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HKUST DeepTech Playbook 2024



HKUST Office of Knowledge Transfer

The Hong Kong University of Science and Technology
 Clear Water Bay, Kowloon, Hong Kong
 Office: Room 3625B (Office of Knowledge Transfer)

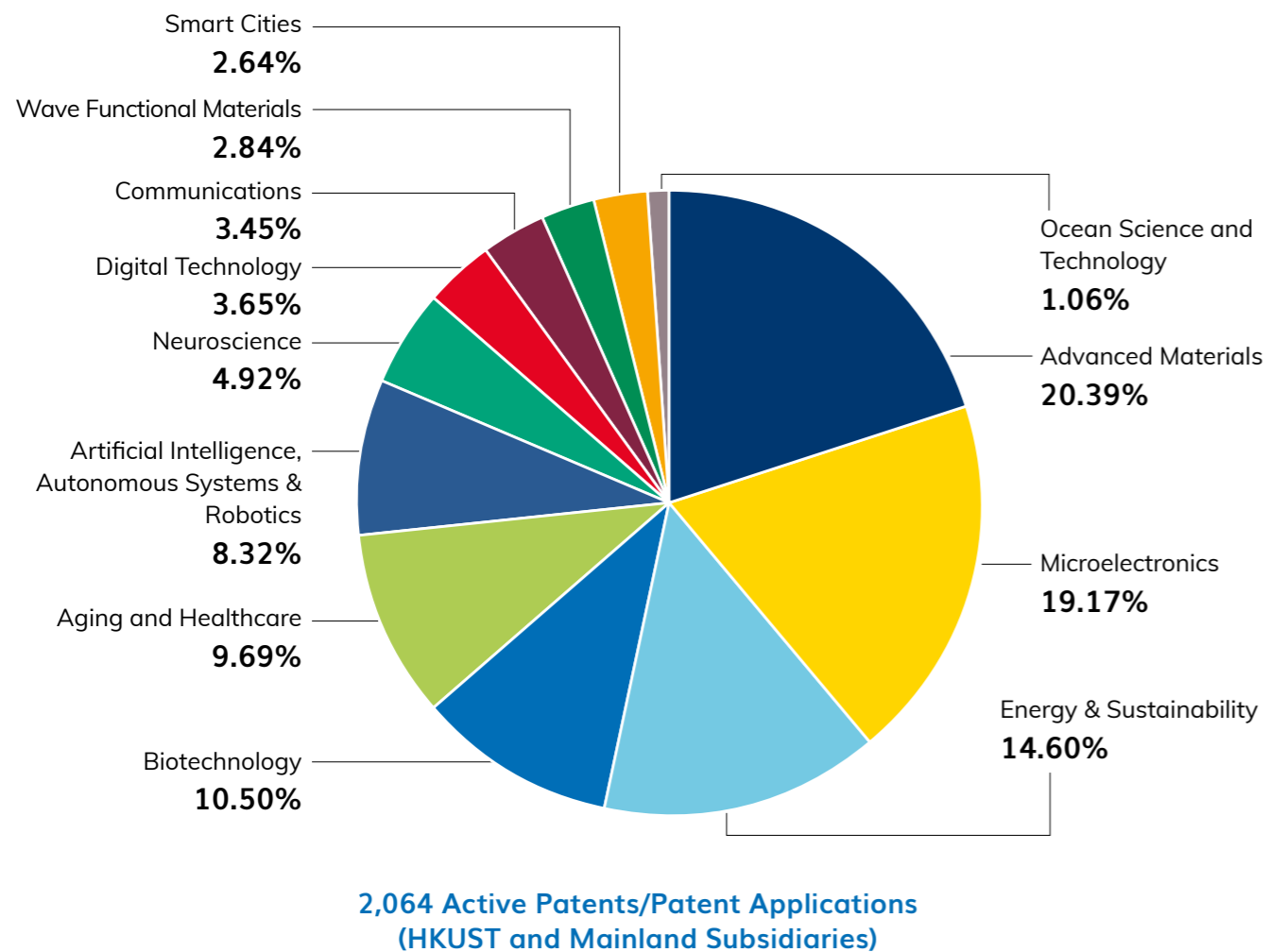
For investment discussion about HKUST DeepTech/startups
 Please contact: efund@ust.hk

For collaboration discussion
 Please contact: oktbd@ust.hk

About The Hong Kong University of Science and Technology

The Hong Kong University of Science and Technology (HKUST) (<https://hkust.edu.hk/>) is a world-class university that excels in driving innovative education, research excellence, and impactful knowledge transfer. With a holistic and interdisciplinary pedagogy approach, HKUST was ranked 3rd in the Times Higher Education's Young University Rankings 2024, while 12 of its subjects were ranked among the world's top 50 in the QS World University Rankings by Subject 2024, with "Data Science and Artificial Intelligence" being ranked first in Hong Kong and 10th in the world. Our graduates are highly competitive, consistently ranking among the world's top 30 most sought-after employees. In terms of research and entrepreneurship, over 80% of our work was rated "Internationally excellent" or "world leading" in the latest Research Assessment Exercise 2020 of Hong Kong's University Grants Committee. As of June 2024, HKUST members have founded 1,815 active start-ups, including 10 Unicorns and 14 exits (IPO or M&A).

Current Active Patent Portfolio by Technology Area



Transforming Industry and Empowering Society: Unveiling Our Impact

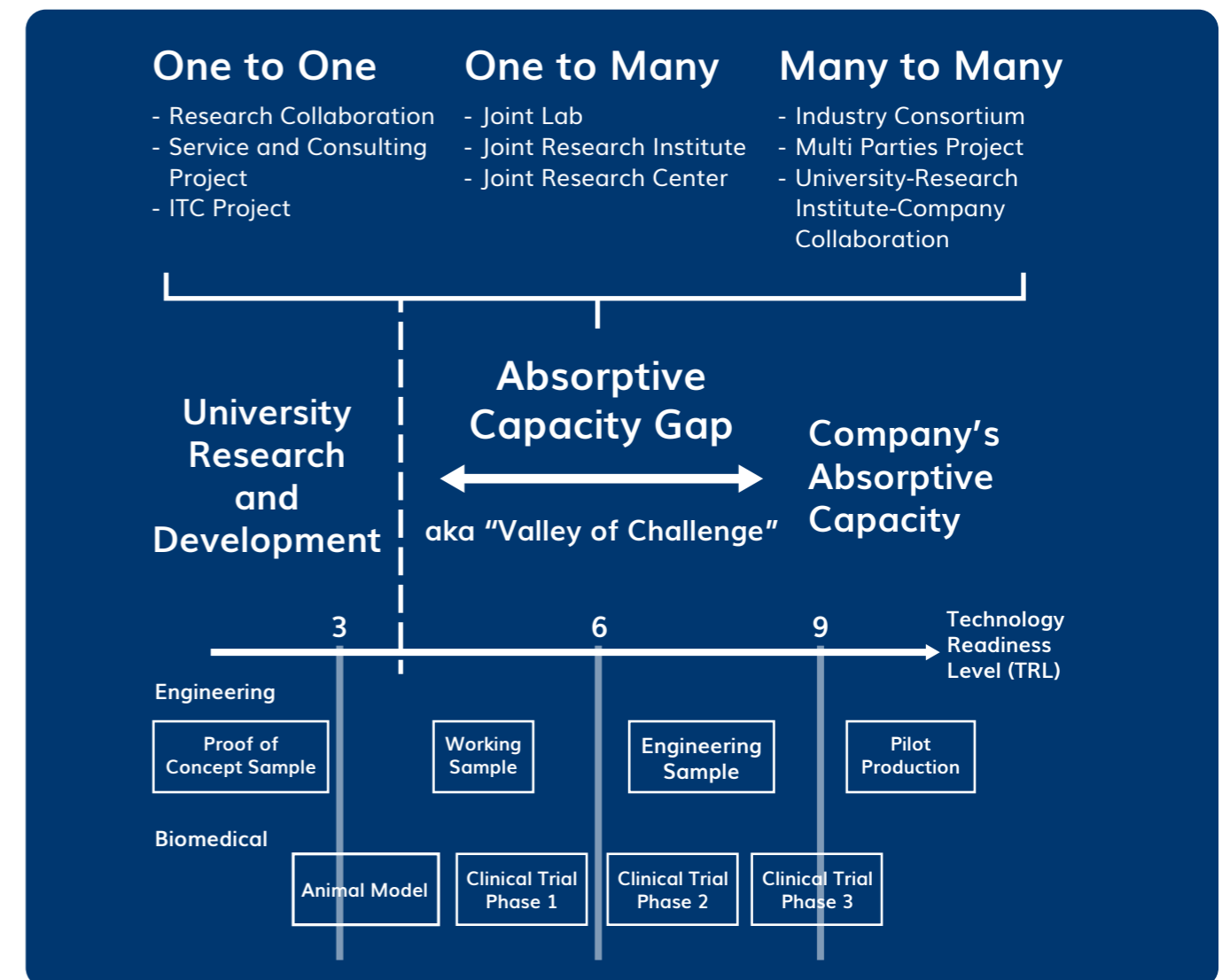
- 1,815 Active startup
- 14 Successful exits (IPOs and acquisitions)
- 10 Unicorns nurtured
- Addressed COVID-19 pandemic and social issues

Research and Strategic IP management enhanced the IP utilization

- No. 1 patent influence metric in China and 33rd in global by Nature Index (2022)
- Patent utilization: 33%

Strong Industry Engagement

- 826 Industry Collaborations
- 173 Active License Agreements
- No. 1 in industry income index in Hong Kong (THE ranking 2023)



Electronics, AI and Smart Systems (EAS)

EAS01	IoT and Sensing Technologies for Smart City Applications (Prof. Gary CHAN)	P.4	EAS23	Innovative Full-Color Micro-LED Micro-Display: A Revolutionary Technology for AR/XR industry (Prof. Wing Cheung CHONG)	P.14
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EAS04	Collaborative and Personalized Digital Twin Platform for Smart Facility Operation Management (Prof. Jack CHENG)	P.5	EAS26	A Time- and Energy-Efficient Ising Computer for Portfolio Optimization and Risk Management (Prof. Qiming SHAO)	P.15
EAS05	Efficient Inference Accelerator for Large AI Model (Prof. Tim CHENG)	P.6	EAS27	AI-Blockchain Enabled Decentralized Art Title, Asset Authentication & Management Platform (Dr. Daniel CHUN)	P.16
EAS06	Biomimetic Olfactory Chips Based on Large-Scale Monolithically Integrated Nanotube Sensor Arrays (Prof. Zhiyong FAN)	P.6	EAS28	Human-friendly Miniature Autonomous Blimp (UST-MAB) (Prof. Fumin ZHANG)	P.16
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EAS 01 IoT and Sensing Technologies for Smart City Applications

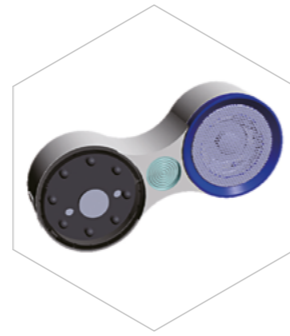
Principal Investigator | Prof. Gary CHAN

Technology Readiness Level | TRL 9 IP status | Patented

Research, develop and deploy innovative IoT and sensing technologies based on machine learning and data mining for smart city applications.

Key Technology Edges:

- **Edge AI:** Our computations are at the edge, saving cloud resources
- **Cost-effective:** Our algorithms are able to use minimal resources in IoT devices without much sacrifice in performance
- **Patented or patent-pending:** Our sensing and video technologies are either patented or patent-pending



Potential Applications



Applicable Industries



EAS 02 AI-Powered Automated Smart Dental Treatment Design System

Principal Investigator | Prof. Hao CHEN

Technology Readiness Level | TRL 6 IP status | Patented

Introducing a game-changing AI-Powered Dental Treatment Design System.

It leverages AI and computer vision for precise treatment planning, including implants, crowns, dentures, braces, and aligners. This technology disrupts dental care by:

- Personalizing treatment options for each patient
- Optimizing the design process for superior outcomes
- Revolutionizing workflow efficiency with advanced medical imaging

Key Technology Edges:

- Contour-aware multi-modality registration for CBCT and 3D intra-oral scan
- Generative teeth crown inpainting
- Human-in-the-loop implant position design

Potential Applications



Applicable Industries



EAS 03 VideoCrafter: A Unified Toolkit for Personalized Text-to-Video Generation and Editing

Principal Investigator | Prof. Qifeng CHEN

Technology Readiness Level | TRL 6

Foundation models for high-quality video generation support a range of controls, including text, image, motion, character, and style, providing users with a highly flexible tool for producing innovative content.

Key Technology Edges:

- **High Controllability:** Our technology provides diverse user controls, encompassing text, image, motion, character, and style. This level of controllability is unmatched by competitors
- **High Resolution Generation:** Our technology supports high-generation resolutions, reaching up to 2K resolution
- **Complex Motion:** Our video generation model manages to generate complex motions include scenarios like "teddy bear riding a bicycle"



Potential Applications



Applicable Industries



EAS 04 Collaborative and Personalized Digital Twin Platform for Smart Facility Operation Management

Principal Investigator | Prof. Jack CHENG

Technology Readiness Level | TRL 5 IP status | Patented

Introducing our groundbreaking Collaborative and Personalized Digital Twin Platform for Smart Facility Management.

It integrates 3D digital environments and real-time sensing data, enabling predictive decision-making and optimization. This innovative platform disrupts facility management by:

- Streamlining operations through real-time asset management and conditions monitoring
- Empowering informed decision-making for built asset stakeholders
- Enhancing efficiency and productivity while reducing costs
- Promoting environmental protection and social well-being through optimized energy usage and occupant interactions

Key Technology Edges:

- Lightweight & standardized digital twin platform for 30-40% faster BIM-based digital twin creation & management
- AIoT-based ESG analytics and LLM-embedded robotic virtual assistants for 20-30% more efficient FM
- Efficient and scalable integration of AIoT and updating of digital twin models
- BIM-Blockchain-enabled common data environment collaboration framework based on open standards for secure & personalized FM

Potential Applications



Applicable Industries



EAS 05 Efficient Inference Accelerator for Large AI Model

Principal Investigator | Prof. Tim CHENG

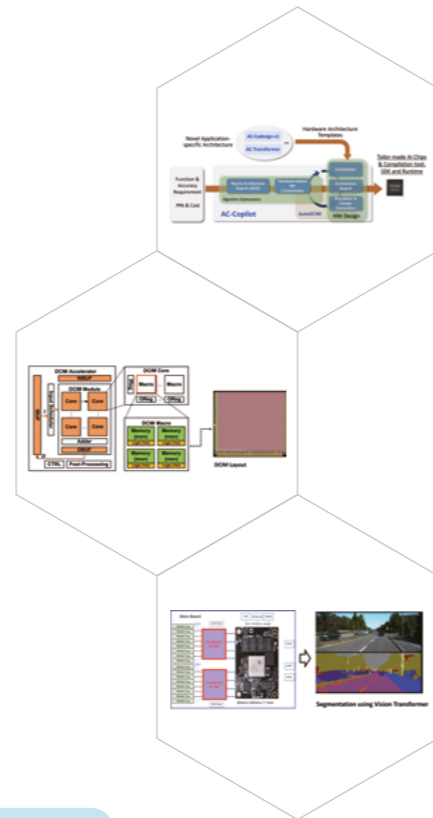
Technology Readiness Level | TRL 4 IP status | Patented

We offer an inference accelerator designed for large-scale AI models, leveraging a cutting-edge application-algorithm-hardware co-design platform and state-of-the-art compute-in-memory technology.

Our solution is specifically tailored to deliver highly efficient and power-optimized computing solutions for transformer-based models such as computer vision, bird eye view (BEV), large language models (LLMs) and AI-generated content (AIGC).

Key Technology Edges:

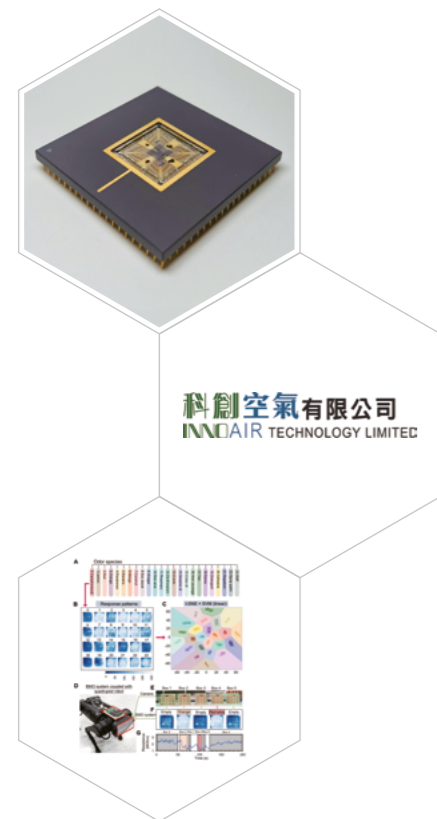
- Customized AI hardware design using application-algorithm-hardware co-design platform
- Digital Compute-In-Memory technology for high power efficiency AI computing
- Compression technology specifically designed for transformer-based large AI models



Potential Applications



Applicable Industries



EAS 06 Biomimetic Olfactory Chips Based on Large-Scale Monolithically Integrated Nanotube Sensor Arrays

Principal Investigator | Prof. Zhiyong FAN

Technology Readiness Level | TRL 6 IP status | Patented

- Gas/odor sensors with high performance and high reliability with the up-scalable processes to manufacture
- Smart gas/odor sensor systems distinguish various kinds of odors
- Wide-range array of applications, including food, environmental, medical, and industrial process control

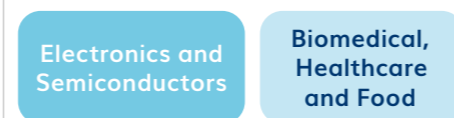
Key Technology Edges:

- The olfactory chip offers high sensitivity to various gases with excellent distinguishability for mixed gases
- Realtime analysis for mixture gases with novel machine learning algorithms
- Small form Factor: monolithic sensor array (from 3x3 to 10x10, 100x100 pixels) in a tiny area (5mm X 5mm)

Potential Applications



Applicable Industries



EAS 07 Middleware for Quantum Computers and Simulators

Principal Investigator | Prof. Gyuboong JO

Technology Readiness Level | TRL 3 IP status | Patented

The market has been lacking comprehensive middleware solutions for quantum technologies, with major players such as IBM and Google keeping their middleware proprietary.

QUANTier is actively addressing this gap by developing an advanced software stack capable of connecting users to quantum devices such as quantum computers and simulators. By doing so, QUANTier aims to create an open and inclusive ecosystem that fosters the development of quantum hardware and algorithms, unlocking new opportunities in the field of quantum computing.

