deficits in Autism**

Tai-Li Chou
Department of Psychology, National Taiwan University

Impaired language and communication are commonly observed in children with autism spectrum disorder (ASD). However, the neural organization of language and communication in children with ASD remains unclear. This presentation addresses this issue with two studies by using neural imaging methods. The first study uses functional near-infrared spectroscopy to study semantic processing. Multi-Time Points Analysis (MTPA) is proposed to discriminate signal differences between conditions by combining temporal information from multiple time points. This approach provides reasonable power for detecting significant time points and ensuring generalizability as compared to conventional mass univariate analysis. The second study uses functional magnetic resonance imaging to examine the ability to share and understand others' mental states in social situations. A social animation task is proposed to explore social interaction between children with ASD and control children. Differential connectivity patterns have been found to show the disruption in neural circuitry between the experience sharing system and the mentalizing system in children with ASD. Following the reported studies, two intervention approaches will be presented to discuss potential treatment of deficits on communication deficits in autism.

**How Poems Bring Joy? Some Neural Changes to the Japanese Fixed Verses**

Sachiko Kiyama
Department of Linguistics, Graduate School of Arts and Letters, Tohoku University, Japan

Poetry, an art form of words, has evolved over time in every culture. Especially, fixed verses (i.e., a type of poetry that has a fixed number of syllables along with required rhyming) represent the fruits of sophisticated beauty and humor, as the composers elaborate affective words in the given rhythm. Therefore, people who appreciate verses are involved in musical experience as well as language processing. In this talk. I will present several collaborative studies utilizing pupil diameter and fMRI to examine how native Japanese lay people are aroused to the two types of Japanese fixed verses, namely, aesthetic *Haiku* and comic *Senryu*. Based on the findings, I will discuss that ordinary people experience stronger arousal with funny, humorous words in an earlier stage of exposure. Aesthetic properties of words, contrarily, may elicit milder changes in the lay listeners' arousal level, presumably because they evoke more implicit, subtle emotional effects.

**Reshaping learning experience with robot**

Hsiu-Ping Yueh
National Taiwan University

# Session 2 (March 12, 2021)

**The scientific study of human consciousness**

Po-Jang Hsieh
Department of Psychology, National Taiwan University

**Temporal factor of spatial context for visual perception**

Sae KANEKO [a,b]
[a] Frontier Research Institute for Interdisciplinary Sciences, [b] Research Institute of Electrical Communication, Tohoku University, Japan

Our visual perception can be affected by the spatial context. Simultaneous contrast, where the object's appearance is pushed away from its surround's, is one example of such spatial context effects. While the spatial properties of such spatial effects are well studied, little is known about the temporal properties of them. In this talk, I will review the works I have done on the spatial context effects (simultaneous contrast of brightness, color, and orientation; as well as Dungeon illusion and the depth effect) and show that these effects change with the stimulus duration. The changes in the effects are mostly quantitative but also qualitative, which suggests the involvement of multiple mechanisms. Analyses of the individual differences observed in these studies also support this view. These studies demonstrate the less known dynamic nature of our visual perception.

**Is the spatial shape of auditory selective attention constant in the horizontal plane?**

Ryo Teraoka [a, b]
[a] Graduate School of Humanities and Social Sciences, Kumamoto University, Japan
[b] Research Institute of Electrical Communication, Tohoku University, Japan

In everyday life, our ears constantly receive a mixture of sounds simultaneously emitted from spatially distributed sound sources. Even in such a scenario, the listener can extract a particular sound from mixed sounds. This ability is well-known as the cocktail party effect. Auditory spatial attention is one of the most important mechanisms to realize this ability. Although the auditory spatial attention can be directed to any direction around the listeners, it has been still unclear whether the spatial shape of auditory selective attention depends on the direction in the horizontal plane. I introduce the directional dependency of the spatial shape of auditory selective attention by measuring listening performance in a multi-talker environment. Furthermore, I compared the present result with the previous result for the front. Results suggest that there is little difference in the spatial shape of auditory selective attention between the front and other sides.

