

FACULTY OF ENGINEERING



RESEARCH CENTRE
ON
DATA SCIENCE &
ARTIFICIAL INTELLIGENCE

VISION

To build a pioneering world with
breakthrough research in DS and AI

MISSION

To develop innovative DS and AI technologies
to benefit society

To generate high impact research by
collaborating with academia, industry and
society

To nurture talents in DS and AI, cultivate an
international education exchange hub and
increase PolyU's public visibility

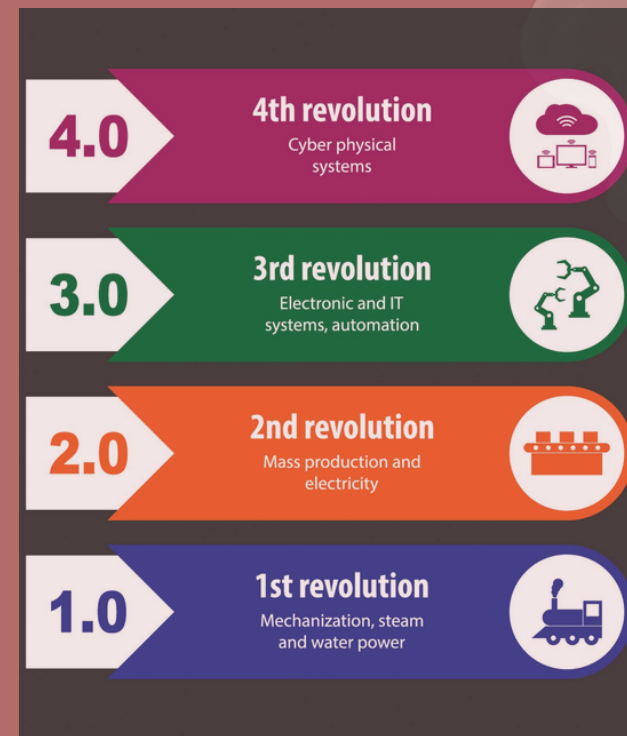
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From The Directors

We are now in the era of the fourth industrial revolution, which is featured by the fast development of application of data science (DS) and artificial intelligence (AI) technologies. DS and AI have become two critical strategic policies for many countries and regions, including HKSAR. AI and DS are transforming our world, both fields are at the forefront of innovation in robotics, healthcare, materials science, autonomous vehicles, and countless other areas that are key to the Hong Kong's future economy and security.

The research centre of data science and artificial intelligence (RC-DSAI) offers an additional resource for solving complex problems like detecting fraud buried deep in financial systems, reducing human bias in the judicial system, and efficiently finding the right compound for the safest and most effective medicine etc. RC-DSAI brings together researchers, labs, institutes, and centres of excellence at PolyU that are focused on advancements in AI, DS, and related areas of research to tackle complex problems.



Prof. Qing Li
Chair Professor of Data Science and Head Department of Computing

The RC-DSAI will perform both theoretical and applied research on DS and AI, including new machine learning theory and algorithms, new deep optimization techniques, new network architectures, deep visual learning and understanding, big data management and analytics, and natural language processing. Based on the research content of fundamental DS and AI research, the RC-DSAI will also set specific research teams, including Fundamental DS&AI Techniques, Big Data Management and Analytics, Computational DS&AI Theory and Algorithms, and Visual Computing with Big Multimedia Data, etc. In the future, the RC-DSAI will also explore new application areas, such as Event Discovery and Management, Financial Event Mining and Prediction, and Social Events and Societal Impact (e.g., youngster depression and suicide), etc.

Our vision is to innovate new means of interrogating and understanding DS and AI then to innovate and apply cutting-edge methodologies to diverse questions. We are a truly interdisciplinary research centre with data scientists, mathematicians, and computer specialists across many of our research labs and departments.



