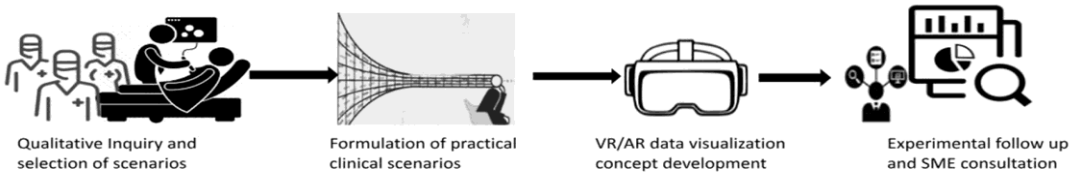
Augmented Reality for Immersive Clinical Data Visualization: Insights from Medical Students and Early Translational Researchers

Neha Sundar Naik[1], Zhonglin Qu[1] , Quang Vinh Nguyen [1,2],
Simeon Simoff[1,2], Paul. J Kennedy[3], Daniel Catchpoole[1,3,4]

[1] School of Computer, Data and Mathematical Sciences, Western Sydney University, Parramatta, Australia
[2] The MARCS Institute for Brain, Behaviour and Development, Westmead, Australia
[3] School of Computer Science, University of Technology Sydney, Australia
[4] Kids Research, Sydney Children's Hospital Network, Westmead, Australia

Augmented reality (AR) has been widely explored and applied in surgical procedures and various 3D clinical contexts, particularly for training purposes. However, its potential in pre-clinical, lab-based research remains relatively underexplored, specifically in the data visualization domain. To explore its application in basic and translational research for understanding complex omics and biomedical data, we used standard features of the HoloLens 2 including the 'Tips' module, along with the Virtual Reality for the Observation of Oncology Model (VROOM). Beyond feature evaluation for data analysis tasks, including comparison, rotation, overlaying, and zooming within current genomic and bioinformatics data visualizations, this study examines their practical clinical utility. It also aims to see how immersive functionalities contribute to analytical reasoning and facilitate data interpretation of complex biological data more effectively.

Method: We engaged two groups of participants - medical students (n=9) and early-stage translational researchers (n=5) from India and Australia. The medical students were in their second or third year of study, while the doctoral students were conducting research within specific subfields of medicine, primarily involving wet lab work and data analysis. Using Microsoft HoloLens 2, we explored their perspectives on the relevance and potential integration of augmented reality into their academic work and clinical research workflows. The in-person interviews included open-ended questions and practical engagement with the HoloLens 2 device. (This is an ongoing study, with plans to expand participation to include clinicians and individuals from other countries)



Study Aim

- Unraveling clinical context, gaining domain experts' perspectives around tasks and interaction with technology.
- Analyze individual features in isolation, such as search trends, specific visual representations like heatmaps and identify opportunities for enriching existing workflows to leverage the application of design-driven solutions within immersive environments.

Study	Objective	Method
Preliminary Study	Understanding level of genomic knowledge and proficiency among clinicians	survey questionnaire Study similar to Schaibley et al., 2022
Modelling Resilience in Clinical Decision-making	To prompt discussion around automated systems under the clinical team's oversight	Qualitative – Interviews Discussions with domain experts
Immersive Interactive Genome Visualization - Exploring Heatmaps and Visual Search	1. Examines the relevance of heatmap visualization in supporting data interpretation or decision-making 2. Exploration of visual search trends aimed at improving data discoverability in AR interfaces	Perspective-based usability inspection (Frame creation process model) Scenario mapping technique
Planned: Working with voice commands and background music	1. Insights into prompt Engineering 2. Exploring impact of audio–visual modalities on clinical tasks	Experimental studies

Contributions

1. Cognitively efficient visualization system to advocate data exploration and collaboration.
2. Unbiased scrutiny of algorithm-based decision support systems. Immersive workflows to enrich interaction and collaboration.
3. The findings of the research will open new pathways for researchers to develop AR/VR applications that are clinically relevant, specifically in identification and development of empirical visualization strategies for omics and biomedical scenarios.
4. An explicit contribution of this study is conceptual design strategies with more nuanced details on requirements, framework and standardization for bioinformatics visualizations and dashboards.