**Using Traditional Wisdom with AI (Buddhabot) to Establish a "Psyche Navigation System"**

Seiji Kumagai[1], Toshikazu Furuya[2] Koshin Higashifushimi[3] Akinori Yasuda[1],
Thubten Gawa Matsushita[1], Takahiko Kameyama[1], Yuho Hasegawa[4]
[1]Kyoto University [2]Quantum Analytics, inc. [3] Shorein Temple [4]Osaka University

The Government of Japan advocates "Society 5.0", a society that integrates "cyberspace" and "physical space" as the next step following the information society (Society 4.0). However, no matter how much physical technology develops, human beings will not achieve complete happiness ignoring the "mental space." Therefore, Kumagai, Miura, Awano, and Ueda have proposed a new concept called "Cyber-Physical-Mental System" (CPMS), which adds the idea of "Mental" to the "Cyber-Physical System" (CPS) aiming at a future society (Society 6.0). By developing a "Psyche Navigation System" (PNS) as its main technology, we aim to realize a society where both well-being and vitality exist. One of the central characteristics of PNS is the enhancement of human happiness based on traditional wisdom. In this presentation, the speakers will release, for the first time, a new type of artificial intelligence called "Buddhabot," which was developed as the main axis of PNS. The "Buddhabot" is a chatbot that has learned the content of the Buddhist Canon. It represents a pioneering trial in the field of informatics in that we explore "religion," which is one of the last frontiers of artificial intelligence.

# Session 3 (March 12, 2021)

### Indoor Navigation using an Illustrated Non-digital Map on Information Board

Yoshihiro Sugaya [a], Kento Tonosaki [a], Masaki Otani [a], Tomo Miyazaki [a], Shinichiro Omachi [a]
[a] Graduate School of Engineering, Tohoku University, Japan

Although many indoor navigation systems have been proposed, most of them require infrastructures and/or a database for positioning, in addition, digitalized maps, and these need the cooperation of facility managers. We propose a novel indoor navigation framework using an illustrated non-digital map, which does not require infrastructures, database, and digitalized maps prepared in advance. In the proposed framework, the captured photo of the floor maps on the information board by a smartphone's camera is analyzed on the spot to extract the passageway regions, and it is exploited in the pedestrian dead-reckoning with map matching. We confirmed that the proposed framework works with promising performance in several actual commercial premises.

### Intelligent Tea Management: What AI Can Help

Shih-Fang Chen
Dept. of Biomechatronics Engineering, National Taiwan University

Tea (Camellia sinensis) is one of the most commonly consumed beverages worldwide. It is also one of the important cash crops in Taiwan. Conventional tea production is a labor-intensive task along the process from growth monitoring, pest and disease management, to harvest tea leaves in time for the best quality. Hence, labor shortage has caused the tea industry to shrink, and actions need to be taken to alleviate the challenging situation. We applied the internet of things (IoTs) and deep convolutional neural network (DCNN) methods to develop machine vision tools for several purposes. The growing status and disease identification system provide farmers real-time information on tea plantations. The timing of fertilization, pesticide application, and harvest operations could be arranged according to the growth status. Early detection of tea leaf lesions is necessary to control infections and prevent further yield loss. For harvesting high-quality tea, hand plucking is preferable to prevent broken leaves and ensure that only the most essentially favorable parts are plucked (e.g., one tip with two leaves). To reduce the labor work, an algorithm is developed to identify the plucking points of the required tea buds. By introducing artificial intelligent technologies in tea plantations, we hope the developed tools would facilitate farmers to manage their farms more efficiently and effectively.

### Modeling of Cultured Neuronal Networks for Analog Hardware Implementation

Satoshi Moriya [a], Hideaki Yamamoto [a], Shigeo Sato [a]
[a] Research Institute of Electrical Communication, Tohoku University, Japan

Neuromorphic computing is gaining strong interest due to the growing demand for its applications in edge computing, which requires advanced information processing with limited computational resource and energy. To deepen our understanding of computation in spiking neural networks and widen their applications, we integrate computational modeling, hardware implementation, and biological experiments to explore how the neurodynamics and information processing is sculpted by the network structure. More specifically, we take advantages of the reservoir computing framework to perform a spoken-digit recognition task to investigate the effect of the network structure on classification performance (Moriya et al., NOLTA, 2020). We will also report on our recent results on the design of a dedicated analog neuron circuit that reproduces the behavior of spiking neurons with a power consumption of less than 10 nW.

### Robust Physical Adversarial Attack on Object Detectors

Shang-Tse Chen
Department of Computer Science & Information Engineering, National Taiwan University

Given the ability to directly manipulate image pixels in the digital input space, an adversary can easily generate imperceptible perturbations to fool a Deep Neural Network image classifier, as demonstrated in prior work.

