# PhD IN INFORMATION SYSTEMS

## SMU
### PhD

Technology and management research for real-world impact

# Aims of Programme



## Mission

Singapore Management University (SMU) offers the PhD in Information Systems programme. The programme produces PhD graduates with expertise that straddles between the Information Technology (IT) and business sectors for Research and Development (R&D) units and applied academic institutions.

## Goal

The programme develops researchers and educators who address deep technology challenges in real-world information systems that impact business processes or management, or who develop tools and methodologies to translate business goals into technological solutions.

Our PhD graduates are capable of collaborating with researchers from different disciplines and designing technology solutions for real-world problems and applications, and producing top-rated academic publications.



## Our Value Proposition

### Interdisciplinary Work

Our PhD students are trained to work across research areas. The curriculum covers five areas that have high market demands – **Cybersecurity; Data Science & Engineering; Information Systems & Management; Intelligent Systems & Optimisation; and Software & Cyber-Physical Systems.**

### Applied Research

The programme provides opportunities for students to work with industry data sets and commercial platforms. Students will learn to conduct their research in the context of real information systems and business goals.

### Industry-relevant Training

Our PhD students will acquire professional skills that are important in industrial R&D, such as intellectual property management. Students will have opportunities to network with academic researchers and industry practitioners.

### Employment Prospects of Graduates

**R&D units** require PhD graduates with an integrated view of business and IT to complement graduates from other institutions who are trained to work on component technologies.

**Academic institutions**, particularly software schools, require PhD graduates with skills in application and systems building, as well as in management.

**Industry** requires PhD graduates capable of developing tools and methodologies that translate business goals into technology requirements, and who can build technology-based solutions that contribute to revenue growth or cost reduction.

# Areas of Research Concentration

| Cybersecurity | Data Science & Engineering | Information Systems & Management | Intelligent Systems & Optimisation | Software & Cyber-Physical Systems |
|---|---|---|---|---|
| Data Security & Privacy | Knowledge Discovery & Data Mining | Economics of IS & Technology | Autonomous Agents & Multi-Agent Systems | Mobile & Wearable Systems & Testbeds |
| Mobile Platform & Application Security | Machine Learning & Deep Learning | Social Media Marketing & Digital Strategies | Behavioural Modeling & Reinforcement Learning | Cyber-Physical & IoT Systems |
| IoT Security & Privacy | Visual Computing & Multimedia Analytics | Platform, Networks & Markets | Game Theory & Mechanism Design | Interactive & Wearable Computing Interfaces |
| Computer & Software Security | Spatial & Context-Aware Data Management | Cloud Computing & Information Security Management | Heuristic Search & Optimisation | Physical Sensing & Analytics |
| Cloud Computing Security | Recommender Systems & Preference Analytics | IT & Supply Chain Management | Planning & Scheduling | Software Mining, Testing & Analysis |
| Human Behaviour-Based Security | Natural Language Processing & Text Mining | Financial IS & Disruptive Technology | Operations Analytics | Empirical Software Engineering |
| Security Policy & Management | Crowdsourcing & Human Computation | Digital Innovation Management & Entrepreneurship | Simulation & Decision Support in Transportation & Logistics | Edge & Cloud-Assisted Computing |

Students can undertake their PhD studies in any of these research areas. SMU encourages research activities that integrate several of these areas.

# Curriculum Structure

This is a direct PhD programme, with a maximum candidature period of five years for full-time students. The curriculum comprises coursework (12 Course Units) and a dissertation (28 Course Units).

**Graduate Coursework:** In the first two years of study, students enrol in intensive courses to build their research depth and breadth, as well as professional skills.

**Depth Requirements:** Students enrol in the advanced course in their respective primary areas and undertake research apprenticeships with their primary advisors. Each advanced course covers important research papers on key topics and techniques that students need to be acquainted with in order to undertake area-specific research.

**Breadth Requirements:** Students attend courses in the five areas of research concentration shown above. These requirements are intended to help PhD students establish their networks and to expose them to industry practices. In addition, students will attend the advanced course in one of the breadth areas.

**Professional Skills:** To round up the PhD training, the curriculum includes workshops on English Communications; Information Systems Research Methodology; Intellectual Property Management; Research Writing and Presentation; and teaching skills.

# Students' Achievements

## Distinguished / Best Paper Awards

| Runner Up, Lee Dirks Award (2017) | Best Paper Award (2015) | Best Paper Award (2013) | Best Workshop Paper Award (2012) | Distinguished Paper Award (2012) |
|---|---|---|---|---|
| Kustini LIM-WAVDE | Sougata SEN | Chee Meng TEY | Kiat Wee TAN | Qiang YAN & Jin HAN |
| iConference | Sensing Systems and Applications Using Wrist Worn Smart Devices (WristSense) | Network and Distributed System Security (NDSS) Symposium | Special Interest Group on Data Communication (SIGCOMM) | Network and Distributed System Security (NDSS) Symposium |

