Office of Research & Development

City-Data through Real-Time Images City real-time images offer huge business opportunities. OmniEyes Co. Ltd. founded by Professor Chun-Ting Chou, Department of Electrical Engineering, and Prof. Ai-Chun Pang and Sho-De Lin, Department of Computer Science & Information Engineering, applies fog computing for a comprehensive collection of city-data. Using cameras on buses, taxis, and other vehicles, they generate real-time city images delivering high

commercial value Prof. Chun-Ting Chou: chuntingchou@ntu.edu.tw Prof. Ai-Chun Pang: acpang@csie.ntu.edu.tw Prof. Shou-De Lin: sdlin@csie.ntu.edu.tw

Fighting Diseases with Healthy Cells

Through aging, our immune system loses its ability to recognize and destroy disease-causing pathogens. Professor Jih-Luh Tang, College of Medicine, developed a technology to separate, propagate, and store young immune cells and peripheral blood stem cells and established Retain Biotech Corp. as the first leading company in the field. The preserved healthy immune cells and tissue regenerating peripheral blood stem cells are a powerful tool to fight future diseases.

Prof. Jih-Luh Tang: tangjh@ntu.edu.tw

New Technological Services and Models for Long-term Care 2.0 Following cooperation between NTU and the Shuang-Lien Elderly Center in 2008, former professor of the Department of Civil Engineering Jessy Kang founded the Smart Aging Alliance for cross-disciplinary solutions for an aging society. In 2018, Jubo.health was established, bringing together professionals from engineering to social work to jointly develop care technology products for a modern, family-oriented elderly care environment. In 2019, Jubo.health received funding from the National Development Fund and Darwin Venture Management. Prof. Shi-Chung Jessy Kang: sckang@ntu.edu.tw

Office of International Affairs

Play A Leading Role in International Higher Education Institutions To implement University Social Responsibility and realize the Sustainable Development Goals, NTU chairs The Association of East Asian Research Universities (AEARU) and cooperates with Asia's leading universities to jointly approach global issues and promote innovative programs, like summer courses on innovation and entrepreneurship. Moreover, NTU and the University of Tokyo jointly host bilateral meetings on the topic "Co-creating the future society in Asia" discussing, e.g. elderly medical care or building a sustainable ecosystem.

Stimulate Exchanges between International Administrators Gathering representatives from 23 universities in 12 countries, the first NTU Family Meeting organized by the OIA offered a forum for international administrators to learn from each other, exchange ideas and experiences, and discuss how to promote innovative cooperation and the implementation of SDGs in international higher education. Besides, NTU participated in International Education Fairs and Erasmus+ Staff Exchange to promote academic exchanges and cooperation.

Take Innovative Steps to Promote Internationalization The OIA takes innovative steps to promote internationalization. This includes the Voyage of Aspirations Scholarship, diverse overseas education programs, and dual degree scholarship schemes to enhance the outward mobility of local students. Besides, an increase in financing and the support of English courses aim to attract outstanding international students to NTU, improve their learning outcomes, and implement internationalization at home.

College of Life Science

NTU and Academia Sinica Cast New Light on Neuroblastoma Treatment

To reveal the mechanism behind the disease NB. Prof. Hsin-Yu Lee's research team, after 15 years of work, discovered that aryl hydrocarbon receptors (AHRs) can improve the survival of patients, and demonstrated AHR's critical role in regulating the development of the neural system. They also discovered that the neuroactive steroid tetrahydrocortico-sterone (THB) can suppress the growth of malignant cells growing and prevent metastasis. These results have been published in Cancer Research and ACS Chemical Neuroscience and new drug development is expected.