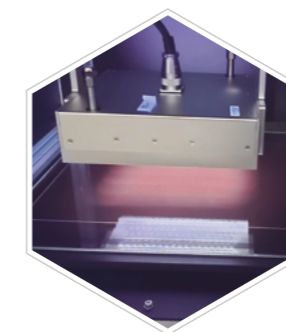
Key Technology Edges:

- Provide labs with an all-in-one solution for the lab control
- Connect the research labs and hardware companies to external users
- First comprehensive middleware company in the quantum computing market

Potential Applications



Applicable Industries



EAS 08 Photo-Aligned Multi-Domain Vertical Alignment LCD for Cost Effective Mass Production with Existing Equipment

Principal Investigator | Prof. Hoi Sing KWOK

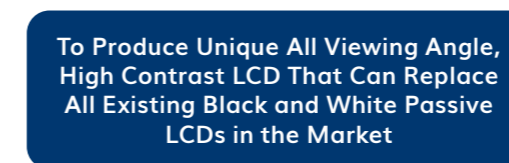
Technology Readiness Level | TRL8 IP status | Patented

The technology offers a method of using azo dye for photorealignment using blue light with viscosity modifiers optimizing the coating solution, allowing the manufacturer to achieve an efficient and cost effective way of LCD mass production using existing equipment.

Key Technology Edges:

- Patented advance material for photo-alignment to break foreign country material monopoly
- Patented LED light exposure system much cheaper than conventional photo-alignment exposure system
- Easy to implement multi-domain manufacturing process suitable for all existing LCD production lines

Potential Applications



Applicable Industries



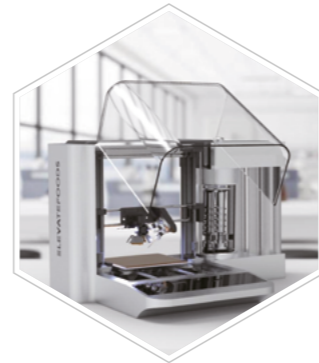
EAS 09 An Integrative System for food 3D Printing and Multi-Level Cooking for Making Personalized Meals with Ease

Principal Investigator | Prof. Mitch LI Technology Readiness Level | TRL 8 IP status | Patented

Creates personalized meals using smart 3D food printing and multi-level cooking, including an ultrafast infrared cooker and selective laser cooking for texture and flavor customization while retaining nutrition.

Key Technology Edges:

- **Multi-Level Cooking with Nano Materials:** Experience fast and efficient cooking and sterilisation without the need for human labor. Our patented world's first commercialised real-time print and cook device utilizes nano materials to enable multi-level radiative cooking, ensuring precise temperature control and enhanced food safety
- **Laser Cooking for Selective Cooking and Texture Creation:** Experience a new level of culinary creativity with laser cooking. This cutting-edge feature enables the selection of specific cooking areas and temperature-sensitive regions, resulting in custom textures like crispiness. Say goodbye to traditional cooking limitations and embrace a world of endless possibilities
- **AI-Generated Food Design Process:** Unleash the power of AI-generated food design. Our advanced algorithm translates text into intricate printing patterns, allowing for the creation of endless possibilities in food shapes and structures while retaining their integrity. Further integration with AI Nutrition Tracking Platform seamlessly connects our Smart 3D Food Printing system with an AI nutrition tracking platform. Analyze personal diet habits and preferences to recommend and prepare personalized food snacks that cater to individual needs, promoting optimal health and well-being



Potential Applications



Applicable Industries



EAS 11 Building the Future: Harnessing Technology's Potential to Transform Construction

Principal Investigator | Dr. Haobo LIANG Technology Readiness Level | TRL 7 IP status | Patented

Combining AI, IoT, 5G technologies, and robotics, we are collaborating to develop cutting-edge robotics and autonomous systems for construction industries.

Highlights include:

- Construction digitalization, enhancing efficiency, quality, and safety
- Construction IoT, driving connectivity and data-driven decision-making
- Construction robotics, revolutionizing processes and productivity
- Operational efficiency: Streamlining construction processes with the integration of robotics technology

Key Technology Edges:

- **Expertise and Innovation:** We have a team of experts with specialized knowledge and experience in the field of construction robotics. This expertise could enable us to develop innovative solutions that meet the specific needs of the construction industry
- **Partnerships and Collaborations:** We have already established partnerships and collaborations with industry stakeholders, such as construction companies and academic institutions. These partnerships could provide access to expertise and resources that could help us to develop and commercialize our products and services
- **Customization and Flexibility:** We offer customized solutions that are tailored to the specific needs of customers. By providing flexible solutions that can be adapted to different project requirements, we could establish a reputation for responsiveness and customer service, which could help to build loyalty and drive growth over time

Potential Applications



Applicable Industries



EAS 12 ezpie: the Ultimate Platform to Unlock Value from Data

Principal Investigator | Prof. Mengqian LU

Technology Readiness Level | TRL 7 IP status | Patent in Progress

One-stop solution to unlock data value by optimally matching tasks with professionals in a secure, functional and AI-empowered environment.

Key Technology Edges:

- Proprietary dynamic pricing and personalized recommendation system that can optimally match data with experts to maximize mutual value proposition at an online marketplace
- Build-in web3.0 online workstation that allows experts to securely work on data-related projects with maximum data security allowing for versatile collaborations
- Generative AI-empowered tools that assist task posting, management and data visualization, making ezpie a marketplace where data, technology, and art meet



Potential Applications



Applicable Industries



EAS 13 Agile Executive Terminal for Robots

Principal Investigator | Prof. Yajing SHEN

Technology Readiness Level | TRL 7 IP status | Patent in Progress

The development of a tactile sensor comparable to the human fingertip is of paramount importance for robotics.

Our project team previously proposed a flexible tactile force sensing solution based on the Hallbach magnetic array in the top robotics journal Science Robotics. This technology achieved precise tactile feedback comparable to human fingertips for the first time, decoupling normal and tangential forces, achieving ultra-high resolution, and possessing characteristics such as small size and low cost. On this basis, we have conducted in-depth research development and technology iteration in terms of high-precision measurement of multi-dimensional forces, product durability and communication compatibility. It now has a foundation for industrialization and has applied for multiple patent protections.

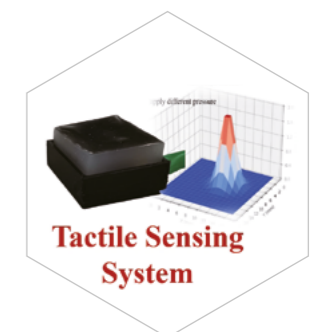
Key Technology Edges:

- **High resolution:** This technology achieved precise tactile feedback comparable to human fingertips for the first time, decoupling normal and tangential forces, and achieving ultra-high resolution
- **High dynamic:** Through structural design and corresponding force decoupling algorithm, the sensor can achieve real-time highly dynamic force detection and feedback, greatly reducing the need for computing power
- **Low cost:** Our sensor is simple and suitable for mass manufacturing, and the cost and selling price are far lower than similar products with similar performance.

Potential Applications



Applicable Industries



EAS 14 Quantum Rod LEDs for Display and Lighting with High Quantum Yield and Tunable Wavelength of Emission

Principal Investigator | Prof. Abhishek SRIVASTAVA

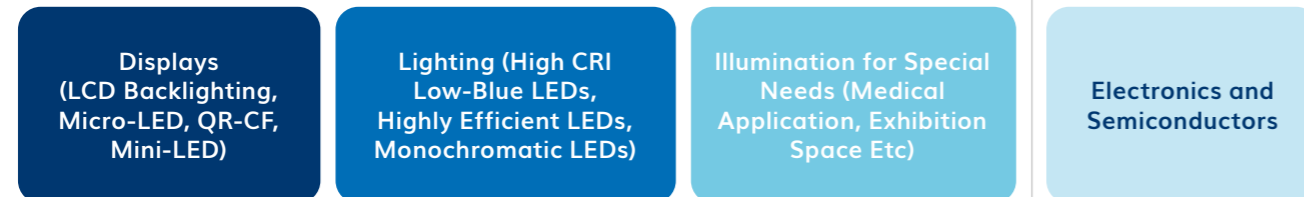
Technology Readiness Level | TRL 7 IP status | Patented

The technology offers a method for fabricating core shell/alloy quantum rods that can have tunable emission in the visible region of the spectrum, particularly around green emission, allowing the maker to produce polarized emission, achieve high quantum yield and tunable wavelength of emission better than quantum dots.

Key Technology Edges:

- Using innovative quantum rod nanomaterial we can create any desired light spectrum solving the main problems of LED illumination
- Better thermal stability of QRs enables development of low-blue lighting LEDs with high color performance and efficacy
- Applying of quantum material in on-chip configuration enables a new generation of QLED display with up to 40% less price and better performance

Potential Applications



EAS 15 Physics-guided AI & Intelligent Satellite-empowered Information System and SaaS platform

Principal Investigator | Prof. Hui SU

Technology Readiness Level | TRL 7 IP status | Patent in progress

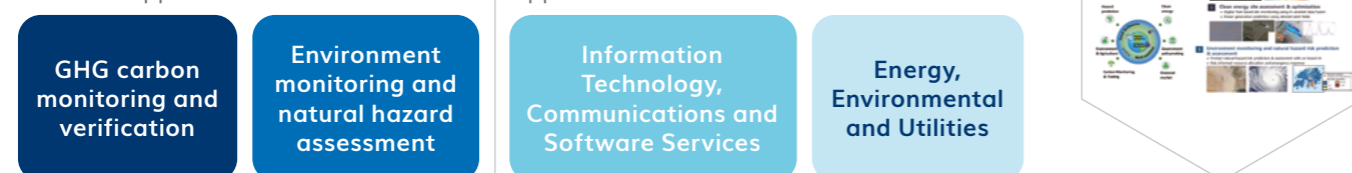
Experience the future of data analytics with our cutting-edge technology combining physics-guided AI and intelligent satellite capabilities. Highlights include:

- Timely and scalable remote sensing data from a multimodal satellite constellation
- Proprietary physics-guided AI algorithms for automatic data-to-insights generation
- Streamlined end-to-end solutions for various domains through a cloud-based SaaS platform

Key Technology Edges:

- Multimodal satellite constellation and on board AI intelligence provides timely, feature-rich and scalable remote sensing data
- Proprietary physics-guided AI algorithms enables automatic data to insights generation for better decision making
- End-to-end streamlined applications for multiple domains delivered by cloud based SaaS platform

Potential Applications



EAS 16 Hardware Accelerator for Financial Computing

Principal Investigator | Prof. Chi-Ying TSUI

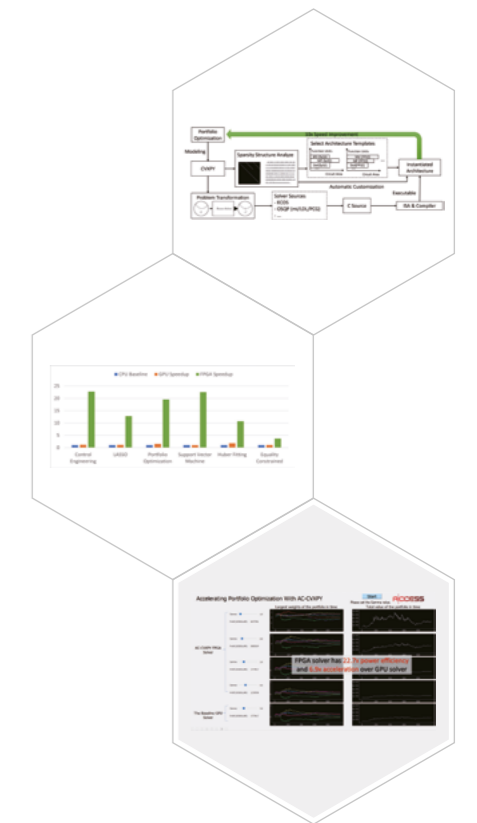
Technology Readiness Level | TRL 4

We offer a hardware accelerator system (AC-CVXPY) for financial computing applications using FPGA and ASIC, implementing software-hardware co-design and reconfigurable circuit technology.

Key Technology Edges:

- Customized high-power efficiency and low latency AI core optimized for finance market prediction using co-design technology
- A hardware solver for fast portfolio optimization and trading strategy suggestion
- Reconfigurable circuit technology for flexible algorithm adoption

Potential Applications



EAS 17 Electronic Design Automation (EDA) for Deep Learning Accelerator Design

Principal Investigator | Prof. Fengbin TU

Technology Readiness Level | TRL 6

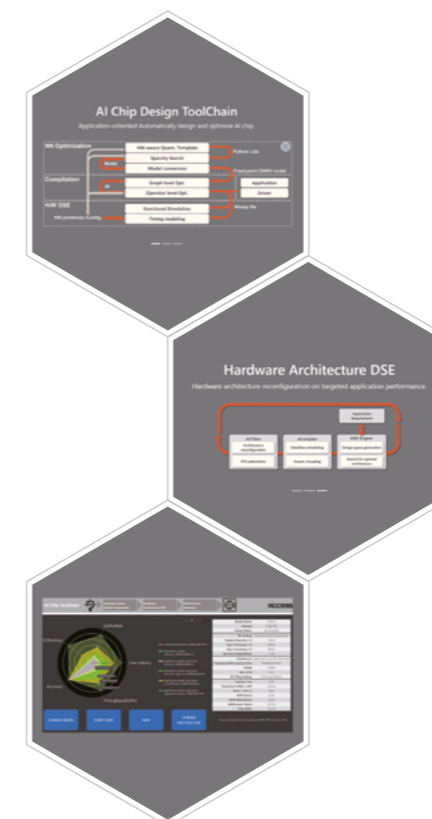
Design automation and optimization for high-energy efficiency, high-performance deep learning accelerator

- Algorithm-Hardware co-design and co-optimization
- Compiler-driving NAS-DSE
- Mix granularity of simulation and modeling

Key Technology Edges:

- Reduce architecture design cycle by about 80%
- Significantly reduced architecture design resources required by 80%~90%
- Improved IC power, performance, and area ratio (PPA) by ~20%

Potential Applications



EAS 18 Towards Carbon Neutral Cities and Countryside: Smart Colourful Integrated Photovoltaic System

Principal Investigator | Prof. Changying XIANG

Technology Readiness Level | TRL 7 IP status | Patented

By combining high-efficiency colored photovoltaic and translucent photovoltaic materials into the building's skin, we work towards the zero- carbon transition of buildings and support the city's carbon neutrality plans.

We provide overall solutions and customized smart photovoltaic building integration systems to provide clean, equal and smart solar energy to all residents, so that every building in the city can take advantage of clean and smart solar energy.

Key Technology Edges:

- High performance color BIPV material
- High-performance translucent photovoltaic windows and curtain walls
- Smart BIPV energy management system

Potential Applications



Applicable Industries



EAS 19 Haptic Sensors for Future Human-Robot Interaction

Principal Investigator | Prof. Hongyu YU

Technology Readiness Level | TRL 6 IP status | Patented

Our cutting-edge technology revolutionizes human-robot interaction by seamlessly integrating vision, RF, and haptic sensing functions. Highlights include:

- High-performance, cost-effective haptic sensor skin for humanoid robots
- Fusion of vision, RF, and haptic sensors for practical cooperation
- Robust tactile sensors for human-like manipulation
- Embedded AI for understanding and enhancing social interaction between humans and robots

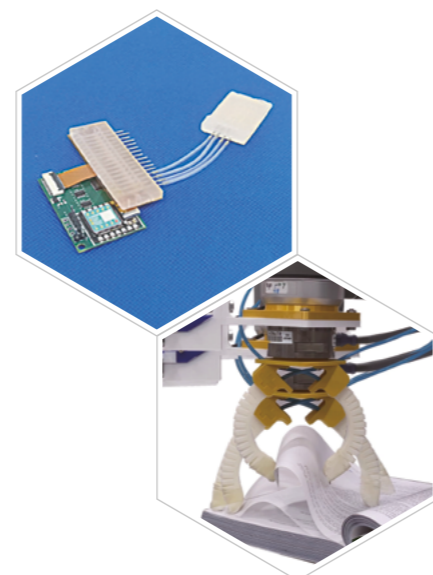
Key Technology Edges:

- A full body, flexible haptic sensor skin for humanoid robots with low cost and high performance
- Fusion of vision, RF, and haptic sensors for full-scale effective human-robot interaction and cooperation
- Robust tactile sensors for dexterous manipulation
- Embedded AI to understand the gathered information from the sensing system for future social interaction between humans and robots

Potential Applications



Applicable Industries



EAS 20 High-performance Specialized Digital Sensor Chip for IoT Era

Principal Investigator | Prof. George YUAN

Technology Readiness Level | TRL 8 IP status | Patented

AtomSemi is a dynamic fabless semiconductor company that is working to revolutionize the IoT landscape with its high-performance, integrated digital sensing chips.

Designed specifically for consumer and industrial IoT devices, our chips empower businesses to unlock the full potential of a connected world.

At AtomSemi, we integrate the full signal chain into a single semiconductor chip capable of meeting the highest requirements. By integrating the signal chain into a single chip, users can bring new functionalities to applications where space is constrained. As such AtomSemi's chips are a perfect fit for wearables, consumer electronics, industrial electronics, smart homes, and the broader IoT field.

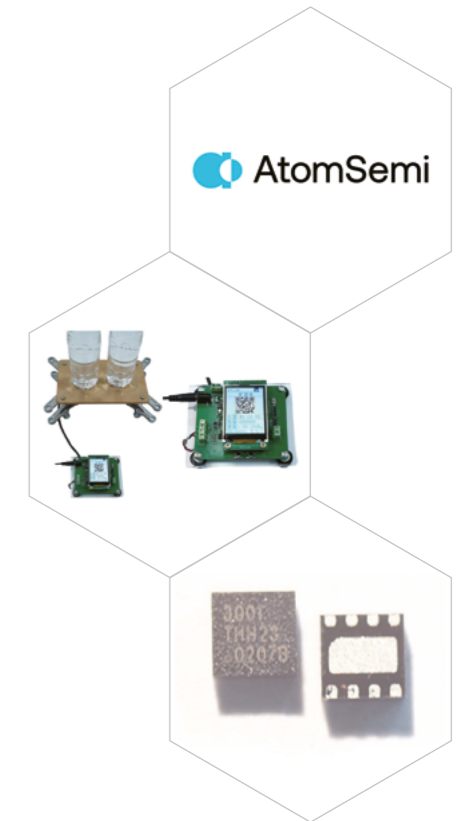
Key Technology Edges:

- Higher level of integration offering smaller form factors for sensing solutions
- Ultra low power consumption enabling IoT applications
- High precision and unmatched stability, enabling high reliability

Potential Applications



Applicable Industries



EAS 22 Next-Generation Financial Indexing with Artificial Intelligence

Principal Investigator | Prof. Chao HE

Technology Readiness Level | TRL 8 IP status | Patented

At AIVI, we leverage artificial intelligence to empower the next generation of intelligent indexing.

