



Information Visualisation

-**ONLINE**-25th International Conference Information Visualisation

5 - 9, July 2021

University of Technology Sydney • Sydney • Australia •

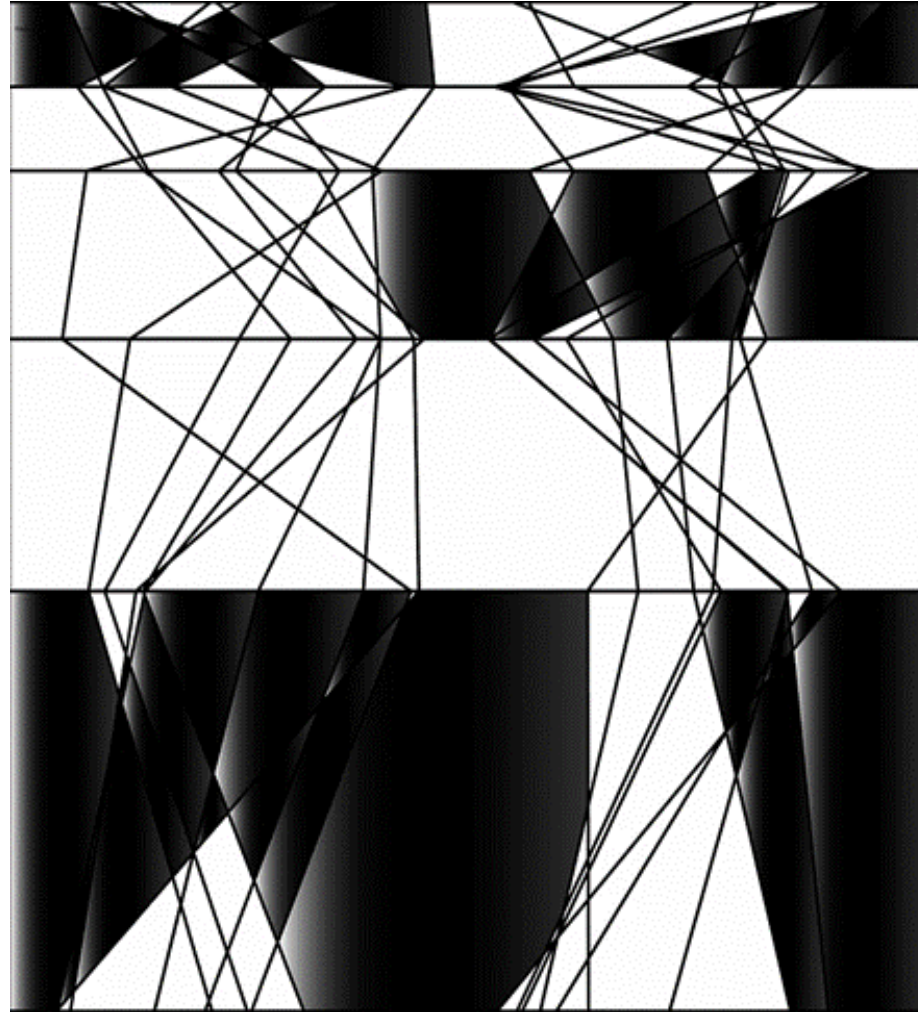
ONLINE

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The

**C O N F E R E N C E
P R O G R A M M E**

Fibonacci
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IV21& CGiV21 | DIGITAL ART GALLERY | Online Exhibition
5 - 9, July 2021

VIRTUAL GALLERY VENUE
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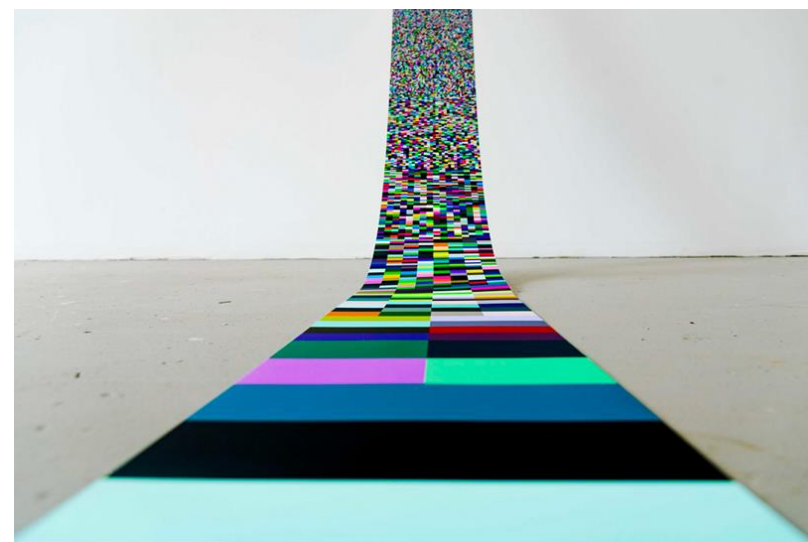
Exhibiting Artists

Amay Katharina
Anastasiia Raina,
Meredith Binnette,
Danlei Huang,
Yimei Hu,
Georgie Nolan
Anna Chupa
Bogdan Soban
Bonnie Mitchell
Chiara Passa
Corrine Whitaker
Crystal Zhen
Hans Dehlinger
Jen Grey
Jing Zhou
John Labadie
Mimi Smith

Nancy Wood
Raymond St Arnaud
Robert Lisek
Santiago Echeverría,
Roger Brown
Anna Ursyn,
Stuart Smith
Matjuška Teja Krašek
Victoria Lee
Madi Spillman



UNIVERSITY OF
NORTHERN
COLORADO



Tend Towards Infinity
© Bogdan Soban

IV21& CGiV21 |
20th Computer Animation & Especial Effects Show |
Online Show |
5 - 9, July 2021

Animation Films:

IV2021- Festival

Belgium: Le Petit Chef

Brazil: Umbrella

Canada: Mia & Morton
The Old Lady

France: Luchador

India: Feel the Punch (Flashback Favourite)

Italy: Arturo and the Seagull

Norway: Reaping for Dummies

Poland: Gordon Goose (Flashback Favourite)

South Korea:
Bernard and the Revolving Door (Flashback Favourite)



USA: A Fistful of Presents
The Right Way
Wig-Less
Suffer For Your Art (Flashback Favourite)

Wales: Fetch (Flashback Favourite)

15th Doctoral Research Workshop Information Visualisation

Organised by

Information Visualisation Conference

In cooperation with

University of Technology Sydney • Sydney • Australia •

The Information Visualisation Conference (IV) is an international conference that aims to provide a foundation for integrating the human-centered, technological and strategic aspects of information visualisation to promote international exchange, cooperation and development. Building upon the reported success of previous years' workshop, IV-Forum is pleased to announce the "**15th Doctoral Research Workshop**" which will run as part of the 25th International Conference on Information Visualisation.

Doctoral Research workshop

This workshop focuses on the issues that doctoral students face during their studies and includes the following interactive sessions – the theme for this year workshop are on:

1. "**Using RMarkdown to create interactive reports, data visualisation and animation**", Maria Prokofieva, and Amanda Cole, Swati Gupta, and Jhoanna Cobo , Victoria University, Melbourne, Australia.
2. "**Design Your (Academic) Future**", Sebastian Kernbach, Creativity and Design Center, University of St. Gallen, Switzerland
3. "**Tree Visualization - History & Future**", Mao Lin Huang, University of Technology, Sydney, Australia,; and Quang Vinh Nguyen, University of Western Sydney, Australia
4. "**Visual Analytics of Omics Data**", Quang Vinh Nguyen, University of Western Sydney, Australia; and Mao Lin Huang, University of Technology, Sydney, Australia

Monday 5 July 2021

Central European Time - CET (UTC + 2) – Summer Time		Australian Eastern Standard Time – AEST (UTC+9)	
07:00	Pre-session checks		15:00
07:30	Zoom-Room < AEST (UTC+9) Time > Monday 5 July 2021		15:30
-	<u>Doctoral Research Workshop</u>		-
09:30	Chair/co-chair: prof. Mao Lin Huang, / Dr Yifei Dong, UTS, AUS		17:30
	RESEARCH WORKSHOP – PART I		
	Using RMarkdown to create interactive reports, data visualisation and animation		
	<u>Maria Prokofieva, and Amanda Cole, Swati Gupta, and Jhoanna Cobo</u> , Victoria University, Melbourne, Australia		
	Session Recording – Unedited version: https://drive.google.com/file/d/1Zqj9VLzoljaGIzDvJD_7dapnnTENAd1O/view?usp=sharing		
09:30	Zoom-Room< AEST (UTC+9) Time >		17:30
	<i>Break</i>		
10:00	Zoom-Room< AEST (UTC+9) Time > Monday 5 July 2021		18:00
-	<u>Doctoral Research workshop</u>		-
12:00	Chair/co-chair: prof. Ebad Banissi, LSBU, UK / Prof. Tony (Weidong) Huang, UTS, AUS		20:00
	WORKSHOP – Part II		
	Design Your (Academic) Future		
	<u>Sebastian Kernbach</u> , University of St. Gallen in Switzerland		
	Session Recording – Unedited version: https://drive.google.com/file/d/1Y6H6zA-1xlbCYYF8cxngUYT74LJ2oFL5/view?usp=sharing		
12:30	<u>Doctoral Research Workshop</u>		20:30
-	WORKSHOP – Part III		-
15:00	Chair/co-chair: prof Maria Prokofieva, Victoria University, Melbourne, Australia // Prof Ebad Banissi		23:00
	Tree Visualization - History & Future		
	<u>Mao Lin Huang</u> , University of Technology, Sydney, Australia;		
	<u>Quang Vinh Nguyen</u> , University of Western Sydney, Australia		
	Session Recording – Unedited version: https://drive.google.com/file/d/1264vOCd17xjqvnbFjC0I443hnGyZ5dj/view?usp=sharing		

Tuesday 6 July 2021

Central European Time - CET (UTC + 2) – Summer Time		Australian Eastern Standard Time – AEST (UTC+9)	
06:30	Pre-session checks		14:30
07:00		Zoom-Room< AEST (UTC+9) Time > Tuesday 6 July 2021	15:00
-	<u>Doctoral Research Workshop</u>		-
08:30	WORKSHOP – Part IV Chair/co-chair: Prof. Tony (Weidong) Huang, UTS, AUS		16:30
	“Visual Analytics of Omics Data” <u>Quang Vinh Nguyen</u> , University of Western Sydney, Australia; <u>Mao Lin Huang</u> , University of Technology, Sydney, Australia Session Recording – Unedited version: https://drive.google.com/file/d/1NOeaf79aZf1Un9qLdP3kN7SVgXhb_xn7/view?usp=sharing		
08:30			16:30
9:00		Zoom-Room< AEST (UTC+9) Time > Tuesday 6 July 2021	17:00
-	Opening & Welcome		-
10:30	Chair: Mao Lin Huang, University of Technology, Sydney, Australia Professor Didar Zowghi, Deputy Dean, Graduate Research School, University of Technology Sydney Prof Tony Huang, UTS, Australia Prof. Ebad Banissi, LSBU, UK Prof. Kawa Nazemi, Darmstadt University of Applied Sciences, Germany Prof. Boris Kovalerchuk, Central Washington University, USA John Counsell, France		18:30
	Session IV21__1.1: Information Visualisation _ Visualising our future communities Chair//co-chair: Prof. João Moura Pires, Univ. NOVA de Lisboa // Dr. Ana Paula Afonso, Univ. Lisboa, Portugal <u>KEYNOTE LECTURE</u> The development of immersive visualisation experiences Case study presentations from the Master of Animation and Visualisation <u>Ian Thomson</u> , Head of the UTS Animal Logic Academy <u>Professor Andrew Jonston</u> , co-director of the UTS Visualisation Institute Session Recording – Unedited version: https://drive.google.com/file/d/1BbYiH9AkWHGuAe_zxaDxgZ0FCYDrO2_B/view?usp=sharing		
10:30	<i>Break</i>	Zoom-Room< AEST (UTC+9) Time >	18:30
10:45		Zoom-Room< Central European Time - CET (UTC +2) > Tuesday 6 July 2021	18:45
-	Session IV21_1.2: Visual Analytics and Data Science		-
11:45	Chair//co-chair: Prof. Kawa Nazemi, / Midhad Blazevic, Darmstadt University of Applied Sciences, Germany Session Recording – Unedited version: https://drive.google.com/file/d/1GUqZHgX4I2Tt2R51NnfFyOVgsxPalhfS/view?usp=sharing pid101 - Localization of Emotion via EEG Analysis using 3D Trilateration <u>Hayfa Blaiech</u> ¹ , <u>Nouredine Liouane</u> ¹ , <u>Med Ali Saafi</u> ² ¹ Ecole Nationale d'Ingenieurs de Monastir; ² Hopital sahloul sousse Keywords: Trilateration; Localization; EEG signals; Emotion.		19:45