Prof. Hsinyu Lee: hsinyu@ntu.edu.tw

Polyamines Enhance DNA Repair

Repair of damaged DNA is a prerequisite for cells to maintain genome integrity and cell survival. How the intracellular metabolites, polyamines, affect DNA repair capabilities remains a mystery. We use the animal. cell-based, and biochemical approaches to address this issue. Our study unveils that polyamines are like the energy drink "Red Bull" for cells. which can promote the homologous recombination-mediated DNA repair system. This discovery provides possible strategies for cancer treatment. Prof. Hung-Yuan Chi: peterhchi@ntu.edu.tw

The Secret of Using Far-Red Light for Photosynthesis in Cyanobacteria Some unique cyanobacteria can harvest far-red light for photosynthesis in addition to visible light. By studying these cyanobacteria, we can show the importance and productivity of far-red light for the environment. Eventually, we hope to transfer this cyanobacterial system to crops, helping them to increase photosynthetic efficiency and productivity. Prof. Ming-Yang Ho: mingyang@ntu.edu.tw

Office of Academic Affairs

International Interdisciplinary Master Degree Programs

NTU strives to cultivate talents with capabilities to solve global challenges and thus established international interdisciplinary Master degree programs with focus on agriculture technology, biodiversity, and disaster prevention. These programs highlight NTU's research achievements and integrate various resources on campus to provide high quality education.

Prof. Tsai-Kun Li: tsaikunli@ntu.edu.tw

Best Education for All @ NTU

NTU embraces diversity and autonomy by creating a transborder learning ground across campuses and academic semesters: around 1500 students from all over the country gathered together at NTU Summer College, studying together and forming networks for collective social endeavor beyond the classroom, in a true essence of liberal formation. A. P. Han-Y. E. Chou: hyechou@ntu.edu.tw

NTU D-SCHOOL Summer Camp: A Social Practice, the Social Responsibility

"NTU D-School Forest Summer School" is a camp that emphasizes co-learning. During the first week, NTU students visited the tribe Kalibuan to learn about the natural environment, tribal culture and agricultural life with local residents. In the second week, NTU students used the results of the field study to design different courses to stimulate Tong-Fu junior high school students' interest in topics such as traditional aboriginal territories, post-disaster recovery and tribal economy. Through this, we not only promote the Experimental Forest as a field for NTU students to practice social services, but also help the Tong-Fu junior high school to improve their summer curriculum.

Asst. Prof. Shu-Wei Huang: shuweian@ntu.edu.tw

College of Electrical Engineering & Computer Science

Equivalent Capacitance Guided Dummy Fill Insertion for Timing and Manufacturability

Dummy fill insertion is widely adopted for reducing the thickness variation after chemical mechanical polishing during semiconductor manufacturing. To minimize timing degradation, existing strategies optimize induced coupling capacitance. In contrast, in the ASPDAC 2020 best paper, we analyze equivalent capacitance friendly regions to wisely prevent unwanted increase in equivalent capacitance of timing critical nets

Prof. Iris Hui-Ru Jiang: huiruijang@ntu.edu.tw

Improving the Sensitivity of Radio Astronomical Receiver by High Linearity MMIC Amplifier

The high-quality wide-tuning local oscillator (LO) signal plays on important role in the radio astronomical heterodyne receiving system. The received signal quality is improved by adapting MMIC power amplifier in LO chain with a linearizer at the drain terminal of the transistor. It features >40 dBc IMD3 across 18-28 GHz with >10 dBm output power.

Prof. Huei Wang: hueiwang@ntu.edu.tw

Power Converters for Emerging Solar Photovoltaic Systems

This research develops power converter hardware and control for improving output power and reliability for solar photovoltaic systems. An innovative structure using differential power processing converters is used to maximize power production while minimizing losses. This enables solar power for applications like wearables, health-monitoring devices, drones, and electric vehicles.

Prof. Katherine A. Kim: kakim@ntu.edu.tw

College of Law

The Development of Digital Technology and the Future of Law

Our research theme The Development of Digital Technology and the Future of Law is a joint project with Hamburg Law School emphasizing topics on important issues such as self-driving, financial technology, social media and democratic processes, digital communication and privacy, and artificial intelligence. Discussion derives from various aspects of jurisprudence, media law, commercial law, criminal law, evidence and procedural law.

