

National University of Singapore

School of Computing

Summer Workshop

11 July 2018 to 2 August 2018

Organizer : NUS School of Computing (Graduate Division)

Program Director : Prof. Tan Tiow Seng

Publicity & Execution : Liv Dai

National University of Singapore (NUS)



Founded in 1905, NUS has since established itself as one of the top universities worldwide

National University of Singapore (NUS)

University Ranking

● **2017**
#12 Worldwide

● **2017**
#1 In Asia
Top 2 in Asia since 2012

National University of Singapore



NUS Today

18 Faculties

8 Overseas Colleges

1 Overseas
Research Institute

over 30,000
students from more
than 100 countries

School of Computing



School of Computing

**University
Ranking**
In Engineering
and Technology

Worldwide

#7



◆ Department

- Computer Science
- Information Systems and Analytics

◆ Staff

- 170 (teaching)
- 139 (research)

◆ Student

- 2300 undergraduate students
- 600 PhD/Master students

Summer Workshop Introduction

Time	11 July – 2 August (3 weeks)
Venue	National University of Singapore (Singapore)
Admission requirement	Year 2 and above undergraduate and postgraduate students majoring in Computer Science, Software Engineering, Electronic Communication, Information Systems and Management, Internet of Things, and related disciplines (you may enquire)
	Good academic achievement and English proficiency
Program Benefits	Opportunity to get a taste of a different education system by immersing oneself in one of the top universities worldwide
	Keep abreast of the state-of-the-art knowledge in a few computing topics and gain deep insights by working on group projects
	Develop a global perspective to prepare oneself for work and studies overseas
	Students will receive a certificate/result that would be greatly advantageous for their future career and further studies

Summer Workshop Application

Application

18 Jan 2018 to 15 Apr 2018

How to apply

Program website : <http://www.comp.nus.edu.sg/~sws>

Apply through the link to the [application portal](#) provided at the program website. See Annex for further details.

Documents required:

- academic transcript (Chinese version is acceptable)
- English qualifications (CET4, CET6 or TOEFL or IELTS)
- scanned copy of Identity Card (both sides)
- Awards/Certificates (if any), and
- Passport with photograph (if available).

Students will be contacted within 1 week after completing the application process.

No fee is collected for the application to participate; program fee is only payable after receiving offer letter/email from the organizer.

Summer Workshop Application

Program Fee

SGD3780 (Payment deadline: 20 Apr 2018)

The fee will cover:

- workshop fee
- 3-week accommodation
- Insurance
- airport transfers
- student card
- telephone card
- bus card
- T-shirt
- 2 major meals (welcome lunch & farewell dinner)
- program certificate and result

You are required to purchase your own plane tickets, and pay for your other living expenses in Singapore.

If you require an additional one week of stay in Singapore to fulfill school requirements, you may write in to apply for extra 1-week accommodation outside of NUS campus.

Others

You are required to have a passport (valid till at least Feb 2019) and VISA to visit Singapore -- the organizer will issue an invitation letter to assist your application of VISA if needed.

- Student to arrive by 11 July 2018, 22:00, to check into dormitory
- While in School of Computing (SOC)
 - Each student will attend 3 topics in the assigned cluster each for 2 days (total 6 lecture days)
 - Each student ranks the topics in order of preference in the cluster to do a group project (4 persons in a team)
 - Each group has about 3 hours of consultation time with the professor (mentor), and each mentor may provide a few more hours of lecture/guidance to all teams
 - Final showcase of all projects of all topics on 1 August 2018
- Check-out of student dormitory early morning of 2 August 2018



Program Itinerary

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	July 9	10	11	12 1 st day in NUS	13 Seminar #1	14 Seminar #1
			Pickup from Changi Airport to Hostel. Try to arrive before 22:00.	Welcome at SOC; get-to-know SOC & its neighborhood; welcome lunch at SOC; city tour.	Day 1 of topic 1 (6 hr) (Parallel Tracks) TA to assist in assessment	Day 2 of topic 1 (6 hr) (Parallel Tracks) TA to assist in assessment
15 Free and easy	16 Seminar #2 Day 1 of topic 2 (6 hr) (Parallel Tracks) TA to assist in assessment	17 Seminar #2 Day 2 of topic 2 (6 hr) (Parallel Tracks) TA to assist in assessment	18 Event Day To be arranged.	19 Seminar #3 Day 1 of topic 3 (6 hr) (Parallel Tracks) TA to assist in assessment	20 Seminar #3 Day 2 of topic 3 (6 hr) (Parallel Tracks) TA to assist in assessment	21 Decision Day Students to rank preference on topics for projects, and professors to decide.
22 Brainstorming or Free and easy?	23 Consultation #1 A dvising students' work (each professor spends 45min per project group). May spread to next day. Assistance from TA (45min per project group). May spread to next day. May have lab work to students too.	24 Project Day More info to students on projects by each professor (3 hr lecture) May have lab work to students too.	25 Consultation #2 C oncentrating students' work (each professor spends 45min per project group). May spread to next day. Assistance from TA (45min per project group). May spread to next day. May have lab work to students too.	26 Project Day More info to students on projects by each professor (3 hr lecture) May have lab work to students too.	27 Consultation #3 E xcelling students' work (each professor spends 30min per project group). Assistance from TA (30min per project group). May have lab work to students too.	28 Project Day Not really a relaxing weekend for students ☺