		<p>pid105 - A Visualization Method for Training Data Comparison <u>Karen Kosaka</u>, Takayuki Itoh Ochanomizu University, Japan <i>Keywords:</i> Training Data, Visualization, Transfer Learning, Machine Learning</p> <p>pid123-Visual Analytics and Similarity Search - Interest-based Similarity Search in Scientific Data <u>Midhad Blazevic</u>, Lennart B. Sina, Dirk Burkhardt, Melanie Siegel, Kawa Nazemi Darmstadt University of Applied Sciences, Germany <i>Keywords:</i> Visual Analytics, Similarity, Collaborative Systems, Trend Analytics, Visual Business Analytics POSTER</p> <p>pid114 Visualisation for social media analytics: landscape of R packages <u>Atousa Ghahramani</u>, Maria Prokofieva Victoria University, Australia <i>Keywords:</i> Visualization, R, Network Science, social media, Analytics</p>		
11:45		<p style="text-align: center;">Zoom-Room < Central European Time - CET (UTC +2) ></p> <p><i>Break</i> <i>Informal < Online Networking Activities ></i></p>	19:45	
12:00 - 13:00		<p style="text-align: center;">Zoom-Room < Central European Time - CET (UTC +2) > Tuesday 6 July 2021</p> <p>Session IV21_1.3: Artificial Intelligence and Application Chair/co-chair: Prof. Razvan Andonie, / Prof. BORIS KOVALERCHUK, Central Washington University, USA Session Recording – Unedited version: https://drive.google.com/file/d/13q2AH2dbZz3ciyLQabni9kauhKmWVx8O/view?usp=sharing</p> <p>pid150 - Context-Sensitive Visualization of Deep Learning Natural Language Processing Models <u>Andrew Dunn</u>¹, Diana Inkpen², Razvan Andonie¹ ¹Central Washington University, United States of America; ²University of Ottawa, Canada <i>Keywords:</i> Natural Language Processing, Transformers, BERT, Visualization of Neural Networks</p> <p>pid153 - Discovering Interpretable Machine Learning Models in Parallel Coordinates <u>Boris Kovalerchuk</u>, Dustin Hayes Central Washington University, United States of America <i>Keywords:</i> Interpretable machine learning, parallel coordinates, hypercube, hyper-block, decision tree</p> <p>pid154 - Full interpretable machine learning in 2D with inline coordinates <u>Boris Kovalerchuk</u>, Hoang Phan Central Washington University, United States of America <i>Keywords:</i> interpretable machine learning, classification, regression, visual knowledge discovery.</p> <p>pid159 - Visualization and Visual Analytics of Big sequential data <u>Carson Leung</u> University of Manitoba, Canada <i>Keywords:</i> Big data Visualization, Visual Analytics</p>	20:00 - 21:00	

Wednesday 7 July 2021

Central European Time - CET (UTC + 2) – Summer Time		Australian Eastern Standard Time – AEST (UTC+9)	
07:00	Pre-session checks		15:00
07:30	Zoom-Room< AEST (UTC+9) Time > Wednesday 7 July 2021		15:30
-	Session IV21_2.1: Information Visualisation – Theory & Techniques		-
08:30	Chair/co-chair: prof. Mao Lin Huang, / Dr Yifei Dong, UTS, AUS		16:30
	Session Recording – Unedited version: https://drive.google.com/file/d/11ClajKrXFIJ1pjp6nXCCnmAwVUGO-22b/view?usp=sharing		
	pid141 - ContourDiff: Revealing Differential Trends in Spatiotemporal Data Zonayed Ahmed , Michael Beyene, Debajyoti Mondal, Chanchal Roy, Christopher Dutchyn, Kevin Schneider University of Saskatchewan, Canada Keywords: Spatiotemporal Data, Change Detection, Contour Plot, Vector Overlay		
	pid126 - ARViz: Interactive Visualization of Association Rules for RDF Data Exploration Aline Menin , Lucie Cadorel, Andrea Tettamanzi, Alain Giboin, Fabien Gandon, Marco Winckler Univ. Côte d'Azur, CNRS, Inria Keywords: association rule mining, interactive visualization, knowledge graph visualization, RDF visualization, COVID-19		
	pid103 - Multidimensional Data Visualization for Investigation of Skin Transparency Ami Tochigi , Takayuki Itoh Ochanomizu University, Japan Keywords: Human Skin, Transparency, Sensory Evaluation, Image Analysis, Multidimensional Data Visualization		
	pid102 - Visualization of sub-network sets by iterative graph sampling from large scale networks Namiko Toriyama ¹ , Mitsuo Yoshida ² , Takayuki Itoh ¹ ¹ Ochanomizu University, Japan; ² Toyoashi University of Technology Tokyo, Japan Keywords: Visualization, Large-scale network, Sampling		
8:30	Zoom-Room< AEST (UTC+9) Time >		16:30
-	<i>Break</i>		
09:00	<i>Informal < Online Networking Activities ></i>		
09:00	Zoom-Room< AEST (UTC+9) Time > Wednesday 7 July 2021		17:00
-	Session IV21_2.2: Future Built Environment		-
10:30	Chair//co-chair: Prof. Farzad Khosroshahi // Dr. Mengbi Li, i, Victoria University, AUS		18:30
	Session Recording – Unedited version: https://drive.google.com/file/d/15QkhemX8jOn78ndepr0-8oei6PTjPZl/view?usp=sharing		
	KEYNOTE LECTURE Ambient Intelligence: A Trans-disciplinary Model of Innovation for the Built Environment Professor Tuba Kocaturk School of Architecture and Built Environment, Deakin University, Australia		
	KEYNOTE LECTURE The Changing Nature of Property and Construction Industries at Digital Transformation Professor Dr Yusuf Arayici		

	Northumbria University, UK		
10:30	Zoom-Room< AEST (UTC+9) Time > <i>Break</i> <i>Informal < Online Networking Activities ></i>	18:30	
10:45 - 11:45	Zoom-Room< Central European Time - CET (UTC +2) > Wednesday 7 July 2021 Session IV21_2.3: Information Visualisation – Theory & Techniques Chair/co-chair: John Counsell, Counsell Consultancy, FR // Prof. Nuno Miguel Soares Datia, ISEL - Instituto Politécnico de Lisboa, Portugal Session Recording – Unedited version: https://drive.google.com/file/d/1vqIS5V3H-C_aKXSzo7Gy4bMidJEzTBsb/view?usp=sharing pid127 - Towards a Visual Approach for Representing Analytical Provenance in Exploration Processes Aline Menin¹, Ricardo Cava², Carla Maria Dal Sasso Freitas², Olivier Corby¹, Marco Winckler¹ ¹ Univ. Côte d'Azur, CNRS, Inria; ² Federal University of Rio Grande do Sul, Institute of Informatics <i>Keywords:</i> Analytical provenance, Multiple views, Chained views, Multidimensional data exploration, Provenance visualization pid130 - Automatic creation of a Vowel Dataset for performing Prosody Analysis in ASD screening Rita Francese, Maria Frasca, Michele Risi University of Salerno, Italy <i>Keywords:</i> Audio signals, autism spectrum disorder, convolutional neural network, deep neural network. pid106 - Analysis of Deep Neural Networks Correlations with Human Subjects on a Perception Task Loann Giovannangeli, Romain Giot, David Auber, Jenny Benois-Pineau, Romain Bourqui LaBRI, UMR CNRS 5800, University of Bordeaux, France <i>Keywords:</i> Information visualization, Deep learning, User evaluation, Correlations, Automated evaluation IV2021-IVapp: Applications of Information Visualization pid158 - μViz: Visualization of Microservices Sara Silva, Jaime Correia, Andre Bento, Filipe Araujo, Raul Barbosa University of Coimbra, Portugal <i>Keywords:</i> Microservices, workflows, visualization, tracing, dashboards.	18:45 - 19:45	
11:45	Zoom-Room< AEST (UTC+9) Time > <i>Break</i> <i>Informal < Online Networking Activities ></i>	19:45	
12:00 - 13:00	Zoom-Room< Central European Time - CET (UTC +2) > Wednesday 7 July 2021 Session IV21_2.4: Visualisation Chair/co-chair: Prof. Rita Francese, // Dr. Loredana Caruccio, University of Salerno, Italy Session Recording – Unedited version: https://drive.google.com/file/d/1NXfeBXCjryHVFawQc5KdCrWOOPG65CKo/view?usp=sharing pid108 - Approach for CAD model reconstruction basing on 3D points insertion and surface approximation Aicha Ben Makhoul¹, Nessrine Elloumi², Borhen Louhichi³, Dominique Deneux⁴ ¹ LATIS, ENISo, University of Sousse; ² SETIT, University of Sfax; ³ LMS, University of Sousse, Tunisia; ⁴ CNRS, UMR 8201-LAMIH, Univ. Polytechnique Hauts-de-France <i>Keywords:</i> Reverse Engineering (RE), geometric model, Computer Aided Design (CAD), 3D objects, B-Spline surface, deformed mesh. pid112 - Aggregating Viewpoints for Effective View-Based 3D Model Retrieval Sou Watanabe, Shigeo Takahashi, Luobin Wang	20:00 - 21:00	

	University of Aizu, Japan <i>Keywords:</i> view-based 3D model retrieval, bag-of-features model, similarity measures, viewpoint aggregation pid115 - Efficient and Physics-based Facial Blendshapes based on ODE sweeping Surface and Newton's second law Junheng Fang¹, Shaojun Bian¹, Jon Macey¹, Andres Iglesias², Hassan Ugail³, Alexander Malyshev⁴, Ehtzaz Chaudhry¹, Lihua You¹, Jianjun Zhang¹ ¹ Bournemouth University; ² University of Cantabria; ³ University of Bradford; ⁴ University of Bergen <i>Keywords:</i> wireframe extraction, ODE sweeping surface-represented 3D models, Newton's second law-based facial blendshapes pid149 - MuVis: Music Visualization Graph embedding of music structures for machine learning approaches Rocco Zaccagnino¹, Gerardo Benevento¹, Roberto De Prisco¹, Alfonso Guarino¹, Nicola Lettieri², Delfina Malandrino¹ ¹ University of Salerno, Italy; ² National Institute for Public Policy Analysis <i>Keywords:</i> Graph embedding, Music style recognition, Machine learning pid168 MediVis2021 - International Conference BioMedical Visualisation Deep Neural Networks for Histopathological Image Classification – Study of Color-space Choice Impact Ghada Ouddai, Ines Hamdi, Henda Ben Ghezala RIADI Laboratory - National School of Computer Science (ENSI) - University of Manouba – Tunisia <i>Keywords:</i> Histopathological image classification, Supervised deep learning, Color-space conversion, Data augmentation, Cancer grading		
13:00	Zoom-Room < AEST (UTC+9) Time >	21:00	
-	Break	-	
13:30	Informal < Online Networking Activities >	21:30	
13:30	Zoom-Room < Central European Time - CET (UTC +2) > Wednesday 7 July 2021	21:30	
-	Session IV21_2.5: Knowledge Visualisation	-	
14:30	Chair/co-chair: Prof. Gilles Venturini, University Tours, FR // Prof. Fatma Bouali, University of Lille, FR Session Recording – Unedited version: https://drive.google.com/file/d/1oLuVpM8-mD334ACPtBQwG9M-CqFcoB52/view?usp=sharing pid 145 - The sight of Justice. Visual knowledge mining, legal data and computational crime analysis Nicola Lettieri¹, Alfonso Guarino², Delfina Malandrino², Rocco Zaccagnino² ¹ National Institute for Public Policy Analysis, Rome, Italy; ² Computer Science Department, University of Salerno, Fisciano (SA), Italy <i>Keywords:</i> Visualization, Legal Knowledge mining, Crime analysis, Legal data pid152 - Insights from Neuroscience: Exploring Highly Sensitive Persons' Use of Knowledge Visualization Sabrina Bresciani¹, Sebastian Kernbach^{1,2} ¹ University of St. Gallen, Switzerland; ² Stanford University, United States <i>Keywords:</i> sensory processing sensitivity, individual preferences, knowledge visualization, aesthetic sensitivity, visual metaphors IV2021: Learning Analytics pid 170 - Enriching Didactic Similarity Measures of Concept Maps by a Deep Learning Based Approach Carla Limongelli¹, Daniele Schicchi², Davide Taibi² ¹ Roma Tre University, Engineering Department, Rome, Italy; ² Italian National Research Council, Institute for Educational Technologies, Palermo, Italy <i>Keywords:</i> Concept Maps, Learning Analytics, Semantic Similarity Measures, Natural Language Processing, Deep Learning, Inferred	22:30	

IV2021-IVapp: Applications of Information Visualization

pid142- EmojiText: an information visualization technique for analyzing phrases and sentiments

Iuri Victor Ferreira Costa¹, Roberto Yuri da Silva Franco², Anderson Gregorio Marques Soares², Rodrigo Santos do Amor Divino Lima¹, Carlos Gustavo Resque dos Santos¹, Bianchi Serique Meiguins¹

¹Federal University of Para, Brazil; ²Federal Rural University of The Amazon, Brazil

Keywords: Text visualization, Sentiment visualization, Visualization Technique

pid 116 - Automated Insights on Visualizations with Natural Language Generation

Richard Brath, Craig Hagerman

Uncharted Software, Canada

Keywords: Natural Language Generation, Automated Commentary, Narrative Visualization

