Curtin HIVE Intern Showcase

Program
23 February 2016

Introduction

The Curtin HIVE Summer Internships provided an opportunity for students to gain valuable research project experience in visualisation related topics. Interns were supervised by leading researchers and undertook challenging research projects utilising the resources provided by the Curtin HIVE. Supervisors and sponsors benefited from the opportunity to explore new techniques and technologies for their research area.

Program
Tuesday, 23 February 2016

9.00 – 9.10	**Opening remarks**
9:10 - 9:30	**Jake Hammelswang** Visualization of Large 3D Seismic Surveys, Northwest Shelf, Australia
9:30 - 9:50	**Tahlia Downes** Interactive visualisation of 3D hydrogeology model of Perth Basin
9:50 - 10:10	**Jaiyi Zhu** MINECRAFT EDU Projection and Input Data
10:10 - 10:30	**Bryan Kwok** Virtual Brain Serious Game
10:30 - 10:50	**Break**
10:50 - 12:00	**Demonstrations**
12:00 - 01:00	**Lunch**
1:00 - 1:20	**Sonia Yap** 3D HCI: 3D User Interaction in VTK
1:20 - 1:40	**Aiden McIntosh** A study of movement and perception relative to eccentricity in the visual field
1:40 - 2:00	**Adam Greenfield** 3D Photographic Archive Visualisation (PAV 3D)
2:00 - 2:20	**Marcia Schneider** Juxtaposing Historical Panoramas with the Modern Day
2:20 - 2:40	**Break**
2:40 - 3:50	**Demonstrations**
4:00 pm	**Close**

Abstracts

Jake Hammelswang
Visualization of Large 3D Seismic Surveys, Northwest Shelf, Australia

Australia's Northwest Shelf is a premier hydrocarbon province with a complex geological history. This western margin is characterized by 4 main tectonic events including; pre-rift sedimentation during the Silurian to Toarcian, a syn-rift phase from the Toarcian to Valanginian, a post break-up subsidence phase from the Valanginian to Santonian, and finally passive margin conditions from the Santonian to present day. To accurately assess some of these key tectonic events seismic mapping of stratigraphic horizons on a regional scale was needed. The primary horizons used to qualitatively study these events were the current day seabed, Windalia Radiolarite, Late Cretaceous Unconformity, the Muderong Shale, Upper Barrow Group, and the Mungaroo Formation. These intervals represent a substantial time period ranging from the Late Triassic to present day. Additionally, the study of these horizons showed a lack of post-rift inversion within the study area, minor extension throughout the Tithonian time interval, and underlying structural controls within the Triassic Period.

Tahlia Downes
Interactive Visualisation of 3D Hydrogeology Model of Perth Basin

A 3D printable model of the Perth aquifer system was created to encourage an improved intuitive grasp of the complex multilevel structure, spanning many thousands of kilometres. The jigsaw like model is separated at significant surfaces allowing tactile interrogation for educational and research purposes. Producing a printable model forced an interpretation of the extent and volume of significant units into tangible objects and highlighted gaps in data where other explanations are plausible compared to previous digital models. Newly acquired geophysical data has been incorporated into a digital model of the Gnangara Mound region showing subsurface structures that update previous models. The printed model is intended to facilitate robust discussion on key concepts as post Neocomian faulting of the Badaminna fault system and possible impacts on basin hydraulics. Interpretation of geophysical imagery was aided by the ultra-high resolution tiled display at the Hub for Immersive Visualisation and eResearch, Curtin University.

Jiayi Zhu
MINECRAFT EDU Projection and Input Data

The project aims at developing a simple but highly interactive Minecraft environment and project onto a wall in Curtin Library makerspace which will encourage players to explore the campus and related library/John Curtin Library information. Curtin library, especially maker space, would like to introduce Kinect and Minecraft Edu to people, not just the software and hardware, but also things behind it. Therefore exploring what can be done with Minecraft Edu as a learning tool is also part of the goal. As most of the game uses traditional methods such as keyboard and mouse to interact with users, it is considered as not interesting and therefore cannot attract players' interest for a long period of time. Thus developing a new interactive way of playing games can be used as teaching tool. Minecraft Edu allows students to enjoy the fun of playing game while they can still learn corresponding knowledge which is the primary goal of this project.