Prof. Lei Zhang
Chair Professor of Computer Vision and Image Analysis

About RC-DSAI

Launched in April 2021, the RC-DSAI is hosted by the Department of Computing, Faculty of Engineering. It aims to encourage greater connection and knowledge-sharing between tertiary and wider research organisations and industry to support the development of a vibrant AI ecosystem in HK, mainland China and the world. The centre has a special focus on real-time analytics for big data, machine learning and deep learning. The establishment of RC-DSAI is the culmination of many years of leading artificial intelligence (AI) and data science (DS) research and teaching led by staff, scholars and researchers at the PolyU.



The RC-DSAI aims to inspire, support and deliver world-leading, challenge-led research that seeks to address some of the world’s most pressing challenges that affect humanity at a global level. The RC-DSAI combines expertise from across the breadth of the HK PolyU and beyond, to build innovative collaborations, address major cross-cutting themes and support new research in DS and AI, RC-DSAI provides a hub for data-intensive science and AI activities within the university and the wider region.

On the other hand, RC-DSAI supports the mission of generating high impact research by collaborating with academia, industry and society, it promotes joint projects with industry partners and commercial organisations. It will act as a platform to bridge academic researchers and industry partners, and at the same time, it will help academic researchers know more the actual needs of industry and help our industry partners know the latest technology advancement in academia, facilitating their research collaboration.



RC-DSAI at PolyU is a focal point for HK in DS and AI, creating one of HK’s leading DS & AI education and research facilities, and providing researchers and professionals with the tools to harness the power of big data, machine learning and AI. The centre’s faculty members, research scientists and PhD students are established experts in the field of DS and AI and their applications. Their interests are in deep learning, machine learning, mathematical statistics, optimization, econometrics, and several application areas including but not limited to sociology, economics, political science, history, privacy, business, finance, and genomics, etc.

Research Domains and Expertise

Focus in Five Strategic Areas

Events Discovery & Management



Smart Manufacturing



*Foundational DS & AI Techniques
Computational DSAI Theory and Algorithms
Visual Computing with Big Multimedia Data
Big Data Management & Analytics*

Social Event & Societal Impact



Smart Transportation



Financial Event Mining



Leverage Multiple Laboratories and Research Centres

Smart Manufacturing Lab

Equipped with advanced manufacturing equipment, paired with digital twins for research & development.



Integrated Computing Lab

Equipped with super computing processors, graphic processors and AI processors for model building and testing.



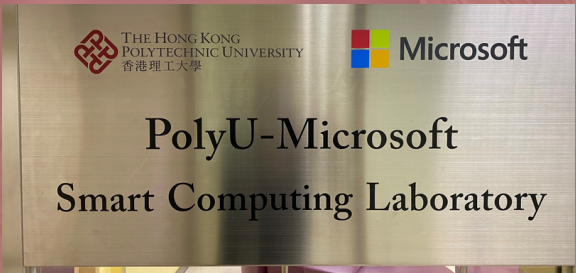
Virtual Reality (VR) and Game Lab

Equipped with advanced VR equipment, this specialised lab is for teaching VR/AR and game programming.



Smart Computing Lab

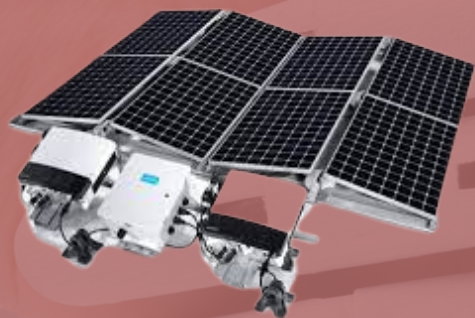
Equipped with special devices and software, this lab is another specialised lab for teaching embedded computing.