## In the headlines

### Discovery of iOS security flaws

**TODAY, 3 Oct 2013**
A*STAR, SMU researchers first to discover iOS security flaws

**The Straits Times, 3 Oct 2013**
Singapore team helps plug flaws in Apple devices

**Lianhe Zaobao, 3 Oct 2013**
Local researchers found three security weaknesses in Apple's iOS operating system (Translated)

**The Straits Times, 2 Oct 2013**
Apple fixes iOS7 after Singapore researchers identify flaws

## Selected Graduates' Professional Appointments after SMU

**Post-Doctoral Fellow**
Carnegie Mellon University, USA
Leibniz University of Hanover, Germany

**Software Engineer**
Alibaba, China
Google Zurich
Samsung Research America
Twitter, Inc., USA

**Research Scientist**
Appthority, USA
Institute for Infocomm Research (I2R), A*STAR, Singapore
DSO National Laboratories, Singapore
HP Labs, USA
TCS Innovation Labs, Bangalore

**Data Scientist**
Booking.com, Netherlands
Global Fashion Group, Singapore
Pindrop, USA
Stealth Mode AI Startup, USA

# Students' Experiences

## Internships



**Jianfei YU**
Intern
(May-Aug 2017)
Alibaba Group
Hangzhou, China

During my internship at Alibaba Group in Hangzhou, China, I worked on the FAQ-based Chatbots. I wrote a research paper about the work I undertook at Alibaba Group, which has recently been accepted by WSDM 2018, a premier international conference on web-inspired research involving search and data mining. Although the internship was only for three months, I gained a lot of experience working on challenging projects, and interacting with, and learning from team members. This experience provided me with research freedom, which enhanced my SMU PhD journey.



**Thanh Son NGUYEN**
Intern
(May-Sep 2017)
IBM Ireland Product Distribution Limited

At IBM, I was in a neuro-linguistic programming (NLP) group, called "Relationship Insights". I was supervised by one of IBM's researchers.

My research focused on targeted sentiment analysis which aims to not only extract the sentiment polarity, but also identify the source and target of the sentiment. As part of the team, I also participated in "NIST TAC Source-and-Target Belief and Sentiment Evaluation 2017", which is a Text Analysis Conference (TAC) by the US National Institute of Standards & Technology (NIST).

The four-month internship gave me the experience of doing independent research in the industry, and this experience will help me a lot when I look for placement in the near future.

Other students have also completed internships at:
- Google Inc. (Mountain View, California, USA)
- Hewlett Packard Research Labs (Palo Alto, California, USA)
- IBM Research Lab (New Delhi, India)
- Microsoft Corporation (Redmond, Washington, USA)
- Samsung Information Systems America, Inc. (Santa Clara, California, USA)
- Yahoo! Research Lab (Barcelona, Spain)

# Selected Dissertations

### CYBERSECURITY

- Techniques for Identifying Mobile Platform Vulnerabilities and Detecting Policy-Violating Applications (Su Mon KYWE, 2016)

- Security and Privacy in RFID-Enabled Supply Chain (Shaoying CAI, 2014)

### DATA SCIENCE & ENGINEERING

- Aspect Discovery from Product Reviews (Ying DING, 2017)

- Mining Diverse Consumer Preferences for Bundling and Recommendation (Ha Loc DO, 2017)

- Modeling Adoption Dynamics in Social Networks (Minh Duc LUU, 2017)

- Real-time Bursty Topic Detection and Virality Forecasting in Microblogs (Wei XIE, 2017)

### INFORMATION SYSTEMS & MANAGEMENT

- How Technology is Reshaping Financial Services: Essays on Consumer Behavior in Card, Channel and Cryptocurrency Services (Dan GENG, 2017)

- Decision Modeling and Empirical Analysis of Mobile Financial Services (Jun LIU, 2016)

### INTELLIGENT SYSTEMS & OPTIMISATION

- Proactive and Reactive Strategies to Handle Surges in Urban Crowds (Jiali DU, 2017)

- Recommending Personalized Schedules in Urban Environments (Cen CHEN, 2017)

### SOFTWARE & CYBER-PHYSICAL SYSTEMS

- Fusing Mobile, Wearable and Infrastructure Sensing for Immersive Daily Lifestyle Analytics (Sougata SEN, 2017)

- Hybrid Based Approaches for Software Fault Localization and Specification Mining (Bui Tien Duy LE, 2017)

- Testing and Debugging: A Reality Check (Pavneet Singh KOCHHAR, 2017)

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**"**

The SMU PhD in Information Systems programme trained me to be a well-rounded researcher. I was not only trained in fundamental topics in Computer Science (such as Information Retrieval), but I was also trained to improve my research skills (such as scientific writing), communication and presentation skills, as well as teaching skills. These were made possible through the different workshops organised by SMU.

Before I joined the programme, I was a 'green' undergraduate with little research experience. I gradually picked up my research skills from small empirical research projects which were part of the programme, as well as from consulting my seniors, and from the strong guidance of my supervisor and other professors. The professors are hardworking, knowledgeable, approachable and always set high expectations for their students.