Thursday 8 July 2021

Central European Time - CET (UTC + 2) – Summer Time		Australian Eastern Standard Time – AEST (UTC+9)	
07:00	Pre-session checks	15:00	
07:15 -	Zoom-Room < AEST (UTC+9) Time > Thursday 8 July 2021	15:15	
08:15	<p>Session IV21_3.1: Information Visualisation</p> <p>Chair/co-chair: prof. Mao Lin Huang, / Prof. Tony (Weidong) Huang, UTS, AUS</p> <p>Session Recording – Unedited version: https://drive.google.com/file/d/1Lmb7gEjkZpsxQhKKswlGectAb0S1ADdL/view?usp=sharing</p> <p>pid107 - ExTraVis: Exploration of Traffic Incidents Using Visual Interactive System Joshua Zerafa¹, Md Rafiqul Islam¹, Muhammad Ashad Kabir², Guandong Xu¹ ¹University of Technology Sydney (UTS), Australia; ²Charles Sturt University, NSW, Australia Keywords: Traffic Incidents, Interactive, Visualization</p> <p>pid109 - VisuaLeague: Visual Analytics of Multiple Games Ana Paula Afonso¹, Maria Beatriz Carmo², Rafael Afonso³ ¹LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal; ²LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal; ³LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal Keywords: Game data visualization, spatio-temporal data, aggregated data visualization, visual analytics, MOBA games</p> <p>POSTER</p> <p>pid164 IV2021: WebViz - Web Visualization</p> <p>A Web-based Interface for the Animation of Declarative Languages Nada Hamdy, Nada Ahmed Hamed Sharaf The German University in Cairo Keywords: Prolog, Visualization, Web-Based Visualization</p> <p>SHORT PAPER</p> <p>pid132 - Simplifying the Structural Recursion of the Data Funnel Interface H. Paul Zellweger ArborWay Labs, United States of America Keywords: data funnel interface, structural recursion, branching data model, BDM, database interface</p>	16:15	
08:15	Zoom-Room < AEST (UTC+9) Time >	16:15	
	<i>Break</i> <i>Informal < Online Networking Activities ></i>		
08:30 -	Zoom-Room < AEST (UTC+9) Time > Thursday 8 July 2021	16:30	
09:30	<p>Session IV21_3.2: Human-computer interaction for Information Visualization</p> <p>Chair/co-chair: Prof. Filippo Sciarrone, Roma Tre University, IT// Marco Temperini, Sapienza University, Rome, Italy</p> <p>Session Recording – Unedited version: https://drive.google.com/file/d/1nCuoersRMFbhd1-dAer2DXam-H4ucHPaC/view?usp=sharing</p> <p>pid 122 - Vibro-tactile feedback models to explore virtual reality without going round in circles Baptiste Hans, Laurent Moccozet</p>	17:30	

	<p>University of Geneva, Switzerland <i>Keywords:</i> haptic, interaction, navigation, vibro-tactile, virtual reality</p> <p>pid133 - Pupil responses by level of valence sensitivity to emotion-evoking pictures Nijika Murokawa, Minoru Nakayama Tokyo Institute of Technology, Japan <i>Keywords:</i> pupil response, emotional assessment, subjective assessment, measurement</p> <p>pid143 - Emotional intensity estimation of a Japanese speech corpus using acoustic features Megumi Kawase, Minoru Nakayama Tokyo Institute of Technology, Japan <i>Keywords:</i> speech, emotion, intensity, acoustic features, deep learning</p> <p>SHORT PAPER</p> <p>pid138 - The effectiveness of virtual reality in understanding a new concept in educational support systems Singo Taniuchi, Kiyotaka Kawahara, Mariko Sasakura Okayama University, Japan <i>Keywords:</i> Virtual Reality, VR, education, visualisation</p>	
09:30	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time ></p> <p><i>Break</i> <i>Informal < Online Networking Activities ></i></p>	17:30
10:00 - 11:00	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time > Thursday 8 July 2021</p> <p style="text-align: center;">NOTE: This panel session is available to the outside conference audiences. Access code to register is: https://unimelb.zoom.us/webinar/register/WN_GjyY9YIVTLe2ezWSemCndw</p> <p>Session IV21_3.3: Envisaged Builtviz – Panel Discussion Chair//C-chair: Professor Richard Laing, Robert Gordon University (RGU), UK; Dr Mengbi Li, Victoria University, Australia</p> <p><u>PANEL DISCUSSION</u> Lockdown life and visualised built environment vis-à-vis post-pandemic envision and reflection – Panel Discussion</p> <p>PANEL MEMBERS: Prof Ali Cheshmehzangi, Professor of Architecture and Urban Design, Faculty of Science and Engineering, The University of Nottingham Ningbo China (UNNC) Prof Farzad Khosrowshahi, Dean, College of Engineering & Science, Victoria University, Australia Prof Lu Aye, Professor of Infrastructure Engineering, The University of Melbourne, Australia A/Prof Masa Noguchi, Environmental Design, Faculty of Architecture, Building and Planning, The University of Melbourne, Australia A/Prof Zora Vrcelj, Discipline Group Leader, Built Environment, Victoria University, Australia Dr Anne Jensen, Senior Scientist, European Politics and Policy, Senior Researcher, Department of Environmental Science - Environmental, social science and geography, Aarhus University, Denmark.</p> <p>Session Recording – Unedited version: https://drive.google.com/file/d/1FRb0mZdzXvaS1WpVLLHjY7CdS1tj9RW4/view?usp=sharing</p>	18:00 - 19:00
11:45	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time ></p> <p><i>Break</i> <i>Informal < Online Networking Activities ></i></p>	19:45

12:00 - 13:00	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time > Thursday 8 July 2021</p> <p>Session IV20_3.4: Information Visualisation</p> <p>Chair/co-chair: Prof. João Moura Pires, Univ. NOVA de Lisboa, // Dr. Ana Paula Afonso, Univ. Lisboa, Portugal</p> <p>Session Recording – Unedited version: https://drive.google.com/file/d/1hofCLnx6xXjhVVy9yMzKeBqjBGU8Q1KK/view?usp=sharing</p> <p>pid118 - PCAPFunnel: A Tool for Rapid Exploration of Packet Capture Files Juraj Uhlár¹, Martin Holkovic^{1,2}, Vit Rusnak³ ¹Flowmon Networks, a.s.; ²Brno University of Technology, Czech Republic; ³Masaryk University, Czech Republic <i>Keywords:</i> Data analysis, Data visualization, Network traffic analysis, Packet captures</p> <p>pid128 - Visualisation Tool to Support Fraud Detection Pedro Nuno Silva, Catarina Maçãs, Evgheni Polisciuc, Penousal Machado University of Coimbra, Centre for Informatics and Systems of the University of Coimbra, Department of Informatics Engineering <i>Keywords:</i> Information Visualization, Data Analytics, Fraud</p> <p>pid135 MediVis2021 - International Conference BioMedical Visualisation Reconstruction and Visualization of Protein Structures by exploiting Bidirectional Neural Networks and Discrete Classes Alessia Auriemma Citarella, Lorenzo Porcelli, Luigi Di Biasi, Michele Risi, Genoveffa Tortora University of Salerno, Italy <i>Keywords:</i> Protein Structure, Torsion Angle Prediction, Long Short-Term Memory, Deep Learning</p> <p>SPOSTER PAPER</p> <p>pid136 - Visualization Resources: A Starting Point Xiaoxiao Liu¹, Mohammed Alharbi², Joseph Best³, Jian Chen⁴, Alexandra Diehl⁵, Elif Firat³, Dylan Rees⁶, Qiru Wang³, Robert S Laramée³ ¹Bournemouth University; ²Swansea University; ³University of Nottingham; ⁴The Ohio State University; ⁵University of Zurich; ⁶Zuken UK Ltd. <i>Keywords:</i> visualization resources, surveys</p>	20:00 - 21:00
13:00 - 13:30	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time ></p> <p><i>Break</i></p> <p><i>Informal < Online Networking Activities ></i></p>	21:00 - 21:30
13:30 - 14:30	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time > Thursday 8 July 2021</p> <p>Session IV20_3.5: Visualisation</p> <p>Chair/co-chair: John Counsell, Counsell Consultancy, FR // Dr. Gehan Ahmed Nagy, British University in Egypt, EG</p> <p>Session Recording – Unedited version: https://drive.google.com/file/d/1eV2i075sbwxYllep_XyQpuiP55eDyWU0/view?usp=sharing</p> <p>pid151 - Development of a visual tool for the design of aggregate-oriented NoSQL databases Antonio Sarasa Universidad Complutense de Madrid, Spain <i>Keywords:</i> NoSQL database, visual design tool, aggregation model, web application.</p> <p>pid110 VIS2021: Dart - Symposium of Digital Art and Gallery MicroWorlds: A macro study of microbial interactions informs a bio-art series Courtney Brake, Yongjin Liu, Paul Straight, Carol LaFayette Texas A&M University, United States of America <i>Keywords:</i> Bio-art, "Art and Science", Bacillus subtilis, Streptomyces, time-lapse, photography, bioluminescence, collaboration, "bacterial interactions"</p>	21:30 - 22:30

		<p>POSTER - IV2021: GVA GeoAnalytics</p> <p>pid167 - A Taxonomy and Interactive Survey of Integrated Spatial-Temporal Data Visualization Ying Zhu Georgia State University, United States of America <i>Keywords:</i> visualization, spatial-temporal analysis, taxonomy, survey</p> <p>pid117 - Visual analytics to support industrial vehicle fleet planning Guilherme Xavier Ferreira¹, Melise Maria Veiga de Paula¹, Rafael Perez Pagan², Bruno Guazelli Batista¹ ¹Federal University of Itajubá, Brazil; ²DDMX - Smart Productivity, Brazil <i>Keywords:</i> visual analytics, information visualization, fleet planning, fleet management</p>		
14:45	-	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time > Thursday 8 July 2021</p> <p>Session IV20_3.6: The 20th Annual Animation and Digital Effects Film Chair: Prof. Mark Bannatyne, USA Session Recording – Unedited version: https://drive.google.com/file/d/1Uflb-EEar9uzwlAaxpCKSp5gkjQKrYkp/view?usp=sharing</p>	22:45	

Friday 9 July 2021

Central European Time - CET (UTC + 2) – Summer Time		Australian Eastern Standard Time – AEST (UTC+9)	
06:30	Pre-session checks	14:30	
07:00 - 08:30	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time > Friday 9 July 2021</p> <p>Session IV2021_4.1: Information Visualisation Chair/co-chair: Prof. Tony (Weidong) Huang, /prof. Mao Lin Huang, UTS, AUS Session Recording – Unedited version: https://drive.google.com/file/d/1iWDu5l-26jud1GSYT-2N8QHw2ivoiulx/view?usp=sharing</p> <p>pid166 - Visualization of trajectory-based queries in images database Roseval Donisete Malaquias Junior, <u>Renato Bueno</u> Federal University of São Carlos, Brazil</p> <p>pid 129 - Real-time visualization reconstruction in a real-world environment using Augmented Reality. Tiago Davi Oliveira de Araújo¹, Beatriz Sousa Santos², Carlos Gustavo Resque dos Santos¹, Bianchi Serique Meiguins¹ ¹Universidade Federal do Pará, Brasil; ²Universidade de Aveiro, Portugal Keywords: augmented reality, real-time visualization, interaction, chart recognition, chart reconstruction</p> <p>pid 131 - Visually exploring a Collaborative Augmented Reality Taxonomy Bernardo Marques¹, Tiago Araújo², Samuel Silva¹, João Alves¹, Paulo Dias¹, Beatriz Sousa Santos¹ ¹IEETA, DETI, University of Aveiro, Portugal; ²PPGCC, Federal University of Pará Keywords: Visualization Tool, User study, Collaboration Taxonomy, Augmented Reality, Remote Collaboration</p> <p>pid139 - A brief review of dashboard visualizations employed to support management or business decisions Davi Augusto Galúcio Frazão, Thiago Syllas Antunes da Costa, Tiago Davi Oliveira de Araújo, Bianchi Serique Meiguins, <u>Carlos Gustavo Resque dos Santos</u> Federal University of Pará, Brazil Keywords: Information Visualization, Dashboard, Business, Management, Literature Review.</p> <p>pid 140 - Visual exploration of the inner representation learned by a convolutional neural network Barthélémy Serres^{1,3}, Fatma Bouali^{1,2}, Christiane Guinot¹, <u>Gilles Venturini</u>^{1,3} ¹University of Tours, LIFAT, France; ²University of Lille, IUT C, Dpt STID, France; ³University of Tours, ILIAD3, France Keywords: Visualization, deep learning, internal representation, proximity graphs</p>	15:00 - 16:30	
08:30	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time ></p> <p><i>Break</i> <i>Informal < Online Networking Activities ></i></p>	16:30	
08:45 - 09:45	<p style="text-align: center;">Zoom-Room < AEST (UTC+9) Time > Friday 9 July 2021</p> <p>Session IV21_4.2: Learning Analytics Chair/co-chair: Prof. Marco Temperini, Sapienza University in Rome, Italy // Tania Di Mascio, University of L'Aquila, Italy Session Recording – Unedited version: https://drive.google.com/file/d/1LMHvKrwO6n4mAalm10bt7Z0NuivUoz8o/view?usp=sharing</p> <p>pid104 - Enhancing Situational Awareness for Tutors of Cybersecurity Capture the Flag Games <u>Karolína Dočkalová Burská</u>¹, Vít Rusňák², Radek Ošlejšek¹ ¹Faculty of Informatics, Masaryk University, Czech Republic; ²Institute of Computer Science, Masaryk University, Czech Republic Keywords: cybersecurity education, hands-on training, situational awareness</p> <p>pid134 - Development of critical thinking skills during online learning</p>	16:45 - 17:45	