Prof. Jen-Guang Lin: andrewlin@ntu.edu.tw

Legal Integrity Safeguards for State Institutions and National **Public Officials**

Legal Integrity Safeguards for State Institutions and National Public Officials is a collaborative study with Radboud University and the University of Hong Kong, which implements a comprehensive discussion of the anti-corruption and clean government issues. Prof. Jen-Guang Lin: andrewlin@ntu.edu.tw

Comparative Law

Comparative Law has long been our law school's main research focus. More recently, our research trend emphasizes the possibility of regional legal integration, such as Civil Law or Contract Law in the developing East Asian countries and courts, comparative analysis of the similarities and differences in Taiwan, Japan, South Korea, and China. Prof. Jen-Guang Lin: andrewlin@ntu.edu.tw



Research Highlights at

NTU_{2020.3} https://oia.ntu.edu.tw/RHL

College of Liberal Arts

Tradition and Innovation in Sinology

Department of Chinese Literature has directed world-class research and teaching in collaboration with institutes worldwide, such as University of Harvard. Professors have offered award-winning open courses on Chinese classics. With this concerted effort, NTU is set to maintain a pivotal role in sinology.

Prof. Chia-Ling Mei: meicl@ntu.edu.tw

The Taiwan Indigenous Collections Housed at the Overseas Museums Department of Anthropology has devoted to the preservation of Taiwan Heritage. The representative work of the Late Prof. Chia-yu Hu, *Local* Aesthetics with Foreign Perceptions: The Taiwan Collections Housed at the British Museum (2018), contributes to reinstate cultural diversity on the world stage. It offers a glimpse at the encounter between Taiwan and the world in the 19th and 20th centuries.

Dr. Kai-Shyh Lin: openlin@ntu.edu.tw

New Theories in East Asian History

Department of History positions itself at the forefront of a cutting-edge research on the History of East Asian Kingship. One focus of this multifaceted project investigates the common political order of this region in order to propose a new international alliance for peace maintenance in East Asia.

Prof. Huai-Chen Kan: kan@ntu.edu.tw

College of Science

Planarization and Integration of Three-Dimensional Magnetic Field Sensor

Professor Ching-Ray Chang in the Physics Department leads an industry-academic cooperation project formed by professors and iSentek. The project aimed to solve the planarization and integration challenge of electric compass and their results got IEEE TNANO 2019 Best Paper Award. Also, this technology joint-development makes iSentek become a leading magnetic sensor provider with a lot of recognitions from worldwide leading customers, such as DJI, Oppo, HTC. **Prof. Ching-Ray Chang: crchang@phys.ntu.edu.tw**

Fight Against Global Warming

We utilized an exclusive "operando X-ray absorption spectroscopy" to discover a new single-atom iron with a high valence of +3 – that can perform a superior activity to electrochemically convert CO₂ into CO with a high conversion efficiency and a low energy consumption. This recycling of CO₂ in a highly efficient manner can not only slow global warming but also produce CO that can be further converted into other valuable fusels for relative chemical industry.

Prof. Hao Ming Chen: haomingchen@ntu.edu.tw

Impacts of Climate Changes on the Groundwater in Africa Previous literature pointed out that under future global warming, surface water and groundwater in semi-arid regions will be significantly reduced, but this study proposes a different view: using long-term hydrological observations in Africa, we found that in semi-arid areas, intermittent rivers and lakes formed by intense rainfall are the primary sources of groundwater replenishment. The previous literature has underestimated the impact of this supplementary mechanism on groundwater resilience. The new finding highlights the essential for advances in the hydro-climatical process in climate models.

