

NUS SOC Summer Workshop 2022

Algorithm, Cloud & Security / X-Cluster

Mining Communities in Big-Data with Algorithms and Computational Thinking

Course Information

Pre-requisites

🐙 Which year of study is appropriate for your topic?

Students must have completed at least Year 2 in CS-related majors AND have done at least 2 programming courses (including data structures). Students should have curiosity and an open mind to learn and change.

🐙 What background and programming languages are required for your topic?

Students should have good programming experience with data structures, including stacks, queues, lists, trees and graphs. Students must have actually programmed with graphs and graph algorithms. And have good software development skills.

🐙 What do you think is attractive/unique about your topic to students?

This course will help you to have fun and fall in love with algorithms. This course will include mini-project where you learn to discover new knowledge that you did not know that you know or don't know. You will also learn how to be a good team player, how to give good presentations. This course will include tutorials that feature an open atmosphere for you to freely express and exchange ideas, brainstorm multiple solutions, and learn creative problem solving methods. This course will help to cultivate important attitudes and life skills – to be an independent learner, to take initiative, to develop a growth mindset.

Sample feedback from a Summer-2019 student:

"Community detection is amazing! I can't imagine that computers are more capable than human in discovering information, but this is true. They can handle a wider range of data showing us lots of indirect information from its calculations. When we analyze and try to explain our community, we will discover what we don't know. I have never realized that computer science can be so interesting. When I deal with our mini-project, I also used what I had learned before, such as programming language and discrete mathematics which applied what I have learned."

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Learning content and Teaching

🐙 What will be covered during “trial” lectures?

SWS3001 Overview & Introduction to the Course *(6 hours)

Why Algorithms is Cool and FUN. (Cool magic card trick with algorithms)

- What is Community Detection, and what can you do with it.
- Big Data Overview, Analysis and Visualization;
- Programming Lab exercise on Big Data

Assignments:

- (10%) Online Quiz DS&A
- (10%) Programming Assignment

🐙 What will be covered during the “advanced” seminars?

- Algorithms is Cool!
- CT, Creative Problem Solving, Meta-Problem Solving Skills, Unplugged activities;
- Community Detection Algorithms (Part 1-4)
- How to do a Successful Team Project
(PPSP, Plan, Milestones, Decomposition, TeamWork)
- Case Study of Algorithm Design and Analysis
- Sample Undergrad Research Project
- Problem Solving / Brainstorming Tutorial Experience
- Life Stories, Good Learning Attitudes, Initiative, Growth Mindset
- and a lot more..

🐙 What will be the nature of the project work? How do you intend to split students into project groups, each consisting of 3 or 4 students?

Students work in teams of 4. Teams are chosen by instructors to maximize diversity of university, year of study, gender. (Diversity is good!)

Each team chooses the topic and finds the data. Then they define the graph, find the communities (or clusters) in the graph. Then they look for “explanations” for clusters they

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identified and look for interesting insights that can be derived from the clusters. They will need to look for additional data to help in this step.

🐙 Do you have any recommendations for references (books) students can study to prepare for your topic before coming to NUS?

NIL. Improve your algorithms and data structure knowledge and skills.

🐙 Besides their own personal laptops, what other equipment or software would students need for your topic?

Personal laptop will be enough. Come with Open Mind to learn, to communicate.

Assessment

🐙 What forms of assessment will there be?

Background Quiz, Programming Lab (also help to do selection of students)

Participation in Class and in Tutorial Discussions

Group Project (distributed over 3 milestones).