	<p>Minoru Nakayama¹, Satoru Kikuchi², Hiroh Yamamoto² ¹Tokyo Institute of Technology, Japan; ²Shinshu University <i>Keywords:</i> Blended learning, Fully online learning, critical thinking, student's characteristics</p> <p>pid162 - Nudging students to reduce procrastination in office hours and forums Eric Fouh, Wellington Lee, Baker Ryan University of Pennsylvania, United States of America <i>Keywords:</i> Nudge; Learning Behavior; Procrastination</p> <p>pid165 - A visual method to identify and characterise students suspected of collaboration during remote quizzes submissions in Learning Environments Riccardo Mazza University of applied sciences and arts of southern Switzerland, Switzerland <i>Keywords:</i> remote exams, quizzes, cheating detection</p>		
09:45	<p>Zoom-Room< Central European Time - CET (UTC +2) > <i>Break</i> <i>Informal < Online Networking Activities ></i></p>	17:45	
10:00 - 11:30	<p>Zoom-Room< Central European Time - CET (UTC +2) > Friday 9 July 2021 Session IV21_4.3: Information Space Chair/Co-chair: Dr Andrew Agapiou, Strathclyde University, UK // John Counsell, Counsell Consultancy, FR</p> <p><u>KEYNOTE LECTURE</u> Accelerating the Innovation Uptake in Advanced Digital and Data-driven Processes in the Built Environment Associate Professor Ajibade Ayodeji Aibinu, Faculty of Architecture, Building and Planning, The University of Melbourne, Australia</p> <p><u>KEYNOTE LECTURE</u> Learning and Teaching Analytics: a Winning Combination Prof Filippo Sciarrone, The Roma Tre University, Italy</p> <p>Session Recording – Unedited version: https://drive.google.com/file/d/1b00dqlKwY7DwYuYyqAZvkD4RrcyqnUyl/view?usp=sharing</p>	18:00 - 19:30	
11:30	<p>Zoom-Room< Central European Time - CET (UTC +2) > <i>Break</i> <i>Informal < Online Networking Activities ></i></p>	19:30	
11:45 - 12:30	<p>Zoom-Room< Central European Time - CET (UTC +2) > Friday 9 July 2021 Session IV21_4.4: Mapping Data Chair/Co-chair: Professor Andrew Johnston, co-director of the UTS Visualisation Institute, / Prof. Tony (Weidong) Huang, UTS, AUS</p> <p><u>KEYNOTE LECTURE</u> Visualising non-geospatial data as maps: how maps can communicate the richness of human data Chuan Jia (Jack) Zhao, Small Multiples, NSW, Australia</p> <p><u>BEST PAPER AWARDS</u> Session Recording – Unedited version: https://drive.google.com/file/d/1TeJ5t-iZoxelRIDJM2gg3VpytTG5kCDj/view?usp=sharing</p>	19:45 - 20:30	

		Subject Theme/track/Symposium Programme Committee Meetings					
12:45	...	Zoom-Room< AEST (UTC+9) Time > Friday 9 July 2021 IV2021_ Programme Committee Meeting IV2021_ Theme Analysis Chair/co-chair: Ebad Banissi Break_Out sessions			21:45		
13:00		Information Visualisation Committee Meeting: InfVis Ebad Banissi, Weidong Huang, Mao Lin Huang IVApp Fatma Bouali Gilles Venturini IVE Michele Risi Ugo Erra HCI Mountaz Hascoet Minoru Nakayama Glyphs Ebad Banissi Richard Brath GTNV Mabule Samuel ++++++ BioMedical Visualization - MediVis Urska Cvek Heimo Mueller Marjan Trutschl Geometric Modelling and Imaging - GMAI Muhammad Sarfraz	AI & Visual Analytics Committee Meeting: AI&App Boris Kovalerchuk Muhammad A. Ahmad, Razvan Andonie Evgenii Vityaev VL_Learning Analytics Marco Temperini, Minoru Nakayama Tania Di Mascio Filippo Sciarrone Visual Analytics and Data Science, VA Kawa Nazemi Loredana Caruccio Autilia Vitiello Visualisation in Data Science and Machine Learning, VDSML Vincenzo Deufemia Giuseppe Polese Advances in Interactive and Visual Data Clustering – AIVDC GeoAnalytics, GVA Joao Moura Pires Nuno Datia Social Issues Analysis SSNN Paloma Díaz Fragkiskos Papadopoulos Visualisation in Business Intelligence and Open Data - VBI_OD Giuseppe Polese, Vincenzo Deufemia	Knowledge Visualization Committee Meeting: KV Sebastian Kernbach DHKV Musical Visualization - MuVis Delfina Malandrino Rocco Zaccagnino, MuELear Rita Francese Veronica Rossano ++++++ Visualisation Visualisation, Viz Haim Levkowitz Web Visualisation, WebViz Co-operative Design Visualisation, CDV Computer Animation, Information Visualisation, and Digital Effects, CAivDE Mark.Bannatyne, Jian J Zhang Symposium and Gallery of Digital Art, Dart Anna Ursyn Augmented Reality Visualisation and Art, ARVA Vladimir Geroimenko	Builtviz Committee Meeting: Builtviz – <ul style="list-style-type: none"> • VH_APAU-Visualisation for the Heritage of Asia-Pacific Architecture and Urbanism • SBH- Sustaining Built Heritage • VBRE: Visualisation in Built and Rural Environments Andrew Agapiou Farzad Khosrow-shahi Richard Laing John Counsell Zora Vrcelj Gehan Nagy Hing-Wah Chau Mengbi Li	22:00	
...	14:00	IV2021_ Programme Committee Meeting IV2022_ Planning Chair/co-chair: Ebad Banissi			...	23:00	

15th Doctoral Research Workshop Information Visualisation

Doctoral Research Workshop

Chair/co-chair: prof. Mao Lin Huang, / Dr Yifei Dong, UTS, AUS

RESEARCH WORKSHOP – PART I

Using RMarkdown to create interactive reports, data visualisation and animation

Maria Prokofieva, and Amanda Cole, Swati Gupta, and Jhoanna Cobo, Victoria University, Melbourne, Australia

Abstract

This workshop is an introduction to data visualization by using free open source environment R and R Libraries, including Tidyverse, ggplot2 and gganimate.. With basic coding knowledge you can learn how to create interactive documents and data viz to present animated results to demonstrate the movement of data though time.

RMarkdown is a high quality interface with the potential of integrating text and R code to produce an informative and productive report that is immediately updated when new data is added. No more copying and pasting from different source files. With a basic understanding of how to code in Rstudio, during this workshop you will create a RMarkdown document to present data insights, code and visualization all together to make an interactive report and share it with your target audience.

Ggplot2 is a package in Rstudio that allows you to create simple and elegant graphs and charts to visualize your data and tell an engaging story.

Gganimate extends the ggplot2 library by including animation to customise the plot to show how the data changes with time.

Throughout this workshop, you will use RStudio to create a beautiful and interactive data report in RMarkdown with embedded graphics created using ggplot2 and gganimate.

Facilitators:

Maria Prokofieva is a senior lecturer at Victoria University, Business school. She has background in IT, linguistics and finance. Maria is passionate about using R in academic research and everyday life. Her area of interest is social media analytics, business intelligence and machine learning. She is a member of R Ladies Melbourne, Melbourne Users of R Network (MelbURN), Melbourne Women in Machine Learning & Data Science and Data Science Melbourne. She is also a Women in Data Science (WiDS) Ambassador.

Amanda Cole holds qualifications in mechanical engineering and occupational health and safety. She is currently studying a Masters in Business Analytics at Victoria University with the aim of assisting small to medium businesses implement performance management tools within their businesses. Amanda is a member of R-Ladies Melbourne and holds the role of President of Data Analytics Student Association at Victoria University.

Swati Gupta is a graduate of B.Tech in Printing, Graphics & Packaging from Kurukshetra University, India, and currently a postgraduate student pursuing Masters of Business Analytics (Professional) at Victoria University. She is a Workshop Coordinator of the Data Analytics Student Association at Victoria University.

Jhoanna Cobo - She is a graduate of International business from Universidad del Valle Cali, Colombia and currently a postgraduate student of Master of Business ERP and Supply Chain Management at Victoria University in Melbourne, Australia. She is volunteering as a Secretary of Data Analytics Student Association at Victoria University. Business Analytics has become a highly interested field because of the increasing importance for quicker decision making processes in any industry and business.

Doctoral Research workshop

Chair/co-chair: prof. Ebad Banissi, LSBU, UK / Prof. Tony (Weidong) Huang, UTS, AUS

WORKSHOP – Part II

Design Your (Academic) Future

Sebastian Kernbach, University of St. Gallen in Switzerland

Abstract

Based on the most popular course at Stanford University, this mini-workshop will help young researchers to create a meaningful and fulfilling future including an (academic) job and also potential side-projects which increase work performance. We will use the innovation method design thinking in combination with positive psychology and behavioral economics to bring more of yourself into your future. You will find out what matters to you, create ideas and find ways to bring these ideas into your future. Join us for an interactive mini-workshop with Prof. Dr. Sebastian Kernbach.

Facilitator



Sebastian Kernbach is Assistant Professor for Creativity and Design at the University of St. Gallen in Switzerland. He is also a Visiting Fellow at Stanford University where he works for the “Creativity in Research Scholar” program and co-author of the book “Creativity in Research” with Cambridge University Press). He is a Guest Professor at the African Doctoral Academy, co-chair of the international symposium of knowledge visualization and the founder of the Life Design Lab (www.LifeDesignLab.ch).

Doctoral Research Workshop

WORKSHOP – Part III

Chair/co-chair: prof Maria Prokofieva, Victoria University, Melbourne, Australia // Prof Ebad Banissi

Tree Visualization - History & Future

Mao Lin Huang, University of Technology, Sydney, Australia;

Quang Vinh Nguyen, University of Western Sydney, Australia

Abstract

In the past 300 years, a group of people have made a great effort and contributions in the research of hierarchical geometry & tree visualization. In IEEE TreeVis website [A Visual Bibliography of Tree Visualization (<http://www.treevis.net>)], it collected 318 most recommended methods recorded in the entire 307 years history of hierarchical data visualization, from 1714 to 2021.

For example, TreeVis collected a method called "Slice-and-Dice Statistical Diagram", drawn by Henry Gannett in 1900 and it was used for representing the statistical result of the "CLASSIFICATION OF OCCUPATIONS BY RACE AND NATIVITY" at Twelfth Census of the United States. This traditional hand-drawn geometric diagram lays the theoretical foundation of today's popular enclosure-based data visualization approach.

In this course, we will provide participants with a general guide of the theoretical knowledge, applications, and tools in the field of tree visualization. The materials reflect the advanced tree visualization in various scientific and business domains. The course is designed for participants who would like to learn or explore the state-of-the-art technologies and the underlined theories in tree visualization.

This course is structured as a two and half hours (150 minutes) course divided into three main sections

- i) The history of the tree visualization ----- Theory and foundation,
- ii) The current applications and technologies ----- practice,
- iii) The future directions of the tree visualization ----- discussion.

Facilitators:



Dr Mao Lin Huang is an Adjunct Professor in the School of Computer Science, University of Technology Sydney and he is an internationally recognized Data Visualization researcher, known for his expertise in Hierarchical Data Visualization and Dynamic Information Visualization. As one of the leading scientists in the field, Prof. Huang invented or co-invented many data visualization techniques. Among them, eight techniques are included in the TreeVis 2.0 [A Visual Bibliography of Tree Visualization 2.0 (www.treevis.net)] as part of the 318 most recommended methods recorded in the entire 306 years history of

hierarchical data visualization, from 1714 to 2020. These innovative data visualization methods are: 1. Space-Optimized Tree (invented in 2002), 2. EncCon Tree 2D (invented in 2004), 3. Radial Edgeless Tree (invented in 2007), 4. EncCon Tree 3D (invented in 2007), 5. Treemap Bar (invented in 2009), 6. Angular Treemap (invented in 2012), 7. Golden Rectangle Treemap (invented in 2017) and 8. Pansy Tree (invented in 2020).

The "Treemap Bar" technique published in IV 2009 has made a Significant Social Impact worldwide. It has been disseminated into at least 6 million (6,000,000) business users in the world by Microsoft Co. (Power BI) and Tableau Software for providing them with business intelligence and advanced data analysis facility.

Dr Huang has so far published 200+ research papers in high quality journals and international conferences. These publications have received 2,359 citations as per Google Scholar (h-, and i10-indices are 22, and 57, respectively). He as a sole investigator had received a large ARC DP (Australian Research Council Discovery Grant) for the project: "Efficient and Effective Interactive Visualization of Large Information Spaces" (approx. \$200K). Dr Huang is supervising and has supervised 24 PhD (and MSc. Res) students.



Dr Nguyen is an associate professor visual in visual analytics and the Director of Academic Program – Postgraduate Information Communications and Technology at the School of Computing, Engineering and Mathematics and The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia. His focus is to find effective visualisations to support the analysis of large and complex datasets, particularly genomic, flow cytometry, health data, relational data, and other application based data. His research expertise has been built up since his PhD study, his various experiences at Western Sydney University, University of Technology, Sydney, University of Texas at Dallas and various visiting positions internationally. For his academic career, he has

authored and co-authored more than 100 refereed publications, including edited book, book chapters, journals and conference papers relating to this research field. He has received multiple research funding. He has been successful (co)supervised as well as is being supervising several research students. His research details are available: <http://staff.scem.uws.edu.au/~vinh/> or <http://orcid.org/0000-0002-0815-6224>

Doctoral Research Workshop

WORKSHOP – Part IV

Chair/co-chair: Prof. Tony (Weidong) Huang, / Dr Yifei Dong, UTS, AUS

“Visual Analytics of Omics Data”

Quang Vinh Nguyen, University of Western Sydney, Australia;

Mao Lin Huang, University of Technology, Sydney, Australia

Abstract

Omics data represent a big data problem that needs accurate visual data processing and analytics. The omics data are very complex with hundreds to millions of rows and thousands of columns that contain the information about the individual patients and the biological mechanisms of their diseases. Understanding the multidisciplinary nature of visual analytics in interactive visualisation, analytical reasoning and visual perception with machine learning and statistical analysis is critical for effective big data analytics.