In this talk, I will show ShapeShifter, an attack that tackles the more challenging problem of crafting physical adversarial perturbations to fool image-based object detectors like Faster R-CNN, posing a potential threat to autonomous vehicles and other safety-critical computer vision systems. I will also introduce some recent development of practical defenses including SHIELD, an efficient defense leveraging stochastic image compression, and UnMask, a knowledge-based adversarial detection and defense framework.

# Session 4 (March 13, 2021)

**Recognition of Stroke Gaits by Deep Neural Networks**

Fu-Cheng Wang
Department of Mechanical Engineering, National Taiwan University

This talk introduces the development of Deep Neural Network (DNN) models to recognize stroke gaits. Stroke patients usually suffer from partial disability and develop abnormal gaits that can vary widely and need targeted treatments. Evaluation of gait patterns is crucial for clinical experts to make decisions about the medication and rehabilitation strategies for the stroke patients. However, the evaluation is often subjective, and different clinicians might have different diagnosis of stroke gait patterns. In addition, some patients may present with mixed neurological gaits. Therefore, we apply artificial intelligent techniques to detect stroke gaits and to classify four abnormal gait patterns seen in post-stroke patients: the drop-foot gait, the circumduction gait, the hip-hiking gait, and the back-knee gait. First, we use inertial measurement units to collect clinical gait data from eight stroke patients and seven healthy subjects. We then apply these data to develop DNN models that can detect stroke gaits. Furthermore, we extend the model to classify the aforementioned four common gait abnormalities. The results show that the DNN models achieve an average accuracy of 99.35% in detecting the stroke gaits and an average accuracy of 97.31% in classifying the gait abnormality. We also apply the PAMAP2 public dataset to the DNN model and find an average accuracy of 99.92% in detecting normal gaits. Based on the results, the developed DNN models could help therapists or physicians to diagnose different abnormal gaits and to apply suitable rehabilitation strategies for stroke patients.

**Adaptive Workspaces: Physically Interacting with Spatial Surfaces**

Kazuyuki Fujita
Research Institute of Electrical Communication, Tohoku University, Japan

We explore Adaptive Workspaces, a new concept of interactive and intelligent physical workspaces to lead us to better states. As one of its recent attempts, this talk will introduce TiltChair, an actuated office chair that physically manipulates the user's posture by actively inclining the chair's seat to address problems associated with prolonged sitting. The system controls the inclination angle and motion speed with the aim of achieving manipulative but unobtrusive posture guidance. The talk will then present results of three experiments to investigate the effects of the seat's inclination angle and motions on the users' task performance, overall sitting experience, and behavior. Based on these results, I will also discuss a design space for arranging the seat inclination behavior in practical scenarios, using the three dimensions of angle, speed, and continuity.

**Breast Ultrasound Computer Aided Diagnosis Using Deep Learning**

Ruey-Feng Chang
[1]Department of Computer Science and Information Engineering & [2]Graduate Institute of Biomedical Electronics and Bioinformatics, NTU

Ultrasound elastography is a newly developed technique of imaging the tissue elasticity and it has been used clinically to examine a variety of breast lesions in patients. In general, the breast cancer tissue is harder than the adjacent normal breast tissue. Recently, we have developed a computer-aided diagnosis (CADx) system for 2D/3D stain and shearwave elastography. Several elastographic features and B-mode features are used in the proposed elastography CADx system. Several companies such as Aloka, U-systems, and Siemens have developed the new automated whole breast ultrasound (ABUS) machines to automatically scan the whole breast and save the US images into an image file. There are several hundreds or even thousands of image slices in an ABUS case. Hence, a computer-aided detection (CADe) system is proposed for the ABUS systems to find suspicious frames and locate the approximate positions of tumors in the ABUS images. An ABUS Viewer system developed in our MOEA Technology Development Program for Academia project has been transferred to TaiHao Medical Inc., Taiwan (http://taihaomed.com/) and the TaiHao's BR-ABVS Viewer has obtained the FDA and Taiwan FDA approvals. Also, a free-hand whole breast US smart system has obtained FDA, Taiwan FDA, and Japan PMDA approvals.

**Experience and Environmental Matters in Human Visual Cognition**

Yoshiyuki Ueda
Kokoro Research Center, Kyoto University, Japan

Many scientists have long believed that basic perceptual processes are universal, but thinking and reasoning vary across societies and cultures. Based on this perspective, computer simulations have been developed to emulate human vision in an attempt to understand human visual cognition. Recently, our research group has found some cultural differences in visual cognition (here, in visual search task), even when thinking and reasoning are not involved. This suggests that we need to reconsider how our visual cognition is achieved. In this talk, I will introduce a series of experiments on this topic and the concept of a "Kokoro world map" to understand what cultural differences exist in our visual cognition and how they are formed. The final part of the presentation will discuss some of the directions that we are currently taking to explore the sources of these cultural differences in visual cognition.