SOC Summer Workshop, 2018

29 Cleaning Up A ssemble components	30 Consultation #4 C onsolidate important contribution (each professor spends 30min per project group) Assistance from TA (30min per project group).	31 Consultation #5 E xcel with presentation preparation (each professor spends 30min per project group) Assistance from TA (30min per project group).	August 1 Showcase Day & Farewell Dinner	2 Really Free now.... Check out from Hostel Home-Sweet-Home or remain in Singapore (moving to off-campus accommodation)	3	4
5	6	7	8	9 Public Holiday (Singapore 53 rd National Day)	10	

Selection of Clusters

Students will select 1 cluster (of 3 topics) from the following 3 clusters to attend lectures (2 days of lecture per topic). Each student will then rank his/her preferences of the topics in the cluster to do a project.

Each topic can take up to 10 project teams (maximum 40 students). The organizer, in consultation with the professors (mentors), has the final say on which topic a student will do a project.

Cluster 1 Artificial Intelligence and Multimedia Computing

Topic 1

Real-Time and
Realistic Graphics
Rendering

Topic 2

The Art of Image
Processing

Topic 3

2D Videogame
Development

Topic 4

Immersive VR
Experience
Development

Cluster 2 Big Data and Cloud Computing

Topic 1

Mining Communities in
Big-Data with Algorithms
and Computational
Thinking

Topic 2

Solving Problems with
Thousands of "CPUs"
– GPU & Geometry

Topic 3

Cloud Computing
with Big Data

Topic 4

Simulation – Allowing
"What if?" Scenarios

Cluster 3 Internet of Things and Security

Topic 1

Tele-Robotic
Deep Learning

Topic 2

DOTA Defense
of the Ancients

Topic 3

Building Your Dream Smart
Home

Available Topics



Cluster 1

Artificial Intelligence and Multimedia Computing

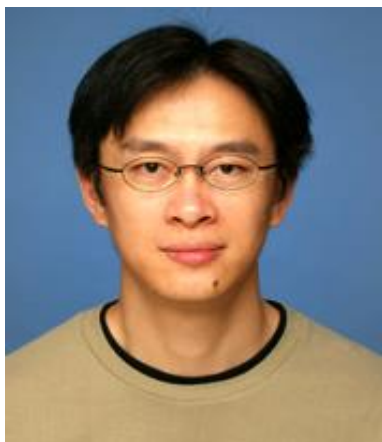
**Real-Time and
Realistic
Graphics
Rendering**

**The Art of
Image
Processing**

**2D
Videogame
Development**

**Immersive VR
Experience
Development**

Real-Time and Realistic Graphics Rendering



Professor LOW Kok Lim

Department of Computer Science, School of Computing, NUS

Prof Low received his Ph.D. in Computer Science from the University of North Carolina at Chapel Hill, and received his M.Sc. and B.Sc. (Honors) degrees in Computer Science from NUS. Recently, he has won the NUS School of Computing Teaching Excellence Award.

His research interests include computational art, real-time rendering, and computational photography. He has published more than 30 peer-reviewed research papers at reputable and leading international conferences and journals. He has also been awarded 4 U.S. Patents and 2 Singapore Patents.

Topic 1

About the topic

3D graphics has been extensively used today to synthesize imagery for 3D computer games, movies and TV shows. This workshop aims to expose students to the fundamentals of 3D graphics image synthesis. It covers two principle paradigms of 3D graphics rendering, namely real-time raster-based rendering, and off-line global illumination-based rendering. The focus of real-time raster-based rendering is speed and it is the main approach of rendering in 3D interactive applications, such as 3D games and 3D visualization. Off-line global illumination-based rendering strives for realistic simulation of light interactions with object surfaces, and is more suitable for non-real-time synthesis of realistic imagery such as for movies.

For real-time raster-based rendering, the workshop will familiarize the students with the OpenGL graphics pipeline. Students will learn how to use OpenGL in their programs, and also learn and practice implementing some of the more advanced rendering techniques, such as multiple-pass rendering, real-time surface effects, and real-time shadow algorithms. For off-line global illumination, students will learn about the interactions between light and object surfaces before going on to learn about the various common simulation techniques, such as simple ray tracing, path tracing, photon mapping and radiosity.