Visual analytics of omics data could support the diagnostics and could allow the clinicians to tailor the treatment to the most efficacious for each individual. This tutorial serves as a practical guide that provides theoretical knowledge and illustrated applications to support big omics data visual analytics. The materials reflect the visual analytics advancement in various health domains, such as genomics and flow cytometry analytics. The tutorial is designed for participants who would like to learn or explore the important state-of-the-art technologies, methods and the underlined theories to support big omics data visual analytics.

This tutorial is structured as a 90-minute course divided into main sections

- i) Theory and foundation for omics visual data analytics.
- ii) Case studies in genomics data analytics
- iii) Case studies in flow cytometry data analytics.

Facilitators:



Dr Mao Lin Huang is an Adjunct Professor in the School of Computer Science, University of Technology Sydney and he is an internationally recognized Data Visualization researcher, known for his expertise in Hierarchical Data Visualization and Dynamic Information Visualization. As one of the leading scientists in the field, Prof. Huang invented or co-invented many data visualization techniques. Among them, eight techniques are included in the TreeVis 2.0 [A Visual Bibliography of Tree Visualization 2.0 (www.treevis.net)] as part of the 318 most recommended methods recorded in the entire 306 years history of hierarchical data visualization, from 1714 to 2020. These

innovative data visualization methods are: 1. Space-Optimized Tree (invented in 2002), 2. EncCon Tree 2D (invented in 2004), 3. Radial Edgeless Tree (invented in 2007), 4. EncCon Tree 3D (invented in 2007), 5. Treemap Bar (invented in 2009), 6. Angular Treemap (invented in 2012), 7. Golden Rectangle Treemap (invented in 2017) and 8. Pansy Tree (invented in 2020).

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Dr Huang has so far published 200+ research papers in high quality journals and international conferences. These publications have received 2,359 citations as per Google Scholar (h-, and i10-indices are 22, and 57, respectively). He as a sole investigator had received a large ARC DP (Australian Research Council Discovery Grant) for the project: "Efficient and Effective Interactive Visualization of Large Information Spaces" (approx. \$200K). Dr Huang is supervising and has supervised 24 PhD (and MSc. Res) students.



Dr Nguyen is an associate professor visual analytics and the Director of Academic Program – Postgraduate Information Communications and Technology at the School of Computing, Engineering and Mathematics and The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia. His focus is to find effective visualisations to support the analysis of large and complex datasets, particularly genomic, flow cytometry, health data, relational data, and other application based data. His research expertise has been built up since his PhD study, his various experiences at Western Sydney University, University of Technology, Sydney, University of Texas at Dallas and various visiting positions internationally. For his academic career, he has authored

and co-authored more than 100 refereed publications, including edited book, book chapters, journals and conference papers relating to this research field. He has received multiple research funding. He has been successful (co)supervised as well as is being supervising several research students. His research details are available:

<http://staff.scem.uws.edu.au/~vinh/> or <http://orcid.org/0000-0002-0815-6224>

Session IV21__1.1: Information Visualisation _ Visualising our future communities

Chair//co-chair: Prof. João Moura Pires, Univ. NOVA de Lisboa, Portugal //

KEYNOTE LECTURE

The development of immersive visualisation experiences

Case study presentations from the Master of Animation and Visualisation

Ian Thomson, Head of the UTS Animal Logic Academy

Professor Andrew Jonston, co-director of the UTS Visualisation Institute, UTS, Australia

Abstract

Along with advances in technologies, our ability to visualise data, information and stories is developing at a rapid pace. Hand in hand with growth in scale comes opportunities through increasing complexity. More and more, we are seeing visualisation projects being developed that draw on design, technology, interactivity and narrative in order to create immersive and emotive visualisation experiences. These have the potential not only to inform but also to inspire, persuade, entertain and transform.

The UTS Animal Logic Academy is a unique collaboration between the University of Technology and one of Australia's leading digital animation studios, Animal Logic. The Academy challenges postgraduate students to develop innovative creative project solutions using emerging visualisation technologies. In recent years, these have included a multi-user hybrid AR & VR Hitchcock-esque thriller, a fully immersive 360° interactive game set in a futuristic underwater world, the virtual chance to step into the paintings of the Japanese artist Hiroshige, and the opportunity for primary school students to experience ancient history through a multi-perspective tablet and mobile phone game.

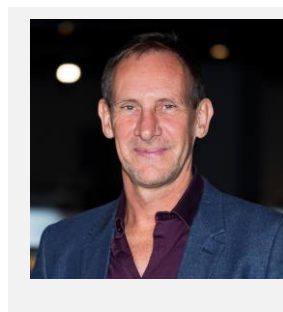
In this keynote presentation, Head of Academy Ian Thomson and Visualisation Institute co-director Professor Andrew Johnston will present case study examples of immersive visualisation projects that tap on the potential of narrative storytelling as an important and

emerging tool in developing emotive and compelling visualisation experiences.

Speaker(s) biography:

Ian Thomson

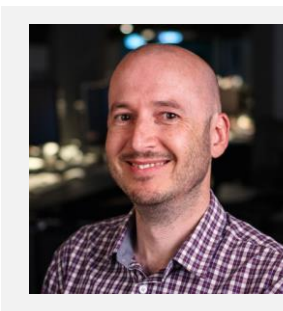
Head of the UTS Animal Logic Academy



Ian has over 30 years of international experience as an award-winning media designer, filmmaker, author and educator with postings in London (Frame Store), Barcelona (OFramestore), Vienna (DMC), Hamburg (Premiere) and Sydney (VPB). Ian has developed media projects, theatre, documentaries and courses for a range of large organisations and brands. He is currently Head of the UTS Animal Logic Academy.

Professor Andrew Jonston

co-director of the UTS Visualisation Institute



challenges.

Andrew Johnston is Professor at the University of Technology Sydney, where he works as the Research and Course Director of the UTS Animal Logic Academy, a unique, professionally-equipped studio focusing on the creative application and design of digital technologies. He also co-directs the UTS Visualisation Institute, a collaborative network of researchers and expert practitioners working across data science, narrative, design and technology. The Visualisation Institute undertakes ambitious visualisation projects across a broad range of technologies and sectors to address industry and societal

Session IV21_1.2: Visual Analytics and Data Science (VA1)

Chair//co-chair: Prof. Kawa Nazemi, / Midhad Blazevic, Darmstadt University of Applied Sciences, Germany

[VA Symposium Opening Note](#):

Visual Analytics & Data Science, Kawa Nazemi, Darmstadt University of Applied Sciences

pid101 - Localization of Emotion via EEG Analysis using 3D Trilateration

Hayfa Blaiech¹, Noureddine Liouane¹, Med Ali Saafi²

¹Ecole Nationale d'Ingenieurs de Monastir; ²Hopital sahloul sousse

Keywords: Trilateration; Localization; EEG signals; Emotion.

The localization of cerebral electrical activity of emotional states on the basis of electrophysiological recordings is an important area of investigation in recent years. This field was explored to locate the sources of the emotions in the cortex. The theory that every emotion can have a unique trigger center in the cortex was followed. A precise and accurate method was used, the Trilateration, recognized in the GPS networks, which deduces the points of interest from the distances. This method gave the exact coordinates of the generating points of emotions in the surface area of cortex under the influence of modulating thalamic nuclei. It was found that the energies are stronger in the occipital and parietal part of the brain. Moreover the frontal part play the role of inhibitor and stimulator of emotions.

pid105 - A Visualization Method for Training Data Comparison

Karen Kosaka, Takayuki Itoh

Ochanomizu University, Japan

With the diversification of machine learning applications, the quality verification and comparison of training data has been an important process. For example, while performing transfer learning, verification the difference in the quality between the source and the target data can prevent the accuracy of the model from deteriorating. However, training datasets for deep learning is getting larger and larger, and analysis of such datasets is not always easy. As a solution to this problem, we are working on the visualization for training data validation. In this study, we apply dimensionality reduction to the training datasets and display them as scatterplots to realize a visual analysis that can easily detect differences in the quality. Our current implementation draws the regions where the points are concentrated as semitransparent polygons for each label in the scatterplot. Also, the implementation provides a slider to set a threshold for the interactive adjustment of polygon generation. This allows us to observe the differences in the distribution of labels among the training data.

pid123 - Visual Analytics and Similarity Search - Interest-based Similarity Search in Scientific Data

Midhad Blazevic, Lennart B. Sina, Dirk Burkhardt, Melanie Siegel, Kawa Nazemi

Darmstadt University of Applied Sciences, Germany

Keywords: Visual Analytics, Similarity, Collaborative Systems, Trend Analytics, Visual Business Analytics

Visual Analytics enables solving complex analytical tasks by coupling interactive visualizations and machine learning approaches. Besides the analytical reasoning that is enabled through Visual Analytics, the exploration of data plays an essential role. The process of exploration can be supported through similarity-based approaches that enable to find of similar data to those that are annotated in the context of visual exploration. We propose in this paper a process of annotation in the context of exploration that leads to labeled vectors-of-interest and enables finding similar publications based on an interest vector. The generation and labeling of the interest vector are performed automatically by the Visual Analytics system and lead find not only similar papers but also categorize the annotated papers.

POSTER

pid114

Visualisation for social media analytics: landscape of R packages

Atousa Ghahramani, Maria Prokofieva

This paper investigates the use of visualization in Social Media Analytics (SMA) in open source environment R. The focus of the paper is on Network Science, or Social Network Analytics (SNA) applications. SNA provides a foundation to study complex networks by considering distinct elements (i.e. nodes, or vertices) and the connections between them (i.e. links, or edges). The study overviews existing research and analyses the landscape of R packages to develop data visualizations to fit the needs of SNA and SMA. The study identifies existing approaches and tools used in network science and maps them to existing packages and tools for visualization tasks in SNA and SMA. The study contributes to the literature by providing an organized framework of available visualization tools in R for SMA and identifying opportunities for further application and software development to address emerging needs.

Session IV21_1.3: Artificial Intelligence and Application

Chair/co-chair: Prof. Razvan Andonie, / Prof. BORIS KOVALERCHUK, Central Washington University, USA

pid150 - Context-Sensitive Visualization of Deep Learning Natural Language Processing Models

Andrew Dunn¹, Diana Inkpen², Razvan Andonie¹

¹Central Washington University, United States of America; ²University of Ottawa, Canada

Keywords: Natural Language Processing, Transformers, BERT, Visualization of Neural Networks

The introduction of Transformer neural network has changed the landscape of Natural Language Processing (NLP) during the last years. So far, none of the visualization systems has yet managed to examine all the facets of the Transformers. This gave us the motivation of the current work. We propose a new NLP Transformer context-sensitive visualization method that leverages existing NLP tools to find the most significant groups of tokens (words) that have the greatest effect on the output, thus preserving some context from the original text.

First, we use a sentence-level dependency parser to highlight promising word groups. The dependency parser creates a tree of relationships between the words in the sentence. Next, we systematically remove adjacent and non-adjacent tuples of n tokens from the input text, producing several new texts with those tokens missing. The resulting texts are then passed to a pre-trained BERT model. The classification output is compared with that of the full text, and the difference in the activation strength is recorded. The modified texts that produce the largest difference in the target classification output neuron are selected, and the combination of removed words are then considered to be the most influential on the model's output. Finally, the most influential word combinations are visualized in a heatmap.

pid153 - Discovering Interpretable Machine Learning Models in Parallel Coordinates

Boris Kovalerchuk, Dustin Hayes

Central Washington University, United States of America

Keywords: interpretable machine learning, parallel coordinates, hypercube, hyper-block, decision tree

This paper contributes to interpretable machine learning via visual knowledge discovery in parallel coordinates. The concepts of hypercubes and hyper-blocks are used to be easily understandable by end-users in the visual form in parallel coordinates. The Hyper algorithm for classification with mixed and pure hyper-blocks is proposed. Algorithms to discover hyper-blocks interactively and automatically in individual, multiple, overlapping, and non-overlapping setting are proposed. The combination of hyper-blocks with linguistic description of visual patterns is presented too. It is shown that Hyper models generalize decision trees. The Hyper algorithm was tested on the benchmark data from UCI ML repository. It allowed discovering pure and mixed HBs with all data and then with 10-fold cross validation. The links between hyper-blocks, dimension reduction and visualization are established. Major benefits of hyper-block technology and the Hyper algorithm are in their ability to discover and observe hyper-blocks by end-users including side by side visualizations making patterns visible for all classes. Another advantage of HBs relative to the decision trees is their ability to avoid both overgeneralization and overfitting of data.

pid154 - Full interpretable machine learning in 2D with inline coordinates

Boris Kovalerchuk, Hoang Phan

Central Washington University, United States of America

Keywords: interpretable machine learning, classification, regression, visual knowledge discovery.

This paper proposed a new approach for machine learning in 2-dimensional space (2-D ML) in inline coordinates. It is shown that this is a full machine learning approach that does not require to deal with n -dimensional data in n -dimensional space. It allows discovering n -D patterns in 2-D space without loss of n -D information using graph representation of n -D data in 2-D. Specifically, the paper shows that it can be done with inline based coordinates in different modifications, which are defined, including static and dynamic ones. The classification and regression algorithms based on these inline coordinates were introduced. A successful case study based on a benchmark data (Wisconsin breast cancer data) demonstrated the feasibility of the approach. This approach helps to consolidate further a whole new area of full 2-D machine

learning with a respective methodology. It has advantages of abilities to actively include the end-users into the discovering of models and their justification. Another advantage is providing interpretable ML models.