# Case Western Reserve University and Tohoku University Special Session (March 13, 2021)

### Knowledge-based Event Analysis in Cyber-Physical Data Streams

Yinghui Wu[a]，Mohammad Hossein Namaki[b], Anurag Srivastava[b], Anton Kocheturov[c]
[a] Department of Computer and Data Sciences, Case Western Reserve University, Cleveland OH, USA
[b] School of Electrical Engineering and Computer Science, Washington State University, WA, USA
[c] Siemens Corporate Technology, Princeton, NJ, USA

Event analysis (detection, localization, and classification) is critical for modern cyber-physical system such as power systems and remains challenging due to the dynamic and heterogeneous data. We propose a knowledge-based framework that incrementally extracts and maintains dynamic knowledge from data streams for power event analysis. (1) We leverage a lightweight knowledge graph, a network of power gird entities (e.g., sensors, data anomalies) and their relations (e.g., spatiotemporal correlations). The graph is incrementally maintained by cost-effective deep graph models, rule-based classification, and spatiotemporal correlation analysis. (2) Exploiting the knowledge graph, the system supports flexible and user-friendly event analytical query classes, such as keyword-based event monitoring, alert detection, query by examples, and root cause analysis. The key enabling techniques are built on efficient graph stream query processing. We make a case with IEEE testbed grids, illustrate the efficiency and accuracy of the system, and discuss possible extensions.

### Robust inference of kinase activity using functional networks

Serhan Yılmaz[1], Marzieh Ayati[2], Daniela Schlatzer[3], A. Ercüment Çiçek[4,5], Mark R. Chance[3,6] & Mehmet Koyutürk[1,3]

[1]Department of Computer and Data Sciences, Case Western Reserve University [2]Department of Computer Science, University of Texas Rio Grande Valley [3]Center for Proteomics and Bioinformatics, Case Western Reserve University, [4]Department of Computer Engineering, Bilkent University [5]Department of Computational Biology, Carnegie Mellon University [6]Department of Nutrition, Case Western Reserve University

Mass spectrometry enables high-throughput screening of phosphoproteins across a broad range of biological contexts. When complemented by computational algorithms, phospho-proteomic data allows the inference of kinase activity, facilitating the identification of dysregulated kinases in various diseases including cancer, Alzheimer's disease and Parkinson's disease. To enhance the reliability of kinase activity inference, we present a network-based framework, RoKAI, that integrates various sources of functional information to capture coordinated changes in signaling. Through computational experiments, we show that phosphorylation of sites in the functional neighborhood of a kinase are significantly predictive of its activity. The incorporation of this knowledge in RoKAI consistently enhances the accuracy of kinase activity inference methods while making them more robust to missing annotations and quantifications. This enables the identification of understudied kinases and will likely lead to the development of novel kinase inhibitors for targeted therapy of many diseases. RoKAI is available as web-based tool at http://rokai.io.

**Spatiotemporal Graph Neural Network for Performance Prediction of Photovoltaic Power Systems**

Roger H. French [a], Ahmad Maroof Karimi [a]

[a] SDLE Research Center, [b] Department of Materials Science and Engineering, [c] Department of Computer and Data Sciences, Case Western Reserve University, Cleveland OH, USA

In recent years, a large number of photovoltaic (PV) systems have been added to the electrical grid as well as installed as off-grid systems. Accurate forecasting of PV performance is critical for the reliability of PV systems. The variability in power output over time, affects the stability of the electricity grid, and accurate forecasting can reduce the uncertainty. We leverage spatial and temporal coherence among the power plants for PV power forecasting, motivated by the observation that power plants in a region undergo similar environmental exposures. Thus, one power plant's performance can be used to improve the forecasting of other power plants. We utilize the relationship between PV plants to build a spatiotemporal graph neural network (st-GNN) and train machine learning models to forecast the PV power. The computational experiments on large-scale data from a network of 316 systems show that spatiotemporal forecasting of PV power performs significantly better than a model that only applies temporal convolution to isolated systems or nodes. Furthermore, the longer the future forecast time, the difference between the spatiotemporal forecasting and the isolated system forecast when only temporal convolution is applied increases further.