We use advanced algorithms, machine learning, and natural language processing to analyse and interpret vast amounts of complex data with remarkable speed and precision. By automating the process of index construction, AI can capture market trends, identify emerging sectors, assess impacts of adverse events, and efficiently reflect market dynamics in real time.

Key Technology Edges:

- Unified analytical framework seamlessly combines traditional fundamental and market data with alternative data, making quantified analysis and interpretation of unstructured data possible
- Industry leading natural language processing (NLP) AI models tailored for financial analysis provide the high accuracy, reliability, and explainability that are crucial for financial applications
- More dynamic, efficient, and predictive financial indexing by injecting AI analysed insights from news and social big data

Potential Applications



Applicable Industries



EAS 23 Innovative Full-Color Micro-LED Micro-Display: A Revolutionary Technology for AR/XR industry

Principal Investigator | Prof. Wing Cheung CHONG

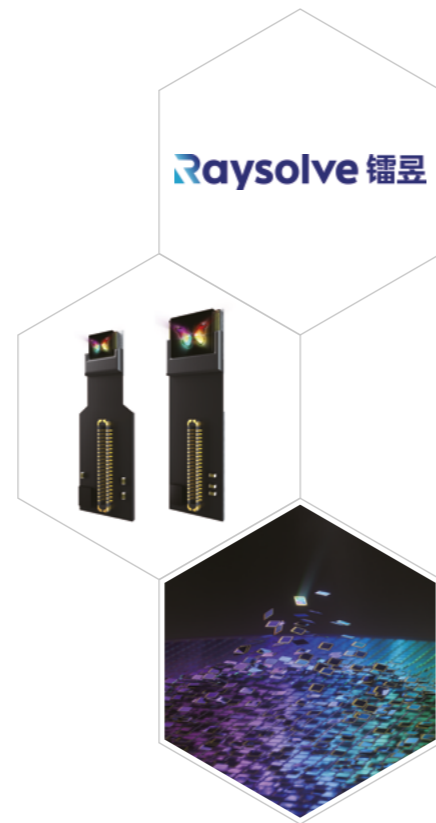
Technology Readiness Level | TRL 7 IP status | Patented

The technology offers high-brightness color images with low power consumption, surpassing other micro-display technologies.

By combining a high-brightness light source with an optical waveguide, a new AR glasses experience can be achieved.

Key Technology Edges:

- Achieving full-color display on a single chip while also setting new records for brightness, PPI, and size
- Minimizing the optical module together with the whole display system
- Large-size wafer bonding technology & 100% semiconductor process



Potential Applications



Applicable Industries



EAS 24 AINIC: A Streamlined, Scalable, and High-Performance RDMA NIC for AI Clusters

Principal Investigator | Prof. Kai CHEN

Technology Readiness Level | TRL 3

High-speed networking is increasingly important for efficient training of AI models, particularly for those large language models trained on tens of thousands of GPUs.

However, current high-speed networking technology used in AI clusters, RDMA, is inherited from general datacenter scenarios. It leverages complex yet general design and integrates redundant functionalities to fit those wide-ranging and flexible demands. Instead, we find some deterministic characteristics both in AI clusters and AI workloads. These insights inspire us to redesign RDMA, simplify the transport, remove unused functionalities, and build a streamlined, scalable, and high-performance RDMA NICs dedicated for AI clusters.

Key Technology Edges:

- **Streamlined:** Reduce the design complexity, which decreases the chip area, facilitating expansion and integration, and lowers development difficulty and failure rates
- **Scalable:** Scalable and modular IP design helps improve the NIC bandwidth by realizing multiple processing units or enhance the GPU-to-GPU bandwidth by realizing multiple on-chip NIC modules
- **High-Performance:** Provide superior network services, including ultra-high bandwidth, low tail latency, large-scale communication, and user-friendly verbs



Potential Applications



Applicable Industries



EAS 25 AI Agents based on Large Language Model

Principal Investigator | Prof. Yang WANG

Technology Readiness Level | TRL 8 IP status | Patented

AI Agents, or Artificial Intelligence Agents, are a system that can act autonomously in a specific environment to achieve predetermined goals.

These agents can learn and make decisions based on the feedback from the environment, optimizing their behavior and improving the efficiency of goal achievement. In different application scenarios, we design customized frameworks, using different large-scale models for different components in the application. These models can work together, achieving an effect where the whole is greater than the sum of its parts, i.e., "1+1>2". This approach can help us create a real "hexagonal warrior", which is a multi-faceted, high-performance AI system.

Key Technology Edges:

- **Efficiency and Cost-effectiveness:** Our technology eliminates the need for pre-training and fine-tuning, reducing both time and monetary costs
- **Flexibility:** Our models and APIs can be replaced and updated at any time, offering unparalleled flexibility
- **Superior Performance:** Our Role-playing Agent, Voice Recognition Agent, and Education Agent outperform competitors in role-playing ability, response repetition, time efficiency, recognition accuracy, and precision respectively

Potential Applications



Applicable Industries



EAS 26 A Time- and Energy-Efficient Ising Computer for Portfolio Optimization and Risk Management

Principal Investigator | Prof. Qiming SHAO

Technology Readiness Level | TRL 3 IP status | Patented

Our project utilizes Voltage-Controlled Magnetic Anisotropy Magnetic Tunnel Junctions (VCMA-MTJs) technology to create a time- and energy-efficient Ising computer for portfolio optimization and risk management.

The Ising model is adept at solving complex optimization problems by mapping multifaceted relationships within a magnetic lattice. By applying this model, our Ising computer will provide faster and more reliable solutions for portfolio optimization and risk management than conventional computing methods. The unique advantage of VCMA-MTJ technology is its ultra-low energy consumption and rapid operation speed. By controlling magnetic states with voltage, we can minimize the energy input required for the Ising system to perform computations. Our project promises to deliver a transformative tool for financial analysts and investors, enabling them to make more informed decisions by evaluating risk and reward scenarios with unprecedented precision and speed.

Key Technology Edges:

- Revolutionary Computational Speed for Optimization Problems
- Unmatched Energy Efficiency & Cost
- First-Mover Advantage with Disruptive Application

Potential Applications



Applicable Industries



EAS 27 AI-Blockchain Enabled Decentralized Art Title, Asset Authentication & Management Platform

Principal Investigator | **Dr. Daniel CHUN** | Technology Readiness Level | **TRL 7** | IP status | **Patented**

The art industry is focusing on enabling the use of digital technologies to support both title and intellectual property management.

This digital platform follows the new ART ID Standard (www.artidstandard.org) and will engage the use of blockchain technologies and W3C approved Decentralized ID (DID:ART) implementation. The AI-enabled features allows for smart categorizing to support valuations and automatic text curation based on image and text analysis which provides high productivity. We have received support from Infineon Secora chipsets and NFCs for developing our PoC projects – and these chipsets are used of creating and storing the blockchain / DID addresses.

Key Technology Edges:

- **Blockchain:** Blockchain technology can be used to create a decentralized and transparent system for managing art assets, titles, and ownership. It can ensure secure and tamper-proof transactions and provide a permanent record of ownership and provenance
- **Smart Contracts:** Smart contracts can be used to automate the transfer of ownership and manage the terms of agreements between parties. They can be used to enforce rules and regulations and ensure compliance with legal requirements
- **AI and Machine Learning:** AI and machine learning can be used to analyze and classify art assets, authenticate artworks, and provide valuations based on market trends and historical data. They can also be used to generate new artworks and enhance the user experience

Potential Applications



Applicable Industries



EAS 29 Automated Testing Technologies for Deep Learning Systems

Principal Investigator | **Prof. Shing-Chi CHEUNG**

Technology Readiness Level | **TRL 6**

Automated testing technologies that reveal the unreliable inferences produced by deep learning systems and provide actionable advice to facilitate the fixing of such unreliability.

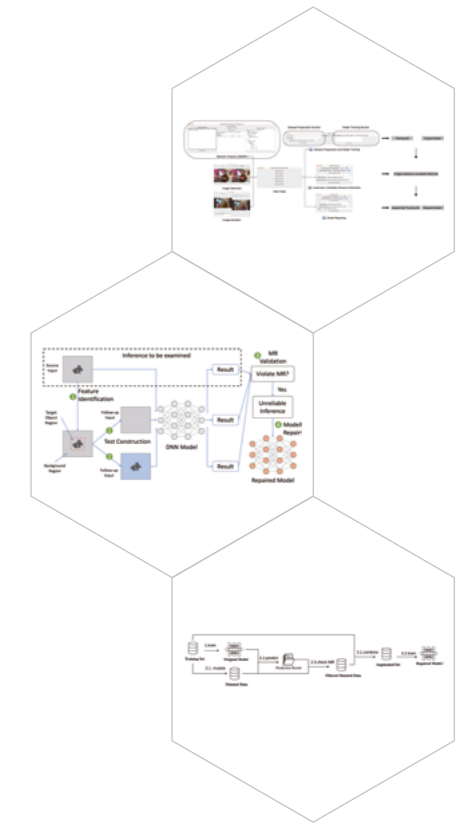
Key Technology Edges:

- Full support of test automation
- Outstanding effectiveness and efficiency
- Applicable to diverse deep-learning applications

Potential Applications



Applicable Industries



EAS 28 Human-friendly Miniature Autonomous Blimp (UST-MAB)

Principal Investigator | **Prof. Fumin ZHANG**

Technology Readiness Level | **TRL 6**

Discover the future of indoor aerial robots with our groundbreaking UST-MAB technology.

Designed to revolutionize human-robot interaction, the UST-MAB offers a range of innovative features:

- **Enhanced safety:** Providing a highly secure environment for human-robot interaction, ensuring peace of mind in indoor settings
- **Extended operation time:** With an impressive maximum operating time of up to 6 hours, the UST-MAB offers exceptional endurance for prolonged missions
- **Versatile control systems:** The advanced control systems developed for the UST-MAB can be replicated for marine robots, expanding the application areas for this cutting-edge technology

Key Technology Edges:

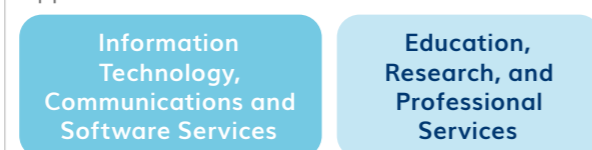
- Provide a highly secure environment for human-robot interaction
- Extremely long operating time (maximum operating time can be up to 6 hours)
- Designed control systems can be replicated for marine robots



Potential Applications



Applicable Industries



EAS 30 Practical Accelerator for Fully Homomorphic Encryption with a Heterogeneous Architecture

Principal Investigator | **Prof. Kai CHEN**

Technology Readiness Level | **TRL 4**

Fully Homomorphic Encryption (FHE) is a promising technology to enable privacy-preserving computations direct over encrypted data.

However, current software FHE solutions suffer 4-5 orders of magnitudes slowdown compared to plaintexts computation. We design a practical accelerator to improve the computation efficiency of FHE by 3-4 orders of magnitudes. Our accelerator is the first to adopt a heterogeneous architecture, similar to ARM big.LITTLE technology, to achieve optimal performance for different kinds of FHE workloads with a practical chip area.

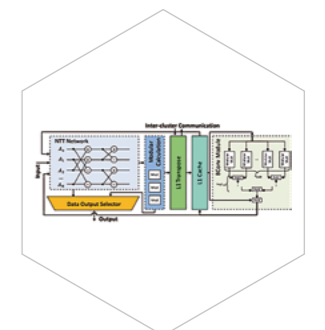
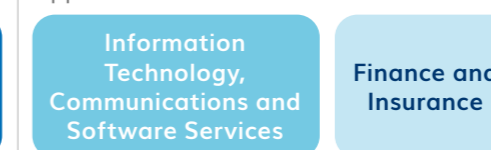
Key Technology Edges:

- Heterogeneous hardware architecture to support both shallow (such as matrix computation, DB query, etc.) and deep FHE (such as data analytics, AI inference, etc.) workloads
- Software/hardware co-design to fully release the power of heterogeneous architecture by analyzing the application and automatically generating the most appropriate scheduling policies
- Integration with various mainstream computation frameworks to support diversity of application scenarios

Potential Applications



Applicable Industries



EAS 31 Open and Decentralized End-to-End AI Computing for Foundation Model-as-a-Service

Principal Investigator | Prof. Song GUO

Technology Readiness Level | TRL 3

Reshaping AI ecosystems with open and decentralized computing power.

Key Technology Edges:

- Integrating heterogeneous computing resources and optimizing supply-demand matching
- Trusted computing for privacy and security of data and model
- Sustainable market models benefiting both demanders and suppliers



Potential Applications



Applicable Industries



EAS 32 AI-Powered Essay Grading Assistant

Principal Investigator | Prof. Joon Nak CHOI

Technology Readiness Level | TRL 8 IP status | Patent in progress

AI essay grading assistant that grades typed and handwritten essays using a teacher's own rubric, reducing time spent grading by 80% while improving consistency, fairness, and the quality of feedback for students.

Key Technology Edges:

- While it is possible to copy and paste essays to foundational AI models to obtain some kind of output, getting good results (i.e., correct grades, quality feedback) is much more difficult in practice. Our solution layers additional technologies on top of foundational models to achieve much better results
- Our UI/UX has been designed and tested with instructors and schools in mind, making it user friendly for instructors. This is a crucial point; teachers and professors are not necessarily familiar with technology and will not use anything that is complex or time-consuming
- Our technology can grade both handwritten and typed essays. This is important because teachers and professors are moving towards in-class essays, as students are transforming themselves into "secret cyborgs" using generative AI for their take-home assignments



Potential Applications



Applicable Industries



EAS 33 Wireless and Self-powered Sensor System

Principal Investigator | Prof. Zhengbao YANG

Technology Readiness Level | TRL 8 IP status | Patented

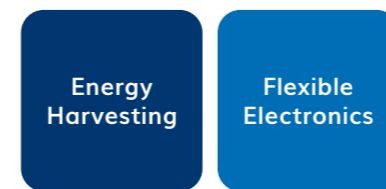
Discover our revolutionary wireless and self-powered sensor technology that is set to disrupt industries such as automotive, aerospace, consumer electronics, healthcare, and environmental monitoring. Key highlights include:

- **Stand-alone and batteryless:** Our sensors operate without the need for external power sources, reducing costs and maintenance requirements
- **High reliability:** Built on 10+ years of research and backed by 22 USA/China invention patents, our sensors offer exceptional performance and longevity
- **Data-driven decision-making:** Our sensor technology enables improved transportation safety, reduced operation costs, and supports data-driven decision-making

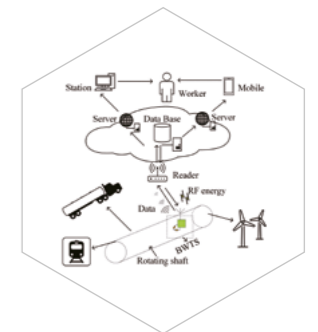
Key Technology Edges:

- WIRELESS, self-powered, battery-less operation, long service time and free of maintenance
- SMALL-size and fit-and-forget features, low fabrication and installation cost
- System-level solution

Potential Applications



Applicable Industries



EAS 34 AI-generated Blockchain System for Legal Term Analysis and Automated Smart Contract Transactions

Principal Investigator | Prof. Jingshen WU Technology Readiness Level | TRL 6 IP status | Patented

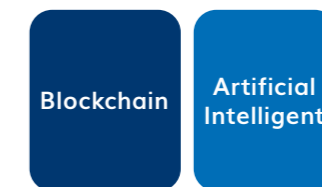
This innovative system, which integrates an AI model with a legal database, professionally analyzes legal contract terms and automatically generates blockchain smart contract code for executing transaction terms and conditions.

The key values and impacts of this system include enhanced accuracy and consistency in contract interpretation, significant improvements in efficiency and timesaving, and a reduction in operational costs. It facilitates real-time, automated execution of contracts, ensuring transparency and trust through the immutable nature of blockchain. Moreover, the system's adherence to the latest legal regulations ensures compliance, while its adaptability and scalability make it versatile for various contract types. The incorporation of blockchain's security features also bolsters the overall integrity and safety of these transactions.

Key Technology Edges:

- **Universal Accessibility in Legal Contract Automation and Blockchain Integration:** This technology can lower the barriers to automating legal contract transactions, offering a universal solution not confined to any specific industry or contract type. By enabling the blockchainization of contract transaction content, it significantly enhances the efficiency and security of these transactions
- **Integration of AI with Professional Legal Databases:** The combination of AI models with professional legal databases facilitates the AI's capability to analyze contracts comprehensively and generate content that meets stringent legal and regulatory standards. This integration ensures that the smart contracts produced are not only technically sound but also legally compliant
- **Empowering Users with Enhanced Accessibility to Web3 Concepts:** This technology empowers users in reading and modifying smart contract codes, bridging the gap between legality and blockchain technology and enabling automated transactions with legal effectiveness. The professional database and AI model's flexibility provides an unparalleled advantage over other legal AI technologies

Potential Applications



Applicable Industries



EAS 35 Distributed AI Heterogeneous Cloud

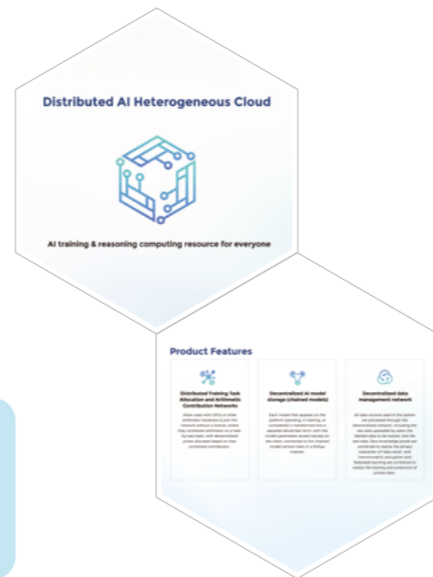
Principal Investigator | Prof. Yang WANG

Technology Readiness Level | TRL 3 IP status | Patented

Solve the current problems of distributed arithmetic network, complete the elastic allocation of computing resources in support of AI model training and reasoning, and improve the resource utilization of the system. Build a distributed system to manage multiple training servers, especially high-performance computing servers with GPUs, pool the computing resources, to make a "GPU cloud".

Key Technology Edges:

- **Integration of AI and Blockchain:** This system combines artificial intelligence with blockchain technology to expand the application possibilities of blockchain
- **Consensus and Consistency:** The introduction of validation nodes to apply predefined consensus algorithms ensures the consistency of initial computation results
- **On-Chain AI Computation**



Potential Applications



Applicable Industries



EAS 37 Segmenting Consumer Location-Product Preferences for Assortment Localization

Principal Investigator | Prof. Jia LIU

Technology Readiness Level | TRL 5 IP status | Patented

The dual Poisson Dynamic System with Multilayer Factorization (dPDS-MF) is a method for managing multiple stores in the same marketplace.