IV2021 - BiWA - Big data Visualization and Visual Analytics

pid159 - Visualization and Visual Analytics of Big sequential data

Carson Leung

University of Manitoba, Canada

Keywords: Big data Visualization, Visual Analytics

In this paper, we present a big data visualization and visual analytics tool for visualizing and analyzing sequential data to give an insight on the temporal trends and variation. The tool helps users to get a better understanding of temporal information. For evaluation, we used the confirmed cases of COVID-19 for visualization and visual analytics. Although this tool is designed for visualization and visual analytics of epidemiological data, it is applicable to visualization and visual analytics of sequential data from many other real-life applications and services.

Session IV21_2.1: Information Visualisation – Theory & Techniques

Chair/co-chair: prof. Mao Lin Huang, / Dr Yifei Dong, UTS, AUS

pid141 - ContourDiff: Revealing Differential Trends in Spatiotemporal Data

Zonayed Ahmed, Michael Beyene, Debajyoti Mondal, Chanchal Roy, Christopher Dutchyn, Kevin Schneider

University of Saskatchewan, Canada

Keywords: Spatiotemporal Data, Change Detection, Contour Plot, Vector Overlay

Changes in spatiotemporal data may often go unnoticed due to their inherent noise and low variability (e.g., geological processes over years). Commonly used approaches such as side-by-side contour plots and spaghetti plots do not provide a clear idea about the temporal changes in such data. We propose ContourDiff, a vector-based visualization over contour plots to visualize the trends of change across spatial regions and temporal domain. Our approach first aggregates for each location, its value differences from the neighboring points over the temporal domain, and then creates a vector field representing the prominent changes. Finally, it overlays the vectors along the contour paths, revealing differential trends that the contour lines experienced over time. We evaluated our visualization using real-life datasets, consisting of millions of data points, where the visualizations were generated in less than a minute in a single-threaded execution. Our experimental results reveal that ContourDiff can reliably visualize the differential trends, and provide a new way to explore the change pattern in spatiotemporal data.

pid126 – ARViz: Interactive Visualization of Association Rules for RDF Data Exploration

Aline Menin, Lucie Cadorel, Andrea Tettamanzi, Alain Giboin, Fabien Gandon, Marco Winckler

Univ. Côte d'Azur, CNRS, Inria

Association rule mining often leads the analyst into a rough rummaging process to identify rules that are relevant to understand specific problems. We propose a visualization interface to assist the rule selection process and evaluate it on an RDF knowledge graph derived from the COVID-19 Open Research Dataset. The user interface supports data exploration with focus on the overview of rules through a scatter plot, subsets of rules through a chord diagram chart, and itemsets through an association graph which is dynamically created by entering an item of interest (i.e. a named entity). Further, the analyst can interactively recover a list of publications containing the named entities involved in a particular rule. Among the original aspects of our approach, we highlight the representation of attributes describing measures of interest (i.e. confidence and interestingness), a visual indication of existence (or not) of symmetry in association rules, the exploration of subsets of rules according to clusters of publications and named entities, and an interactive prompting that aims at expanding the discovery of named entities within selected association rules. We assess our approach through a semi-structured interview involving expert users in the domains of data mining and bio-medicine, whose feedback could assist the refinement of the visual and interaction tools.

pid103 - Multidimensional Data Visualization for Investigation of Skin Transparency

Ami Tochigi, Takayuki Itoh

Ochanomizu University, Japan

“Skin Transparency” is an important keyword for women of all generations as one of the conditions for beautiful skin. Although, no one has clear definitions of “Skin Transparency”. As it stands, beauty experts are often invited to visual evaluations in skin transparency evaluation; however, it has not been still sufficiently clarified which visual properties are related to skin transparency. In this study, we aim to discover the relations between skin image features and sensory evaluations applying real human skin images. Specifically, we investigate “Skin Transparency” by comparing them using the Parallel Coordinate Plots. We observed their complex distributions by the visualization task.

pid102 - Visualization of sub-network sets by iterative graph sampling from large scale networks

Namiko Toriyama¹, Mitsuo Yoshida², Takayuki Itoh¹

¹Ochanomizu University, Japan; ²Toyohashi University of Technology Tokyo, Japan

Multi-layer network visualization techniques have been developed so that users can firstly overview the large-scale network and then explore the interesting parts of the data. Meanwhile, local features of the networks are often more interesting rather than their overall structures. It often happens with particular kinds of applications such as social networks. We developed a visualization technique for such types of large-scale networks. The technique iteratively applies a graph sampling algorithm to extract small-scale sub-networks from a large-scale network and then visualize the features of the sub-networks as hierarchically arranged icons. User-specified sub-networks are then visualized by applying our own graph visualization technique. Using networks generated from Twitter data, we actually visualize small-scale networks using the proposed method.

Session IV21_2.2: Future Built Environment

Chair//co-chair: Prof. Farzad Khosrowshahi // Dr. Mengbi Li, Victoria University, AUS

KEYNOTE LECTURE

Ambient Intelligence: A Trans-disciplinary Model of Innovation for the Built Environment

Professor Tuba Kocaturk

School of Architecture and Built Environment, Deakin University, Australia

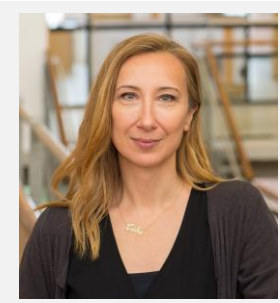
Abstract

The transition from digital to experience economy has already made significant impact in other industries and are likely to be a step change in how we design, build and interact with our Built Environment. As data-driven and intelligent design is introducing and establishing a new set of economic, social and cultural values, we have started to question some of our age-old assumptions and practices. The presentation will explore the transformational potential of embedding computation, spatial intelligence and real-time connectivity into the conception and realisation of our buildings and environments. A particular focus will be on “user-centred” and “systemic” approach to the design of intelligent environments, responsive to human needs and actions. In this regard, an alternative model of Ambient Intelligence will be introduced, that is based on a trans-disciplinary approach to innovation and which challenges not only our existing working methods but also how we interact with other disciplines and sectors. The arguments will be presented through showcases of some of the most recent projects from the MInD (Mediated Intelligence in Design) Research Lab, in collaboration with various cross-sector industry partners.

Speaker biography:

Professor Tuba Kocaturk

School of Architecture and Built Environment, Deakin University, Australia



Tuba Kocaturk is Professor of Integral Design at Deakin University, School of Architecture and Built Environment. She is the founding-director of the MInD (Mediated Intelligence in Design) Lab; a transdisciplinary and practice-based research group that operates at the intersection of Built Environment, Information Technology and Design Innovation. Her expertise centres upon the creative, generative and collaborative use of information and communication technologies and digital media in Built Environment and in Design.

Tuba is the Senior Editor of International Journal of ‘Architectural Computing, which is committed to deepening the understanding of the foundations of digital systems for Architectural and Urban Design and the technologies enabling their development and application. Her work is predominantly practice-based and advocates the use of “design thinking” and “system thinking” as a methodology for knowledge production and as a strategy for cross-sector innovation. She is also the founding co-director of Resilient Urban Ecosystems (RUE) Research Network and European Network of Design, both advocating a trans-disciplinary approach to innovation. Tuba is currently collaborating with the City of Greater Geelong for the development of the city’s future Built Environment agenda as a UNESCO City of Design.

KEYNOTE LECTURE

The Changing Nature of Property and Construction Industries at Digital Transformation

Professor Dr Yusuf Arayici

Northumbria University, UK

Abstract

Construction industry is transforming itself while society is in transition towards the digital age. How construction companies operate in the near future will be very different even though it lags behind the other sectors such as manufacturing, automotive and finance. With the motivational factors such as Green and Sustainability targets, sophisticated smart technologies appears set for the improved performance and use in design, construction and facilities management practices.

Building Information Modelling (BIM) is maturing in practice and providing opportunities to eradicate costly errors and integrate changes in building design before construction even begins. Increased awareness and use of BIM has paved the way for advanced technologies such as 3D printing and robotics solutions to also have their place in design and construction. Such 3D printing and robotic technologies using BIM data are predicted to vastly improve efficiency in the construction industry.

Despite the contradicting views on Digital Construction Twin and BIM concepts, they are making significant contribution to the transition for digital construction and so digital built environment. Construction industry is long fragmented and poor in performance. However, the implementation such technologies can make the processes integrated over a building lifecycle towards the consolidated construction that is improved in performance.

Overall, the digital transformation of the construction industry would require the unlearn how we do construction and introduce new construction paradigms for relearn.

This presentation amalgamates the key outcomes from research projects undertaken over the years with the evidential examples from practice to think deeply how the existing problems can be reframed about technology, process and people: Unlearning and reframing.

Speaker biography:

Professor Dr Yusuf Arayici

Northumbria University, UK



Professor Dr Yusuf Arayici is a professor in construction project management in the School of Architecture and Built Environment at Northumbria University. With an international outlook, he fulfilled academic management role as a dean before. He also successfully completed his research fellowship of TUBITAK (Research Council of Turkey) in Digital Design and Construction with BIM.

His research spans from Building Information Modelling to sustainability through research projects since 2000. He has led substantial research groups over a prolonged period of time through continuous cycles of research with funded research projects, graduated many PhDs and MSc students, published

more than 100 papers and five books.

Currently, he is researching on AI supported Heritage BIM.

Session IV21_2.3:

Chair/co-chair: John Counsell, Counsell Consultancy, FR // Prof. Nuno Miguel Soares Datia, ISEL - Instituto Politécnico de Lisboa, Portugal

pid127 - Towards a Visual Approach for Representing Analytical Provenance in Exploration Processes

Aline Menin¹, Ricardo Cava², Carla Maria Dal Sasso Freitas², Olivier Corby¹, Marco Winckler¹

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Keywords: Analytical provenance, Multiple views, Chained views, Multidimensional data exploration, Provenance visualization

Visualization techniques are useful tools to explore data by enabling the discovery of meaningful patterns and causal relationships. The discovery process is often exploratory and requires multiple views to support analyzing different or complementary perspectives to the data. In this context, analytic provenance shows great potential to understand users' reasoning process through the study of their interactions on multiple view systems. In this paper, we present an approach based on the concept of chained views to support the incremental exploration of large, multidimensional datasets. Our goal is to provide visual representation of provenance information to enable users to retrace their analytical actions and to discover alternative exploratory paths without losing information on previous analyses. We demonstrate that our implementation of the approach, MGEplorer (Multidimensional Graph Explorer), allows users to explore different perspectives to a dataset by modifying the topology of the input data, choosing visualization techniques, arranging the visualization space in meaningful ways to the ongoing analysis and retracing their analytical actions. MGEplorer combines multiple visualization techniques and visual querying while representing provenance information as segments connecting views, which each supports selection operations that help define subsets of the current dataset to be explored by a different view. We demonstrate the usage of the tool through a study case where we explore co-authorship data. We assess the approach through performance metrics, temporal ordering of tasks, number of physical actions, and amount of information to be recalled in-between actions applied to the chosen visual exploration scenarios using chained views.

pid130 - Automatic creation of a Vowel Dataset for performing Prosody Analysis in ASD screening

Rita Francese, Maria Frasca, Michele Risi
University of Salerno, Italy

Keywords: Audio signals, autism spectrum disorder, convolutional neural network, deep neural network.

Autism Spectrum Disorder (ASD) is a term used to describe a constellation of early-onset social communication deficits and repetitive sensorimotor behaviours associated with a strong genetic

component as well as other causes. This paper aims at creating a tool for automatically isolating segments of the speech useful for extract prosody features for identifying children with ASD. In particular, in this first phase of the research, we are interested in the creation of a large dataset of 'a' vowels of ASD and not ASD people. The 'a' vowel contains relevant information on the voice quality and emotional states. The proposed methodology is divided into 2 phases. In the former the input audio is analyzed to determine the vowel onset and offset points, useful to extract the vowel regions. Then a spectrogram graphically visualizing the identified vowels is provided as input to the second phase, where a convolutional neural network classifies whether the histogram represents the vowel 'a'. The convolutional network reaches an average accuracy of 95.00% (standard deviation +/- 2.60%) on a dataset of 640 samples with Stratified K-Fold Cross-Validation.

pid106 - Analysis of Deep Neural Networks Correlations with Human Subjects on a Perception Task

Loann Giovannangeli, Romain Giot, David Auber, Jenny Benois-Pineau, Romain Bourqui
LaBRI, UMR CNRS 5800, University of Bordeaux, France

Keywords: Information visualization, Deep learning, User evaluation, Correlations, Automated evaluation

In information visualization, it has become mandatory to assess visualization techniques efficiency either to write a survey, optimize a technique or even design a new one. To do so, the common way is to conduct user evaluations through which human subjects are asked to solve a task on different visualization techniques while their performances are measured to assess which technique is the most efficient. These evaluations can be complex to design and setup in order not to be biased and, in the end, their results can become contestable when the evaluation methods standards evolve. To overcome these flaws, new evaluation methods are emerging, mostly making use of modern and efficient computer vision techniques such as deep learning. These new methods rely on a strong assumption that has not been studied deeply enough yet: humans and deep learning models performances can be correlated.

