Tumour Evolution in Augmented Reality: Understanding Genomic Complexity

Tamsin Robb1, Bianca Haux2, Cherie Blenkiron1, Peter Tsai1, Kate Parker1, Braden Woodhouse1, Alexei Drummond3, Alex Gavryushkin4, Mike Davis5, Uwe Rieger5, Nick Young2, Jack Guo5, Jane Reeve6, Cristin Print1, Ben Lawrence1

1 Faculty of Medical and Health Sciences, University of Auckland, New Zealand 2 Centre for eResearch, University of Auckland, New Zealand 3 Centre for Computational Evolution, University of Auckland, New Zealand 4 Biological Data Science Lab, University of Otago, New Zealand 5 School of Architecture, University of Auckland, New Zealand 6 Radiology, Auckland District Health Board, New Zealand

Background

• Understanding tumour heterogeneity and evolution remain fundamental challenges in cancer.
• Decreasing DNA sequencing costs have enabled more multi-site cancer genomic and evolutionary studies.
• Novel visualization techniques are required to better understand and investigate complex metastatic cancer studies.

Clinical Timeline

Lung NET diagnosis 2007
Eye tumour 2014
Brain progression 2015
Brain progress 2016
Patient passed away 2017

Evolutionary Tree

A Rare Research Opportunity

A patient with highly disseminated lung neuroendocrine tumour requested and consented to rapid autopsy, providing an opportunity to study tumour evolution and heterogeneity in a single patient. We have created an interactive Augmented Reality visualisation to follow disease progression and genomic data by anatomical site.

Methods

A call for novel visualisation strategies

10 years of clinical data
22 clinical imaging scans
89 tumours
358 sampled locations
44 sites with genomic data
20 anatomical locations

3D skeletal model segmented from CT scans
3D tumour models across key time-points extracted from CT scans
3D spheres placed as locations of genomic sampling sites

Augmented Reality

• Microsoft Hololens: a self-contained holographic computer
• Presents a holographic projection overlaid into the real world
• Interactive, using hand gestures and voice commands
• Highly collaborative, with many users able to discuss and interact at the same time.

Experience Cancer Evolution in Augmented Reality

Participate during the Poster Session:
4:30-5:30pm on Friday