Prof. Min-Hui Lo: mlo@as.ntu.edu.tw

College of Social Sciences

Globalization and Migration

New immigration to Taiwan since the early 1990s has brought a quick accumulation of social scientific knowledge on newcomers in Taiwan. Our research concentration aims to establish the external linkages of diverse social scientific fields to stimulate new research insights in immigration studies in the context of globalization. **Prof. Pei-chia Lan: pclan@ntu.edu.tw**

Public Economics

The Public Economics Research Center of NTU acts as an integrated platform for academia, politics, and industry to apply research and policy analysis to produce a comprehensive picture of Taiwan's current economic problems across issue areas such as taxation, public debt, and the fiscal balance.

Prof. Jin-Tan Liu: liujt@ntu.edu.tw

Risk Society and Policy

The Risk Society and Policy Research Center of NTU conducts research on sustainable development, climate change and energy transition, and their impact on society. In 2019, major research findings are published in the "Taiwan in Transition" report in tribute to the German Advisory Council on Global Change's 2012 World in Transition report. **Prof. Kuei Tien Chou: ktchou@ntu.edu.tw Prof. Kuo-Hui Change: changk@ntu.edu.tw**

College of Medicine

Dysbiosis of Gut Microbiota Associated with the Development of Allergies in Infants

We investigated what microbe(s) might be involved in analyses of infant twins. Abundant and premature colonization of Ruminococcus gnavus shapes the aberrant structure of the intestinal microbial consortium of respiratory allergic infants. This bacterium and its gene products may be the targets of therapies for allergic diseases. **Prof. Yen-Hsuan Ni's Group: yhni@ntu.edu.tw**

Risks of HBV-Related Hepatocellular Carcinoma: HBcrAg Matters

Patients with chronic HBV infection are at different risks of hepatocellular carcinoma development. Using a large-scale cohort study, Kao' s team is the first time to show that hepatitis B core-related antigen (HBcrAg), a novel viral biomarker, is useful in predicting risks of hepatocellular carcinoma, especially in those with intermediate viral load. **Prof. Jia-Horne Kao's Group: kaoih@ntu.edu.tw**

The Mechanisms that Build the Brain

Molecular mechanisms that sculpt the connectivity of the nervous system are not completely defined. Using the soil-living nematode Caenorhabditis elegans, we uncovered genetic pathways that control the morphology, connections and functions of neurons. We also identified neuronal signals that promoted lifespan in response to sensory perception.

Prof. Chun-Liang Pan's Group: chunliangpan@gmail.com

College of Engineering

Enhanced Near - Infrared Photoresponse of Inverted Perovskite Solar Cells through Rational Design of Bulk -Heteroiunction Electron - Transporting Lavers

The development of sustainable energy, such as photovoltaic cells, has become an important subject of human socio-economic development. Prof. Chueh's research group in Chemical Engineering Department has recently developed a novel bulk-heterojunction electron-transporting layer, which can efficiently enhance the NIR Photoresponse of the derived inverted perovskite solar cell.

Prof. Chu-Chen Chueh: cchueh@ntu.edu.tw

Using Atomic Layer Materials for Solar to Hydrogen Generation

Prof. Chun-Wei Chen's research group at the Department of Materials Science and Engineering developed a novel method for water splitting or solar-to-fuel conversion based on the formation of graphene/Si Schottky junctions with a 3D architecture which significantly improved the performance and durability of Si-based photo-electrochemical systems. **Prof. Chun-Wei Chen: chunwei@ntu.edu.tw**

Dubai World Challenge for Self-Driving Transport—Intelligent Self-Driving Transport Systems through Integration of V2X and AI Technologies

Prof. Kang Li led an autonomous vehicle R&D consortium, iAuto, to attend the 2018-2019 World Challenge for Self-Driving Transport (SDT), which was held by Dubai RTA. There were 65 entities from 20 countries participating in this World Challenge, and Taiwan iAuto was the only team from East Asia finishing all tests and winning the second place in the startup category. The iAuto team demonstrated V2X enhanced SDT technology and XiL simulation techniques in this World Challenge. **Prof. Kang Li: kangli@ntu.edu.tw**