This paper explores the performances of both a state-of-the-art deep neural network and human subjects on an outlier detection task taken from a previous experiment of the literature. The objective is to study whether the machine and humans behaviors were different or if some correlations can be observed. Our study shows that their results are significantly correlated and a machine learning model efficiently learned to predict human performances using deep neural network metrics as input. Hence, this work presents a use case where using a deep neural network to assess human subjects performances is efficient.

IV2021-IVapp: Applications of Information Visualization

pid158 - μViz: Visualization of Microservices

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University of Coimbra, Portugal

Keywords: Microservices, workflows, visualization, tracing, dashboards.

IV2021_Abstract

Microservice architectures have become very popular and widely adopted by the industry, because of the benefits they bring to the software development process and resulting systems, such as parallel development, modularity and scalability.

However, as interfaces become more fine-grained and systems grown in size, complexity is moved from the component services to their interactions, eventually leading to intricate workflows that are hard to observe, visualize, and understand.

This problem is compounded by the typically high workloads that produce intractable amounts of observation data.

To deal with these challenges, operators need support from tools able to take in observation data, in particular tracing, and provide a fast and intuitive understanding of which components or workflows require attention and how are they affecting a module, service, instance, or the whole application.

In this paper, we present the design of a microservice visualization application that can fill a gap that exists in leveraging tracing data, aggregating and navigating it in ways that are actionable for operators.

Our application provides multiple views of the system and uses spatial and hierarchical navigation using flip zoom to simplify their exploration, while preserving context.

Our application can provide a better understanding of the system than existing applications that lack navigability and do not preserve context when switching between different services, layers or views.

Session IV21_2.4: Visualisation

Chair/co-chair: Prof. Rita Francese, // Dr. Loredana Caruccio, University of Salerno, Italy

pid108 - Approach for CAD model reconstruction basing on 3D points insertion and surface approximation

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¹LATIS, ENISo, University of Sousse; ²SETIT, University of Sfax; ³LMS, University of Sousse, Tunisia; ⁴CNRS, UMR 8201-LAMIH, Univ. Polytechnique Hauts-de-France

Keywords: Reverse Engineering (RE), geometric model, Computer Aided Design (CAD), 3D objects, B-Spline surface, deformed mesh.

Reverse engineering (RE) consists in the reconstruction of a geometric model of a 3D object from a set of points, a mesh or a 3D triangulation. This model is a combination of geometric primitives (cylinders, planes, spheres, etc.) and complex surfaces (B-Spline, NURBS...) defined by parameters that can be estimated from the 3D data. RE is widely used in different fields such as mechanic, artistic, medical, Building Information Modeling, reality augmentation, etc. In this context, the reconstruction of 3D surface is an important task to obtain the Computer Aided Design (CAD) model in order to visualize 3D objects and approximate their shapes by mathematical formulations. Triangular surface models are now commonly used to model three-dimensional object. Many of these geometric models are obtained from scanning techniques or modeled through CAD software. This paper presents a new approach to rebuild a CAD model basing on

the reconstruction of the B-Spline surfaces given a set of points extracted from a deformed mesh. To guarantee a good precision of the fitted surface, new 3D points are inserted to the input mesh using the Walton's method. Given the updated set of points, the B-Spline surface is approximated. To validate the proposed method, reconstruction errors of different complex 3D surfaces before and after the points insertion are calculated. A comparison with the existing methods prove the efficiency of the developed algorithm.

pid112 - Aggregating Viewpoints for Effective View-Based 3D Model Retrieval

Sou Watanabe, Shigeo Takahashi, Luobin Wang

University of Aizu, Japan

Keywords: view-based 3D model retrieval, bag-of-features model, similarity measures, viewpoint aggregation

The bag-of-features (BoF) model is the standard platform for image retrieval systems and successfully extended to systems for exploring 3D models through their projected views. However, we need a large number of views for each 3D model to achieve shape retrieval systems with high accuracy, which results in increased data storage and long computation time for shape comparison. This paper presents an approach for reducing projected images in such image-based shape retrieval by aggregating views of each 3D model. Our approach begins by discovering a proper metric for evaluating dissimilarity between 3D models by referring to their high-dimensional feature vectors obtained from the BoF model. We then introduce a variant of the k-means clustering method to identify the representative views of each 3D model, given the number of such essential views. Finally, we adjust the degree of such view aggregation by assessing the number of plane symmetries for each 3D model. We test our approach with a dataset containing 200 3D models and we learn that we can reduce the number of views to less than 10% while limiting the degradation of accuracy to approximately 5%.

pid115 - Efficient and Physics-based Facial Blendshapes based on ODE sweeping Surface and Newton's second law

Junheng Fang¹, Shaojun Bian¹, Jon Macey¹, Andres Iglesias², Hassan Ugail³, Alexander Malyshev⁴, Ehtzaz Chaudhry¹, Lihua You¹, Jianjun Zhang¹

¹Bournemouth University; ²University of Cantabria; ³University of Bradford; ⁴University of Bergen
Keywords: wireframe extraction, ODE sweeping surface-represented 3D models, Newton's second law-based facial blendshapes

Online games require small data of 3D models for low storage costs, quick transmission over the Internet, and efficient geometric processing to achieve real-time performance, and new techniques of facial blendshapes to create natural facial animation. Current geometric modelling and animation techniques involve big data of geometric models and widely applied facial animation using linear interpolation cannot generate natural facial animation and create special facial animation effects. In this paper, we propose a new approach to integrate the strengths of ODE (ordinary differential equation) sweeping surfaces and Newton's second law-based facial blendshapes to create 3D models and their animation with small data, high efficiency, and ability to create special facial effects.

pid149 - MuVis: Music Visualization

Graph embedding of music structures for machine learning approaches

Rocco Zaccagnino¹, Gerardo Benevento¹, Roberto De Prisco¹, Alfonso Guarino¹, Nicola Lettieri², Delfina Malandrino¹

¹University of Salerno, Italy; ²National Institute for Public Policy Analysis

Keywords: Graph embedding, Music style recognition, Machine learning

Several works on representation learning for graph-structured data have been proposed in recent literature. However, most of such techniques have several downsides. On the one hand, graph kernels using handcrafted features (e.g., shortest paths) and hampered by poor generalization problems. On the other hand, methods for learning representations of whole graphs deal with unattributed or single-attributed graphs. In this work, we propose a novel technique for graph embedding learning able to take into account multi-attribute graphs (from 1 to an arbitrary number). Given a multi-attribute graph, the proposed method generates an embedding vector as follows: (i) the graph is split into several single-attribute graphs; for each of these, one numeric vector is generated by using state-of-the-art graph embedding techniques; (ii) the obtained vectors are concatenated in one representative vector using a multi-view learning integration technique; (iii) the size of such a vector is reduced through deep autoencoders. Experiments have been conducted on the music style recognition problem. We focus on the corpus of 4-voice J. S. Bach compositions. First, such a corpus has been decomposed and translated into graph-based structures corresponding to the music scores. Then, the proposed method is applied to generate the embedding vectors from the obtained graphs. Finally, a Random Forest model trained on such obtained vectors is used for generating novel music compositions in the learned style. Results obtained show the effectiveness of the proposed approach.

pid168

MediVis2021 - International Conference BioMedical Visualisation

Deep Neural Networks for Histopathological Image Classification – Study of Color-space Choice Impact

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RIADI Laboratory - National School of Computer Science (ENSI) - University of Manouba – Tunisia

Keywords: Histopathological image classification, Supervised deep learning, Color-space conversion, Data augmentation, Cancer grading

Histopathology is one of the most used practices in the bio-medical field for disease and cancer detection and grading. Following the digitalization of biological data and improvement of machine/deep learning methods, the challenges for developing Computer-Assisted Diagnosis (CAD) systems arose. In this paper, we present a guide to the preparation of histopathological image for classification; we studied the impact of color-space migration for each histological staining technique, as well as the importance of preprocessing and data augmentation. The grading of our data was performed using four different CNN architectures: ResNet32, ResNet50, VGGNet16 and VGGNet19. For IHC stained images, L*u*v* and XYZ color-spaces outperformed

the rest, in other hand, for H&E preprocessed images, RGB color-space combined with a proposed preprocessing method gave the best classification results.

Session IV21_2.5: Knowledge Visualisation

Chair/co-chair: Prof. Gilles Venturini, University Tours, FR // Prof. Fatma Bouali, University of Lille, FR

pid 145 - **The sight of Justice. Visual knowledge mining, legal data and computational crime analysis**

Nicola Lettieri¹, Alfonso Guarino², Delfina Malandrino², Rocco Zaccagnino²

¹National Institute for Public Policy Analysis, Rome, Italy; ²Computer Science Department, University of Salerno, Fisciano (SA), Italy

Keywords: Visualization, Legal Knowledge mining, Crime analysis, Legal data

One of the challenges in the emerging field of computational crime analysis is that of extracting actionable knowledge from heterogeneous (both legal and empirical) information hidden into criminal proceedings. Public prosecutors generally deal with information systems that do not provide advanced information extraction functionalities and that boil down to databases containing complaints, criminal records or police reports. In this paper, we dwell on how visualization can support knowledge mining in criminal investigations by playing a three-fold role: (a) depicting the structural and qualitative features of both criminal organizations and their members; (b) showing the evolution of criminal networks over time; (c) enhance the interaction between the domain expert and computational heuristics in the knowledge construction process. We present three visualizations designed to support knowledge mining in criminal investigations that have been tested with real data and evaluated by legal scholars and public prosecutors within a computational crime analysis project.

pid152 - **Insights from Neuroscience: Exploring Highly Sensitive Persons' Use of Knowledge Visualization**

Sabrina Bresciani¹, Sebastian Kernbach^{1,2}

¹University of St. Gallen, Switzerland; ²Stanford University, United States

Keywords: sensory processing sensitivity, individual preferences, knowledge visualization, aesthetic sensitivity, visual metaphors

About one fourth of humans (and animals) have a highly sensitive brain: they attend and process visual stimuli with more intensity. Brain scans show that highly sensitive individuals have greater activation of neural regions involved with higher-order visual processing. It has been theorized that highly sensitive people are more creative and can benefit more from structuring information into knowledge maps compared to text. We investigate this proposition by conducting a qualitative explorative analysis of artifacts created by subjects attending a course based on design thinking. We find that highly sensitive individuals used more colors, and

created visual metaphors more often compared to individuals who do not have this temperament trait. Non-highly sensitive people created linear diagrams more often compared to highly sensitive individuals. These promising preliminary findings seem to indicate the need for visualization studies to include high sensitivity as a potential important moderator of visualization effectiveness

IV2021: Learning Analytics

pid 170 - Enriching Didactic Similarity Measures of Concept Maps by a Deep Learning Based Approach

Carla Limongelli¹, Daniele Schicchi², Davide Taibi²

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Keywords: Concept Maps, Learning Analytics, Semantic Similarity Measures, Natural Language Processing, Deep Learning, Infersent

Concept maps are significant tools able to support several tasks in the educational area such as curriculum design, knowledge organization and modeling, students' assessment and many others. They are also successfully used in learning activities in which students have to represent domain knowledge according to teacher's assignment.

In this context, the development of Learning Analytics approaches would benefit of methods that automatically compare concept maps. Detecting concept maps similarities is relevant to identify how the same concepts are used in different knowledge representations.

Algorithms for comparing graphs have been extensively studied in the literature, but they do not appear appropriate for concept maps.

In concept maps, concepts exposed are at least as relevant as the structure that contains them. Neglecting the semantic and didactic aspect inevitably causes inaccuracies and the consequently limited applicability in Learning Analytics approaches.

IV2021-IVapp: Applications of Information Visualization

pid142- EmojiText: an information visualization technique for analyzing phrases and sentiments

Iuri Victor Ferreira Costa¹, Roberto Yuri da Silva Franco², Anderson Gregorio Marques Soares², Rodrigo Santos do Amor Divino Lima¹, Carlos Gustavo Resque dos Santos¹, Bianchi Serique Meiguins¹

¹Federal University of Para, Brazil; ²Federal Rural University of The Amazon, Brazil

Keywords: Text visualization, Sentiment visualization, Visualization Technique

Concept maps are significant tools able to support several tasks in the educational area such as curriculum design, knowledge organization and modeling, students' assessment and many others.

They are also successfully used in learning activities in which students have to represent domain knowledge according to teacher's assignment. In this context, the development of Learning Analytics approaches would benefit of methods that automatically compare concept maps. Detecting concept maps similarities is relevant to identify how the same concepts are used in different knowledge representations.

Algorithms for comparing graphs have been extensively studied in the literature, but they do not appear appropriate for concept maps. In concept maps, concepts exposed are at least as relevant as the structure that contains them. Neglecting the semantic and didactic aspect inevitably causes inaccuracies and the consequently limited applicability in Learning Analytics approaches.

pid 116 - Automated Insights on Visualizations with Natural Language Generation

Richard Brath, Craig Hagerman

Uncharted Software, Canada

Keywords: Natural Language Generation, Automated Commentary, Narrative Visualization

Quantitative data, such as a 10k financial report, requires cognitive load to scan the columns and rows and identify patterns and important takeaways, whether novice or subject matter expert. Visualizations can be used to summarize and reveal patterns. However, unless a visualization contains arrows or other callouts, it still requires cognitive load to understand and rank the important conclusions to which a reader should pay attention. In this research, we reduce the cognitive load in understanding tabular data by combining charts with ranked natural language generated (NLG) bullet point statements that summarize the top takeaways. The contribution of this work is an NLG pipeline to computationally extract insights from tabular data and provide textual comments, which are then integrated with visualizations of the same data set.

