Data61 PhD opportunity: Privacy-Enhanced Analytics on Evolving Graphs

There is a PhD opportunity with potential full scholarship available for those interested in research involving privacy-preserving graph analytics.

Project description

Graphs are typical data structures used for representing complex entities and their relationships, such as Export Supply Chains, transactions in global finance institutions, or contacts between people in a global pandemic. The applications of graph analytics to these various domains yield tremendous societal and economic benefits. Market researchers (e.g. Market Bridge, Meticulous Research) estimate the value of global graph analytics to about USD 600 million in 2019 and project its growth to USD 2 to 3 billion by 2026. While Machine Learning (ML) based graph analytics can unlock high utility, they can also reveal sensitive individual or commercially confidential information. Moreover, one key challenge in today's fast-paced digital world is the continuous streams of data by several applications, which result in highly dynamic structural changes to these graphs.

Despite many advances, the existing work in privacy-enhanced ML graph analytics assumes a static setting, and there is a lack of systematic study of the various dynamic scenarios, their complexity impact on the analysis tasks, and the challenges in building efficient systems that can support such private analytics at a large scale. The privacy concerns associated with analysis over dynamic graphs without compromising sensitive information are emerging as extremely challenging research both theoretically and practically. To this end, this PhD project aims at developing different ML-based analysis algorithms with provable privacy guarantees on evolving graphs and validating their corresponding theoretical properties and applications.

In this research, the PhD student will focus on:

(1) conduct a comprehensive survey on provably private techniques, such as differential privacy, and dynamic graph analytics,

(2) engage with cross-disciplinary partners to identify 2-3 real-world graph analytics use-cases in different application domain,

(3) develop ML-based algorithms with strong privacy guarantees for tasks such as subgraph pattern matching or node/graph classification, and develop associated private mechanisms for further sharing of sensitive model or dynamic graph training data if required, and

(4) conduct extensive experiments on the real-world use cases identified above.

The expected outputs include a novel privacy-preserving analytical framework with theoretical guarantees for sensitive dynamic graph data, and publications in high-impact conferences/journals. The project outcomes may also benefit a wider range of sectors, such as cybersecurity and health analytics.

Skills/Capability required for the project

- Bachelor's degree in Computer Science or relevant field.
- Strong mathematical knowledge, knowledgeable in graph theory and/or machine learning techniques.
- Some experience with programming languages (e.g. Python, R) and Privacy-Enhancing Technologies.

For more details and how to apply, please visit the following link

https://jobs.csiro.au/job/Various-Data61-PhD-Scholarships/796808000/?locale=en_GB