Prerequisites

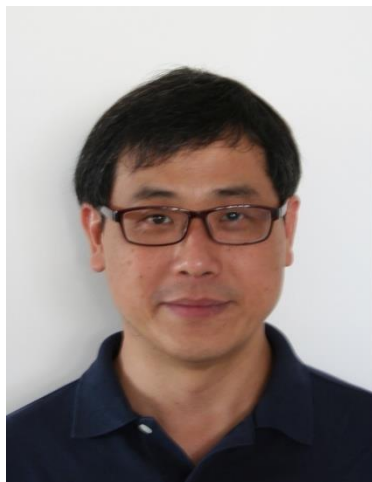
- Basic C or C++ programming skill
- High school mathematics (simple linear & vector algebra, trigonometry, basic calculus concepts)

Topic 2

The Art of Image Processing

Professor NG Teck Khim

Department of Computer Science, School of Computing, NUS



Professor Ng received his undergraduate education in National University of Singapore and earned his PhD from Carnegie Mellon University. His research interest is in geometrical computer vision and its innovative applications.

Prior to starting his career in NUS, he served in the defence R&D for much of his career, doing research in computer vision and signal processing. He is a three-time recipient of School of Computing faculty teaching excellence award. He is also the head of research of Smart Systems Institute, NUS.

Topic 2

About the topic

Image processing is both science and art. In this workshop, you will learn the theories and basic skills in handling images such as doing image enhancement techniques and color spaces. You will also learn to look at images from a different perspective – frequency domain. Explore the basics of Fourier Transform, and how to effectively manipulate images in the frequency domain.

You will also gain an understanding of the basics of camera projection and how the geometry of such projection can be used effectively to geometrically analyse real life pictures. The workshop will include a project component that allows the student to make use of the theories learned in class, and coupled with their creative artistic instinct to produce stunning results from images.

Prerequisites

Elementary calculus, elementary linear algebra, good coding skills.

Topic 3

2D Videogame Development



Professor Kelvin SUNG

Department of Computing and Software Systems, University of Washington Bothell

Prof Sung received his Ph.D. in Computer Science from the University of Illinois at Urbana-Champaign in 1992. His background is in computer graphics, hardware and machine architecture. He came to UWB from Alias|Wavefront (now part of Autodesk) in Toronto where he played a key role in designing and implementing the Maya Renderer, an Academy Award winning image generation system.

Before joining Alias|Wavefront, Prof Sung was an Assistant Professor with the School of Computing, National University of Singapore. Kelvin's research interests are in studying the role of technology in supporting human communication. Funded by Microsoft Research and United States National Science Foundation, Kelvin's recent work focuses on the intersection of videogame mechanics, real-world problems, and mobile technologies. His publications in the Communications of the ACM, IEEE Computers, IEEE Transactions Journals, a published textbook on Computer Graphics, a book on 2D casual game development, and an upcoming book on approaches to building 2D game engines.

Topic 3

About the topic

This workshop examines the fundamental issues in designing and developing computer videogames. We begin with examining technical issues in developing a game including: software architecture, interaction model, mathematic concepts, elementary special effects, and algorithms relevant to supporting in-game logic and autonomous behaviors. After the technical knowledge, during the second phase students will work in groups to design, implement, and playtest their own games while learning the typical videogame development process of optimizing resources and working in close collaboration in delivering a production quality vertical slice.

Prerequisites

- Data Structures
- Linear Algebra
- In depth knowledge of an Objected Oriented Programming Language (e.g., C++, C#, Java)

Topic 3

Immersive VR Experience Development

Professor ANAND Bhojan

Department of Information Systems, School of Computing, NUS



Prof Bhojan Anand has received Ph.D. degree in Computer Science from National University of Singapore. He has received several awards for academic excellence including state government's higher education scholarship, gold medal for securing university first rank, graduate research achievement award and his thesis was nominated for best thesis award. He is teaching game development, computer networks and virtual reality courses at NUS. He has served mentor for Gambit (game development lab) at MIT. USA.

His research interests center on wireless networks, robotics, interactive virtual media environments. He has published five books on mobile computing and networks and two books on Robotics. He often speaks in conferences and has received best-invited presenter award in SIAA's International M2M (Machine-2-Machine) conference and expo. His works on wireless networks and interactive virtual environments are published in prestigious conferences like ACM-Multimedia, ACM -Mobisys, IEEE-Infocom, ACM-SIGCOM. He is an Associate Editor of Elsevier - Computers and Electrical Engineering Journal.

Topic 3

About the topic

Virtual Reality (VR) and Augmented Reality (AR) are nascent fields that can benefit many different areas such as medicine, education, engineering, etc. In this workshop, you will learn fundamentals of immersive VR application design, human perceptions of reality, interaction design for VR, VR sickness and techniques to mitigate VR sickness.

You will learn to program using popular game engines such as Unity3D and Unreal to develop VR experiences for higher-end VR platforms such as Oculus Rift and HTC Vive. You will also learn how to program various sensors attached to human body or common hardware such as exercise bike machine and integrate them with the VR system. The workshop includes a project component that allows you to use the theories and skills acquired in the class to build brilliant VR experiences.

