

Kun-Ting Chen

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RESEARCH SUMMARY :

- Information Visualisation
- Network Layout Algorithms
- Human-Computer Interaction
- Interaction Techniques
- Visual Eye tracking Analytics
- Load Balancing Algorithms

Kun-Ting is a 3rd year PhD student at the Department of Human-Centred-Computing (HCC) at Monash University, supervised by Tim Dwyer, Kim Marriott, and Benjamin Bach (The University of Edinburgh).

Kun-Ting's research involves human-centred development of novel interactive visualisation techniques that help analysts to explore complex data. To achieve this, Kun-Ting contributed new algorithms for network visualisation, novel interaction design, and extensive empirical testing and comparative user studies to evaluate and further refine these techniques. So far, he has eight peer-reviewed publications including four ACM CHI papers, one IEEE VIS paper (2021) and other prior publications.

PHD RESEARCH :

My research concerns complex and dense data sets, such as thousands of links between data points. In such data it is difficult for data analysts in many domains to understand connectivity or clusters within the data. My work makes it easier to comprehend such data sets by improving the network layout quality and readability. Specifically, I look at network diagrams that are drawn on a 2-dimensional torus topology, a rectangular area while "wrapping" specific links around the border, like the game Asteroids where a player can leave the screen on, e.g., the right side, and reappear on the left. This allows us to create network layouts that have less link crossings and better reveal its high-level network structures. In our user studies, it clearly shows that participants were able to use such "doughnut" wrapping to identify network structures such as clusters more accurately than in standard representations.

The title for my PhD thesis is *It's a Wrap: Visualisations that Wrap Around Cylindrical, Spherical, or Toroidal Topologies*. The thesis is currently under development and is due to submit before 28 Oct 2022. The thesis contributes an exploration of visualisations that "wrap around", that is, visualisations which when interactively panned such that marks disappear from one side of the display, these marks reappear on the opposite side. Our studies demonstrate that these are useful for representation of, for example, cyclical time-series data (e.g. average hourly measurements across a 24-hour period). We explore the design space of

such visualisations, in terms of their underlying topologies: cylindrical for one-dimensional wrapping, or toroidal for two-dimensional wrapping. This design space exploration leads us to novel interaction techniques for not only such time series data, but also geographic, multidimensional and network structured data. Through a series of user studies, we find numerous benefits for such interaction, and also a number of caveats and design guidelines for future applications.

As part of my PhD, I have developed a few websites that demonstrate novel visualisations created. Each link below connects to a CHI/VIS paper:

- Making complex and dense datasets (networks) easier to understand their structures than the standard layout: <https://ialab.it.monash.edu/~kche0088/its-a-wrap/index.html>
- Charts that wrap around - Real-world examples of 2D interactive wrapping of 3D geometry & its usefulness: <https://ialab.it.monash.edu/~kche0088/WrappingChart/>
- What is the best torus network layout: <https://ialab.it.monash.edu/~kche0088/WebCola/examples/torusgraphexample.html>

EDUCATION :

- Apr, 2019—current: **Ph.D. candidate at Department of Human-Centred Computing (full time)**, Monash University, Melbourne, Australia. **Thesis submission due date: 28 Oct 2022**
- Sep, 2007—Jul, 2009: **M.Sc. in Computer Science and Engineering (full time)**, National Chiao Tung University, Hsinchu, Taiwan.
- Sep, 2002—Jun, 2006: **B.Sc. in Computer Science Engineering (full time)**, Tatung University, Taipei, Taiwan.

