

Research Assessment Exercise 2020
Impact Overview Statement

University: Hong Kong Baptist University

Unit of Assessment (UoA): 13 Computer Studies/Science (Incl. Information Technology)

Total number of eligible staff of the university in the UoA: 13

(1) Context

Non-academic users of the Department's research output include government departments, high-tech companies, and non-government organisations. Intellectual, technical, and social impact is achieved at regional, national, and international levels in the fields of healthcare and business. Our impactful and world-leading research on Artificial Intelligence (AI) has influenced the national policies of the Chinese Center for Disease Control and Prevention (China CDC) and significantly improved their front-line surveillance and control practices. Our big data research has been used by high-tech companies (for example, Lenovo, Samsung, and Tencent among others) to enhance their products' performance. Our staff members have filed nine patent applications during the current assessment period (2013-2019), besides engaging in various consultancy activities.

(2) Approach to impact

In order to achieve maximum impact, we adopt the following approaches:

a) World challenges as strategic directions: Healthcare is a highly complex and challenging global field and in the interest of tackling this crisis effectively, numerous heterogeneous factors have to be considered including populations that are extremely diverse, aging and mobile. The data-driven paradigm applicable to address this complexity is in high demand and yet poses various challenging issues such as data acquisition, analytics and complex computing interactions. In addition, mission-critical applications such as healthcare systems face numerous healthcare data security challenges pertaining to individual security and privacy. Since 2009, the Department has outlined a strategic direction of development for "Health Informatics (HI)", and then with "Security and Privacy Aware Computing (SPAC)" added in 2014.

b) Basic research as core competency: High impact research requires creative initiatives and a comprehensive understanding of real-world problems so as to tackle the challenges by applying cutting-edge technologies. We emphasise the importance of conducting basic scientific research on cutting-edge technologies as our core competency and expect academic staff to secure related external research grants, as communicated through the annual performance review exercise. The impact case study we have submitted details a blending of novel data analytics methodologies (with GRF grants secured and research findings published in top-tier AI conferences and journals) and its deployment in real-world settings (in cooperation with China CDC) for malaria prevention and control.

c) Capability building for strategic development: The Department makes use of the financial support secured from the University under the Strategic Development Fund Scheme and its own private funding from self-financed programmes for building up capacities to support high impact research in HI and SPAC. We endeavour to strategically recruit candidates who are suitably versatile and able to contribute to the strategic themes based on their own expertise and research interests. To further encourage colleagues to compete for external grants for high-impact research and knowledge transfer projects, a departmental incentive scheme has also been established to provide matching funds. Likewise, the Department also provides funding support for patent applications and renewals.

d) Partnership with stakeholders/end-users: Engaging key stakeholders/end-users of the application domains is a key success factor for establishing impact. The University's Knowledge Transfer Office (KTO) is instrumental in providing knowledge transfer related support (for example, start-up seed funding, promoting external industry grants, patent writing, application, and IP management). The Graduate School, in turn, provides support for establishing various types of strategic agreements with external research institutes. With the support, we have established a joint laboratory with the National Institute of Parasitic Diseases of China CDC in 2013, a faculty secondment in the Hospital Authority (HA) in 2016, collaborative research projects and internships with high-tech companies including Lenovo, Inspur, Digital Blockchain Technology Limited, etc.

e) Persistence to ensure flow through to impact: (1) *Our research has generated social impact on healthcare.* The spatio-temporal data analytics technologies for epidemic prediction developed by Prof. Jiming Liu's team have been adopted by China CDC as guidelines for malaria surveillance and control, and deployed in all China-Myanmar border cities. They have also been recognised by the World Health Organisation (WHO), the Health Poverty Action (HPA), and the national health authorities of countries in Greater Mekong Subregion (GMS) and Southeast Asia (SEA), and are being adopted in their region/country-wide programmes. (2) *Our research outputs have been used by high-tech companies.* Examples include: (i) Geo-Social K-Cover Group (GSKCG) (a new type of search for geo-social data) and a novel attribute-based community mining algorithm developed by Prof. Jianliang Xu's team, which have been extensively used by Samsung for promoting Samsung Pay to targeted small and medium-sized merchants, as well as being employed by Lenovo in their graph analytics product, HyperGraph, to enrich its knowledge discovery features; (ii) Research on optimising distributed GPU systems for large-scale deep learning (developed by Prof. Xiaowen Chu) has been applied to an industry product at Tencent Ltd., the Jizhi training system, which has achieved a world record time of training the AlexNet model on ImageNet in four minutes with 2,048 GPUs; (iii) A face-based biometrics technique for mobile devices, developed by Prof. Pong Chi Yuen in 2001, was subsequently adopted by Omron Corporation, Japan, while a US patent [US 15/649,647] has been filed in 2018 for a new method for 3D mask face anti-spoofing; (iv) A lip-based biometrics technique, developed by Prof. Yiu-Ming Cheung in 2017, was awarded a US patent [9,159,321B2] and acquired two top awards at the 46th International Exhibition of Inventions of Geneva in 2018.

f) Engaging the public and outreach: Our longstanding and recognised commitment to the community is evidenced by the various outreach activities and programmes offered to the community, for example, organising international workshops and events (such as, the Advanced Study Institute in 2016 and 2017, co-sponsored by the Croucher Foundation, the IEEE/IAPR Winter School on Biometrics in 2018, and the International Workshop on AI-enabled Malaria Control and Prevention in 2019); participating in competitions, for example, the Asia Student Supercomputer Challenge (ASC) (First class award in 2016, 2017); carrying out industry related consultancy projects (worth HK\$2 million in the current assessment period); and participating in innovative technology exhibitions (for example, the International Exhibition of Inventions of Geneva).

(3) Strategy and plans

The Department's Research Committee places special emphasis on impact as the first priority in research strategy planning. Our plans include:

- a) To strengthen our synergy and impactful research in healthcare via collaborative research projects with healthcare practitioners (including China CDC and HA). To advance this objective, various related projects have received external research funds.
- b) To develop and actualise as planned the joint laboratories established with different strategic partners, conducive to generating viable solutions for regional and global issues with technological innovations for real-world challenges.
- c) To leverage on the University-level Research Cluster on "Data Analytics and AI in X", wherein new faculty members and research staff will be hired for related impactful interdisciplinary research, including AI in Chinese Medicine, AI in Media Communication, etc.
- d) To provide strategic resources to support potential impact cases identified by the Department Management Committee and to invite official department advisors from applied research laboratories and high-tech corporations for their expert opinions and recommendations.
- e) To leverage on our Master of Science Programme (revamped to focus on AI and Data Analytics in 2018), an interdisciplinary undergraduate concentration on Data and Media Communication (launched in 2018), and an interdisciplinary undergraduate programme on Business Computing and Data Analytics (launched in 2019) to facilitate faculty interaction and research collaboration.

(4) Relationship to case studies

"A Computational Approach to Malaria Elimination with China CDC" relates to the social impact of Prof. Jiming Liu's research work that transforms the path ahead for policy-making and front-line malaria surveillance and control at regional, national, and international levels.