Cluster 2

Big Data and Cloud Computing

**Mining
Communities in
Big-Data with
Algorithms and
Computational
Thinking**

**Solving
Problems with
Thousands of
“CPUs”
– GPU &
Geometry**

**Cloud
Computing
with Big
Data**

**Simulation –
Allowing
“What if?”
Scenarios**

Topic 1

Mining Communities in Big-Data with Algorithms and Computational Thinking

Professor LEONG Hon Wai

Department of Computer Science, School of Computing, NUS

Prof Leong received the B.Sc. (Hon) in Mathematics from University of Malaya and Ph.D. degree in Computer Science from the University of Illinois at Urbana-Champaign. His research interests are in the design and analysis of algorithms, optimization and discrete mathematics. He works in many areas including VLSI design, transportation logistics, multimedia systems, and computational biology. In Singapore, he started the Singapore training program for the IOI (International Olympiad in Informatics). He is a member of ACM, IEEE, ISCB, and a Fellow of the Singapore Computer Society.



In this topic, student will get first hand experience with solving real world problems with computational thinking and community detection on big-data in a team project. The topic will also teach a well-structured methodology for doing good team projects. As a side benefit, student can learn the famous Polya's Four-Step Problem Solving Process. The process is simple, but, if applied consistently, will help to cultivate a creative problem solving mindset.

Topic 1

About the topic

This topic will teach students how to use Computational Thinking and algorithms for community detection in large graphs (big-data) to solve real world problems. Computational thinking is about applying powerful ideas in computer science (problem formulation, abstraction, decomposition, pattern recognition, and algorithm design) to tackle real world problems. We then combine this with modeling of big data using graphs and using community detection algorithms to identify communities in these graphs. Identification of communities in these big-data networks can help to provide give new insights to how the individual nodes interact and the role of certain nodes in the communities (the driver nodes, the hubs and authorities in the graph), can also help to condense large graphs into communities, and can help in visualization of these large graphs which is helpful in many other big-data analytics tasks.

Prerequisites

In general, students should already have some good experience with basic data structures: arrays, matrices, stacks, queues, trees, hashing, graphs, etc. And knows complexity analysis of algorithms using the big-O notation.

Specifically, to take this topic, students must have

- (a) taken two or more programming and data-structure courses,
- (b) actually programmed with graph algorithms, and
- (c) good software development skills.

Solving Problems with Thousands of “CPUs” – GPU & Geometry

Professor TAN Tiow Seng

Department of Computer Science, School of Computing, NUS

Prof Tan obtained his PhD degree from the University of Illinois, Urbana-Champaign, USA. He specializes in algorithm designs, in particular, geometric algorithms. He leads a research group which focuses on geometric algorithms with applications to interactive graphics, visualization and games. His team has released a number of GPU software on geometric computation for free download to the community. These are the only ones available that are robust, accurate and efficient till date.



Prof Tan holds five US/Singapore patents, and is also active in developing new courses and teaching methodologies. He is a two-time recipient of the NUS Teaching Excellence Award. He is active in the development of the digital media industry; he has served as an expert panel member for MDA to evaluate funding proposals on digital media projects, and is the Chairman/cofounder of G Element Pte Ltd, a graphics/visualization company.

In the past few years, Prof Tan was the Deputy Director (Education), NUS Suzhou Research Institute, started the summer programs for Chinese students to NUS.

Topic 2

About the topic

Personal computers have tremendous computing power that we do not utilize. Here, we are not referring to the brain commonly known about computer, i.e. CPU, but GPU (graphics processing unit). GPU is the supplementary brain in the computer that generates those nice and cool graphics for, very often, playing computer games. Each GPU is like thousands of CPUs, and can be programmed just like CPU to solve computational problems in general. By its nature as thousands of CPUs, GPU solves problems many times faster than the CPU living in the same computer.

Many scientific problems that used to be solved by expensive supercomputers are now solved in a much shorter time with personal computers that cost just a few hundred dollars. In fact, many of us have access or own such a computer at home or in work. Software systems and search engines are or being built to take advantage of the computing power of GPUs, and the use of GPUs has spread beyond scientific computations.

In this workshop, we would like to introduce to you the exciting development in the latest GPU architecture and its programming model, in particular, CUDA programming with NVidia GPU. We will study a couple of examples, and let you practice controlling a GPU (of thousands of CPUs) to solve cool problems. Though our examples are centred on photo/image processing, you can apply the skill (developing parallel C/C++ programs with Microsoft Windows) to solve other computational problems, such as computational geometry.

Prerequisites

Must be proficient in C or C++ programming language.

Topic 3

Cloud Computing with Big Data

Professor TEO Yong Meng

Department of Computer Science, School of Computing and an
Affiliate Professor at the NUS Business Analytics Centre, NUS



Prof Teo was a Visiting Professor at the Chinese Academy of Science in China from 2010–2014. He received his PhD and MSc in Computer Science from the University of Manchester in UK.

Prof Teo's recent research focuses on the performance of heterogeneous systems and formalizing emergence in complex systems. Among the awards he won the Wintersim Best Applied Paper Award in 2015, Best Paper Award at the 10th International Conference on Algorithms and Architectures for Parallel Processing in 2010. At the School of Computing, he is the leader for Systems and Network Research. He has received various research grants including European Commission, Fujitsu Computers (Singapore) Pte Ltd, Fujitsu Laboratories Ltd (Japan), Sun Microsystems/Oracle (USA), NVIDIA and PSA Corporation.