Featured Projects

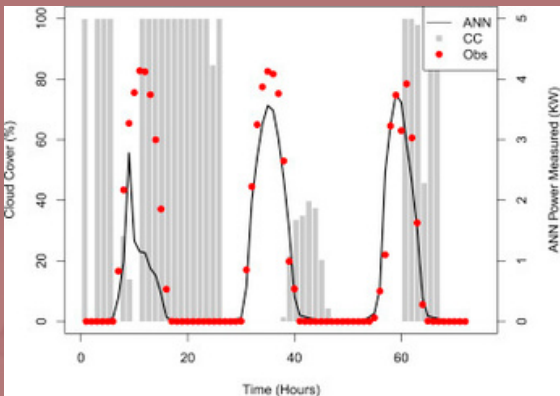
Solar Energy Performance Management System

This project develops a novel intelligent solar energy management system based AI, digital twin and big data analytics, which is a cloud-based holistic solar energy performance management platform for operational efficiency and performance enhancement for one or multiple PV systems locally, with integrated functions such as real-time monitoring, comprehensive system data collection, cross-system performance data sharing and benchmarking, advanced analytics for production prognosis and reliability analysis etc.



Research on Very Short-term Photovoltaic Power Forecasting Based on Cloud Tracking

A methodology based on Artificial Neural Networks (ANN) and an Analog Ensemble (AnEn) is presented to generate 72 h deterministic and probabilistic forecasts of power generated by photovoltaic (PV) power plants using input from a numerical weather prediction model and computed astronomical variables. ANN and AnEn are used individually and in combination to generate forecasts for three solar power plants located in Italy. The computational scalability of the proposed solution is tested using synthetic data simulating 4450 PV power stations. The National Center for Atmospheric Research (NCAR) Yellowstone supercomputer is employed to test the parallel implementation of the proposed solution, ranging from one node (32 cores) to 4450 nodes (141,140 cores). Results show that a combined AnEn + ANN solution yields best results, and that the proposed solution is well suited for massive scale computation.



Research and Design of a Machine Learning Based Adaptive Fault Prediction Data Analytics System for Lift Monitoring

Wind Turbines (WT) are one of the fastest growing sources of power production in the world today and there is a constant need to reduce the costs of operating and maintaining them. Condition monitoring (CM) is a tool commonly employed for the early detection of faults/failures so as to minimise downtime and maximize productivity. This paper provides a review of the state-of-the-art in the CM of wind turbines, describing the different maintenance strategies, CM techniques and methods, and highlighting in a table the various combinations of these that have been reported in the literature. Future research opportunities in fault diagnostics are identified using a qualitative fault tree analysis.



Smart Space

Smart home technology is tech you live with: digital devices and systems that operate inside the home to create a simpler, faster and more efficient way of life. whether it's checking your fridge from the aisle of the supermarket, or boiling your kettle from under your duvet, smart home technology means your devices and appliances can speak to each other, so you can control them all under one roof

The project aims to adopt latest research results in artificial intelligence (AI), data science (DS) and robotic technologies to create an environment where human beings can interact naturally with their electronic appliances such as coffee machines, washing machines and multimedia players etc. as similar to interact with another human.



