WESTERN SYDNEY UNIVERSITY

School of Computer, Data and Mathematical Sciences

HDR Seminar 30

Program

25 July 2023

12:00pm - 12:15pm	**Briefing:** A/Prof. Dongmo Zhang **Topic:** Policy updates and announcements
12:15pm - 12:45pm	**Invited Speech** **Topic:** How to Talk to a Doctor about your Innovation **Speaker:** Dr Jagdeesh Singh Dhaliwal
12:45pm - 01:05pm	**Student Presentation** **Topic:** Enhancing Precision Medicine Outcomes with Immersive VR, Real-time Analysis, and Generative AI **Speaker:** Rani Adam (PhD Candidate 22104050) **Supervisory Panel:** A/Prof. Quang Vinh Nguyen, Prof. Simeon Simoff, Prof. Paul Kennedy, A/Prof. Daniel Catchpoole
01:05pm - 01.35pm	**MPhil Completion Presentation** **Topic: Parallel Nonlinear Dimensionality Reduction Using GPU Acceleration** **Speaker:** Yezihalem Tegegne (MPhil Candidate 19201971) **Supervisory Panel:** A/Prof. Quang Vinh Nguyen and A/Prof Yu (Max) Qian
01:35pm	**Closing Remarks**

Meeting ID: 843 7276 5036
Password: CDMS
https://uws.zoom.us/j/84372765036?pwd=WHM3Y2x0cHN0bkVwTnVVb0g0R1BNQT09

Next Event: HDR Seminar
29th August 2023

How to Talk to a Doctor about your Innovation

Speaker: Dr Jagdeesh Singh Dhaliwal

Abstract:
I'm an experienced doctor and an experienced consultant to health innovators and technology companies. And so I see and experience the issues from the frontline. I see and experience examples of innovation. And I also see how these worlds often fail to communicate and so fail to help patients because of a failure to connect and to speak a common language. In this talk, I will share some conceptual principles with you which I hope will enable you to successfully connect to doctors and other healthcare professionals about how your innovations can help them to help patients.

Biography:
Dr Jagdeesh is a GP in South Eastern Melbourne with a special interest in aged care. He is the Chair of the Expert Advisory Group for Older Adults at North Western Melbourne PHN and Senior Lecturer at Monash Medical School. Jag has over twenty years experience as a GP partner in England and has served as Deputy Director of Postgraduate Medicine at Keele Medical School, Honorary Associate Professor in Health Services Management at the University of Warwick and as a Consultant Medical Adviser in Healthcare Technology Strategy to global companies including BT plc and a variety of Australian and UK SME technology companies. Jag has lectured widely in the UK, USA, Latin America and Asia and his particular interests lie in healthcare leadership, ageing and complexity and supporting new technologies and innovation. LinkedIn: https://au.linkedin.com/in/jsdhaliwal.

Enhancing Precision Medicine Outcomes with Immersive VR, Real-time Analysis, and Generative AI

Speaker: Rani Adam (Candidate ID: 22104050)

Abstract:
In recent years, there has been a growing interest in leveraging immersive virtual reality (VR) and artificial intelligence (AI) technologies to enhance healthcare practices. This study focuses on applying these technologies to advance precision medicine, which aims to provide personalized approaches for accurate diagnoses and treatment decisions. To address gaps in existing healthcare technology frameworks, this research proposes a near real-time framework that integrates immersive virtual reality, generative AI algorithms, and voice command functionality to enable more accurate and personalized healthcare outcomes. The framework primarily focuses on integrating health data and analysis using generative AI algorithms. This allows healthcare professionals to efficiently access and interpret patient information. By utilizing immersive VR technology, the framework creates an interactive and immersive environment where healthcare professionals can explore and analyze patient data, leading to a comprehensive understanding of each patient's unique circumstances and facilitating precise medical decisions. To enhance user experience and streamline the interaction process, the framework incorporates voice command functionality. This enables healthcare professionals to control and navigate the VR environment through simple voice commands, providing a hands-free and intuitive user experience. Overall, this research aims to bridge the gap between advanced technologies such as VR and AI and the practice of precision medicine. By providing healthcare professionals with a near real-time framework that integrates immersive VR, generative AI algorithms, and voice command functionality, this study seeks to revolutionize the way medical decisions are made, ultimately resulting in more accurate and personalized healthcare outcomes.

Parallel Nonlinear Dimensionality Reduction Using GPU Acceleration

Speaker: Yezihalem Tegegne (Candidate ID: 19201971)

Abstract:
The development and applications of Omics technologies are evolving rapidly over recent years and the creation and consumption of data are constantly growing. Modern omics datasets such as human genomics data are notoriously difficult to explore and analyze due to their high dimensionality and massive data amount. Understanding and exploring such complex and high-dimensional data requires innovative methods for analysis and visualization. To handle real-world data with high dimensions, its dimensionality needs to be reduced and it is a crucial step and a common practice for every data scientist and machine learning expert to apply dimensionality reduction (DR) techniques. Dimensionality reduction methods that project high dimensional data into lower dimensions, usually in two or three dimensions are commonly used. The projection methods can reduce the complexity of multi-dimensionality, reveal patterns, and identify relevant subpopulations in the data. Dimensionality reduction does not automatically reduce the existing features but has undertaken several data pre-processing steps before beginning training machine learning models. Thus, the reduced representation should have a lower dimensionality corresponding to the data's intrinsic dimensionality. This data process is an important task to reduce time and storage, helps to remove multi-collinearity which improves the interpretation of the parameters of a machine learning model and makes data visualization more effective with low dimensional data, such as 2D or 3D. The concept is to reduce the number of features or input variables in our data set without having to lose much information or variation and improve the model's performance. Dimension reduction can be done in two different ways either by keeping the most relevant variables from the original data or by finding a smaller set of new variables. Among recent dimensional reduction techniques, uniform manifold approximation and projection (UMAP) is one of the popular nonlinear dimensionality-reduction techniques, especially for omics data. It can be used for data visualization purposes by transforming high-dimensional data into low-dimensional representations. Compared with other similar approaches such as t-distributed stochastic neighbor embedding (t-SNE), UMAP is both efficient and effective. However, the current implementation of the UMPA algorithm is not parallelized, which is still relatively slow to process huge omics datasets with multi-millions or more items. To overcome this problem, we propose and develop a new method that optimizes the implementation of the UMAP algorithm with parallel processing on the GPU-RAPIDS platform. Graphical Processing Units (GPUs) are more effective and powerful for parallel processing due to their high number of cores per unit in comparison with CPUs. Our experiments on both benchmarking and real datasets show that the proposed method improved the computational speed by more than a hundred times than the original UMAP method. While UMAP is a random process and the layout is slightly different each time, our method preserves the output quality as in the original CPU-based algorithm. The proposed approach will allow researchers and medical domain users to run UMAP to analyze and visualize much bigger real datasets that otherwise could not be done without using a down-sampling step.