Topic 3

About the topic

This workshop exposes students to both the theory and practice of cloud computing. The learning objectives include understanding of key principles of cloud computing concepts, models, technologies and its application for big data. For projects, students will learn to develop web-based big data cloud applications.

Topics include: principles of cloud computing, key business drivers, basic concepts and terminology, technical and non-technical challenges; fundamental concepts and models, reference architecture, cloud deployment models; technologies behind cloud computing, main components in a datacenter, virtualization, multitenancy; cloud architecture, how to operate/manage resources to meet certain objectives, cloud bursting; cloud applications and paradigms, challenges in developing applications, application development models – IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service), MapReduce programming model.

Cloud-based Big Data Projects – The learning outcome

To design a big data application and to develop its implementation on a public cloud. A hackathon-like approach will be adopted to allow students to suggest ideas and form teams based on individual interests and skills. Two 3-hr lectures cover programming PaaS and SaaS IBM cloud services and pattern-based approach to design and implement big data applications. Students learn by examples with hands-on laboratories. For data, students will tap on the rich Singapore Smart Nation Open Government Data repositories.

Prerequisites

Knowledge of programming is compulsory; web programming experience will be useful.

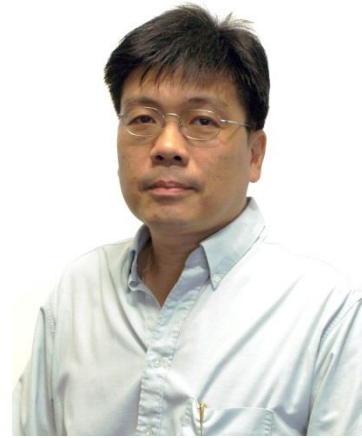
Topic?

Simulation – Allowing ‘What if?’ scenarios

Professor Gary TAN

Department of Computer Science, School of Computing, NUS

Prof Tan received his B.Sc (Hons 1st) from the National University of Singapore, and his M.Sc and Ph.D from the University of Manchester, United Kingdom. He has taught many subjects, including Digital Logic, Computer Organisation and Architecture, Unix, and programming. He has won numerous teaching awards for his teaching at NUS, and has been included in the NUS Honour Roll for teaching.



His research interests include parallel and distributed computing, parallel and distributed simulation, Traffic simulation and Crisis management. He has had over 20 years' experience in Simulation. For the past seven years, he has been actively conducting research in Distributed Simulation. Currently he is investigating into Crisis Management Simulation and Symbiotic Simulation applied to Transportation Systems. He has published over 80 refereed journal and conference papers, and has served as program committee member in many reputable international conferences, e.g. Annual Simulation Symposium, and Distributed Simulation and Real-time Applications, and Modelling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS). He is currently on the Editorial Board of the International Journal of Modelling, Simulation and Scientific Computation.

Topic?

About the topic

This workshop aims to provide students with a working knowledge of modelling and simulation. Students will learn how to apply simulation techniques to model, simulate and study systems. It covers techniques in simulation model design, input modelling, model execution and model analysis. There will also be an introduction to parallel and distributed simulation. Students will have hands-on experience using a simulation package to gain a better understanding of how simulation is applied in the real world.

The objectives of this workshop are:

- Understand how computer simulation can be used to model complex systems and solve decision problems.
- Learn to use simulation software, such as Arena, to run simulation projects from start to finish.
- Learn how to incorporate statistical methods when designing a simulation.
- Learn how to interpret and validate the results obtained from simulations.
- Communicate insights obtained from the simulation analysis to the lay audience.

Prerequisite

Students interested in this course should have basic knowledge of statistics/probability.

Cluster 3

Internet of Things and Security

**Tele-
Robotic
Deep
Learning**

**DOTA
Defense
of the
Ancients**

**Modern Agile
Full-stack
Application
Development**

Topic 1

Tele-Robotic Deep Learning



Professor Colin TAN

Department of Computer Science, School of Computing,
NUS

Prof Tan received his Ph.D. degree in Computer Science from the National University of Singapore. He has taught classes on embedded systems design, control system design, real-time operating systems, and mobile applications development. He has conducted research on unmanned aircraft for over 10 years in NUS.

His research is in autonomous control of Unmanned Aerial Vehicles, and has publications in prestigious conferences like the Guidance and Navigation Conference held by the American Institute of Aeronautics and Astronautics, and the International Conference on Autonomous Agents and Multiagent Systems (AAMAS).

Topic 1

Tele-Robotic Deep Learning

Professor SOO Yuen Jien

Department of Computer Science, School of Computing,
NUS

Prof Soo received the B.Sc., M.Sc. and Ph.D degree from NUS in year 2000, 2001 and 2006 respectively. He has since enjoyed teaching for 10 plus years to receive numerous teaching awards such as NUS Annual Teaching Excellence Award (2012/13, 2010/11, 2007/08), NUS Annual Teaching Excellence Award Honor Roll (2014); Faculty Teaching Excellence Award (2009/10, 2008/09, 2007/08, 2006/07); Faculty Teaching Excellence Award Honor Roll (2009/10). He has been inducted to the NUS Teaching Academy in 2012.