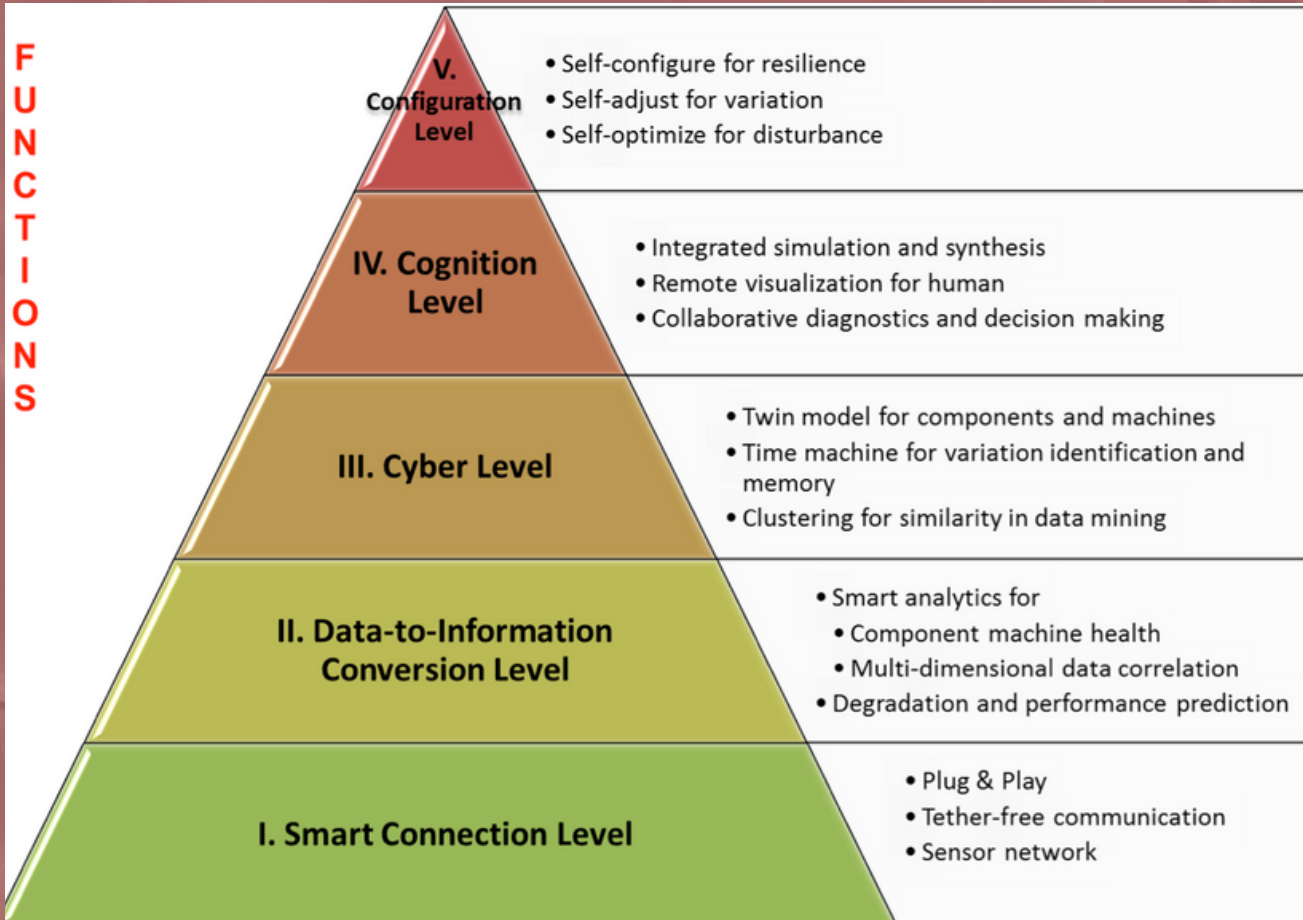
More Project Information >>>



Other Featured Projects

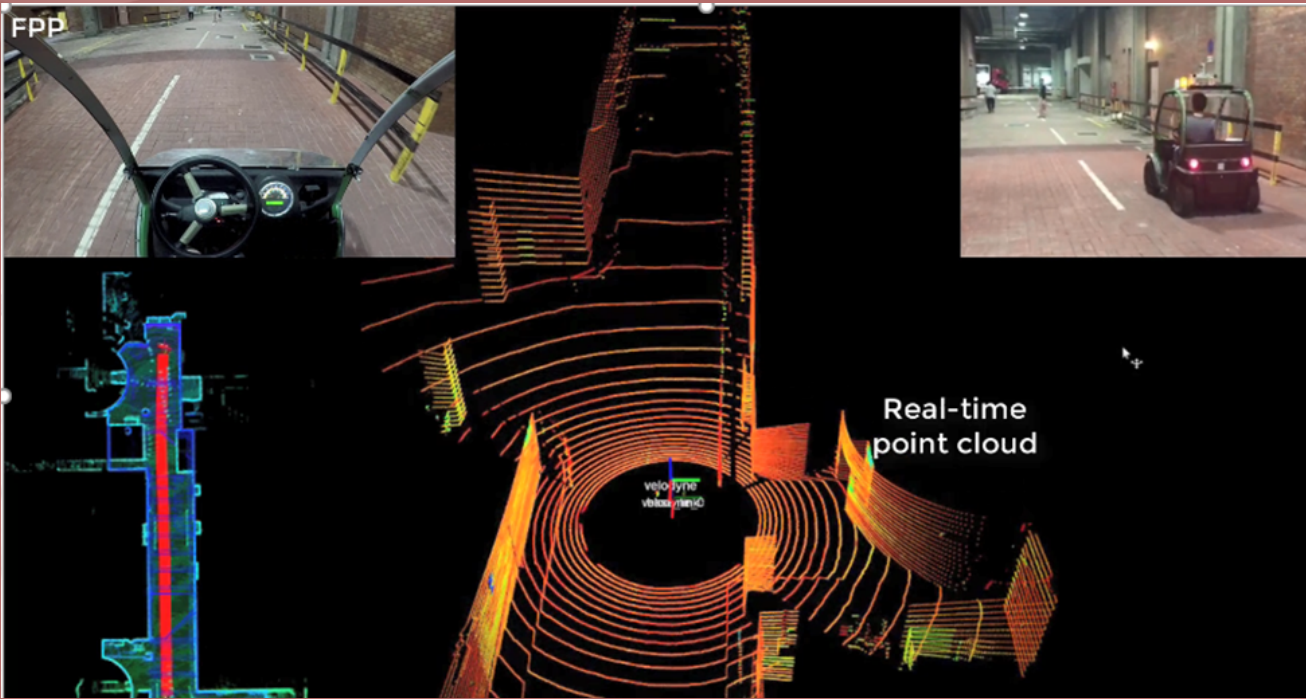
CYBER-PHYSICAL ASSET MANAGEMENT SYSTEM

There is an increasing trend to adopt indoor location asset tracking in enterprises to enable better supply chain visibility and more efficient operations. In the past, Radio Frequency IDentification technology (RFID), Bluetooth Low Energy (BLE) and Wifi are commonly used in indoor positioning systems. Recently, Ultra-wideband (UWB) is considered as the new ideal solution for asset management for complex environments. Comparing to other similar technologies, UWB performs better in different aspects including accuracy, cost efficiency, reliability, scalability and safety. In the future research direction, the UWB-based Cyber-Physical Asset Management System can locate and monitor the factory assets, equipment, workers and products in real time. It can also progressively conduct workflow and resources utilization analysis, and carry out predictive maintenance so as to optimize the operations and minimize the cost as well as the energy consumption.



DEVELOPMENT OF LOW-SPEED UNMANNED GROUND VEHICLE IN CAMPUS ENVIRONMENT

There are four fundamental technical challenges to develop a low-speed unmanned ground vehicle (UGV); Localization, Perception, Control and Mapping. The AAE IPNL (Intelligent Positioning and Navigation Laboratory) has been working the state-of-the-art localization, mapping and control algorithm to realize this UGV. This UGV can potentially contribute to various applications including (but not limit to): 1. Automatic food/document delivery; 2. Automatic cleaning in public areas such as parks; 3. Space and military applications.



More Project Information >>>



Other Featured Projects

INTELLIGENT WORKLOAD BALANCE CONTROL OF THE ASSEMBLY PROCESS CONSIDERING CONDITION-BASED MAINTENANCE

A fuzzy control system is developed to make real-time decisions to balance the workloads based on the processing abilities of workstations, given the policy of condition-based maintenance. Fuzzy controllers are used to decide whether to re-balance the assembly line and how to adjust the production rate of each workstation. It is showed that the buffer level of the assembly line with our fuzzy control system is lower than that of the assembly line without any control system and the buffer level of the assembly line with another control system is the lowest. The intelligent automation can improve the performance of the assembly process by the fuzzy control system since real-time information of the assembly line can be used for adaptive decision-making