Bryan Kwok
Virtual Brain Serious Game

The aim of this project was to create a functional and working 3D brain that could be visualised and explored. The initial plan was to use MRI/CT brain scan data and discover a

method to import those into the game development engine known as Unity for the brain to render as a volume. A mixture of the use of medical programs for brain visualisation and brain segmentation and the use of miscellaneous programs such as Blender were used in this project. Through the use of a ray-cast drawing model developed by a user of the Unity forums and the provided brain scan data, it was possible to create an interactive 3D brain from a set of brain scan images. The final product is a rotatable 3D brain model that has the ability to be cut at certain locations. A game has also been developed beside the 3D brain to accompany it and expand its list of functionalities.

Sonia Yap
3D HCI: 3D User Interaction in VTK

The three-dimensional (3D) visualisation of business risk maps could provide a new way of analysing data which is not achievable in a two-dimensional (2D) form. However, to achieve an immersive 3D visualisation experience the user should be provided with intuitive ways of interacting with the 3D visualisation. This project explores the different ways in which the user can interact with the 3D environment, primarily with a 3D cursor allowing the user to select nodes in the graph, reviews the existing techniques used to integrate 3D interaction devices with the Visualization Toolkit (VTK), and considers how to apply them for interacting with 3D risk maps. The potential solutions explored were to integrate the VRPN (Virtual Reality Peripheral Network) with VTK to use any VR device supported by VRPN, or to extend on VTK's existing 3DConnexion functionality. By creating an intuitive user interface, users would be free to explore and analyse the data without the limitations of the 2D cursor.

Aiden McIntosh
A Study of Movement and Perception Relative to Eccentricity in the Visual Field

The aim of this project is to explore the cortical responses to foveal and peripheral vision of the typical human using the HIVE Dome. Current understanding is that static perceptual information is optimally processed in the foveal and parafoveal regions of the visual field, while movement related information is processed peripherally. We plan to use both static and moving targets to test the static visual perception and visual movement detection across the entire visual field. Specifically both static and moving visual targets will be presented to a participant within the Dome display while eye movements are tracked. The system will interact with the eye tracking device to ensure stimuli are gaze contingent (i.e., eccentricity of targets to the foveal centre of vision will be managed in real time). Visually evoked potentials (VEPs) to visual stimuli have been measured using electroencephalography (EEG). This project will enable understanding on how humans typically process different types of stimuli and how they are processed in different parts of the visual field. The study will provide baseline data for studies of typical and atypical visual development.

Adam Greenfield
3D Photographic Archive Visualisation (PAV 3D)

The 3D Photographic Archive Visualisation (PAV 3D) was a project centered around taking historical photographs from the archival databases of the State Library of Western Australia (SLWA) and conveying them in a 3D interactive environment. Seeing as most businesses with large visual databases (make up most of the big data online) are currently converting their resources to be conveyed through Virtual Reality, It has only begun to be used by state libraries (such as the New South Wales Library, through LOOM) as a tool in order to make their resources more accessible and visually appealing to the public. The Oculus Rift and Unity 3D engine have allowed people to make their own virtual environments and visualisations of content, making it an open resource for companies aiming to create eye-popping imagery. What PAV3D aimed to do was to make sense out of the random nature of

the Library's archives, by making a set of environments, which offered a more efficient and appealing way of exploring, viewing and categorising photos from the Libraries vast archives. What this leads to is an entirely new method not only to view, but to further understand the flourishing history of Western Australia.

Marcia Schneider
Juxtaposing Historical Panoramas with the Modern Day

In an attempt to bring to light the historical photographic archives of the State Library of Western Australia, Juxtaposing Historical Panoramas with the Modern Day aims to present the content of the archives in an immersive, engaging way. The project involved sourcing historical panoramic photographs of Perth, Fremantle and surrounds from the State Library's pictorial collections as well as exploring a number of other sources. Over 100 historical panoramas were found, many of which were originally photographed in parts and had to be merged digitally to form seamless panoramic images. A sample set of 10 historical panoramas was then selected and the exact locations of each identified. Nine of these locations were able to be accurately re-photographed; three of which required the use of a drone for accurate re-creation, two of which were taken in 2015 and sourced from other photographers as the sites are no longer accessible. The historical and modern day panoramas were then used to create a virtual tour, allowing the user to toggle between past and present while navigating their way through Perth and Fremantle.