**Ha Loc DO**
Algorithm Engineer
Alibaba Group,
China

"During my PhD journey, I was always given the freedom to choose projects or topics that I found interesting. While some of the projects required interdisciplinary collaborations, there were yet others that required external collaborations. Such collaborations are highly encouraged at SMU. In addition to collaborating with researchers from SMU, I also had the opportunity to collaborate with researchers from institutes such as the Univer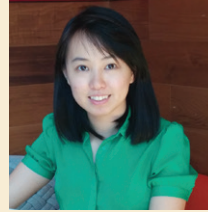sity of Hawaii, Carnegie Mellon University (CMU) in Pittsburgh, IBM India Research Labs, Samsung Research America, and other such institutions.

During the programme, I visited CMU as a research scholar, as well as interned at IBM India and Samsung Research America. While the projects and collaborations provided me with the opportunity to work on interesting topics, the diversity of these projects helped me become a more systematic and independent researcher.

**Sougata SEN**
Postdoctoral Scholar
Dartmouth College,
New Hampshire,
USA

"I did both my undergraduate and postgraduate degrees at SMU, and those have been the best years of my life so far. I met amazing friends who are talented and full of drive, as well as mentors who are very supportive and nurturing.

I had the opportunity to travel to Switzerland for an international conference, took classes at Carnegie Mellon University, and interned in Samsung Research America.

I am very appreciative to each and every professor, staff member, teammate, classmate and friend from SMU for making me become who I am today.

**Su Mon KYWE**
Research Scientist
Appthority, USA

# Admission and Application

## Admission Requirements

At least a good Bachelor's degree.
A Master's degree is useful but not required.

Good GRE or GMAT results.

Good TOEFL or IELTS scores.
For applicants whose medium of instruction at the Bachelor's/Master's level was not English.

Submission of the following documents:
Copy of Identity Card/Passport
Latest Curriculum Vitae
Copies of Degree Certificates and Transcripts
Personal and Research Statements
Recommendation and/or Reference Letters



## Application Information

The PhD in Information Systems is a full-time programme. Part-time study is available for Singapore citizens and permanent residents. The University's application windows are listed below.

| Intake | Opening Date for Application | Closing Date for Application |
|--------|------------------------------|------------------------------|
| August | 1 September* (of prior year) | 31 October* (of prior year) |
| | 1 November (of prior year) | 31 January (of intake year) |
| January | 1 February* (of prior year) | 31 March* (of prior year) |
| | 1 April (of prior year) | 30 June (of prior year) |

* Candidates applying during these periods would be given priority for consideration of scholarships.

Details of programme fees and application procedure can be found at **http://smu.sg/phd-is**.

# Financial Assistance Schemes

SMU awards three types of scholarships and fellowships on a competitive basis. We assess applicants for different award schemes either at the time of admission based on qualification and suitability for these schemes or during their PhD journey based on their outstanding academic performance.

## SMU Scholarship

The scholarship covers registration and subsidised tuition fees. This scheme also provides successful recipients with monthly living stipends.* The scholarship is renewed yearly, conditioned on good academic performance, for a maximum duration of four years. Beyond the scholarship duration, students who have been on the scholarship may receive continued support through research and teaching assistantships or industry grants.



## SMU Presidential Doctoral Fellowship

The SMU Presidential Doctoral Fellowship* is awarded to exceptionally qualified students who enrol into SMU's PhD programmes as well as to existing PhD students who have outstanding academic performance. The Fellowship is a one-year award that is renewed annually, for up to four years.

## SMU Multidisciplinary Doctoral Fellowship

The SMU Multidisciplinary Doctoral Fellowship* is awarded to existing PhD students whose research output show the use of techniques from two or more fields of research. This Fellowship is also a one-year award that is renewed annually, for up to four years.

\*   The stipend rates are published at **http://smu.sg/phd** and are subject to change.

# A Unique University in Vibrant Singapore



# SMU has been designed to provide a different model of university education in Singapore.

## A Strong and Innovative Research Culture

- Internationally recognised for its world-class research and distinguished teaching conducted by faculty members who joined us from top universities.
- Faculty members collaborate on cross-disciplinary work to generate impactful and real-world relevant ideas, over and above research in their own disciplines.
- Faculty members establish research centres and institutes to conduct problem-driven research and influence industry practice across a wide range of topics.

## A Different Learning Approach

- Faculty members encourage an interactive learning environment through inquiry, participation and teamwork.
- Seminar-style teaching in small classes optimises student-instructor interaction.

## State-of-the-Art Infrastructure

- Research support includes proprietary and published databases.
- SMU's library provides access to many scientific journals, electronic books and other necessary publications and materials.

Being in the heart of the city, students will have easy access to industry partners who provide research data and validation platforms.

Each School has dedicated personnel to take care of students' administrative needs. Furthermore, many SMU research centres and institutes provide post-doctoral fellowships and/or research assistantships that add value to students' research experience.

![SMU Singapore Management University logo]

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