The dPDS-MF utilizes panel data on product assortments and consumer purchases to profile consumer segments, analyze relationships between store locations, and estimate product preferences. It employs a Bayesian nonparametric prior and an efficient MCMC inference algorithm for large-scale data. The method is applied to the retail vending market in major Japanese train stations, demonstrating its effectiveness in optimizing vending location decisions and location-specific assortments. Additionally, the dPDS-MF can be combined with a choice model to efficiently determine localized assortments. Compared to benchmark strategies, the proposed assortment strategy improves expected revenue by up to 30% and provides more meaningful localized assortment decisions.

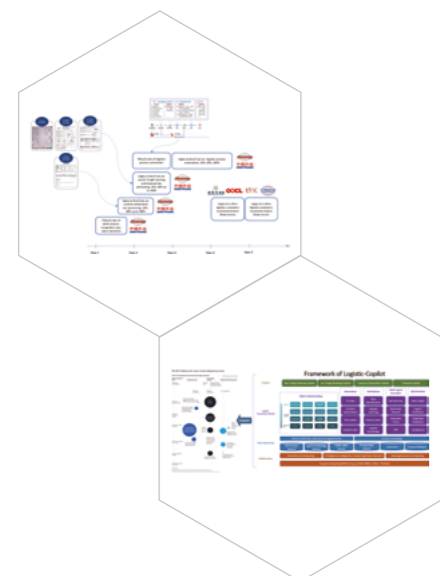
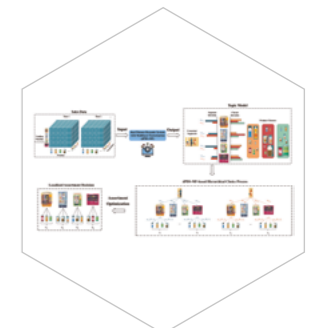
Key Technology Edges:

- Track sales dynamics across locations and products
- Identify opportunities for new vending locations
- Determine the product assortments per vending location

Potential Applications



Applicable Industries



EAS 36 FMLoCo: Foundation Model based Logistics Copilot

Principal Investigator | Prof. Yike GUO

Technology Readiness Level | TRL 6

Our mission is to create a logistics co-pilot powered by large-scale foundational models and multi-agent intelligence

This system will facilitate the automatic recognition and generation of Bills of Lading (BL), thereby enabling seamless automatic processing.

FMLoCo is meticulously crafted to substantially ease the load of manual labor associated with demanding and repetitive tasks, including BL entry, verification, and complex procedural work. The result is a streamlined and expedited logistics process that opens up fresh business opportunities on a global scale.

Key Technology Edges:

- Multilingual & multimode foundation model, pretrained and finetuned on the largest H800 AI cluster in HK
- Logistics specific optimization based on 90M logistic documents
- Tie-1 customer design-in with GMG and SinoTrans (Top-5 logistic company in the world)

Potential Applications



Applicable Industries



EAS 39 FinSent - AI-powered Text Analysis for Informed Investment Decisions

Principal Investigator | Prof. Allen HUANG

Technology Readiness Level | TRL 3

FinSent is not just a financial analysis tool; it's a game-changer powered by FinBERT, a finance-domain specialized NLP model from HKUST Business School that outperforms GPT-4 by 15.2%, with up to 91% sentiment analysis accuracy and an impressive 96% ESG classification accuracy.

Experience a distinctive three-dimensional perspective as it meticulously analyzes sentiments from the company, media, and public viewpoints over a period of more than 20 years. Imagine a financial dashboard that doesn't just show numbers but reveals the emotions behind them, guiding investors with a better understanding.

Key Technology Edges:

- Cutting-Edge NLP Technology Powered by FinBERT Language Model
- Comprehensive Sentiment Analysis and Report Text Highlights
- Web-Based Accessibility on Any Device

Potential Applications



Applicable Industries



EAS 40 Micro-second Response Ferroelectric Liquid Crystal (FLC) Light Modulator for Time-Sequential-Multiplexed 3D, Vivid-Color Display, and Wavelength Selective Switch (WSS)

Principal Investigator | Prof. Hoi-Sing KWOK | Technology Readiness Level | TRL 8 | IP status | Patented

Field-sequential high resolution displays with high refresh rates are in demand for emerging technologies such as VR, AR, naked-eye 3D, and HUD displays.

To achieve a three-color RGB display, one pixel is divided into three small red, green, and blue pixels. Field-sequential display is a time-sequential multi-pixel multiplexing technology implemented through fast refresh in time sequence. Liquid crystal display technology has huge potential in the field of field sequential display, but it requires the response speed of the liquid crystal to be lower than 1 ms. Ferroelectric liquid crystal (FLC) has microsecond-level response speed and has attracted a lot of attention. DHFLC display technology is one of the most suitable display technologies for realizing high-resolution field-sequential display. Because of its fast response speed, voltage-controlled continuous grayscale, low operating voltage, and no edge field effect, DHFLC can support refresh speed within 2 kHz, high-resolution display with high pixel density.

Key Technology Edges:

- Compatible with existing production technology by testing on the G4.5 production line as a drop-in replacement of IPS LCD
- Self-developed and patented FLC materials that can achieve kg-level mass production
- Balanced electro-optical performance, fast response speed, high transmittance, low birefringence, large phase modulation depth

Potential Applications



Applicable Industries



EAS 41 Mask-free Material Deposition on Arbitrary Substrate by Direct Laser Writing

Principal Investigator | Prof. Sen YANG

Technology Readiness Level | TRL 5 | IP status | Patented

The photon induced material deposition method uses a focused laser to trigger local light-assisted chemical reactions and form patterned material.

The technology enables additive manufacturing of electronics with nanoscale features on various substrates.

Key Technology Edges:

- Low cost, single-step, customized and fast additive manufacturing of functional material structures with nanoscale resolution and high performance
- The deposition method applies to a wide range of conductor, insulator and semiconductor on various substrates, whether stiff or flexible, transparent or opaque
- The material used for fabrication is environmentally friendly, nonhazardous and sustainable



Potential Applications



Applicable Industries



Material, Energy and Sustainability (MES)

MES01	SANI® Process - A Paradigm - Shift Sewage Treatment Technology with a 70% Reduction of Sludge (Prof. Guanghao CHEN)	P.24
MES02	Smart Polymer Processing Plant (S-P3) - Open Collaborative Intelligent Platform (Prof. Furong GAO)	P.24
MES03	Strength in Thinness: Ultra-Strong Polymer Nanofilm for Cutting-Edge Applications (Prof. Ping GAO)	P.25
MES04	Revolutionizing Energy Storage: Tube transport-Inspired All-solid-state Electrolytes for Li-based Batteries (Prof. Yoonseob KIM)	P.25
MES05	On-Site Microplastic Detection for Rapid and Accurate Waste Effluent Analysis (Prof. Leung Yuk Frank LAM, Prof. Cindy Ka Sin LAM)	P.26
MES06	Time-reversal Diagnostic for the Health Monitoring of Pressurized Pipelines (Prof. Moez LOUATI)	P.26
MES07	Cementless Lightweight Materials from CO ₂ -Sequestering Waste Mixtures for Sustainable Construction (Prof. Charles Wang Wai NG)	P.27
MES09	Acoustic Metamaterials: Next-Generation Noise Control and Audio Solution (Prof. Ping SHENG)	P.27
MES10	Green-House-Gas-Free Elastocaloric Cooling/ Heating Technology - Materials and Devices (Prof. Qingping SUN)	P.28
MES11	Multi-functional Green Coating Materials for Sustainable Glazing Surface (Prof. Jinglei YANG)	P.28
MES12	Material Innovations for a Sustainable World (Prof. Jinglei YANG)	P.29
MES13	Safe and Affordable Energy Storage enabled by Self-organized Metallic Nanostructure (Prof. Qing CHEN)	P.29
MES14	Energy Conversion from Waste Heat to Electricity by Giant Pyroelectric Effect (Prof. Xian CHEN)	P.30
MES15	Redefining Wearables: Skin Patch Sweat Sensor for Non-invasive & Continuous Health Monitoring (Prof. Ping GAO)	P.30
MES16	Smart EcoClean Matrix (Prof. Wei HAN)	P.31
MES17	A Solar Control Film for Glass Window, that Blocks Heat and UV While Maintaining High Visibility and RF/WiFi Transmission (Prof. Baoling HUANG)	P.31
MES18	Nano Positioning Stage for Applications under Extreme Environmental Conditions (Prof. Berthold JAECK)	P.32
MES19	Epitaxial Growth of Mixed-Dimensional Heterostructures for High-Efficient Self-Powered Photodetector (Prof. Zhengtang LUO)	P.32
MES20	Branching in Instant Tissue Adhesives for Softer Mechanical Properties (Prof. Zhengtang LUO)	P.33
MES21	Green Antifouling Solutions Based on Patented Butenolide Technology (Prof. Peiyuan QIAN)	P.33
MES22	High-Performance Polymer-Based Quasi-Solid Electrolytes for Commercial High-Energy-Density Batteries (Prof. Minhua SHAO)	P.34
MES23	High-Energy, Safe Solid-state Lithium Batteries (Prof. Minhua SHAO)	P.34
MES24	Next-Generation Lithium Metal Batteries with Ultra-High Nickel Cathode Material (Prof. Minhua SHAO)	P.35
MES25	High Performance and Long Durability Pd@Pt Core-Shell Fuel Cell Catalysts (Prof. Minhua SHAO)	P.35
MES26	Microcapsule Technologies for High Value-added Industrial Adhesives (Prof. Jinglei YANG)	P.36
MES27	Zero Carbon GelSoap for a Healthy and Sustainable Living Style (Prof. King Lun YEUNG)	P.36
MES28	Optical Metamaterials: Radiative Cooling for Zero Energy Thermal Management (Prof. Chongjia LIN)	P.37

MES 01 SANI® Process – A Paradigm – Shift Sewage Treatment Technology with a 70% Reduction of Sludge

Principal Investigator | Prof. Guanghao CHEN

Technology Readiness Level | TRL 7 IP status | Patented

SANI® process was developed for the removal of organics and nitrogen with sludge minimization in the treatment of saline sewage generated from seawater used for toilet flushing or salt water intrusion.

Key Technology Edges:

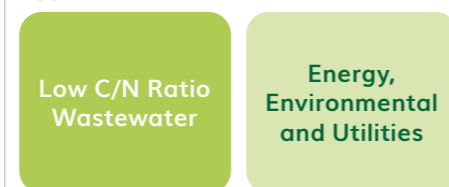
- Reduces 60%-70% of biological sludge production
- Saves 30%-40% of space
- Saves 20%-30% of energy consumption and CO2 emission



Potential Applications



Applicable Industries



MES 03 Strength in Thinness: Ultra-Strong Polymer Nanofilm for Cutting-Edge Applications

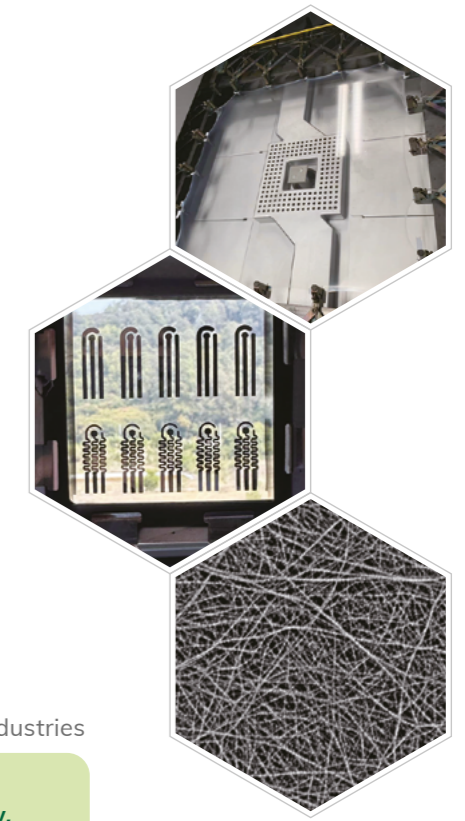
Principal Investigator | Prof. Ping GAO

Technology Readiness Level | TRL 7 IP status | Patented

Ultrathin polymer nanofilm, 25 times stronger than steel with the same mass, transparent, gas-permeable and adjustable porous, ideal for advanced energy separators, wearables, biomedical applications and desalination.

Key Technology Edges:

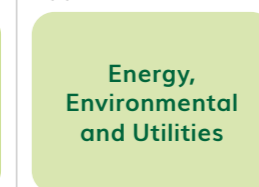
- **Ultrathin:** 20 nanometers or less than one thousandth the thickness of a hair strand
- **High strength:** 25 times stronger than steel with the same mass
- **Formulation improvement to reduce cost**



Potential Applications



Applicable Industries



MES 02 Smart Polymer Processing Plant (S-P3) - Open Collaborative Intelligent Platform

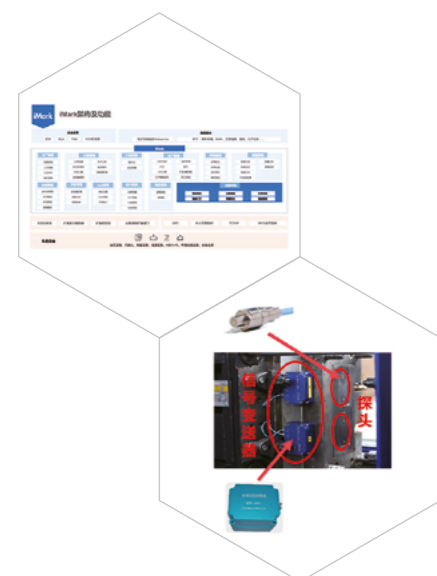
Principal Investigator | Prof. Furong GAO

Technology Readiness Level | TRL 7 IP status | Patented

The next-generation intelligent injection molding with real-time material and quality monitoring using breakthrough sensors, award-winning control algorithms for superior precision, and a dedicated big-data system for intelligent collaboration.

Key Technology Edges:

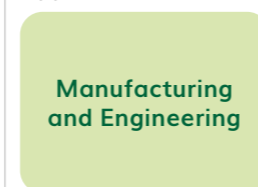
- Breakthrough and world first sensor for capturing material and quality changes on line
- Award winning control algorithms for superior precision for injection molding
- Dedicated big-data open system for collaborative intelligent molding



Potential Applications



Applicable Industries



MES 04 Revolutionizing Energy Storage: Tube transport-Inspired All-solid-state Electrolytes for Li-based Batteries

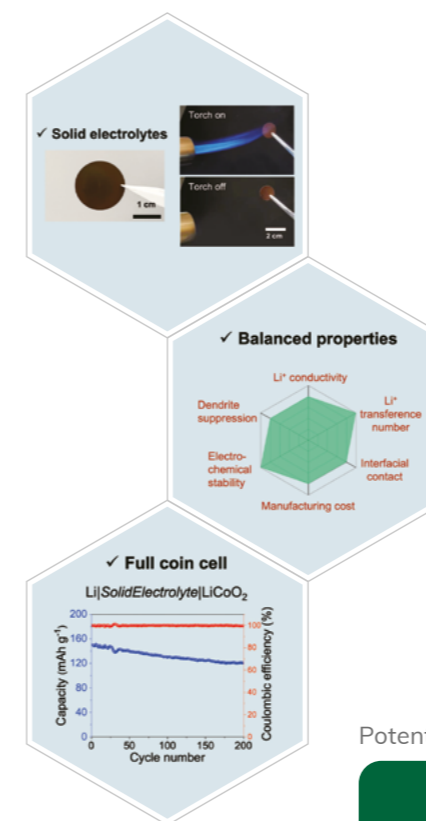
Principal Investigator | Prof. Yoonseob KIM

Technology Readiness Level | TRL 5 IP status | Patented

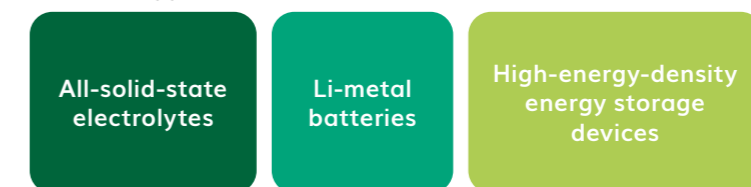
Composite all-solid-state electrolytes selectively transport Li+ rapidly and reliably. This technology can enable smaller and lighter Li-based rechargeable batteries.

Key Technology Edges:

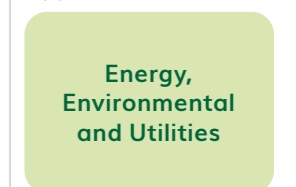
- Our electrolytes' Li+ conductivity and transference number outperform liquid electrolytes and sulfides
- These all-solid-state electrolytes are fire-proof and economical in large-scale production
- Prototype coin cell, paired with Li metal anode and LCO cathode, shows a capacity of 150 mAh g⁻¹



Potential Applications



Applicable Industries



MES 05 On-Site Microplastic Detection for Rapid and Accurate Waste Effluent Analysis

Principal Investigator | Prof. Leung Yuk Frank LAM, Prof. Cindy Ka Sin LAM

Technology Readiness Level | TRL 5 IP status | IP Protected

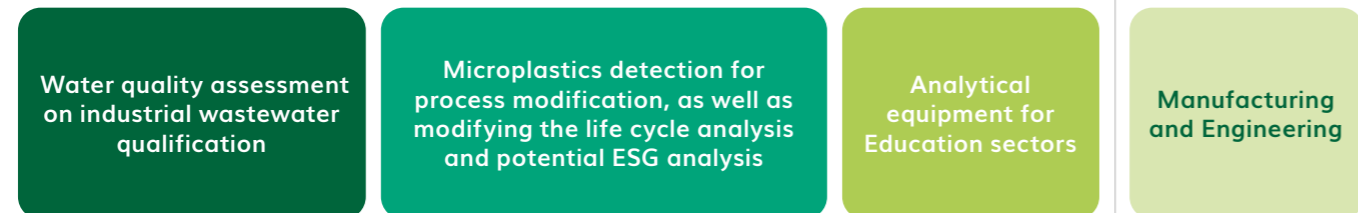
An innovative and ground-breaking portable device to conduct microplastics and microfiber detections efficiently and effectively for real-time effluent quality monitoring.

Key Technology Edges:

- The first portable device for microfiber/microplastic detection
- Offers a prompt response to reflect process effluents' quality, enabling the engineers to provide an instant solution for process modification
- Builds a solid foundation for efficient and effective microfiber detection technology in the field of related industries



Potential Applications



MES 07 Cementless Lightweight Materials from CO₂-Sequestering Waste Mixtures for Sustainable Construction

Principal Investigator | Prof. Charles Wang Wai NG

Technology Readiness Level | TRL 4 IP status | Patented

Construction and household wastes, including plastic waste and food waste, are recycled and reused to produce sustainable construction materials.

