INTERVIEW WITH DR. CHUAN-YU CHANG

Dr. Chuan-Yu Chang is with the National Yunlin University of Science and Technology as a distinguished professor at the Department of Computer Science and Information Engineering and the director of the intelligent Recognition Industry Service (IRIS) Research Center. He is concurrently the Deputy General Director of the Service System Technology Center at the Industrial Technology Research Institute (ITRI). At the same time, he is the chairman (2021-2022) of the Chinese Image Processing and Pattern Recognition Society, which is the most indicative and largest academic society in the field of artificial intelligence. In the past, he also served as the Dean of Research and Development, Director of the Incubation Center for Academia-Industry Collaboration and Intellectual Property, Director of the Department of Computer Science and Information Engineering, and the division director of the Systems Section of the Information Technology Services Center at the National Yunlin University of Science and Technology. He has comprehensive experience in administrative and industrial services. Dr. Chuan-Yu Chang has actively participated in various international academic organizations and is highly reputable in the academic fields. He is a Fellow of the Institution of Engineering and Technology (IET) and a senior member of the Institute of Electrical and Electronics Engineers (IEEE).

In 2021, Dr. Chuan-Yu Chang received the National Award for Distinguished Contribution to Industry-Academic Cooperation from the Ministry of Education in Taiwan for his outstanding industry-academia research results. The award is the most prestigious in technical and vocational education. Additionally, he received numerous other awards, including the National Science Council's Future Tech award, the Chinese Institute of Electrical Engineering's Outstanding Professor Award, ITRI's Outstanding Research Award, and the IEEE's Outstanding Technical Achievement Award.

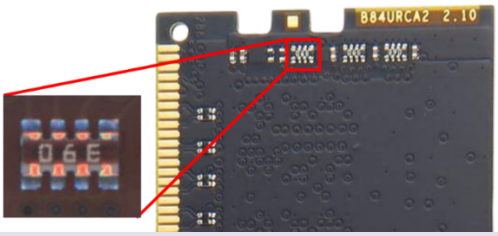
In 2018, Dr. Chuan-Yu Chang convened 22 professors in the Artificial Intelligence field from the National Yunlin University of Science and Technology and established the lntelligent Recognition Industry Service (IRIS) Research Center. The Ministry of Education's Higher Education Sprout Project selected the center as Global Taiwan's Featured Areas Research Center. The center explores the actual requirements of the industries to develop forward-looking AI intelligent recognition technologies and emphasizes on intelligent detection, intelligent healthcare and intelligent living.

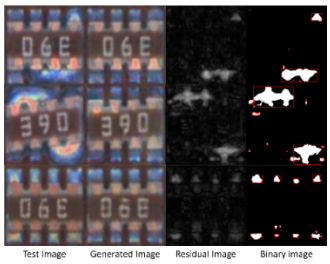
Dr. Chang, you have developed many innovative technologies. Is there one you are most proud of?

Dr. Chuan-Yu Chang has served in academia for around 20 years. Since 2003, he has served at the National Yunlin University of Science and Technology and established the Medical Image Processing Laboratory (MIPL). He has been involved in machine learning, medical image processing and related research for a long time. The MIPL's objectives are to develop technologies that solve industrial difficulties, involve student teams in medical and industrial facilities to thoroughly understand industrial issues, and provide intelligent solutions for various industries. The center has provided services to over one hundred enterprises and supported one hundred students to complete their postgraduate degrees. The most representative research is the globally-renowned Infant Crying Translator. In 2013, Dr. Szu-Tah Chen from the National Taiwan University Hospital Yun-Lin Branch consulted Dr. Chang regarding the possibility of interpreting infant cries via computers to provide suggestions to the parents, which started the long-term collaboration between Dr. Chang and the National Taiwan University Hospital. After three years of research, the team has collected over three million samples of infant cries (the largest database globally) and developed the first infant cry recognition application in the world in 2016, namely, the Infant Crying Translator. The application utilizes machine learning to determine the infant's needs based on the infant's cry (hungry, sleepy, wet diaper, or seeking comfort).

The application can also customize an individual infant's cry model (the only one in the world). The application's recognition accuracy is 92% for cries from babies less than one week old, which helps to reduce confusion for new parents. Furthermore, Dr. Chang leads the team of MIPL students in entrepreneurship to commercialize infant cry recognition technology. The technology has received the Ministry of Science and Technology's Entrepreneur potential award (top 10) in the From IP to IPO (FITI) project and has been selected as an entrepreneurial team by the Taiwan Innovation and Entrepreneurship Center (TIEC) for the Silicon Valley Startup Accelerator. The team has been reported by hundreds of international media (including Reuters from the US and the Sankei newspaper from Japan), and the technology has been transferred to several renowned international companies (Japan, The Netherlands and China). The team also facilitated Taiwanese brands to enter the European and American markets. To provide comprehensive infant care service, the team has also developed technologies to detect other infantile events such as milk spitting, mouth and nose obstruction, face monitoring, heart and respiration monitoring, and more. The target is to implement an all-around intelligent baby monitor which contributes significantly to the industry.

