Kartik Sankaran

Address	Systems and Networking Research Lab 5		
	School of Computing		
	National University of Singapore	**Mobile Phone**	+65 92249727
	#B1-03, Computing 2, 13 Computing Drive	**Email**	kar.kbc@gmail.com
	Singapore 117417	**Date of Birth**	7th Sept 1988
Website	*http://www.cir.nus.edu.sg/kartik/*	**Status**	Singapore PR

Education

2010-2016   **Doctor of Philosophy** - School of Computing, National University of Singapore
Advisors: Assoc Prof. Chan Mun Choon and Prof. Ananda A. L.
Thesis topic: Smartphone-based Decentralized Public-transport Applications
CAP: 4.75/5

2006-2010   **Bachelor of Engineering in Computer Science** - PES Institute of Technology, Bangalore, India
Aggregate: 82.72%

Research Experience

2016-Present   **Postdoctoral Research** - School of Computing, National University of Singapore
Personalized Travel Activity Detection on Highly Resource-constrained Wearables

Developed a wearable system that detects the user's personalized high-level travel activities (e.g. home, office, lunch, bus service number) in real-time, using a memory, compute, and power-constrained TI sensor tag. The algorithm does not use any high-power location sensors, leading to a battery life of over 20 days on just a coin cell. The user can view a timeline of his/her travel activities by sync-ing the wearable using Bluetooth LE to the associated Android application. Evaluation shows higher accuracy in comparison to Google's GPS-based Maps Timeline.

2010-2016   **Doctoral Research** - School of Computing, National University of Singapore
Smartphone-based Decentralized Public-transport Applications

Proposed novel techniques for building decentralized public-transport applications on smartphones that do not require an Internet connection or a central server. The barometer sensor and local user collaboration are used to tackle the key challenges of context detection, route and transit-stop detection, and deployment of transport applications. The system makes very few assumptions about infrastructure, enabling it to work in developing countries where other approaches fail. The use of the barometer sensor makes the system independent of user hand movement and phone placement, and reduces power consumption.

2009-2010   **Bachelors Research** - PES Institute of Technology, Bangalore, India
Multi-core Implementation of Planted Motif Problem
in collaboration with Old Dominion University, Virginia, USA

Described and implemented a multi-core version of the Sagot algorithm for solving the challenging (21, 8) case of the Planted Motif Problem in bioinformatics. Evaluation on a 16-core system, and comparison to the state-of-the-art multi-core bit-based approach that requires 1 GB of memory and 1 hour execution time, shows that our algorithm is able to solve the problem in 2 hours, but using only 50 MB of memory, resulting in a 95% space saving with a trade-off of 2X running time.

Work Experience

2016-Present   **Research Fellow** - School of Computing, National University of Singapore
funded through the Singapore-MIT Alliance for Research and Technology (SMART) program

Worked on new sensing modalities for resource-constrained high-level transport activity detection on wearable tags and Android smartphones.

2014-2016   **Research Assistant** - School of Computing, National University of Singapore
funded through the Singapore-MIT Alliance for Research and Technology (SMART) program
Worked on novel techniques for public-transport applications in countries with limited infrastructure, using Android smartphones and Android watches.

2011-2014   **Teaching Assistant** - School of Computing, National University of Singapore
Teaching score: 4.75/5
6 nominations for best TA *(out of the 8 student feedback responses)*
Conducted lectures on Android programming, weekly tutorials, set and graded projects and assignments.
1. CS3103 Computer Networks and Protocols (4 semesters)
2. CS4222 Wireless Computing and Sensor Networks (4 semesters)

Software Projects

1. **Travel activity wearable tag** *(Research project)* Developed a wearable system using a TI sensor tag, that operates similar to Fitbit, but for travel activities instead of fitness activities. The user wears/carries the tag during the day, and later syncs it with the Android phone via Bluetooth LE to view the travel timeline and statistics. It makes novel use of the low-power air pressure and step counter sensors. The tag can last for over 20 days on a 600 mAh coin cell battery, running on 7 kB of free RAM and 512 kB of external flash. *[Apr 2016 - Present]*

2. **Bus tracking wearable** *(Research project)* Developed a bus tracking application for an Android smartwatch, TI sensor tag, and an Android smartphone. It detects which bus service number the user is travelling in, and tracks the location in real time. Makes novel use of the air pressure sensor for extremely low-power operation (high-power location sensors like GPS are not used) and a memory-optimized lightweight algorithm. *[Jan 2015 - Mar 2016]*

3. **DTN middleware** *(Research project)* Developed a middleware for Android that supports dynamic loading and customization of Delay-Tolerant Network (DTN) network protocols at run-time to suit diverse application requirements and network scenarios. Using the middleware, a mobile web application was developed to help wheelchair people board buses easily. The middleware was implemented using OSGi, AJAX, and remote binder IPC. *[Aug 2012 - Dec 2013]*

4. **WPA password cracking** *(Course project)* Designed and implemented a WPA password cracking tool using inexpensive GPU compute power on Amazon EC2 and Nvidia CUDA. The tool can crack 8 digit passwords in less than 2 hours, at a cost of less than $2. *[Feb 2012 - Apr 2012]*

5. **DASH video streaming** *(Course project)* Implemented a DASH-compliant client(Android)-server(Linux) video hosting service. The user can take a video on an Android tablet, and upload it to a DASH video hosting server. The video can then be played in any DASH-compliant player, such as VLC, dynamically switching between 3 streamlet qualities. *[Aug 2011 - Nov 2011]*

6. **Thread library** *(Self-interest project)* Simple user-thread library in C to demonstrate the "Many to One" multithreading model, implemented using UNIX interval timers. *[Sept 2009]*