**Crystal growth of AlN from Ni-Al solution**

Masayoshi Adachi [a], Taichi Nagasaku [a], Rintaro Miyata [a], Makoto Ohtsuka [a], Benjamin Pierce [b], Roger French [b], Hiroyuki Fukuyama [a]

[a] Institute of Multidisciplinary Research for Advanced Materials (IMRAM), Tohoku University, Japan

[b] Department of Materials Science and Engineering, Case Western Reserve University, USA

AlN is a promising substrate material for AlGaN-based optical and electrical devices. However, fabricating large diameter AlN bulk crystal at a reasonable cost has not been achieved yet. One of the promising methods of producing large diameter AlN crystals could be a solution growth method. The authors have been focusing on a Ni-Al alloy melts as a solution for the AlN growth. The activity of Al in Ni-Al melts is low enough to keep Al stably in the solution even at high temperature. According to a thermodynamic principle, it is possible to control the driving force of the AlN formation reaction in the Ni-Al solution by appropriate choice of solution composition, nitrogen partial pressure, and temperature. In-situ observation of AlN formation was conducted using levitation technique to understand the AlN growth behavior and design an optimum crystal growth technique. Based on the results, we constructed a Ni-Al solution growth facility for AlN crystal and demonstrated the AlN growth using the Ni-Al solution. (Ref. M. Adachi et al. J. Am. Ceram. Soc., 103 (2020) 2389-2398.)

**Pedagogical Methods of Online Practical-based Learning in Data Science**

M. Samy Baladram [a], Yamada Kazunori [a]

[a] Graduate School of Information Sciences, Tohoku University, Japan

With the gain of the popularity of data science, the number of institutes hosting classes related to data science has increased considerably in the last few years. We are interested in figuring out effective methods in conveying theories and practical knowledge related to data processing. We will be looking at the curriculum and also the construction of an online platform that can synchronize multiple courses. We found that students show a high understanding in a 15-week lecture when the basic theoretical aspect of data science is complemented with practical exercises sans coding. While in a more intensive 3-week practical course, focusing the course on programming in data cleaning and processing shows the best result. This intensive course is also followed by group project-based learning to further familiarize the students with big data. We found that the teams consisting of two people show the most promising result.

**Ten Challenges in Advancing Machine Learning Technologies towards 6G**

Nei Kato
Graduate School of Information Sciences, Tohoku University, Japan

As the 5G standard is being completed, the academia and industry have begun to consider more developed cellular communication technique, 6G, which is expected to achieve high data rate up to 1Tb/s and broad frequency bands of 100GHz to 3THz. Besides the significant upgrade of the key communication metrics, Artificial Intelligence (AI) has been envisioned by many researchers as the most important feature of 6G, since the state-of-the-art machine learning technique has been adopted as the top solution in many extremely complex scenarios. Network intelligentization will be the new trend to address the challenges of exponentially increasing number of connected heterogeneous devices. In this talk, I will introduce ten most critical challenges in advancing the intelligent 6G system. These challenges are analyzed from the perspectives of 6G service requirements, AI algorithm design, practical deployment, and future standardization.

# Session 5 (March 13, 2021)

**Implicit Attitudes toward Dishonesty as a Predictor of Self-serving Dishonesty**

Hirokazu Hatta [a], Ryuhei Ueda [b, c], Hiroshi Ashida [a], Nobuhito Abe [d]
[a] Graduate School of Letters, Kyoto University, Kyoto; [b] Center for Information and Neural Networks (CiNet), National Institute of Information and Communications Technology (NICT), Osaka;[c] The Japan Society for the Promotion of Science (JSPS), Tokyo; [d] Kokoro Research Center, Kyoto University, Kyoto, Japan

What makes people honest or dishonest? This study examines two potential inhibiting factors of dishonesty – implicit attitudes toward dishonesty and executive control. The participants completed the Implicit Association Test (IAT), the working memory (WM) task, and a coin-flip prediction task wherein they were given opportunities for dishonest reward acquisition and punishment avoidance. The results revealed that individuals showing stronger negative implicit attitudes toward dishonesty engaged in a lower frequency of dishonest behavior for punishment avoidance. In contrast, WM capacity was not associated with variations in dishonest reward acquisition and punishment avoidance. A follow-up experiment on other-serving dishonesty revealed that neither implicit attitudes toward dishonesty nor WM capacity was associated with dishonest behavior, indicating the specificity of the contribution of implicit attitudes to self-serving dishonesty. We conclude that implicit attitudes toward dishonesty reflect individuals' "moral default", which serves as an important determinant of self-serving dishonesty.