Key Technology Edges:

- Minimize the use of carbon-intensive cement and natural aggregates that are typically required for production of construction materials
- Sequester carbon dioxide (CO₂) in mixture of wastes to form cementless construction materials
- Enable production of lighter construction materials with different dimensions to improve construction flexibility



Potential Applications



MES 06 Time-reversal Diagnostic for the Health Monitoring of Pressurized Pipelines

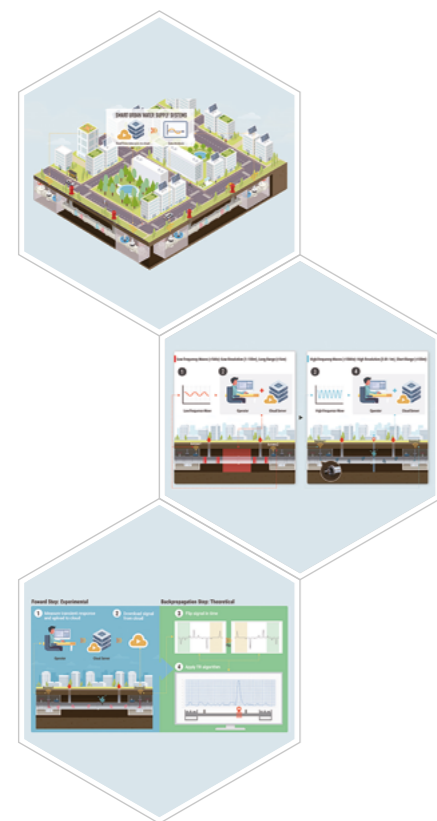
Principal Investigator | Prof. Moez LOUATI

Technology Readiness Level | TRL 5 IP status | Patented

The time-reversal diagnostic technology enables a quick and non-disruptive way to identify diverse and multiple defects in pipelines including drainage and potable water mains.

Key Technology Edges:

- The technology uses fast-traveling waves for rapid diagnostic testing, around 1000 times faster than roving sensors
- The TR methodology is non-disruptive and non-intrusive, eliminating service interruption, isolation of mains, and contamination risks
- The technology offers controllable localization resolution and allows for the development of automated and autonomous processes



Potential Applications



MES 09 Acoustic Metamaterials: Next-Generation Noise Control and Audio Solution

Principal Investigator | Prof. Ping SHENG

Technology Readiness Level | TRL 8 IP status | Patented

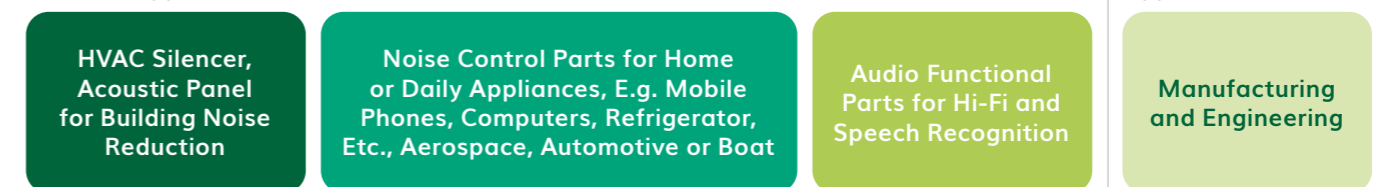
Coupling applied physics with intelligent design, the acoustic metamaterials finely construct tiny artificial structures to achieve optimal noise absorption performance.

Key Technology Edges:

- Low frequency noise absorption capabilities covering broadband frequency as well
- Customization of absorption spectrum
- High-efficiency noise absorption while maintaining High ventilation



Potential Applications



MES 10 Green-House-Gas-Free Elastocaloric Cooling/ Heating Technology - Materials and Devices

Principal Investigator | Prof. Qingping SUN

Technology Readiness Level | TRL 4 IP status | Patented

By harvesting the unique phase transformation latent heat of shape memory alloys, the elastocaloric effect is utilized and developed into cooling/heating modules like fridges and air conditioners. This green technology revolutionizes the conventional refrigeration technology that has used harmful refrigerants for decades.

Key Technology Edges:

Compared with the conventional vapor-compression cooling, our elastocaloric cooling technology has the following advantages.

- Completely avoid the usage of greenhouse gas refrigerants. Use solid shape memory alloys instead
- Save electricity consumption and the related carbon emission by at least 10%
- The cooling core material (shape memory alloy) is a typical smart material and is 100% recyclable

Potential Applications



Applicable Industries

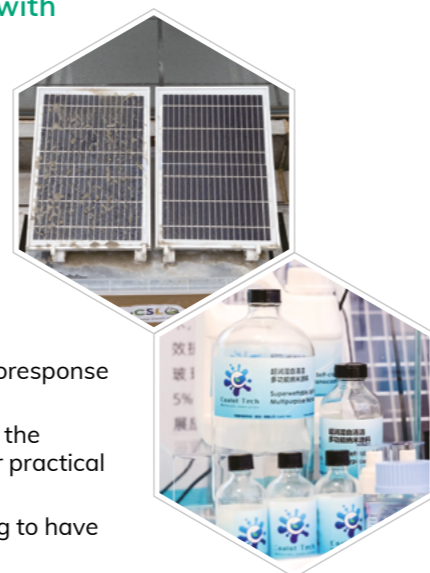


MES 11 Multi-functional Green Coating Materials for Sustainable Glazing Surface

Principal Investigator | Prof. Jinglei YANG Technology Readiness Level | TRL 6 IP status | Patented

Leveraging cutting-edge in-house polymer graft modification, and encapsulation technology, HKUST has developed multi-functional green coating materials with high photocatalytic performance, anti-reflection and durability for various glazing surfaces, including PV panel, curtain wall, automobile rearview mirror.

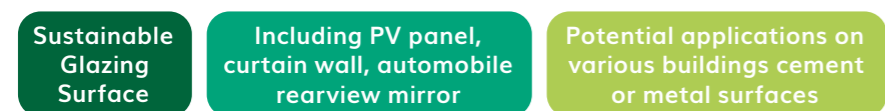
Notably its application on PV panel can enhance power generation by 15-20%. In contrast to commercial coating, this technology enables the nanocoating to have a unique inorganic micro-nano hierarchical porous structure inside, while maintaining high transparency and promoting superior photocatalysis under visible light radiation. In addition to glazing surfaces, this coating also can be applied to various building cement or metal surfaces.



Key Technology Edges:

- **Efficient photocatalysis:** Doping-modified core materials can expand the photoresponse area to visible light and improve photocatalytic performance
- **Superior anti-reflection:** The unique surface porous core-shell structure makes the coating exhibit extremely high porosity and mechanical durability demanded for practical use, resulting in a low refractive index
- **Strong durability:** The in-house synthesized organic segment allows the coating to have long-lasting wetting properties and resistance against water

Potential Applications



Applicable Industries



MES 12 Material Innovations for a Sustainable World

Principal Investigator | Prof. Jinglei YANG

Technology Readiness Level | TRL 6 IP status | Patented

Quantifiable life cycle analysis with considerations of low energy consumption and low carbon emission has been adopted and developed to innovate green materials and composites that contribute to a sustainable world.

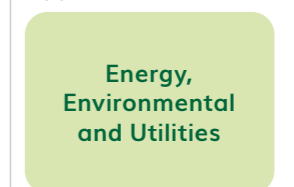
Key Technology Edges:

- Fundamental innovation of materials via controllable interfacial science and engineering
- AI+Robotics empowered high throughput discovery of new materials
- Durable and long-lasting performance, low cost, customizable

Potential Applications



Applicable Industries



MES 13 Safe and Affordable Energy Storage enabled by Self-organized Metallic Nanostructure

Principal Investigator | Prof. Qing CHEN

Technology Readiness Level | TRL 4 IP status | Patented

Self-organized Metallic Nanostructure are scalable, robust, conductive, highly permeable to fluids, and abundant in functional surface sites.

We leverage nanoporous zinc to stabilize zinc anodes during the charging and discharging processes of rechargeable zinc batteries, enabling safer and cheaper alternatives to lithium-ion batteries for stationary energy storage.

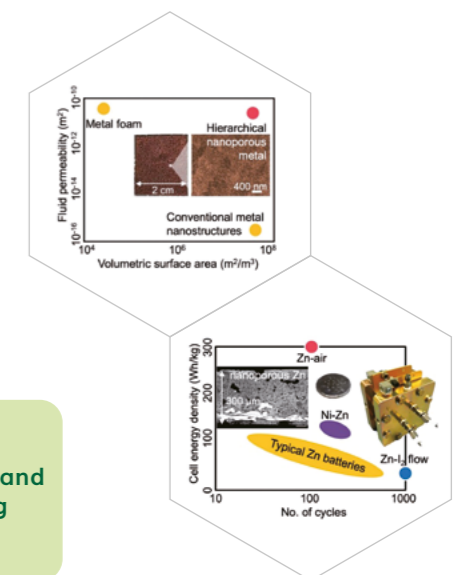
Key Technology Edges:

- The battery adopts the mature build of commercial alkaline batteries, ready for applications
- The battery electrolyte has water instead of flammable organics as the solvent for intrinsic safety
- The nanoporous structure can be tailored according to the design of a battery to fulfill its potential

Potential Applications



Applicable Industries



MES 14 Energy Conversion from Waste Heat to Electricity by Giant Pyroelectric Effect

Principal Investigator | Prof. Xian CHEN

Technology Readiness Level | TRL 5 IP status | Patented

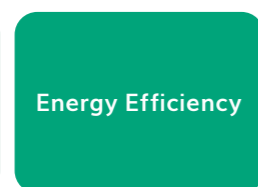
Pyroelectric energy conversion has generated huge interest for their ability to turn waste heat energy to electricity, thereby greatly reduce carbon emissions in the power sector.

A series of novel energy materials used for pyroelectric energy conversion with immensely improved performance. In addition, we established a mature material development approach considering both bottom-up lattice design and top-down grain morphology optimization with much broader interests in the field of functional ferroelectric devices.

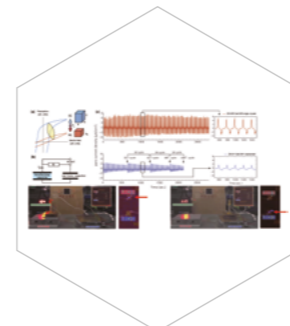
Key Technology Edges:

- Direct energy conversion: material is an engine
- Conversion by small thermal fluctuations around 100°C – energy harvesting from waste heat
- Solid state energy conversion – clean, simple and compact

Potential Applications



Applicable Industries



MES 16 Smart EcoClean Matrix

Principal Investigator | Prof. Wei HAN

Technology Readiness Level | TRL 7 IP status | Patented

Excessive algal growth poses serious environmental health problems, yet the development of a cost-effective solution for long-term inhibition of algal growth remains a huge challenge.

This invention utilizes algicidal hydrogels comprising safe and environmentally friendly bioactive ingredients for practical applications in fresh water and sea water. The hydrogels can release oxidizing and cell-permeable algicides in a controlled manner to inhibit algal growth for a long time without adverse effects on aquatic organisms. Their controlled release performances and algicidal activities have been verified in laboratories and a 1500 m³ sea water reservoir in Hong Kong. Real-time monitoring equipment effectively provides data to adjust the amount of hydrogel and perform daily water quality testing.

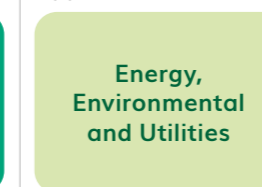
Key Technology Edges:

- 3D structural hydrogel with environmental friendly ingredients achieve slow release effect
- Long term effect can constantly inhibit algae growth in the water body without pollutant introduce to the natural water body
- Intelligently and dynamically adjusted to control the concentration of microorganisms and microalgae in the water body within a safe range for a long time

Potential Applications



Applicable Industries



MES 15 Redefining Wearables: Skin Patch Sweat Sensor for Non-Invasive & Continuous Health Monitoring

Principal Investigator | Prof. Ping GAO

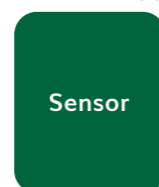
Technology Readiness Level | TRL 6 IP status | Patented

UHMWPE-based nanomembrane skin sensor that detects biomarkers (e.g. hormones, metabolites, proteins) non-invasively and transmits directly to mobile app in real-time for precautionary diagnostics.

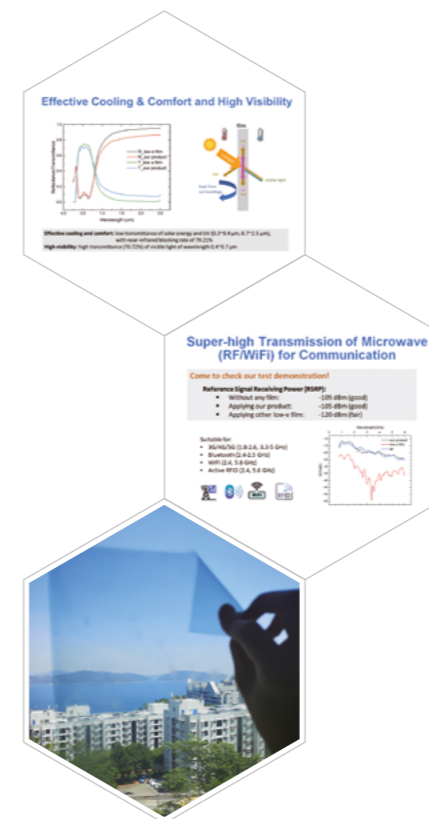
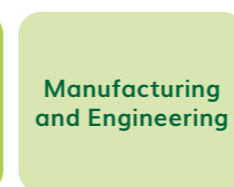
Key Technology Edges:

- Ultra-thin (i.e. 1/3000 of human hair), yet having specific tensile strength 25x than stainless steel at the same mass
- Platform material: highly modular biomarker detection with interchangeable biomolecular receptors (i.e. enzymes, MIP, aptamers, etc.)
- Highly porous & breathable (i.e. ~150x faster compared to human sweat secretion rate)

Potential Applications



Applicable Industries



MES 17 A Solar Control Film for Glass Window, that Blocks Heat and UV While Maintaining High Visibility and RF/WiFi Transmission

Principal Investigator | Prof. Baoling HUANG

Technology Readiness Level | TRL 4 IP status | Patented

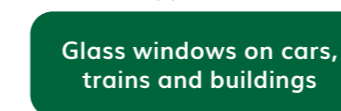
This innovative film effectively moderates the environment to a pleasant temperature by selectively dealing with the solar light and infrared of different spectra and filtering out undesired radiation.

Several cooling films for glass windows have been developed for cars, trains and buildings, tailor-designed according to their application scenarios.

Key Technology Edges:

- **Effective cooling and comfort:** it can block over 80% of near infrared solar energy and the majority of UV exposure
- **High visibility:** it can achieve similar visual comfort as other Low-E films, by our developed micron-scale manufacturing techniques
- **Super-high transmission of microwave (WiFi/RF) for communication:** it can significantly reduce film electromagnetic shielding effects, by our novel techniques

Potential Applications



Applicable Industries



MES 18 Nano Positioning Stage for Applications under Extreme Environmental Conditions

Principal Investigator | Prof. Berthold JAECK

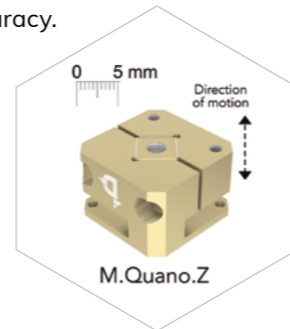
Technology Readiness Level | TRL 5 IP status | Patented

Today, advances in artificial intelligence, quantum technologies, and space exploration rest on our ability to fabricate nanometer-sized computer chips and physical components with extreme accuracy.

This makes precision positioning devices a cornerstone of today's high-technology and manufacturing stack. Quano Technologies Ltd. innovates, manufactures, and sells next generation nano positioning devices for technically demanding applications in the high-tech industry and research sector. Our positioning devices use piezoelectric actuation to realize millimeter to centimeter displacements with nanometer accuracy.

Key Technology Edges:

- **Reliable operation.** Our positioning devices can operate at extreme environmental conditions high and low temperatures and pressures
- **Heat Load Management.** Their design affords an efficient heat removal across the positioning device. This is a unique selling point of our technology
- **Mechanical Stability.** Our positioning devices have a reinvented structural design that avoids glue joints, resulting in unmatched mechanical stability



Potential Applications

Construction of optical and microscopy setups

Steering, alignment, and focusing of lithography instrumentation

Applicable Industries

Research Instrumentation

Semiconductor lithography instrumentation

MES 19 Epitaxial Growth of Mixed-Dimensional Heterostructures for High-Efficient Self-Powered Photodetector

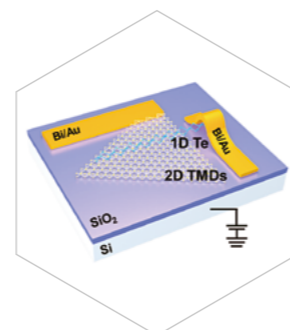
Principal Investigator | Prof. Zhengtang LUO

Technology Readiness Level | TRL 5 IP status | Patented

The technology offers a controllable epitaxial growth of highly aligned 1D/2D mixed-dimensional heterostructures with an ultraclean interface and defect-free vdW contact, allowing efficient transfer of photogenerated carriers and self-driven behavior with high performance, including high responsivity, high external quantum efficiency, competitive specific detectivity, and rapid response rate.

Key Technology Edges:

- A series of mixed-dimensional heterostructures with ultraclean interface achieved by in-situ synthesis strategy
- The self-powered photodetector exhibits higher energy efficiency, more portability, and flexibility, as well as enhanced safety
- Offer new opportunities to design and fabricate next-generation functional devices with reduced sizes and high densities, further enabling miniaturization and integration opportunities



Potential Applications

Semiconductor

Applicable Industries

Electronics and Semiconductors

Manufacturing and Engineering

MES 20 Branching in Instant Tissue Adhesives for Softer Mechanical Properties

Principal Investigator | Prof. Zhengtang LUO

Technology Readiness Level | TRL 4 IP status | Patented

A tissue adhesive formulation that enables a straightforward branching polymerization method of cyanoacrylate-based tissue adhesives to introduce new properties while maintaining the practical features of these fast-acting, strong adhesives.