PUBLICATIONS :

- May., 2022: **Kun-Ting Chen**, Tim Dwyer, Yalong Yang, Benjamin Bach, and Kim Marriott. (paper conditionally accepted with a minor revision, to be shown when finally accepted) ACM CHI Conference on Human Factors in Computing Systems (CHI 2022)
- Oct., 2021: **Kun-Ting Chen**, Tim Dwyer, Benjamin Bach, and Kim Marriott. “Rotate or Wrap: Interactive Visualisations of Cyclical Data on Cylindrical or Toroidal Topologies.” IEEE Transactions on Visualization and Computer Graphics (VIS 2021)
- May., 2021: **Kun-Ting Chen**, Tim Dwyer, Benjamin Bach, and Kim Marriott. “It’s a Wrap: Toroidal Wrapping of Network Visualisations Supports Cluster Understanding Tasks.” ACM CHI Conference on Human Factors in Computing Systems (CHI 2021)
- May., 2021: Florian ‘Floyd’ Mueller, Rohit Khot, Tim Dwyer, Sarah Goodwin, Kim Marriott, Jialin Deng, Han Phan, Jionghao Lin, **Kun-Ting Chen**, Yan Wang. “Data as Delight: Eating data”. ACM CHI Conference on Human Factors in Computing Systems (CHI 2021)
- May., 2020: **Kun-Ting Chen**, Tim Dwyer, Kim Marriott, and Benjamin Bach. “DoughNets: Visualising Networks Using Torus Wrapping”. ACM CHI Conference on Human Factors in Computing Systems (CHI 2020). p1–11
- Aug. 2014, **Kun-Ting Chen**, Chien Chen, and Po-Hsiang Wang, “Network Aware Load-Balancing via Parallel VM Migration for Data Centers.” in Proc. of the 23rd International Conference on Communications and Networks (ICCCN), Aug 2014
- Sep. 2010, Shin-Shiang Lan, **Kun-Ting Chen**, Chien Chen, Jing-Ying Chen, and

Rong-Hong Jan, “An Integrated Bus and Taxi Routes for a Mobile Trip Planning System.” in Proc. of the IEEE International Conference on e-Business Engineering (ICEBE), Nov. 2010

➤ July, 2009, Chih-Chiang Yang, **Kun-Ting Chen**, Chien Chen and Jing-Ying Chen, “Market-based Load Balancing for Distributed Heterogeneous Multi-Resource Servers.” in Proc. of the 15th IEEE International conference on parallel and distributed systems (ICPADS), 2009

➤ July, 2009, **Kun-Ting Chen**, Jing-Ying Chen, “A Token-based approach of Heterogeneous multi-resource Systems.” master’s thesis, National Chiao Tung University Library, 2009

AWARDS :

➤ Nov 2021: Special Recognitions for Outstanding Reviews for ACM CHI 2022 full paper

➤ Jun 2019 - current: Faculty of Information Technology Research Scholarship

➤ Jun 2019 - current: Faculty of Information Technology International Postgraduate Research Scholarship

SUPERVISION :

➤ Jul., 2021-current: Co-supervising Monash Faculty of Information Technology research project: “Visual Software for Eye Tracking Data Analysis”

➤ Jun., 2011: Co-supervised undergraduate project in Department of Computer Science & Engineering, National Chiao Tung University: Travel Web server/Android mobile applications of Fleet system using Trip planner web services. The project was entered in European Satellite Navigation Competition (ESNC, 2011)

INTERNATIONAL CONFERENCE ORGANISING/SERVICES :

➤ IEEE Visualization Conference (VIS) Student Volunteers Organising Co-chairs (VIS 2022-2023)

➤ IEEE Visualization Conference (VIS) Student Volunteer Captains (VIS 2019-2021)

➤ EuroVIS Conference 2021 Student Volunteer Captain

➤ ACM CHI Conference 2021 Student Volunteer Captain

INTERNATIONAL JOURNAL/CONFERENCE PAPER REVIEWER :

➤ ACM CHI Conference on Human Factors in Computing Systems (CHI) – 2022, 2021

➤ IEEE Pacific Visualization Symposium (PacificVis) - 2022

➤ IEEE VR 2022

➤ IEEE Transactions on Visualization and Computer Graphics (TVCG) – 2021

➤ IEEE Visualization Conference (VIS) - 2021

➤ Visual Informatics - 2021

➤ International Symposium on Graph Drawing and Network Visualization (GD) - 2021

- IEEE International Symposium on Mixed and Augmented Reality (ISMAR) - 2021
- Visualization in Data Science (VDS) - 2021
- China Visualization and Visual Analytics Conference (ChinaVis) - 2021

PUBLIC RESEARCH TALKS :