His research interests are in computer organization and computer architecture.

Topic 1

About the topic

Search and rescue operation during the aftermath of disasters / accidents is a race against time. Hazardous obstacles e.g. falling debris, high temperature, radiation leak, etc pose significant hindrance to human rescuers. The unique challenges give rise to increasing wider deployment of robotic platforms.

In this workshop, you will learn to build a robotic platform capable of scanning, mapping and exploring an unknown environment through either self- or remote-controlled navigation. Through deep learning techniques, the robotic platforms can help to identify objects in the environment and enable the human operators to make crucial decision.

Detailed learning outcomes

- Design and build circuits using various sensors (ultrasound, infrared, Lidar, temperature, light, humidity, etc), actuators (motors, sound, light, etc) and microcontrollers.
- Design and build a self-navigating robot using the sensors, actuators and microcontrollers in part i).
- Build secure network links over the cloud to control the robots, and to relay back sensor and image data.
- Build deep neural networks using industry standard tools like Tensorflow and to visualize the neural networks using tools like Tensorboard.
- Produce meaningful analytics and pattern information using the deep learning tools and data relayed back by the robots.

Topic 2

DOTA Defense of the Ancients



Professor Hugh ANDERSON

Department of Computer Science, School of Computing,
NUS

Prof Anderson received his B.Sc. from Victoria University of Wellington (NZ), M.Sc. from the University of the South Pacific (Fiji), and Ph.D. from the National University of Singapore. Since being at NUS he has won faculty and NUS-wide teaching awards. He has been involved in electronics and computing for over 40 years, taking his first University level computer course in the early 1970's, and building his first computer in 1976.

Prof Anderson has an eclectic range of skills and interests in electronics and computing, derived from his background both in industry and academia. Since 2001, he has been involved designing, and teaching, a range of computer security courses in the School of Computing at NUS. His research interests of late include working with embedded, and medical information systems.

Topic 2

About the topic

No - not DOTA, and not DOTA 2. This workshop is all about computer security. We are building a brave new world, where computer systems intrude everywhere, in your home, at your work, in your pockets. Many systems are based on truly ancient technology. We will look at how to defend our ancient systems, providing practical guidance as to how to make you, your organization, and even your country safer.

DOTA will cover topics such as: attack surfaces for Windows and UNIX based systems, Android, GSM, SCADA/PLCs networking hardware, remote car controllers; injections, cross-site scripting, overflows, classic attacks, cryptography, PKI; defenses: software techniques, design approaches, configurations, IDS.

Prerequisites

Some programming experience, and an interest in computer security. Good humor is welcome as well.

Topic 3

Building Your Dream Smart Home

Professor TAN Wee Kek

Department of Information Systems and Analytics,
School of Computing, NUS

Professor TAN is currently a Senior Lecturer in the Department of Information Systems and Analytics at the School of Computing, National University of Singapore (NUS). He is also a Fellow of the prestigious NUS Teaching Academy. He holds a Doctor of Philosophy in Information Systems and a Bachelor of Computing in Information Systems (1st Class Honours), both from NUS.

Professor TAN has more than a decade of experience in teaching students how to design and develop largescale enterprise software systems. He has also taught other courses on digital commerce, data analytics, and most recently Internet of Things (IoT). He has won both the Faculty Teaching Excellence Award and University-level Annual Teaching Excellence Award for four consecutive years (2009-2012) cumulating in him being placed on the honour roll of both awards. Most recently, he was conferred the Commendation Medal (Pingat Kepujian) by the President of Singapore on the occasion of the National Day Award 2017. His research interests primarily focus on consumer-based information technology and the design science paradigm. His work has been published in journals such as Journal of the American Society for Information Science and Technology (JASIST) and Decision Support Systems (DSS).

Topic 3

About the topic

The Internet of Things (IoT) is set to disrupt the way we live and work. In particular, smart homes that are filled with connected devices are loaded with endless possibilities to make our lives easier, more convenient, and more comfortable. Imagine that you are taking a train home on a hot summer day. But rather than turn the air conditioner on when you get home and wait for your house to cool, your smartphone reports your current location back to a home automation gateway. The gateway detects that you have left school for home, and senses that the ambient temperature in your house is on the high side. Immediately, the gateway tells the thermostat to lower the temperature and turn on the air conditioner. The next moment you know, you have stepped into the cool comfort of your house with your favorite music playing in the background!

In this workshop, you will learn how to work with single-board microcontrollers in conjunction with various connected devices such as sensors, smartphones, smartwatches, Bluetooth Low Energy beacons, and other interesting hardware to build your dream smart home. You will get to hands on with designing and developing IoT solutions that rival commercial products such as Xiaomi Smart Home, Google Home and Nest.

You will also have a chance to work in small teams to conceptualize a novel IoT idea, and then realize your idea by developing a working prototype consisting of various connected devices.

Topic 3

Preferences

Basic to intermedia software engineering, computer hardware and computer networking knowledge. Some experience with electronics and circuit prototyping using breadboard would also be advantageous.