Key Technology Edges:

- An adhesive formulation generating branched structure upon application instead of the conventional linear ones
- Soft mechanical properties of the tissue adhesive
- Straightforward method of application that finishes in seconds



Potential Applications

Medical device

Applicable Industries

Biomedical, Healthcare and Food

MES 21 Green Antifouling Solutions Based on Patented Butenolide Technology

Principal Investigator | Prof. Peiyuan QIAN

Technology Readiness Level | TRL 8 IP status | Patented

With more than 20 years of innovative and intensive research, David Von Hanseemann Professor of Science and Chair professor Pei-Yuan Qian, a distinguished marine biology scientist at HKUST, discovered and elucidated the property of a novel biodegradable antifouling compound from a marine microbe.

The excellent antifouling efficiency, safe biological profile and green chemical production method of this compound led to the establishment of Ocean Science. Ocean Science aims to become the global premier solution provider and innovator in green antifouling technology; to address the global marine pollution, extra energy consumption and carbon emission issues; and to enhance the national maritime power in the sustainable development of maritime industries.

Key Technology Edges:

- Potent against broad-spectra marine fouling organisms while be safe to other marine organisms
- The molecular structure is simple, allowing the easy production of the compounds
- The chemical synthesis methodology is green of minimal environmental impact and biodegradable in seawater and safe to marine environment

Potential Applications

Anti-Fouling

Coating

Applicable Industries

Energy, Environmental and Utilities



MES 22 High-Performance Polymer-Based Quasi-Solid Electrolytes for Commercial High-Energy-Density Batteries

Principal Investigator | Prof. Minhua SHAO

Technology Readiness Level | TRL 7 IP status | Patent in Progress

Our groundbreaking technology involves the development of polymer gel electrolytes with exceptional conductivity and safety characteristics through in situ polymerization.

This innovation has been successfully implemented in commercial high-loading batteries, addressing critical issues such as graphite exfoliation and silicon pulverization. With its remarkable performance, our technology holds immense potential for commercialization.

Key Technology Edges:

- Compatibility with current commercial electrodes and suitability for high mass loading batteries
- Unique mechanical properties of the quasi-solid electrolyte prevent electrode pulverization, setting it apart from conventional liquid electrolytes
- Elimination of free mobile liquid molecules minimize the risk of battery firing and explosions, especially under harsh conditions

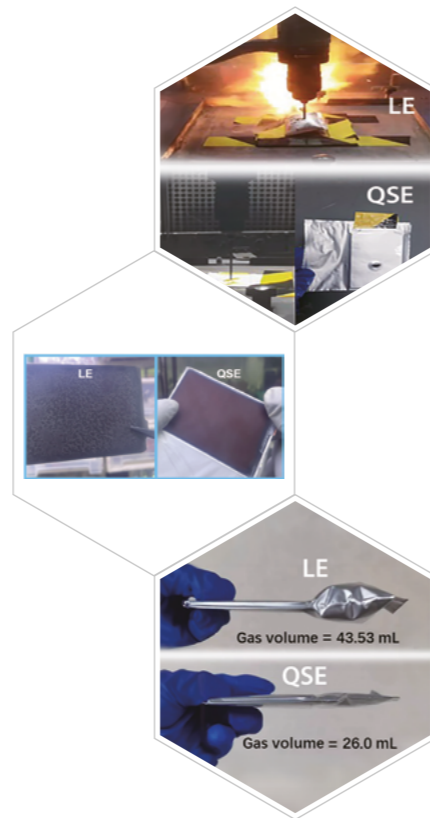
Potential Applications

Energy Storage

Energy Efficiency

Applicable Industries

Energy, Environmental and Utilities



MES 24 Next-Generation Lithium Metal Batteries with Ultra-High Nickel Cathode Material

Principal Investigator | Prof. Minhua SHAO

Technology Readiness Level | TRL 6 IP status | Patented

The next-generation lithium metal batteries utilizing ultra-high nickel content in the cathode material offer a unique combination of benefits from both the anode and cathode components.

These batteries provide higher capacity and energy density while also delivering longer lifespan, making them ideal for applications such as electric aircraft and UAVs. This innovation holds great promise for advancing various energy-related fields.

Key Technology Edges:

- High capacity: 230 mAh/g, high voltage: 4.6V, high cyclability (long lifespan); 90% capacity retention after 500 cycles, high rate capability (fast charge/discharge): 10C discharge capacity; 170mAh/g
- Good potential for low-temperature performance
- The higher the nickel (Ni) content, the higher the capacity and the lower the cost (Cobalt (Co): RMB 600,000/ton; Nickel (Ni): RMB 100,000/ton; Manganese (Mn): RMB 10,000/ton)

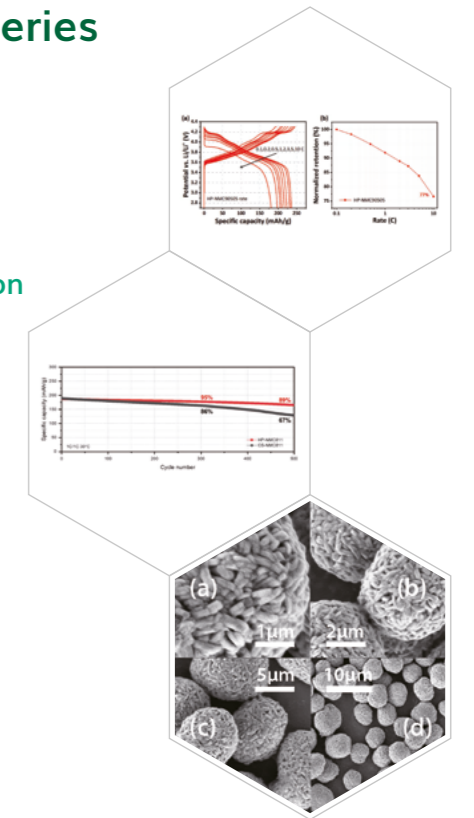
Potential Applications

Energy Storage

Energy Efficiency

Applicable Industries

Energy, Environmental and Utilities



MES 23 High-Energy, Safe Solid-state Lithium Batteries

Principal Investigator | Prof. Minhua SHAO

Technology Readiness Level | TRL 5 IP status | Patent in Progress

Through the combination of a conversion-type composite cathode, a composite hybrid electrolyte, and a stable Li-metal anode, HKUST research team aims to develop a solid-state battery with an energy density surpassing 400 Wh/kg.

It is anticipated that the successful research outcome will have a profound impact on the advancement of next-generation solid-state battery technology and the widespread adoption of electric vehicles.

Key Technology Edges:

- Large-scale synthesis of high-energy cathode materials
- Electrolyte optimization through in-situ polymerization
- Systematic application of optimized cathode materials, solid electrolytes, and lithium hosts to pouch cells

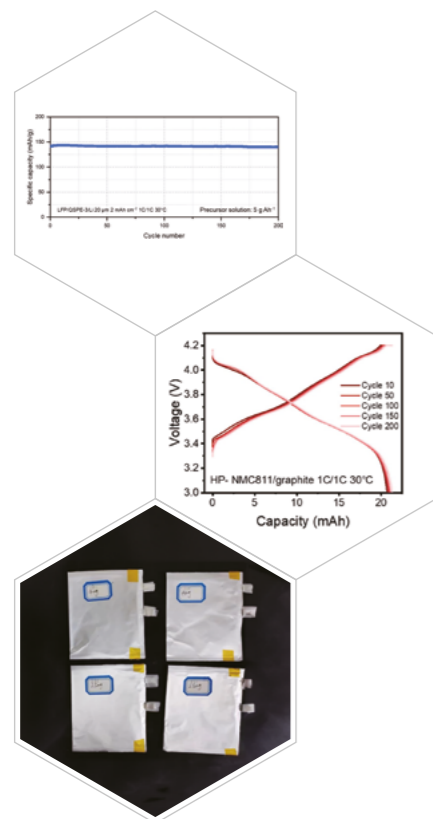
Potential Applications

Energy Storage

Energy Efficiency

Applicable Industries

Energy, Environmental and Utilities



MES 25 High Performance and Long Durability Pd@Pt Core-Shell Fuel Cell Catalysts

Principal Investigator | Prof. Minhua SHAO

Technology Readiness Level | TRL 7 IP status | Patented

This technology enables the conversion of hydrogen's chemical energy into electricity, generating only water as a byproduct over an extended period.

The catalyst utilizes a low amount of platinum and demonstrates superior performance and long-lasting durability.

Key Technology Edges:

- High performance and high power density output
- Long-lasting durability, demonstrating excellent performance in two extreme acceleration tests (DOE Standard)
- Reduced costly platinum usage

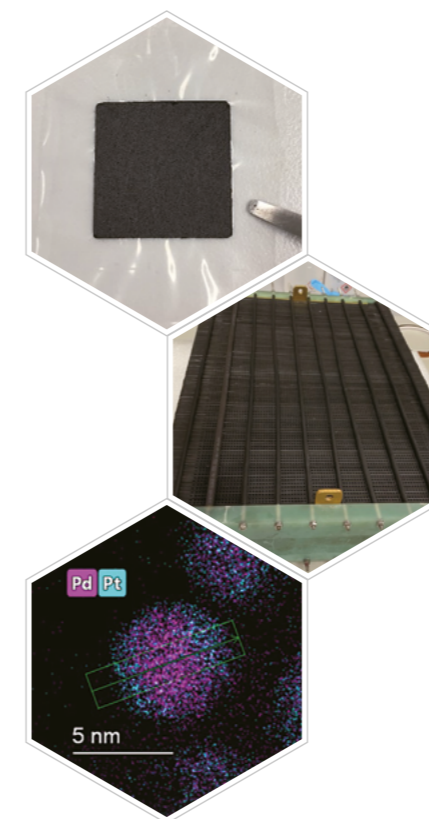
Potential Applications

Energy Storage

Energy Efficiency

Applicable Industries

Energy, Environmental and Utilities



MES 26 Microcapsule Technologies for High Value-added Industrial Adhesives

Principal Investigator | Prof. Jinglei YANG

Technology Readiness Level | TRL 8 IP status | Patented

Industrial adhesives are essential for bonding materials in modern manufacturing. They offer advantages over traditional fastening methods and are used across various industries, including automotive, aerospace, electronics, and construction.

However, traditional industrial adhesives have uncontrollable curing time, limited temperature and chemical resistance, and pose health/safety and environment concerns. HKUST has developed microcapsule technologies for high-value-added industrial adhesives, with a focus on nurturing nationalized related products, autonomous and controllable technologies, and secure supply chain.

Key Technology Edges:

- High performance-price ratio
- Eco-friendly (low VoC, and waterborne)
- High temperature stability
- Fulfill the urgent need for Domestic Replaceable & Customizable microencapsulation technologies

Potential Applications

High-value-added Industrial Adhesives

Applicable Industries

Energy, Environmental and Utilities

Manufacturing and Engineering



MES 28 Optical Metamaterials: Radiative Cooling for Zero Energy Thermal Management

Principal Investigator | Prof. Chongjia LIN

Technology Readiness Level | TRL 9 IP status | Patented

We fabricate nano/micro-engineered surfaces for all-day radiative cooling via high atmospheric mid-infrared emission and strong solar reflection.

The surface temperature can be cooled down up to ~10 degrees lower than the ambient air and ~45 degrees lower than the original surface. It provides efficient passive cooling for buildings, outdoor equipments, facilities or products with zero energy consumption. Our products include film and paint. It can be either opaque or transparent and the color can be customized.

Potential Applications

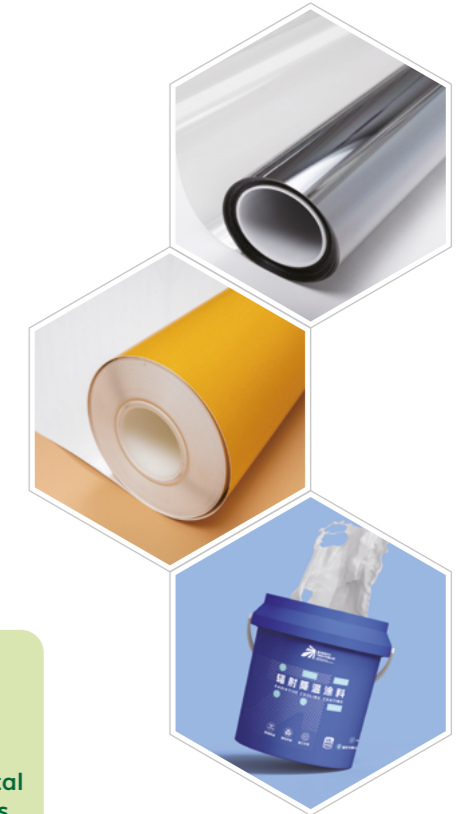
Various constructions: like residential and commercial buildings, storehouses, industrial plants

Various outdoor equipments or facilities: like vehicle, electrical cabinet, container, chemical tank and PV panels

Applicable Industries

Construction and Property

Energy, Environmental and Utilities



MES 27 Zero Carbon GelSoap for a Healthy and Sustainable Living Style

Principal Investigator | Prof. King Lun YEUNG

Technology Readiness Level | TRL 8 IP status | Patented

Silica capsules with prolonged release property is designed to extend the usage period of different types of household, personal hygiene or healthcare products.

This unique technology involves the encapsulation of concentrated active ingredients within silica-based capsules. A small amount of the capsule-infused product, when mixed with water, can provide the same functionality as a significantly larger quantity of traditional products, thereby significantly reducing the size and weight of these products, making them more economical and environmentally friendly. Using silica capsule technology, GelSoap has been developed as an alternative environmentally-friendly soap product, and a bundle of related household/personal products is under development.

Key Technology Edges:

- **Environmental Impact:** The manufacture, transport, and disposal of traditional health and hygiene products pose significant environmental challenges. These products typically include a high percentage of water, making them heavy and bulky. This results in high carbon emissions during transportation and significant storage space. The small size and light weight of our silica capsules can significantly reduce these environmental impacts
- **Waste Reduction:** Traditional health and hygiene products often lead to packaging and disposable plastic dispenser. Our silica capsules reduce the packaging wastage by reducing its size and reuse eco-friendly dispenser
- **Cost saving:** The bulk and weight of traditional products lead to high storage and transportation costs. Our silica capsules can revolutionize logistics across the health and hygiene industry by reducing the size and weight

Potential Applications

Personal care products, including hand soaps, shampoos, conditioners, and lotions

Household cleaning products, including surface cleaners, dishwashing liquids, car washing liquid and laundry detergents

Applicable Industries

Energy, Environmental and Utilities

Manufacturing and Engineering



Bio-Medical and Healthcare (BMH)

BMH01	Advanced Polymer-Based Therapeutics for Chronic Diseases (Prof. Ying CHAU)	P.39
BMH02	AimGel: Supercharging Cell Therapy Production and Development (Prof. Ying CHAU)	P.39
BMH03	High-Throughput AI-Based Screening Platform for Drug Discovery (Prof. Tom CHEUNG)	P.40
BMH04	Secretion-Management Targeted Skin Cancer Treatment (Prof. Yu Song GUO)	P.40
BMH05	Non-Tolerance Type-1 ^{1/2} ALK Inhibitor for Cancer Treatment (Prof. Yong HUANG)	P.41
BMH06	Triple the mRNA Vaccine Efficacy Via Tailored Tail Sequence (Prof. Becki Yi KUANG)	P.41
BMH07	Alleviate Glaucoma Symptoms with an Wearable Device (Prof. David LAM)	P.42
BMH09	Population-Wide Disease Prediction: A Data-Driven Blood Test Health Assessment (Prof. David LAM)	P.42
BMH10	Drug development for CNS regeneration (Prof. Kai LIU)	P.43
BMH11	sST2 – Novel Therapeutic Target for Alzheimer's Disease (Prof. Nancy IP)	P.43
BMH12	A Blood-Based Biomarker Detection System can Screen Alzheimer's Disease Early, Allowing for Timely Treatment (Prof. Nancy IP)	P.44
BMH13	Natural Herbal Products for Treating Memory Loss and Neuronal Degeneration (Prof. Nancy IP)	P.44
BMH14	Gene Editing for Familial Alzheimer's Disease Treatment (Prof. Nancy IP)	P.45
BMH16	Development of Anti-Angiogenic Eyedrop for Eye Disease (Prof. Karl TSIM)	P.45
BMH17	A Non-invasive Solution to Amputation and Skin Transplant (Prof. Karl TSIM)	P.46
BMH19	AI-Enabled Medical Imaging for Next-Gen Histological Imaging (Prof. Terence WONG)	P.46
BMH20	Massively Parallel High-Throughput Multi-Omic Single-Cell Sequencing for Target Discovery (Prof. Angela WU)	P.47
BMH21	DMCC: An Environmental Friendly API Purification System (Prof. Hong XUE)	P.47
BMH22	Portable Device for Quick DNA Testing Using CRISPR/Microfluidic Technology (Prof. Shuhuai YAO)	P.48
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BMH24	AAV – Gene Therapy Delivery Platform for Treatment of Brain Diseases (Prof. Nancy IP)	P.49
BMH27	New Treatment for Amyotrophic Lateral Sclerosis (ALS) and Frontotemporal Dementia (FTD) by Targeting G4C2 DNA and RNA Tandem Repeats with Selective Small Molecules (Prof. Guang ZHU)	P.49
BMH30	MeticTouch – Non-Invasive Ultrasound Ocular Drug Delivery Platform (Prof. Ying CHAU)	P.50
BMH31	A Revolutionary Approach to Develop Innovative Anticancer Drugs Targeting DNA Replication-Initiation Proteins (Prof. Chun LIANG)	P.50
BMH32	Physics-constrained Dictionary Learning for Medical Image Compression and Denoising (Prof. Yanglong LU)	P.51
BMH33	A Multifunctional Bioprinting Platform for Next-Generation Synthetic Tissues (Prof. Yanglong LU)	P.51

BMH 01 Advanced Polymer-Based Therapeutics for Chronic Diseases

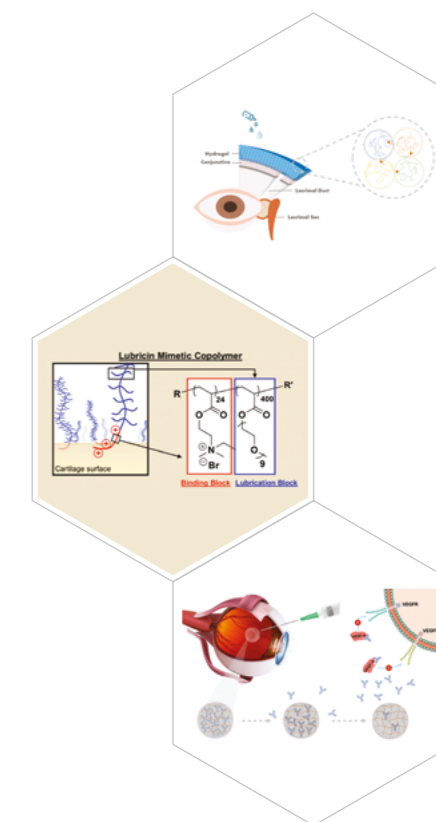
Principal Investigator | Prof. Ying CHAU

Technology Readiness Level | TRL 7 IP status | Patented

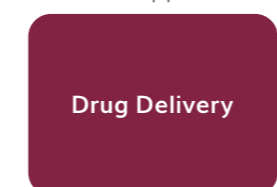
Pleryon Therapeutics: Polymer-based therapeutics for new drug development and drug delivery.

