[Engineering Department Panda Lecture] Small Data Generates Big Impact — Roy Maxion Urges Prudent Use of Data

Dr. Roy Maxion, a professor in the Computer Science Department at Carnegie Mellon University (CMU), who gave a lecture as part of the Panda Lecture series at our school, presented his ongoing research on "Analyzing Information Data from Keyboard Input for Individualized Identification."

On the morning of November 14, in the Chang Yeo Lan International Conference Hall of Hsu Shou-Chlien International Conference Center, he demonstrated the comparison of data collected in the laboratory and in real-world scenarios as part of the experiment. Dr. Maxion highlighted the concept of "bad data," which arises from data collection equipment and can lead to significant misjudgments. He earnestly informed the audience that such misjudgments resulting from this data have impacted security systems using facial recognition, medical applications, and even court decisions. In his concluding slide, he reminded everyone of the importance of seemingly insignificant data, emphasizing that small data can have a substantial impact. He advised cautious, accurate, and careful data filtering, stating, "You may forget a few details...but they won't forget you."

The lecture, hosted by the Department of Civil Engineering, commenced with an opening address by the Vice President for International Affairs, Dr. Hsiao-Chuan Chen. Also present were Dean Tzung-Hang Lee of the Colleges of Engineering, Artificial Innovative Intelligence, and Precision Healthcare, as well as chairs from various departments within the College of Engineering. The auditorium was filled with students from the College of Engineering. Dr. Maxion, with the topic "When the Rubbish Meets the Road: A Lesson About Data," shared insights from his research and engaged in a discussion with the faculty and students present.

During his speech, Roy Maxion used his empirical research to demonstrate how data corruption can be identified in the behavioral biometrics of a

two-factor authentication system. Taking the example of entering a password for identity verification, he stated, "I know your password, I can log in, and I can become you. But, if I have to enter it at the same rhythm as you, I can't do that. This is what we call two-factor authentication: one factor is the password, and the other factor is how you enter the password." He then walked with a staggering gait towards the center of the stage, performing a "gait" to illustrate data input on a keyboard. He explained that just as there is a "gait" in walking, there is also a "gait" in entering data on a keyboard, emphasizing to the faculty and students present, "What you naturally do on the keyboard is a form of behavioral biometric technology that cannot be imitated."

He further pointed out that seemingly inconspicuous behaviors in our daily lives, such as human fingerprints, typing rhythms, and walking strides, can all serve as valuable criteria through biometric recognition. The examples mentioned can be utilized for identity verification through the sensitivity of artificial intelligence systems. As a result, they conducted an experiment with Parkinson's patients, where they could determine aspects such as whether the patients had taken their medication, how their day had been, whether it was good or bad, and the trends in their condition, all based on the way they typed. He confidently stated, "We understand patients better than doctors."

He then illustrated, through a comparison of experimental and on-site collected data, that "even 1% of bad data can result in a 16% difference in decision thresholds" and "even the smallest data anomaly can cause surprisingly significant changes." These minor data discrepancies could potentially overturn court judgments, changing a verdict from innocent to guilty.

Professor Su-Ling Fan from the Civil Engineering Department, who had extended the invitation to Dr. Maxion, moderated the Q&A session following Roy Maxion's speech. Questions from Dean Lee and Chair Hsiao-Chung Tsai of the Water Resources and Environmental Engineering Department covered topics such as data collection methods and whether machine learning could mimic human behavior, potentially bypassing biometric technology. Roy Maxion

shared that the equipment used in his laboratory is meticulously calibrated, achieving an accuracy of 100 microseconds, emphasizing his rigorous approach to data collection. Regarding machine learning, although it can input relevant data, the specification for transforming it into mimicked behavior is not yet fully developed. He believes that his research on keyboard input can even identify the pressure and emotions of the typist, aspects that cannot be replicated through machine learning.

On the morning of November 13, invited by the Department of Civil Engineering, Dr. Roy Maxion, along with Dean Lee, Chair Yung-Shan Hong and Professor Fan from the Department of Civil Engineering, visited President Huan-Chao Keh, and Chairperson Flora Chia-I Chang, respectively. President Keh and Chairperson Chang each presented the Panda trophy and a vase imprinted with calligraphy by Master Chi-Mao Li and painting by Master Ben-Hang Chang, featuring Tamkang campus scenery and the school anthem, to Dr. Maxion a s a commemoration.

President Keh and Chairperson Chang not only extended a warm welcome and gratitude to Dr. Maxion for his first visit to Taiwan but also explained the university's Three Objectives of Education. They shared insights into the origin of the Panda Lecture series organized by the founders, Dr. and Mrs. Chang, and gained a preliminary understanding of the lecture's topic, "When the Rubbish Meets the Road: A Lesson About Data." Dr. Maxion provided an overview of his academic expertise and highlighted his current research focus, emphasizing the analysis of keyboard input data for more accurate personalized identification. He expressed the view that information from keyboard input alone might not be sufficient for individual recognition. Other characteristics, such as the frequency and force of individual keystrokes, should be considered to enhance the accuracy of personalized identification, preventing system misjudgments resulting from the theft of personal passwords.

Drawing upon extensive experience, across diverse domains of AI development, offering consultations to entities such as the U.S. State Department and various industrial and government organizations. His influence extends globally as a guest lecturer at various international universities.

In his past roles, Dr. Maxion was the Program Co-Chair for the International Conference on Dependable ___ and Networks. He has been a member of esteemed professional organizations including the IEEE Fault Tolerance Technical Committee, the U.S. Defense ___ce Board, and the European Commission's AMBER Advisory ___tee. Additionally he contributed to the advancement ___ serving on the editorial boards of prestigious ___ Transactions on Dependable and Secure ___ormation Forensics and Se ___ecurity and Networks, ___ the ___rial boards of IEEE Securi ___onal Journal of Machine Learning

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