7. **3D graphics editor** *(Self-interest project)* Simple 3D graphics editor in C++ (using OpenGL, Win32 native APIs, and the C++ standard template library), with an interface similar to Google Sketchup, to draw coloured 3D scenes. *[Jan 2009 - May 2009]*

8. **Simple bootloader** *(Self-interest project)* Simple bootloader that loads, relocates, and runs a 16 bit C++ executable into memory from a bootable CD on an Intel machine. *[2008 - 2010]*

Technical Skills

- **Languages** Java, C
- **Platforms** Android, Android Wear, TI RTOS, Contiki, Windows, Linux
- **Android app development** Contemporary app design (single activity with multiple fragments), recycler views, rich notifications, action bar, Firebase login and storage, image caching, using animations, calendar views, card views, floating action buttons, dialog fragments, fragment-fragment and fragment-service communication, responsive GUI layouts, shared preferences, showcase views

- **Android Wear 1.0 app development** Creating a standalone Wear app, displaying notifications, adding primary and additional action buttons
- **Embedded system programming** TI RTOS, Contiki, tasks, message handling, optimizing display power, SPI programming, resolving pin clashes (e.g. between screen/flash/debugger), power measurement using Monsoon power meter, optimizing memory footprint
- **Sensing** Porting and modifying sensor drivers (including loading and interacting with DMP firmware), use of environmental and motion sensors for context detection, sensor batching using hardware FIFO buffers, interfacing external sensors (e.g. 3 lead ECG heart rate sensor)
- **Bluetooth Low Energy** Slave side (sensor tag): implementing custom services and attributes, use of rapid notifications for faster data sync, beacon scanning (additional observer role); Master side (Android): scanning, connecting, and receiving notifications

Professional Affiliations and Activities

- **IEEE Member** 2011-Present
- **ACM Member** 2014-Present
- **Reviewer** IEEE TMC journal, IEEE SECON 2015 conference, ACM UbiComp 2016 conference, Elsevier ComCom journal, IJSN 2016 journal
- **Technical Program Committee** COMSNETS 2018 conference
- **Mentoring** Mentored students from NUS Singapore, MIT Boston, ETH Zurich, and SUTD Singapore during the week-long SMART Future of Science, Technology and Policy workshop on the topic of 'Smart Nation'. This included visits to the Singapore government agencies URA, LTA, MoT, HDB, PUB, NEA, and IDA to discuss the role of science and technology on public policy in Singapore (June 2016)
- **Talks** *"Personalized Travel Activity Detection on Resource-constrained Wearables"*, Future Mobility Symposium, Singapore-MIT Alliance for Research and Technology (July 2017)
- **Training** Conducted 1-day training on the Freescale HCS12X microcontroller for the staff of the PESIT computer science department (Jan 2009)

Awards

2010	**NUS Research Scholarship** NUS, Singapore, Aug 2010 - July 2014	
2009	**Intel Threading Champion Competition Award** Won Intel research lab grant to PESIT	
2008	**Prof. M R Doreswamy Scholarship Award** 1st rank in first 4 semesters of Bachelors	
2006-2010	**Distinction Awards** Distinction in every semester of Bachelors	

List of Publications

Conference

1. <u>Kartik Sankaran</u>, Minhui Zhu, Xiang Fa Guo, A. L. Ananda, Mun Choon Chan, Li-Shiuan Peh. *Using Mobile Phone Barometer for Low-power Transportation Context Detection.* Proceedings of the 12th ACM Conference on Embedded Networked Sensor Systems, SenSys Nov 2014
   (70+ citations as of March 2018)
2. <u>Kartik Sankaran</u>, A. L. Ananda, Mun Choon Chan, Li-Shiuan Peh. *Dynamic Framework for Building Highly-Localized Mobile Web DTN Applications.* 9th ACM MobiCom workshop on Challenged networks, CHANTS Sept 2014
3. Chengwen Luo, Hande Hong, Long Cheng, <u>Kartik Sankaran</u>, Mun Choon Chan. *iMap: Automatic Inference of Indoor Semantics Exploiting Opportunistic Smartphone Sensing.* 12th IEEE International Conference on Sensing, Communication, and Networking, SECON June 2015

Journal

1. <u>Kartik Sankaran</u>, A. L. Ananda, Mun Choon Chan, Li-Shiuan Peh. *Dynamic Framework for Building Highly-Localized Mobile Web DTN Applications.* Computer Communications, Volume 73A, Jan 2016
2. <u>Kartik Sankaran</u>, Mun Choon Chan, Li-Shiuan Peh. *Personalized Travel Activity Recognition and Prediction on Resource-constrained Wearables.* Ongoing submission (accepted with major revisions) to the Proceedings of the ACM Interactive, Mobile, Wearable and Ubiquitous Technologies, IMWUT 2018

References

1. **Assoc Prof. Mun Choon Chan** School of Computing, National University of Singapore
   Email: *chanmc@comp.nus.edu.sg*
   Phone: *+65 65167372*
   Web: *http://www.comp.nus.edu.sg/˜chanmc/*

2. **Prof. Li-Shiuan Peh**[*] School of Computing, National University of Singapore
   Email: *peh@nus.edu.sg*
   Phone: *+65 66011734*
   Web: *http://www.comp.nus.edu.sg/ peh/*

3. **Dr. Bhojan Anand** School of Computing, National University of Singapore
   Email: *banand@comp.nus.edu.sg*
   Phone: *+65 65167351*
   Web: *http://www.comp.nus.edu.sg/˜bhojan/*

[*]Li-Shiuan Peh was professor in the *EECS department, MIT, Cambridge, USA* till Sept 2017