Key Technology Edges:

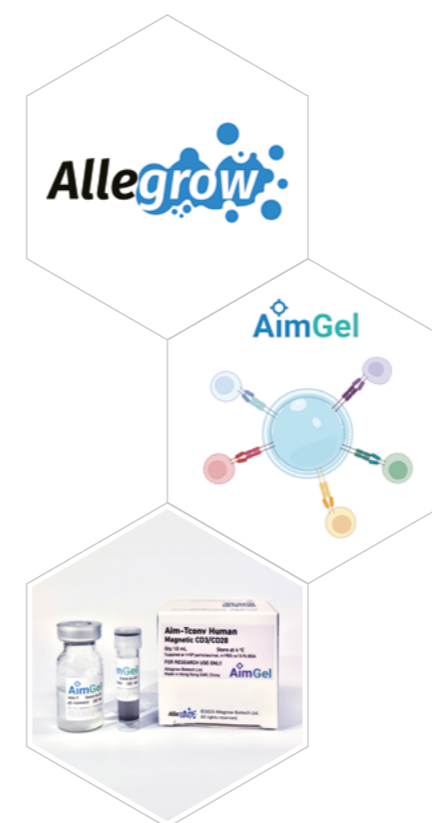
- Pleryon is a platform company dedicated to improving the standard of living across the global community by advanced polymer and drug delivery technologies



Potential Applications



Applicable Industries



BMH 02 AimGel: Supercharging Cell Therapy Production and Development

Principal Investigator | Prof. Ying CHAU

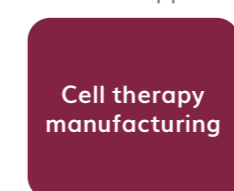
Technology Readiness Level | TRL 6 IP status | Patented

An artificial cell-based system for ex vivo live cell growth and manipulation in cell therapy.

Key Technology Edges:

- Doubling Efficiency:** The cell-mimicking matrix accelerates T-cell growth, achieving a 2X faster proliferation rate and delivering a 4X increase in cell yield compared to conventional materials
- Customizable Flexibility:** With the ability to fine-tune biochemical signals, AimGel adapts to different cell types much quicker than existing technologies
- Seamless Integration:** AimGel seamlessly fits into existing cell production workflows to enhance performance without incurring additional costs

Potential Applications



Applicable Industries



BMH 03 High-throughput AI-based screening platform for drug discovery

Principal Investigator | Prof. Tom Hiu Tung CHEUNG

Technology Readiness Level | TRL 4 IP status | Patent in Progress

Our drug discovery platform combines AI-powered high-throughput screening and cutting-edge motion-based preclinical assessment, expediting drug development by allowing for the rapid evaluation of over 3000 compounds each month.

Key Technology Edges:

- **High-Throughput Screening:** Leveraging deep learning, our semi-automatic platform can adapt dynamically to diverse disease models, vastly increasing the drug discovery pipeline's efficiency (3000 compounds per month)
- **Unique Biologics Library:** A collection of biologically compounds derived from human cell secretomes provides a rich source for potential therapies
- **Proprietary Targets:** We hold IP for novel targets that enhance mitochondrial function and combat cellular senescence, addressing unmet needs in age-related diseases



Potential Applications



Applicable Industries



BMH 05 Non-Tolerance Type-1^{1/2} ALK Inhibitor for Cancer Treatment

Principal Investigator | Prof. Yong HUANG

Technology Readiness Level | TRL 3 IP status | Patented

Innovative Drug Structure Optimization with AI Structural Fitting.

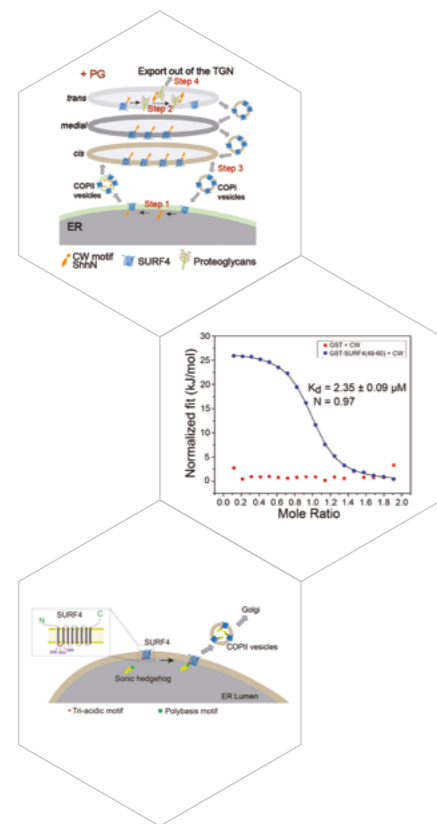
Key Technology Edges:

- A bridged inhibitor to combat drug resistance
- Identification of the key linker joining two warheads
- Exceptional efficacy in xenograft mouse models

Potential Applications



Applicable Industries



BMH 04 Secretion-Management Targeted Skin Cancer Treatment

Principal Investigator | Prof. Yu Song GUO

Technology Readiness Level | TRL 2 IP status | Patent in progress

Controlling the secretion of Shh as a new therapeutic target for drug discovery in Melanoma Treatment.

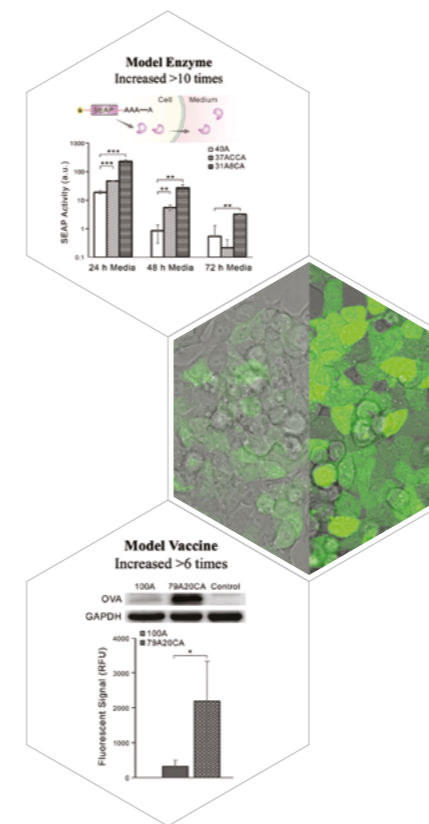
Key Technology Edges:

- Identified a novel target for blocking hedgehog signaling for cancer treatment
- Hedgehog signaling is one of the most important drug target for cancer treatment
- A robust platform to screen drugs to block secretion of sonic hedgehog

Potential Applications



Applicable Industries



BMH 06 Triple the mRNA Vaccine Efficacy Via Tailored Tail Sequence

Principal Investigator | Prof. Becki Yi KUANG

Technology Readiness Level | TRL 4 IP status | Patented

Optimized tail sequences enable mRNA therapeutics and vaccines to have stronger and long-lasting efficacy.

Key Technology Edges:

- Do not increase synthesis cost
- Do no need to change synthesis protocol
- Can be combined with existing mRNA enhancement technologies

Potential Applications



Applicable Industries



BMH 07 Alleviate Glaucoma Symptoms with an Wearable Device

Principal Investigator | Prof. David LAM

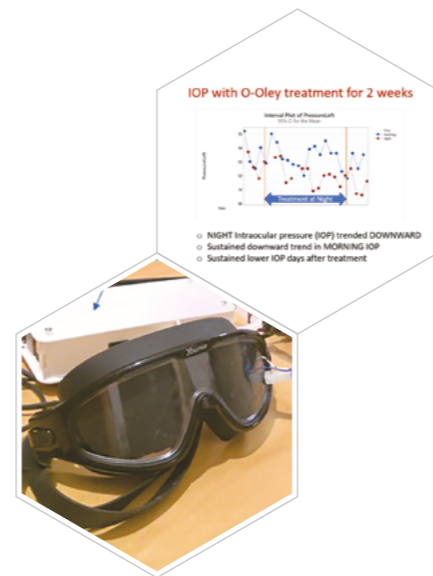
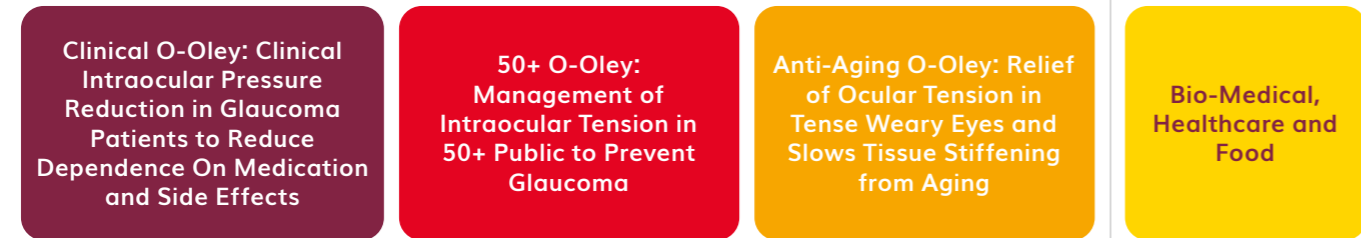
Technology Readiness Level | TRL 4 IP status | Patent in progress

An eye-mask providing immediate ocular tension relief to help alleviate glaucoma symptoms, offer protection for those over 50 and restore comfort for weary eyes.

Key Technology Edges:

- O-Oley clinical and O-Oley home therapy reduce intraocular tension and glaucoma risk
- First preventive treatments to decrease intraocular tension and reduce glaucoma danger in the clinic and at home
- Specific therapy with a mask that reduces the risk of overdosing and the side effects of medications

Potential Applications



BMH 10 Drug development for CNS regeneration

Principal Investigator | Prof. Kai LIU

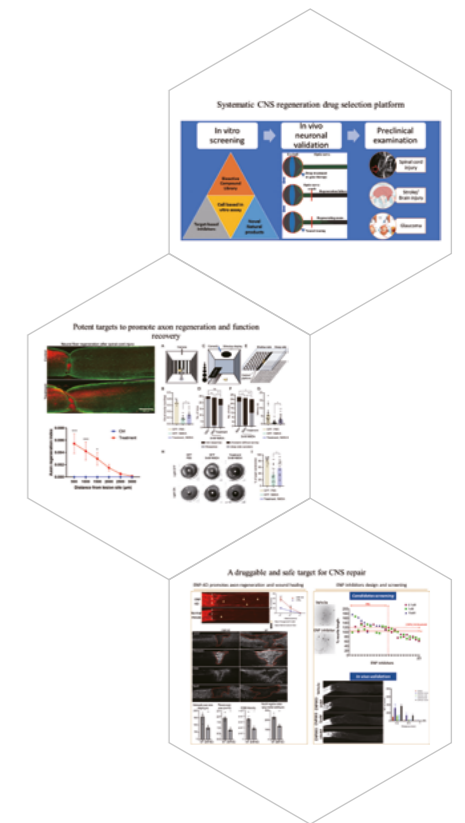
Technology Readiness Level | TRL 4 IP status | Patent in Progress

Our neuroregenerative technology heralds a new era for treating CNS traumas and degenerative diseases, offering new hope for conditions such as glaucoma, stroke, and spinal injury paralysis. By fostering axonal regeneration and neural circuit repair with small molecule therapies, we're reshaping CNS healthcare.

Key Technology Edges:

- **Tailored Therapeutics:** Our treatments are designed for specific neuron diseases, providing targeted and effective remedies for conditions with limited options
- **Innovative Advantage:** With novel small molecules, our platform stands out for its precision and potential
- **Commercial Trajectory:** Currently in the preclinical trial phase with secured funding, our path to market entry is clear, targeting a sector with a projected value of over \$120 billion by 2030

Potential Applications



BMH 09 Population-Wide Disease Prediction: A Data-Driven Blood Test Health Assessment

Principal Investigator | Prof. David LAM

Technology Readiness Level | TRL 2 IP status | Patent in progress

SpectrumCheck - Utilizes routine blood test items for a fast and accessible screening for stroke, heart disease and cancer.

Key Technology Edges:

- Implemented in multiple local public hospitals
- Based on 20 years of Hong Kong Chinese cohort data from Hospital Authorities
- Successfully predicts risk levels for stroke, heart disease, liver health, and Colon/Gaslic Cancer

Potential Applications



BMH 11 sST2 – A Novel Therapeutic Target for Alzheimer's Disease

Principal Investigator | Prof. Nancy IP

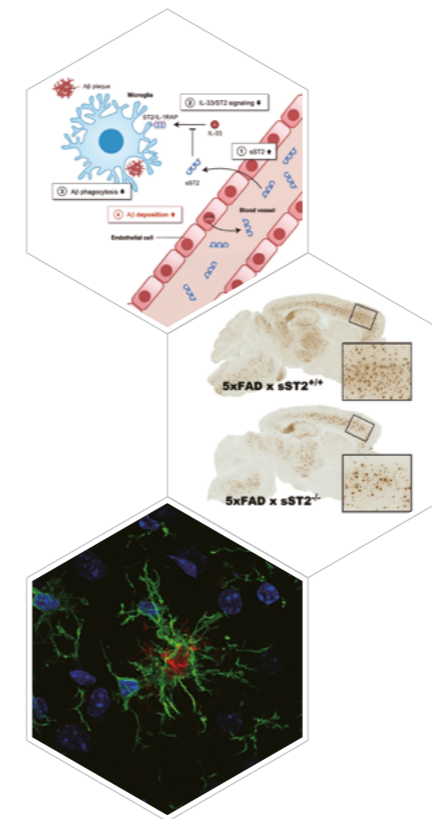
Technology Readiness Level | TRL 5 IP status | Patented

sST2, a decoy receptor of interleukin-33-ST2 signaling, is a newly identified disease-causing factor and a promising therapeutic target for Alzheimer's disease.

Key Technology Edges:

- **Unique therapeutic target:** sST2 holds potential disease-modifying effects for Alzheimer's disease (AD) treatment. Promising research demonstrated the role of the sST2 pathway in AD pathology and microglial function, offering a novel mechanism that could significantly disrupt the AD treatment market
- **Advanced sST2 drug development:** Preclinical studies have validated that sST2 modulation reduces AD pathology in disease models. Approaches using ASO, siRNA, and small molecules are in progress, with an IND application expected by 2026
- **Broad therapeutic application:** Applicable to other diseases beyond AD that have increased sST2 levels, such as heart failure, Parkinson's disease, etc

Potential Applications



BMH 12 A Blood-Based Biomarker Detection System can Screen Alzheimer's Disease Early, Allowing for Timely Treatment

Principal Investigator | Prof. Nancy IP

Technology Readiness Level | TRL 7 IP status | Patent in Progress

In the battle against Alzheimer's disease, early detection is key to effective intervention.

Our cutting-edge diagnostic system employs proteomics and advanced machine learning to identify early-stage Alzheimer's up to a decade before clinical symptoms manifest. By analyzing subtle changes in blood biomarkers, our technology not only detects the disease early but also monitors its progression and response to treatment, enabling timely and personalized therapeutic strategies.

Key Technology Edges:

- **Early Detection:** Capable of identifying Alzheimer's 5-10 years before symptom onset, our system offers a critical head start for disease-modifying treatments
- **Disease Monitoring:** Tracks the pathology of Alzheimer's in the brain through blood biomarkers, facilitating ongoing assessment of disease progression
- **Screening Tool:** Serves as an invaluable screening solution for initiating early-stage Alzheimer's interventions, potentially altering the course of the disease

Potential Applications

Applicable Industries

Medical device

Biomedical,
Healthcare and
Food



BMH 14 Gene Editing for Familial Alzheimer's Disease Treatment

Principal Investigator | Prof. Nancy IP

Technology Readiness Level | TRL 5 IP status | Patented

Genome editing-based approaches to delete Alzheimer's risk genes and permanently rescue disease pathologies.

The gene editing technology can be applied to other inherited diseases.

Key Technology Edges:

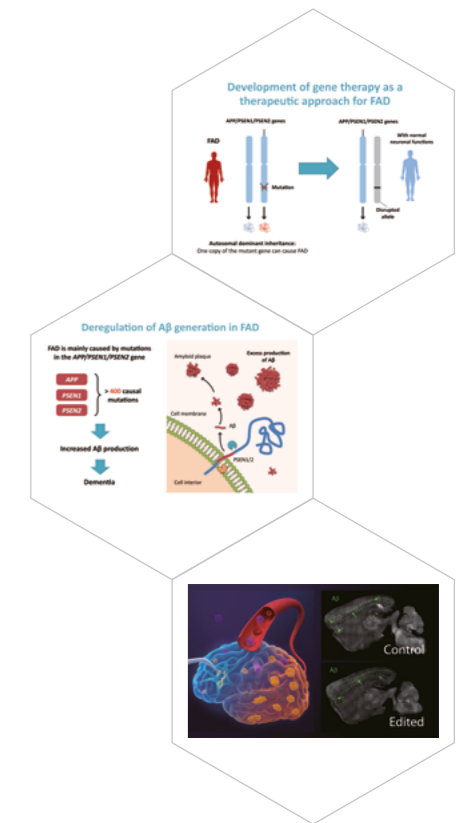
- Targeted deletion of Alzheimer's risk genes to rescue disease pathologies
- First in the world to achieve non-invasive brain-wide genome editing approach
- Universal genome editing approach for disease mutations based on genome-wide association studies

Potential Applications

Applicable Industries

Drug Discovery

Biomedical,
Healthcare and
Food



BMH 13 Natural Herbal Products for Treating Memory Loss and Neuronal Degeneration

Principal Investigator | Prof. Nancy IP

Technology Readiness Level | TRL 5 IP status | Patented

Blending traditional Chinese medicine with contemporary neuroscience, our team pioneers herbal solutions to enhance synaptic plasticity—key to memory and cognition. Our research yields herbal formulas targeting Alzheimer's, Parkinson's, and stroke-related cognitive deficits, uniting ancient wisdom with modern science.