College of Bio-Resources & Agriculture

Natural Products for the Prevention of Metabolic Disorder and Age-Related Diseases

Prof. Pan and his research team cooperated with hospital on a project to find out that dietary intake provided can lead to changes in microbiota composition with positive impact in retarding aging or improving related chronic condition. These results are also in line with the UNDP SDG 3. **Prof. Min-Hsiung Pan: mhpan@ntu.edu.tw**

Molecular Variety Identification Systems for Major Crops and Vegetables in Taiwan

The faculty of the Department of Agronomy developed molecular marker-based variety identification systems for major crops and vegetables to ensure fair competition in the seed industry and encourage continuous innovation to accommodate market demands and climate change. These tools are also integral components of quality control system to produce genetically pure seeds.

A. P. Kae-Kang Hwu: khwu@ntu.edu.tw

Intelligent Urban Metabolic Systems for Green Cities of Tomorrow: a WFE Nexus-based Approach

This Collaborative Research Action Project awarded by Belmont Forum conducts interdisciplinary research on the Water-Food-Energy (WFE) Nexus and SDGs through configuring WFE synergies in an equal and secure manner using artificial intelligence, big data, and life cycle assessment to optimize resources utilization for achieving healthy urban metabolism and intelligent green cities.

Prof. Fi-John Chang: changfj@ntu.edu.tw

College of Management

The Career Satisfaction of IT Professionals With Mixed Job Demands Career demands on information technology (IT) professional have evolved. No longer do organizations demand strictly managerial or technical competencies. The results suggest that pure managerial demands lead to the highest satisfaction while adding technical demands lessens satisfaction but in a complex pattern that allows potential compromises.

Prof. James J. Jiang: jjjiang@ntu.edu.tw

The Information Advantage of Underwriters in IPOs

Using a unique data set of dealer level trading data in bookbuilding initial public offerings (IPOs), we find strong evidence that lead underwriter trades in IPO firms are significantly related to subsequent IPO abnormal returns. Underwriters of bookbuilding IPOs gain unique insight into the values of these client firms and trade on this information advantage. **Prof. Yao-Min Chiang: yaominchiang@ntu.edu.tw**

Customer Satisfaction Underappreciation

We show that customer-satisfying executives are underappreciated: being productive is financially rewarding for both firms and executives, while being customer-satisfying is financially rewarding for firms but not as much for executives. We further demonstrate that using total shareholder returns to benchmark firm financial performance and reward executives with a higher proportion of stock compensation can encourage a long-term focus that alleviates this customer underappreciation.

Prof. Ming-Hui Huang: huangmh@ntu.edu.tw

College of Public Health

The Discovery of Particulate Matter (PM) and Precision Prevention for Colorectal Cancer

A cascade of causal effects of PM2.5 on a continuous spectrum of carcinogenesis of colorectal cancer was first corroborated, including the short-term effect on inflammatory process and the role of initiator and promoter for multistep carcinogenesis. The precision public health intervention can be designed by different levels of PM2.5 exposure. **Prof. Chang-Chuan Chan: ccchan@ntu.edu.tw**

Smart Exercise Modifies Obesity-causing Genes

The novel study design on gene and types of exercise associated with obesity provides a discovery and insight that genetic effects on obesity measures can be decreased to various extents by performing different kinds of exercise. The benefits of regular physical exercise are more impactful among eighteen kinds of exercises.

A. P. Wan-Yi Lin: linwy@ntu.edu.tw

Precision Population Health for Longer Life Expectancy through Integrated Public Health Interventions

Precision population health provides a new avenue for enhancing life expectancy in the domain of public health. A systematic framework of integrating public health interventions including environmental pollution control, lifestyle modification, and awareness of early detection and treatment, was conducted to demonstrate the improvement of life expectancy by seven years. **Prof. Hsiu-Hsi Chen: chenlin@ntu.edu.tw**