**Building Emotion-Centered AI:**
**How Humanistic Sociologists Can Help Break the Bottleneck of AI's "Emotional Intelligence"**

Vivian Ching-Mei Chu
Department of Drama and Theatre, National Taiwan University

Affective computing will completely revolutionize the existing human lifestyle in the future. According to the research by Stanford University, "emotional intelligence" will be the most crucial ability of artificial intelligence (AI) to interact with human beings. However, for Taiwan AI to catch up with the global trend of right brain AI emotion industry, it still has to overcome the following pain points:

1. The academic research on emotional intelligence is almost always led by the field of information engineering, which falls short of expertise in the sensibility area of emotions.
2. Lack of integrative and multi-year research projects on emotional recognition, deficient in research depth and continuity.
3. Lack of available emotional Big Data database. Take facial expressions as an example, first, the existing Big Data databases are unable to meet the needs of deep-learning computing in terms of quantity; second, the image data are mostly front shots, and third, most images show exaggerated, dramatic expressions and are not applicable to daily life situations of multiple angles and micro-expressions.

4. Most of the domestic and foreign emotional databases are labeled/tested and assessed by non-professionals, which results in varying database qualities.

Therefore, I would like to use my over 30 years of expertise in the field of theater acting and my 16 years' research in emotional AI and experience in building Big Data databases, to share in this presentation by practical examples of my research findings that address the above pain points. In the future, we plan to create in the field of theatrical performance the world's first emotional Big Data database that integrates "facial expression," "speech text," "vocal expression," and "body movement," and to collaborate with professors in information technology to build the first "multimodal real-time emotion recognition system" that synchronizes the afore-mentioned four media, and introduces professors of law to create "friendly AI" that aims to prevent the threat of AI and the risk of AI abuse and protect the users' information security. We hope to accelerate and enhance the research and development of affective AI from humanistic and social perspectives and to promote more humanities scholars to join the cross-disciplinary research of AI.

**Towards a Neurometric-based Construct Validity of Trust**

Pin-Hao Andy Chen
Department of Psychology, National Taiwan University

Trust is a nebulous construct central to successful cooperative exchanges and interpersonal relationships. In this study, we introduce a new approach to establishing construct validity of trust using "neurometrics". In study 1, we first combine data from two studies (N = 40) to develop a whole-brain multivariate pattern that can classify whether new participants will trust a relationship partner using a linear support vector machine combined with leave-one-subject-out cross-validation. Our trust signature was able to successfully discriminate decisions to invest compared to keep money with 90% accuracy. In study 2, we find that the pattern can accurately discriminate trust decisions with an accuracy of 75% in participants collected in a separate country demonstrating generalizability of the pattern. In study 3, we establish construct validity by testing the pattern on ten separate datasets measuring distinct psychological processes. We find that our trust signature can successfully discriminate safe compared to risky decisions across two different datasets (N = 123 and 15, respectively) and viewing neutral images from those depicting negative arousing scenes across another two distinct datasets (N = 95 and 56, respectively). This is consistent with the notion that trust involves an expectation of reciprocation by a relationship partner to avoid negative betrayal experiences. Moreover, we find that the signature does not generalize to reward, cognitive control, or other social cognitive processes, such as facial familiarity and self-referential processing, indicating that the pattern is highly specific. These results provide strong support for the use of "neurometrics" in identifying the psychological processes associated with a brain-based multivariate representation. These results provide strong support for the use of "neurometrics" in identifying the psychological processes associated with a brain-based multivariate representation.

**When ELSI meets Design: On Design-centered AI Governance**

Yueh-Hsuan Weng
The Frontier Research Institute for Interdisciplinary Sciences, Tohoku University

This study will employ an interdisciplinary approach to see how Legal Informatics and the AI Ethics could contribute to developing good practices for AI governance and possible design-centered regulatory approaches.

Along this line of thought, the first design-centered approach this study will consider is called "Ethically Aligned Design" and will look at how to embed ethical values into the design process of autonomous systems. Additionally, intelligent robots for healthcare and medical services will be the main object of study in this project. Given the co-existence between humans and these "embodied" intelligent systems we shall also consider an inside-out way of thinking when designing their sociability not from their own bodies, but from the many "social systems" surrounded in the real-world environments in which they are located.