Programming Languages

We will be using JavaScript and/or Python to program microcontrollers, and Java to program Android devices (e.g., smartphone, smartwatch and smart TV).

Reference Books

- The Official BBC micro:bit User Guide – <https://amzn.to/2HWm7pc>
- Programming the Raspberry Pi: Getting Started with Python – <https://amzn.to/2Jw9RJ6>
- Android Programming: The Big Nerd Ranch Guide – <https://amzn.to/2HTptZR>

Development Platforms

- Micro:bit – <http://www.microbit.org>
- Raspberry Pi – <https://www.raspberrypi.org>
- Android Developer – <https://developer.android.com/docs>

Getting to Know Singapore



Garden city, developed country with security stability



716 square kilometers, population 5.47 million (2014)



Temperature between 25 to 32 °C



4 official languages: English, Chinese, Malay and Tamil

4th

The fourth largest international financial center after London, New York, Hong Kong



GDP of \$51000 per capita, ranked fourth in the richest countries in the world

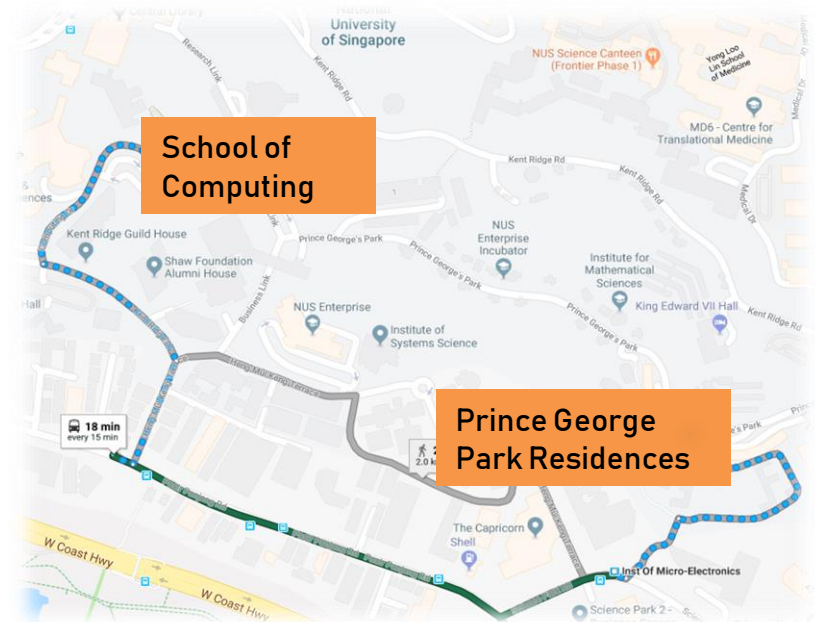


Accommodation @ NUS Campus

Prince George Park Residences (PGPR)

<http://www.nus.edu.sg/ohs/future-residents/undergraduates/pgpr/about-pgpr.php>

- Located on the eastern end of the Kent Ridge Campus
- Comfortable apartment-style living arrangement
- Within close proximity to Science Park and Kent Ridge MRT Station



Accommodation @ NUS Campus

Students will be assigned to either PGPR Type B or Type C rooms depending on their availabilities and at the discretion of the organizer. Organizer reserves the right to find alternative accommodation (on- or off-campus upon consultation with applicant) if PGPR has no more vacancy beyond its currently allocated 300 rooms.



Transportation

Singapore has a developed, well-connected urban traffic network
Students can easily get around using various modes of transport

- ◆ **NUS shuttle bus**: Free ride throughout the whole campus
- ◆ **Public bus**: Over 310 routes, each interval of 10-20 minutes
- ◆ **MRT**: 5:30am to 1:00am, 119 stations, 10 transfer stations
- ◆ **LRT**: Route 28.8 kilometers long, with about 40 stations
- ◆ **Taxi**: Make an appointment by calling or through phone apps like Uber/Grab



MRT



public bus



NUS free shuttle bus

Food

Diverse culture and rich history makes Singapore a gourmet paradise. Food lovers in this country will be spoilt for choice. You can expect to find international cuisine from all over the world. Singapore is known for the wide spread of food choices from Asian countries such as China, India, Malaysia.

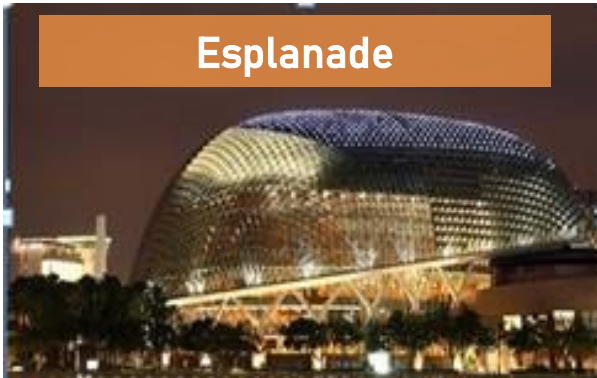
There are many restaurants and food courts in every corner of the NUS campus. Restaurants are clean and tidy. Food is affordable and delicious. Breakfast costs RMB5-10 and lunch and dinner costs RMB25-40 per meal.