- Oct, 2021: Presenting author at IEEE VIS 2021 conference
- Oct, 2021: Guest speaker for FIT5147 (S2) Data Exploration and Visualisation
- Jul, 2021: Guest speaker for FIT5147 (S1) Data Exploration and Visualisation
- Jun., 2021: Monash Faculty of Information Technology - Three Minute Thesis (3MT 2021)
- May, 2021: Presenting author at ACM CHI 2021 conference
- Jan, 2021: Invited seminar talk at Monash Software Engineering Lunch & Learn Seminar Series
- Jul., 2020: Monash Faculty of Information Technology - Three Minute Thesis (3MT 2020)
- May, 2020: Presenting author at ACM CHI 2020 (CHI Down Under 2020)

PROFESSIONAL EXPERIENCE :

Kun-Ting has 6 years' experience working as a software engineer, 4 years as an agile Scrum team player and device owners of Automatic Fare Collection (AFC) software, developing and maintaining mission-critical AFC software in use in production for bus and MRT systems in Singapore and Bangkok. Kun-Ting's significant software development skills and enthusiasm allowed him to successfully deploy the software applications system-wide in more than 50 Skytrain stations and depots in Bangkok Mass Transit System (BTS).

➤ **Sep, 2017-Apr, 2019 (full time): Consultant at Fare System Business Unit, System Development Division, MSI Global Pte Ltd, Land Transport Authority (LTA), Singapore**

- Device lead and full-stack software developer of Monitor and Control Workstation (MCW) software and Station Computer (SC) for Auto Fare Collection (AFC) in use in public transport in Bangkok Mass Transit System (BTS) Skytrain.
- Designed and developed web server applications for monitoring real-time, event-driven event, status and control of station equipment across multiple client applications using Apache Active MQ, C++ messaging service (CMS), and web socket
- Analysed and improved SC Windows GUI application performance and MySQL database server performance
- Designed and developed SVG-based station layout authoring tools for BTS MCW
- Introduced software visualization tool Visual Studio Code Map/IntelliJIDEA Flow to improve software design and issue discussion, debugging, and knowledge transfer

➤ **Sep, 2015-Sep, 2017 (full time): Senior Software Engineer at Zenith InfoTech (S) Pte Ltd, working at client site: Fair system department, Land Transport Authority (LTA), Singapore**

- Device lead and full-stack software developer of Master Depot Computer System

(MDCS) software for Auto Fare Collection (AFC) in use in public transport bus contracting model (BCM) in Singapore. The software was successfully deployed system-wide in more than 13 bus depots in Singapore.

- Designed and developed web applications for monitoring real-time bus communication status inclusive of information about uploading transactions from bus console UI to depot gateway (DAGW), downloading configuration parameters from MDCS, and authenticating card key version with DAGW and authentication server
- Agile tools: used Scrum, Jira, Trello to manage product development process.

➤ **Oct, 2013-Sep, 2015 (full time): Software Engineer at Trek 2000 International Ltd. Singapore**

- Software developer of Cloudstringers Media Broadcasting Ecosystem with Wifi-enabled SD Card project
- Role: chief software developer in charge of Cloudstringers web server application design and development, developing Linux shell script to automate backend media files conversion/uploading/downloading, and MySQL database update process

➤ **Jul, 2008—Dec, 2010 (part time): Assistant Engineer at Computer Vision Lab, National Center for High-Performance Computing (NCHC), Taiwan, R.O.C.**

- Developed OpenGL Graphical User Interface (GLGUI) applications (using C++) for rich text display, image display used by National center for high performance computing (NCHC)
- Developed GLGUI widget classes and functions for all GUI classes in C++

➤ **Aug, 2008—Jul, 2009 (part time): Assistant Engineer of Safety and Health Technology Center (SAHTECH), Industrial Technology Research Institute (ITRI), Taiwan, R.O.C.**

- Role: in charge of developing and maintaining four of SAHTECH's project websites including council of labor affair (CLA), Taiwan Occupational Safety & Health Management System (TOSHMS), SAHTECH official website, and internal employee website
- Developed web applications using [ASP.NET](#), DotNet framework, and MSSQL