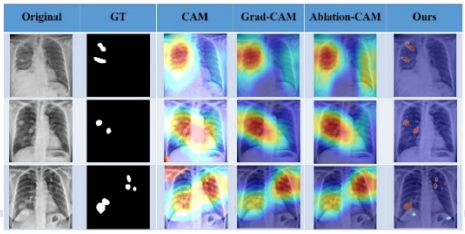
Since its establishment four years ago, the IRIS center (directed by Dr. Chang) has developed 81 AI recognition technologies. Can you please share the industrial contributions of the developed technologies?

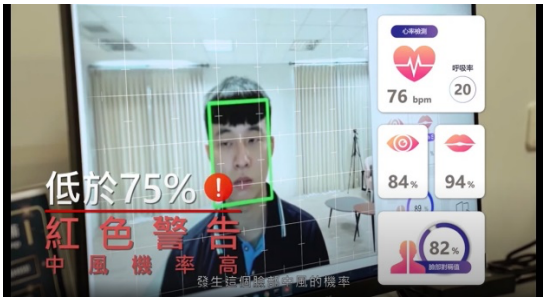




The IRIS center is focused on implementing industrial technologies for the industries. So far, 81 novel technologies have been developed and integrated into the industries. In the following, we will introduce the center's results and highlights with regard to three main areas.

In intelligent detection, the target is to integrate computer vision detection technologies into the industries towards the Industry 4.0 concept. The main research goals are to improve the detection rate and reduce misdetections due to staff fatigue and lack of experience. Research outcomes include defect detections for tires, solar power EL, memory modules, electronic components, copper foil, precision glass, textiles, and so on. Among the developed technologies, "The application of deep learning in the detection of soldering points of DRAM modules" used the Generative Adversarial Network (GAN) for defective image classification of DRAM modules and achieved an overall accuracy rate of 99% with a defect misdetection rate lower than 0.3%. The technology effectively solves problems such as high misdetection rates and large manual rechecks in the conventional AOI detection setup. The technology is successfully integrated into the largest memory module manufacturing plant in the center of Taiwan. Furthermore, the work also received a gold medal in the 2020 International Innovation and Invention Competition Award (IIIC), as well as a first prize and best innovation prize in the 2020 Pan-Pearl River Delta and undergraduate computer competition. The technology has a profound contribution in the advancement of AOI industrial technologies.





In intelligent medicine, various AI-aided diagnosis systems have been developed to assist medical practitioners in clinical diagnoses by reducing diagnosis difficulties, shortening examination time, and increasing treatment quality. The technologies have been extended to telemedicine. Some research highlights are computer-aided diagnosis systems for glaucoma, lung lesions, thyroid nodules, breast cancer, rheumatoid arthritis, pancreatic cancer, endotracheal tube, and pneumothorax, developed in collaboration with the Dalin Tzu Chi Hospital, National Taiwan University Hospital Yunlin Branch and the National Cheng Kung University Hospital. A major highlight is the world's first non-contact facial symmetry, heart rate and respiration detection technology. The technology utilizes facial asymmetry with the eyes and mouth to evaluate the risk of a stroke from facial features and observes the micro-vibrations of the head due to heart contractions. The technology uses a standard camera to overcome existing image measurement issues such as lighting variations and provide simultaneous, instantaneous and continuous measurement for several people. The error rate for heart rate detection is around four beats per minute, and the respiration error rate is one breath per minute. The accuracies are close to medical-grade physiological signal monitoring machines, indicating high clinical application values. The technology is commercialized and marketed with the National Taiwan University Hospital Yunlin Branch and Insight Vision. It was

awarded the 2020 MOST Future Tech award for its uniqueness and innovation and obtained five patents in the US and Taiwan.

Intelligent life includes various technologies associated with intelligent living, behavior recognition, hyperspectral identification, infant cry recognition, intelligent automotive electronics, and so on. These technologies can be applied to historical artifacts, sports technology, environmental monitoring, agriculture, and other fields to improve the quality of life. Research outcomes include the baby monitor, human face and emotion recognition, artifact and artwork preservation and recognition and agricultural produce examination. Apart from the Infant Cry Translator App, a major highlight is the AI artifact preservation monitoring system developed in collaboration with a national antiquities appraiser in the IRIS team. The system integrates AI, environment sensing and the Internet of Things to determine the authenticity of artifacts, monitor artifact degradation conditions and provide warnings. The technology is applied to the idols and artifacts in the Taisheng Temple in Budai Township, Chiayi County and Beiji Temple in Dapi, Yunlin County, and the Chien-lung stele in Chiayi Park. The technology aims to solve artifact restoration difficulties with AI technology, alleviate the lack of artifact restorers and improve artifact preservation.

What are the goals and vision for the IRIS center?

The IRIS center is focused on developing AI recognition technologies and aims to develop practical technologies to solve actual industry issues. In addition to industrial collaborations, the center seeks to cultivate industrial application talents to connect with enterprises. In four years, the center has cultivated 303 outstanding graduates, provided industrial work experience for 42 students, received 35 international awards and published 89 SCI journal papers, including 56 Q1 rank papers, establishing the center's status internationally. With regard to industrial collaborations, 81 AI recognition technologies have been integrated into various industries to service over 400 enterprises, and the total enterprise collaboration amount is 135 million NTD.

The IRIS center aims to be Asia's first-class and Taiwan's number one intelligent recognition benchmarking center. I hope that our technologies will not only help to upgrade Taiwan industries but to establish our brand and take place in the global market so that the world knows about the strong AI potential in Taiwan.