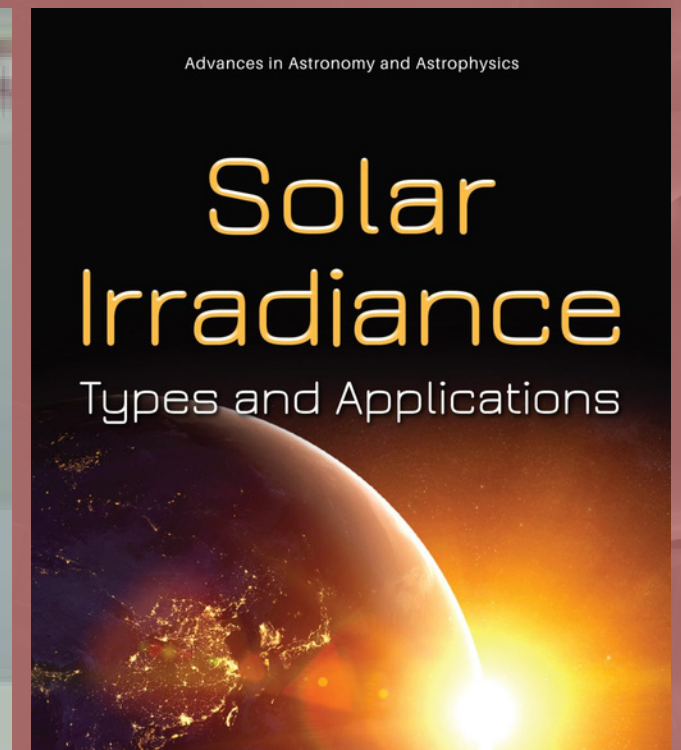


MOBILE EXO-NEURO-MUSCULO-SKELETON

The system is a light-weight mobile device with excellent rehabilitative effectiveness for tele-rehabilitation based on the internet of things. The invention of the exo-neuro-musculo-skeleton won a Grand Prize, a Gold Medal and a Special Merit Prize at the 47th International Exhibition of Inventions of Geneva in 2019. The invention was ranked as one of the Top 100 Science Spinoffs 2018, covering all industries in SPINOFF.COM Database (SDB) because of the uniqueness of the technology, high commercial potential and positive impact on the humanity's well-being. The mobile exo-neuro-musculo-skeleton is also recognized as one of the five key developments which will impact the rehabilitation robotic global market from 2018 to 2026 by the COHERENT MARKET INSIGHTS.

HIGH FIDELITY SOLAR IRRADIANCE FORECASTING FOR SOLAR POWER INTEGRATION

Solar energy is an abundant and renewable alternative to fossil fuels with essential implication of carbon neutrality. If utilized efficiently, it has the potential to supply the energy demand of the entire globe. However, there are two major obstacles that hinder the rapid deployment of solar power systems: (1) high temporal and spatial variability of solar irradiance that would cause instability and failure of power grids; and (2) low power production density per unit land area that would cause land competitions with existing infrastructures. To achieve the net-zero emission goal by 2050 set by several countries, innovate designs for solar power systems are essential to overcome the abovementioned obstacles. Large-scale energy storage (e.g. batteries) could stabilize fluctuate solar power to the grid, but grid wide battery systems are still not economically viable. A low-cost alternative to decrease the uncertainty in the solar power output is forecasting the solar power production to help with real-time dispatch and grid balancing. Accurate forecasting will also benefit the real-time control of the storage system.



More Project Information >>>



Founding Members

Our members are well-experienced and inspirational professors and doctors. Most of them are graduated from internationally renowned universities and their research capabilities cover high comprehensive spectrum of important research areas.



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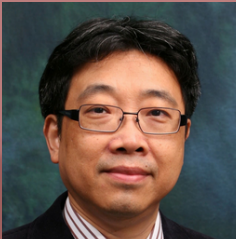
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