Fun

Singapore has a unique style of architecture, reflecting it's rich heritage. The city is also known for its world-renowned scenic spots, your time outside the classroom would be just as electrifying!

Esplanade



Merlion Park



Garden by the Bay



Universal Studio



Chinatown



Sentosa



Annex: Application Procedure

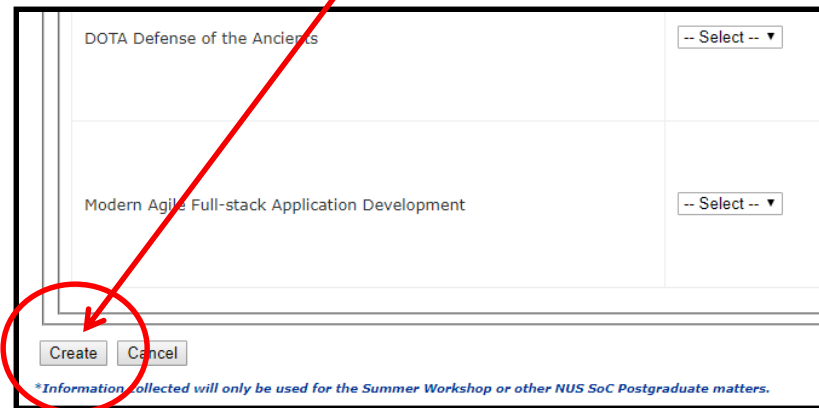
<http://www.comp.nus.edu.sg/~sws>

Application Procedure

- **Application opens from 18 January till mid April 2018**
 - Student must meet required English proficiency and academic standing. CET4 or CET6 or TOEFL or IELTS certificates
 - Applicant will be contacted within a week, and a decision will be made on the application. Email/letter of offer will be issued to successful applicant.
 - Upon accepting the offer, student will then make payment of program fee, and then be assigned to a preferred cluster as much as possible (out of 3 clusters).

To apply, enter the application portal
<https://app.comp.nus.edu.sg/app/appln/>

- Click to enter the “Apply” submenu to fill in the application form
- After completing the form, click create at the end of the form



DOTA Defense of the Ancients -- Select --

Modern Agile Full-stack Application Development -- Select --

Create Cancel

*Information collected will only be used for the Summer Workshop or other NUS SoC Postgraduate matters.

- You will be redirected to this page. A unique application account has been opened for you.

“An email with login account information has been sent to the email account that you have specified”

Create Application

New Account Created

Login ID and Password has been generated for you.

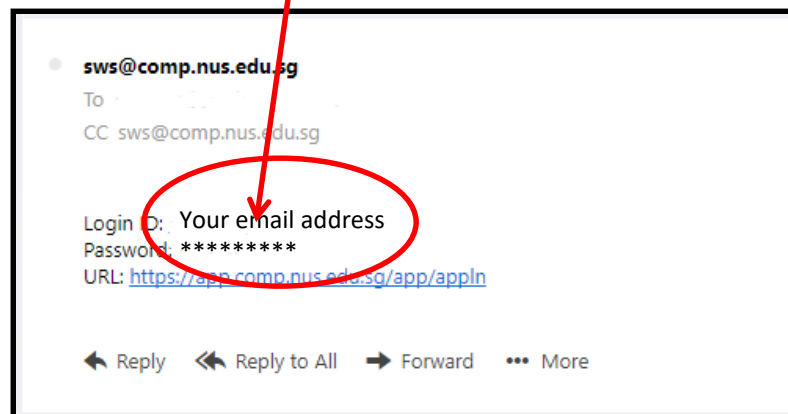
An email with login account information has been send to the email account that you have specified.

Please use this Login ID to login to *Application for NUS SOC 2018 Summer Workshop (11 July - 2 August)* to modify your personal particulars and complete your application.
Please proceed to upload a pdf file containing all supporting documents to complete your application.

Login ID:

[Enter to upload the compulsory files](#)

- Check your email for the password and login to submit your documents, you may also edit your particulars if necessary



Account Login

Login

Login ID (Email Address):

Your email address

Password:

Login

- After logging in, proceed to upload your supporting documents.
Please **combine all your documents into 1 PDF file** and upload your file.

Uploaded File

File submitted (if any)

Please combine the followings into 1 PDF file:

- China ID (both front and back)
- Academic transcript (no need to translate to English)
- English results (such as CET4, CET6, TOEFL, IELTS, etc.)
- Awards/Certificates (if any)
- Passport (if any)
- Others

Upload

- And your application is complete! You will hear from us within a week.

1. Click on "Edit" button to update your CV provided, and click on "Upload" button to upload your pdf file containing your supporting documents.

COMPULSORY DATA CHECK FOR COMPLETE APPLICATION

- STATUS: Your application has been completed

Thank You

email: sws@comp.nus.edu.sg

<http://www.comp.nus.edu.sg/~sws>