Key Technology Edges:

- **Synaptic Enhancement:** Natural active ingredients identified to enhance synaptic communication, addressing the early stages of neurodegeneration
- **TCM Integration:** Expertly selected Chinese herbs with a legacy of clinical use, now validated by scientific research
- **Advanced Characterization:** A cutting-edge platform that scientifically pinpoints and utilizes the synaptic benefits of TCM, directly targeting the source of memory loss and neurodegeneration

Potential Applications

Applicable Industries

Herbal formulations for memory loss

Herbal medicines for Alzheimer's disease, Parkinson's disease, and stroke

Biomedical,
Healthcare and
Food

Retail,
Consumer
Goods, and
Hospitality



BMH 16 Development of Anti-Angiogenic Eyedrop for Eye Disease

Principal Investigator | Prof. Karl TSIM

Technology Readiness Level | TRL 3 IP status | Patent in progress

Therapeutic potential of resveratrol, polydatin and/or its analogues for eyedrop against age-related macular degeneration (AMD) by angiogenic inhibition.

Key Technology Edges:

- Solid foundation and clinical applications of VEGF-targeted drugs from traditional Chinese medicines (TCMs) [7 publications and 1 Chinese patent]
- Phytochemicals targeting VEGF with easy administration with low-cost manufacturing, long-term administration and easy topical instillation
- New therapeutic and non-invasiveness strategy over standard treatment options such as argon laser photocoagulation and photodynamic therapy

Potential Applications

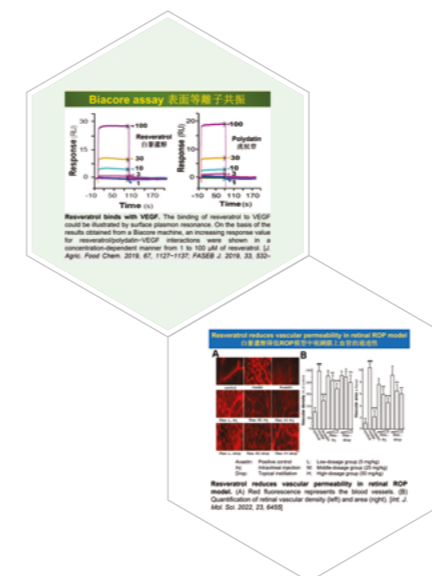
Applicable Industries

Anti-Angiogenic Therapy for Abnormal or Pathologic Angiogenesis in Age-Related Macular Degeneration (Amd), Retinopathy of Prematurity (Rop) and Diabetic Retinopathy

Anti-Angiogenic Therapy for Angiogenesis of Various Cancers E.g., Colorectal Cancer

Prevention of Oxygen Radical Damage in Rheumatoid Arthritis (Ra), Atherosclerosis, Pulmonary Emphysema, Cancer, Inflammatory Bowel Disease And Periodontal Disease

Bio-Medical,
Healthcare and
Food



BMH 17 A Non-Invasive Solution to Amputation and Skin Transplant

Principal Investigator | Prof. Karl TSIM

Technology Readiness Level | TRL 6 IP status | Patented

Our SGC biologic revolutionizes refractory wound care with a patented, protein-based regenerative technology, proven in 3A hospitals to heal stubborn wounds efficiently, reducing time and costs.

Key Technology Edges:

- **Personalized Effectiveness:** Treatments from autologous blood can achieve a 100% healing success, revolutionizing the management of stubborn wounds
- **Robust Research Foundation:** Backed by over 3 publications and 15 patents, the ongoing development with animal blood sources ensuring safety through comprehensive Immunogenicity and Ames Tests
- **Therapeutic Versatility:** Versatile applications across diabetic foot ulcers, burns, eczema, dermatitis, and upcoming potential in spinal nerve recovery, arthritis, and anti-aging skin treatments



Potential Applications



Applicable Industries



BMH 20 Massively Parallel High-Throughput Multi-Omic Single-Cell Sequencing for Target Discovery

Principal Investigator | Prof. Angela WU

Technology Readiness Level | TRL 5 IP status | Patent in progress

OneDrop: A high-throughput solution for single-cell sequencing with redesigned reaction and chip.

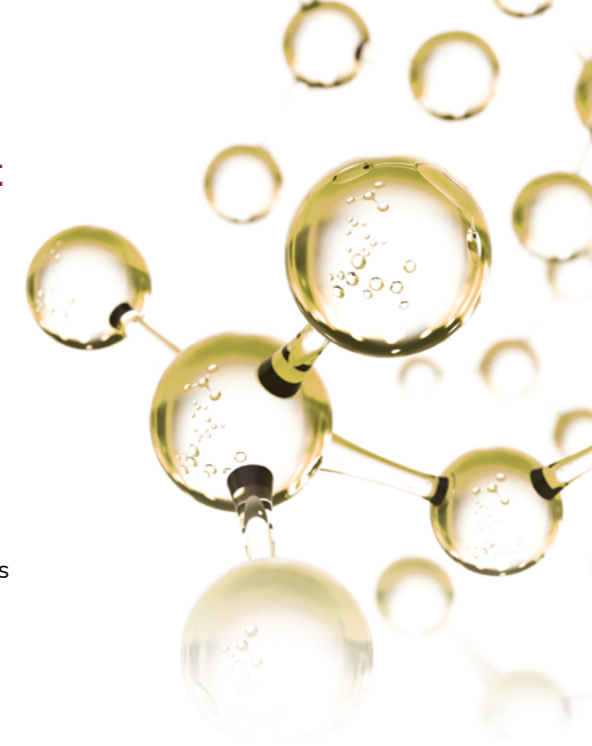
Key Technology Edges:

- Novel droplet single cell sequencing platform distinct from existing products on the market
- High-throughput sequential droplet reactions, up to 18,000 reactions per run
- Multi-omic single-cell sequencing solutions for DNA/RNA simultaneous profiling

Potential Applications



Applicable Industries



BMH 19 AI-Enabled Medical Imaging for Next-Gen Histological Imaging

Principal Investigator | Prof. Terence WONG

Technology Readiness Level | TRL 5 IP status | Patented

CHAMP (Computational High-throughput Autofluorescence Microscopy by Pattern Illumination) is a transformative diagnostic tool that revolutionizes histological imaging by providing rapid, preparation-free cancer imaging.

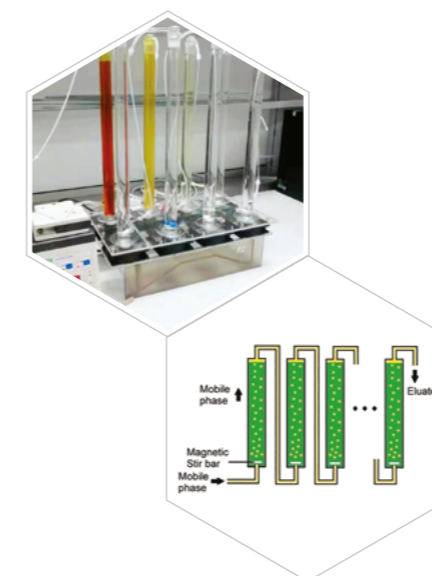
Key Technology Edges:

- **Rapid Results:** CHAMP is expected to deliver clinical gold standard images within 3 minutes compared to 3 days for the current clinical method
- **Intraoperative Utility:** CHAMP offers rapid, stain-free and preparation-free, thick tissue histological imaging suitable even during surgery
- **Versatile Application:** CHAMP, unlike current intraoperative method, is applicable to nearly all biological tissues with primary focus on lung and breast cancer

Potential Applications



Applicable Industries



BMH 21 DMCC: An Environmental Friendly API Purification System

Principal Investigator | Prof. Hong XUE

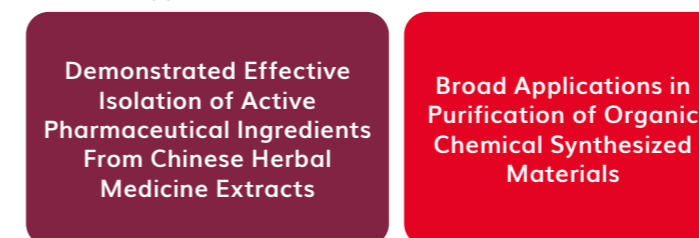
Technology Readiness Level | TRL 6 IP status | Patented

A highly scalable dispersed mobile-phase countercurrent chromatography platform for purification of commercially valuable chemicals.

Key Technology Edges:

- A breakthrough platform technology with patent protections, for effective purification of commercially valuable chemicals
- Unprecedented scalability for purification of chemical materials at industrial scales unachievable with any existing technologies
- Both user and environmentally friendly, with no solid waste and no irreversible material loss, commonly occurred using competitive technologies

Potential Applications



Applicable Industries



BMH 22 Portable Device for Quick DNA Testing Using CRISPR/Microfluidic Technology

Principal Investigator | Prof. Shuhuai YAO

Technology Readiness Level | TRL 5 IP status | Patent in progress

Molecular tests with sensitivity as PCR using next-generation nucleic acid detection system.

Key Technology Edges:

- Simpler self-testing enabled by microfluidic passive-driven chip
- Faster determination of CRISPR to compete with PCR
- Lower cost of miniaturized fluorescence system to test at home



Potential Applications

Flexible High-Performance AI Chip for Market Prediction

Applicable Industries

Bio-Medical, Healthcare and Food

BMH 23 Painless Microneedles for Transdermal Drug Delivery

Principal Investigator | Prof. King Lun YEUNG

Technology Readiness Level | TRL 3 IP status | Patented

A new generation of painless drug delivery system suitable for advanced pharmaceuticals, biomolecules, and stem cells.

Key Technology Edges:

- Uses extremely hard and sharp crystalline zeolites as microneedle materials that are extremely safe
- Easy and inexpensive to fabricate, use, and dispose
- Application flexibility and compatibility



Potential Applications

Advanced Painless Administration of Drugs, Hormones, Vaccine, and Cell Therapeutics

Allows Design of Wearable Devices for Long-Term, Controlled Administration

Potential for Smart and Intelligent Components for Monitoring Health and Well Being

Applicable Industries

Bio-Medical, Healthcare and Food

BMH 24 AAV - gene therapy delivery platform for treatment of brain diseases.

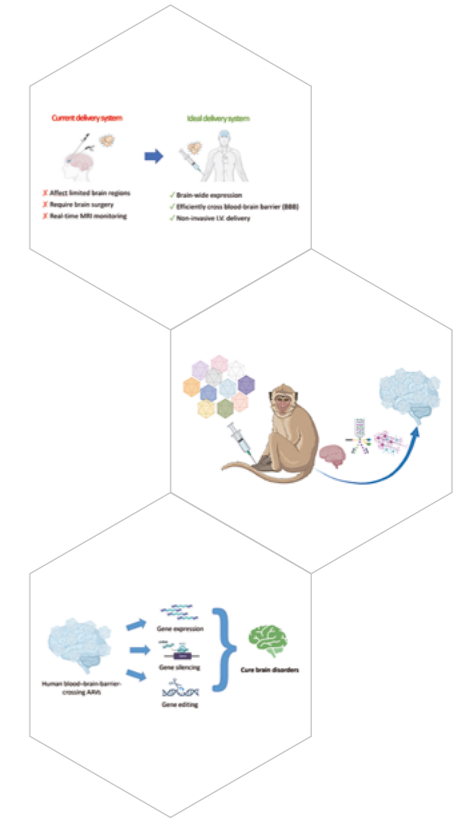
Principal Investigator | Prof. Nancy IP

Technology Readiness Level | TRL 4 IP status | Patented

We aim to develop AAVs that can effectively cross the blood-brain barrier and deliver therapeutic genetic materials or tools to target brain cells for the treatment of brain diseases.

Key Technology Edges:

- **Targeted AAV Screening:** Identify AAV capsids capable of crossing the BBB and delivering to specific brain cells while exhibiting limited off-target expression, reduced systemic organ toxicity, and low immunogenicity
- **Non-Invasive Delivery Method:** Achieve non-invasive delivery to brain cells through IV injection, offering a patient-friendly treatment approach
- **Strategic Partnership for AAV Development:** Engage in a strategic partnership with Cure Genetics to co-develop and license AAV(s), utilizing a primate model



Potential Applications

Drug Delivery

Drug Discovery

Applicable Industries

Biomedical, Healthcare and Food

BMH 27 New treatment for Amyotrophic Lateral Sclerosis (ALS) and Frontotemporal Dementia (FTD) by Targeting G4C2 DNA and RNA Tandem Repeats with Selective Small Molecules

Principal Investigator | Prof. Guang ZHU

Technology Readiness Level | TRL 4 IP status | Patented

Our project leads ALS and FTD research, targeting the G4C2 expansions in C9orf72. We've detailed G4C2 structures and patented molecules binding these targets, a significant stride toward a cure.

Key Technology Edges:

- **Structural Mastery:** Mapping of G4C2 DNA and RNA structures associated with ALS and FTD, establishing a foundation for targeted drug development
- **Innovative Lead Compounds:** Pioneering identification and development of lead compounds that selectively target pathogenic G4C2 DNA/RNA structures
- **Selective Efficacy:** Proven high specificity of our small molecules for G4C2 structures, a distinction not found in current anti-G-quadruplex molecules

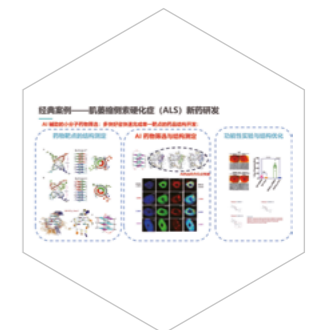
Potential Applications

Drug Discovery

Drug Optimization

Applicable Industries

Biomedical, Healthcare and Food



BMH 30 MetiTouch – Non-invasive Ultrasound Ocular Drug Delivery Platform

Principal Investigator | Prof. Ying CHAU

Technology Readiness Level | TRL 6 IP status | Patented

MetiTouch® is an innovative non-invasive ocular drug delivery technology that offers a patient-friendly approach to administering medications to the eye. By eliminating the need for injections, MetiTouch® improves comfort, convenience, and potentially enhances treatment outcome.

Key Technology Edges:

- **Innovative Delivery:** MetiTouch® is the world's first non-invasive ocular drug delivery technology that has shown a solid safety profile and effectiveness across various ocular conditions
- **Pharma Compatibility:** Designed to seamlessly integrate with both existing and new drug products without requiring reformulation, MetiTouch® is highly adaptable to a broad range of therapeutics
- **Customizable Solutions:** MetiTouch® can be tailored to meet the strategic needs of biopharmaceutical companies, enhancing the value proposition of both new and established drugs



Potential Applications



BMH 31 A Revolutionary Approach to Develop Innovative Anticancer Drugs Targeting DNA Replication-Initiation Proteins

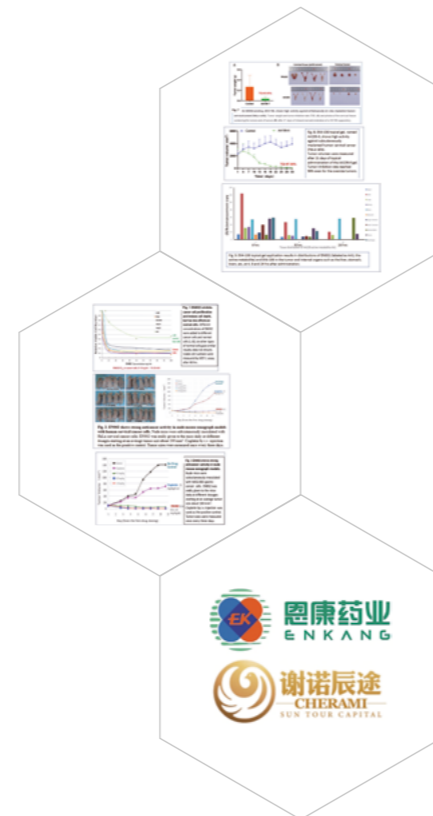
Principal Investigator | Prof. Chun LIANG

Technology Readiness Level | TRL 6 IP status | Patented

Our platform targets cancer's pre-RC proteins with DRIPs inhibitors, offering a transformative approach for various cancers and precancerous conditions, with potential in CGT and neurodegeneration. EN002 and EK4-106 show preclinical success; EN002-gel is Phase II-ready after a successful Phase I, highlighting our solution's market promise.

Key Technology Edges:

- **Broad Application:** Pioneering treatments for a wide array of cancers and precancerous lesions, with implications for CGT and neurodegenerative diseases
- **Competitive Advantage:** Exceptional potency and safety, offering significant improvements over current cancer therapies
- **Commercial Progress:** Successful Phase I clinical trials and forthcoming Phase II, signaling rapid progress towards market entry



Potential Applications



BMH 32 Physics-constrained Dictionary Learning for Medical Image Compression and Denoising

Principal Investigator | Prof. Yanglong LU

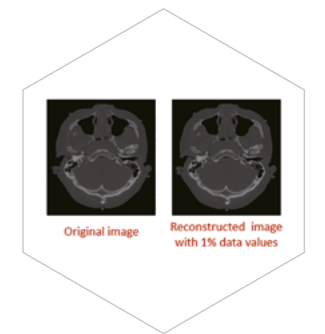
Technology Readiness Level | TRL 5 IP status | Patented

Our innovative method compresses and denoises medical images using a physics-constrained dictionary, reducing data storage to less than 1% and preserving image integrity with minimal noise.

Key Technology Edges:

- **High Compression Ratio:** Achieves extreme data reduction, compressing three-dimensional medical images to a fraction of their original size
- **Dual Functionality:** Simultaneously compresses and denoises images, enhancing clarity and diagnostic value
- **Versatile Application:** Adapts to various data dimensions and types, ensuring broad utility across medical imaging

Potential Applications



BMH 33 A Multifunctional Bioprinting Platform for Next-Generation Synthetic Tissues

Principal Investigator | Prof. Yanglong LU

Technology Readiness Level | TRL 4 IP status | Patent in progress

Our cutting-edge bioprinting platform excels in precision, printing various materials and featuring real-time monitoring to detect and correct defects instantly, advancing tissue engineering.

Key Technology Edges:

- **Open-source Customization:** Tailor both software and hardware without cost, encouraging innovation and adaptation in various research settings
- **Multi-material Capability:** Print with a minimum of three materials concurrently, allowing the creation of intricate, multi-faceted structures
- **Real-time Quality Assurance:** Immediate monitoring and adjustment during the printing process guarantee superior quality and rapid error mitigation

Potential Applications



World's No.47

QS World University
Ranking 2025

**World's No.3,
Hong Kong No.1**

Young University Rankings 2024
by Times Higher Education

**36th Worldwide,
1st in Hong Kong**

Times Higher Education
Impact Rankings 2024

**Patent Influence Metric
No.1 in China and
33rd Globally**

Nature's leading 200 academic
institutions by patent influence
metric published in 2022

**Overall No. of
Patents Granted
No.1 in Hong Kong**

Based on UGC's definition
under the Common Data
Collection Format (CDCF)
in 2022/23

**Granted US Utility
Patents 2023
Top 100 Worldwide
Universities**

Published by the US National
Academy of Inventors

**World's Top 10 in Data Science & Artificial Intelligence
Hong Kong's Best in Engineering & Technology
and Natural Sciences**

World's Top 50 for 12 Subjects

QS World University Rankings by subject 2024