Session IV21_3.1: Information Visualisation

Chair/co-chair: prof. Mao Lin Huang, / Prof. Tony (Weidong) Huang, UTS, AUS

pid 107

ExTraVis: Exploration of Traffic Incidents Using Visual Interactive System

Joshua Zerafa¹, Md Rafiqul Islam¹, Muhammad Ashad Kabir², Guandong Xu¹

¹University of Technology Sydney (UTS), Australia; ²Charles Sturt University, NSW, Australia

Keywords: Traffic Incidents, Interactive, Visualization

The impact of road traffic incidents (e.g., road accidents, vehicle breakdowns) have become progressively worse over the years, being a major cause of many adverse issues such as serious injury, economic loss, and lifelong disabilities. Thus, it is essential to acknowledge these issues and proactively construct appropriate solutions to mitigate the impact of these issues in the future. This study outlines the history of traffic incident research and covers several solutions such as machine learning, mathematical modeling, and visualization system to traffic incident analysis. In this paper, we design a unique visualization system, ExTraVis, for incident data exploration and analysis that can be used to help traffic management controllers, aid to make decisions, and help them to understand how past incidents affected and where incidents may occur. The key features of this system are visual exploration and analysis to overcome the problems linked with road traffic incidents and to encourage future work and improvements. Additionally, we gathered various custom queries for free text search feature. We find that people ask questions and our system provide 90% correct visual insights. Finally, we demonstrate the effectiveness and robustness of ExTraVis by comparing with three different incident visualization dashboards and a user study.

pid 109 - VisuaLeague: Visual Analytics of Multiple Games

Ana Paula Afonso¹, Maria Beatriz Carmo², Rafael Afonso³

¹LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal; ²LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal; ³LASIGE, Faculdade de Ciências, Universidade de Lisboa, Portugal

Keywords: Game data visualization, spatio-temporal data, aggregated data visualization, visual analytics, MOBA games

One of the most popular eSports (electronic sports) game types practiced is the Multiplayer Online Battle Arena (MOBA) genre, represented by one of the most popular competitive games, League of Legends (LoL). As in many traditional sports, to improve player and team performance, players and coaches analyze all the game events, such as, the positions and trajectories of the players, representing their movements, events and actions they performed during the game (spatial and temporal data). This paper presents VisuaLeague, a visualization tool for analysis of LoL matches for single player, teams, professional matches, and multiple games. The tool offers interaction with the visualizations, filtering and aggregation of data, and clustering to solve the common problems presented in analysis with voluminous amount of data, like cluttering and overlapping. We evaluated VisuaLeague through a user study covering the

various types of analysis with two professional coaches. Results indicate that the tool was overall intuitive, useful, efficient and innovative and coaches show a particular interest in the analysis of professional training matches and multiple games as those provide visualizations that often lack in common tools, specially, regarding spatio-temporal data.

POSTER

pid164

IV2021: WebViz - Web Visualization

A Web-based Interface for the Animation of Declarative Languages

Nada Hamdy, Nada Ahmed Hamed Sharaf

The German University in Cairo

Keywords: Prolog, Visualization, Web-Based Visualization

Prolog is a declarative programming language that is widely used in the fields of symbolic computations and many areas of artificial intelligence. This paper introduces a complete visual web-based interface for visual programming using blocks to simulate Prolog programs and animating the algorithms of the executed program. Visual programming languages are useful for beginners to understand the concepts of the programming paradigms and start writing simple programs with less errors. Program animation is useful in understanding and tracing how the program works.

pid132 - Simplifying the Structural Recursion of the Data Funnel Interface

H. Paul Zellweger

ArborWay Labs, United States of America

Keywords: data funnel interface, structural recursion, branching data model, BDM, database interface

The paper investigates the improvements made to the structural recursion of the Data Funnel Interface. The data funnel interface organizes the raw data in a database table into nested data sets that guide users to information. These new developments streamline the algorithm and the data file it produces for interfaces with either fixed or adjustable pathways. On each recursive pass, the algorithm constructs a new SELECT statement to retrieve a subset of data from the table. Next, it transforms the subset's structure into a pattern for the nested lists of data that users can navigate in the interface. The branching data model (BDM) provides the framework for combining these two capabilities into a single algorithm. This data model features a precise data mapping between two table attributes as one-to-many data relationships. The recursion's input data, a list of table attributes, models a data funnel network. Each new subset of data folds into the former subset until it reaches the final subset, a primary key value. In the past, the prior algorithm draws on the predictability of the depth-first tree growing methodology of the OHDS structure to organize these subsets. The paper introduces a new numbering scheme in light of the new requirement for adjustable pathways. This improvement assigns both list numbers and attributes identifiers when adding subset data from different table fields. This capability replaces the need for the OHDS; it also simplifies the data funnel software and makes it easier to maintain.

Session IV21_3.2: Human-computer interaction for Information Visualization

Chair/co-chair: Prof. Filippo Sciarrone, Roma Tre University, IT// Marco Temperini, Sapienza University, Rome, Italy

pid 122 - Vibro-tactile feedback models to explore virtual reality without going round in circles

Baptiste Hans, Laurent Moccozet

University of Geneva, Switzerland

Keywords: haptic, interaction, navigation, vibro-tactile, virtual reality

The paper investigates the improvements made to the structural recursion of the Data Funnel Interface. The data funnel interface organizes the raw data in a database table into nested data sets that guide users to information. These new developments streamline the algorithm and the data file it produces for interfaces with either fixed or adjustable pathways. On each recursive pass, the algorithm constructs a new SELECT statement to retrieve a subset of data from the table. Next, it transforms the subset's structure into a pattern for the nested lists of data that users can navigate in the interface. The branching data model (BDM) provides the framework for combining these two capabilities into a single algorithm. This data model features a precise data mapping between two table attributes as one-to-many data relationships. The recursion's input data, a list of table attributes, models a data funnel network. Each new subset of data folds into the former subset until it reaches the final subset, a primary key value. In the past, the prior algorithm draws on the predictability of the depth-first tree growing methodology of the OHDS structure to organize these subsets. The paper introduces a new numbering scheme in light of the new requirement for adjustable pathways. This improvement assigns both list numbers and attributes identifiers when adding subset data from different table fields. This capability replaces the need for the OHDS; it also simplifies the data funnel software and makes it easier to maintain.

pid133 - Pupil responses by level of valence sensitivity to emotion-evoking pictures

Nijika Murokawa, Minoru Nakayama

Tokyo Institute of Technology, Japan

Keywords: pupil response, emotional assessment, subjective assessment, measurement

Pupillary change due to emotion-evoking stimuli and the relationship between pupil responses and emotion-rating behaviours were analysed carefully. Chronological pupil responses were compared by level of emotional impression, which was standardised using item response theory.

The results show that mean pupil size changes according to the level of emotional impression, and the maximum size depends on the classification level, such as middle-group negative on the valence scale. Also, the duration of appearance of the significant difference between the various

levels of the groups depends on the number of levels. These results confirm the results of some of the previous studies. Therefore, they suggest that pupil response consists of the composite reactions mentioned above.

The importance of assessment of the individual rating responses was confirmed in a detailed analysis.

pid143 - Emotional intensity estimation of a Japanese speech corpus using acoustic features

Megumi Kawase, Minoru Nakayama

Tokyo Institute of Technology, Japan

Keywords: speech, emotion, intensity, acoustic features, deep learning

Pupillary change due to emotion-evoking stimuli and the relationship between pupil responses and emotion-rating behaviours were analysed carefully. Chronological pupil responses were compared by level of emotional impression, which was standardised using item response theory.

The results show that mean pupil size changes according to the level of emotional impression, and the maximum size depends on the classification level, such as middle-group negative on the valence scale. Also, the duration of appearance of the significant difference between the various levels of the groups depends on the number of levels. These results confirm the results of some of the previous studies. Therefore, they suggest that pupil response consists of the composite reactions mentioned above. The importance of assessment of the individual rating responses was confirmed in a detailed analysis.

SHORT PAPER

pid138 - The effectiveness of virtual reality in understanding a new concept in educational support systems

Singo Taniuchi, Kiyotaka Kawahara, Mariko Sasakura

Okayama University, Japan

Keywords: Virtual Reality, VR, education, visualisation

The purpose of this research is to confirm the effectiveness of Virtual Reality (VR) on education, especially grasping a new concept. Quantum programming is a new field of programming which is basically unknown to conventional programmers. Therefore, we select quantum programming as a topic in which we check the effectiveness of VR. We develop education support systems on quantum programming, one of them with VR and the other without VR. Subjects use both systems and we compare the results. The results suggest that VR is effective to grasp a new concept.

Session IV21_3.3: Envisaged Builtviz – Panel Discussion

Chair//C-chair: Professor Richard Laing, Robert Gordon University (RGU), UK; Dr Mengbi Li, Victoria University, Australia

PANEL DISCUSSION

Lockdown life and visualised built environment vis-à-vis post-pandemic envision and reflection – Panel Discussion

PANEL MEMBERS:

Prof Ali Cheshmehzangi, Professor of Architecture and Urban Design, Faculty of Science and Engineering, The University of Nottingham Ningbo China (UNNC)

Prof Farzad Khosrowshahi, Dean, College of Engineering & Science, Victoria University, Australia

Prof Lu Aye, Professor of Infrastructure Engineering, The University of Melbourne, Australia

A/Prof Masa Noguchi, Environmental Design, Faculty of Architecture, Building and Planning, The University of Melbourne, Australia

A/Prof Zora Vrcelj, Discipline Group Leader, Built Environment, Victoria University, Australia

Dr Anne Jensen, Senior Scientist, European Politics and Policy, Senior Researcher, Department of Environmental Science - Environmental, social science and geography, Aarhus University, Denmark.

CHAIRS**Prof Richard Laing**

Professor, Robert Gordon University (RGU), UK

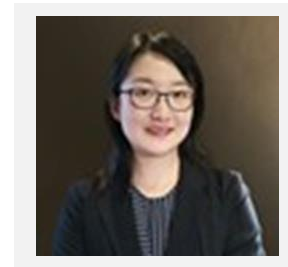


Richard's research concentrates on the subject of visualisation and its use within public evaluation of open space, built heritage and urban design. His skills in relation to visual environmental valuation have developed through leading significant and large-scale externally funded research projects. He has been an active participant in research concerning the evaluation of public open space, and the manner in which such studies can benefit from information visualisation (IV). He has co-chaired BuiltViz in 2007-present. Richard is a Fellow of the RSA, a Chartered Surveyor and is a trained

chairman and assessor for the RICS APC. He has represented the RICS on the European Construction Technology Platform, and is a member of EPSRC peer review college.

Dr Mengbi Li, Victoria University, Australia

Lecturer in Built Environment (Architecture), First Year College and Research Fellow, ISILC, Victoria University



Dr Li is a Lecturer in Built Environment (Teaching Focused Academic) in the First Year College at Victoria University, Melbourne. She currently serves as unit convenor and key academic in the College. She was awarded a prestigious Research Fellowship in 2019-2021 at VU's Institute for Sustainable Industries and Liveable Cities (ISILC). Dr Li holds a PhD in Built Environment (Architecture) from the University of New South Wales (UNSW), Sydney.

Her research primarily seeks pathways to intellectual understanding and response in architecture and urbanism from its own history, with a particular focus on the pre-modern architecture and settlements in China. A recent project of hers investigates the rich history of Chinese cities in relation to quarantine urbanism. She has published research in premium peer-reviewed journals in architecture, including *The Journal of Architecture*, and *The Journal of Architecture and Urbanism*. Beyond academia, her recent pandemic-related reflections on architectural and urban design have been published by *The Conversation* and reported by *SBS*.

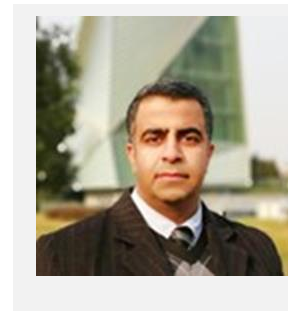
PANEL MEMBERS**Prof Ali Cheshmehzangi**

Head of Department of Architecture and Built Environment

Professor of Architecture and Urban Design

Department of Architecture and Built Environment

Faculty of Science and Engineering, The University of Nottingham Ningbo China (UNNC)



Professor Ali Cheshmehzangi is Head of the Department of Architecture and Built Environment. He is Professor of Architecture and Urban Design, focusing on research and teaching in the fields of sustainable urbanism, urban transitions/experimental city studies, and urban design. He is an architectural and urban designer/urbanist by profession, with qualifications, practice experience, and research profile in urban design, sustainable urban planning, and development. He is also Director of Urban Innovation Lab (UIL), focused on three themes of urban data, urban climate, and urban planning and design. Since January 2018, he is also Director of

Centre for Sustainable Energy Technologies (CSET). Previously, Ali has held several university-level administrative and managerial roles, such as Advisory Committee member for Student Experience and Engagement, Deputy Warden, the University's Strategic Regional Representative for Africa and the Middle East, Research Priority Group co-lead in IAPS (on Contemporary

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Challenges of China), Head of Research Group, and the Academic Director of Nottingham Advantage Award (NAA). The latter is the largest teaching and learning platform across our three campuses in the UK, Malaysia, and China. Currently, Ali works on two research projects on integrated and information-based city modelling (funded by NSFC), and sustainable urbanism. He is completing a project on urban regeneration in China, and is Co-I of two on-going projects. Prior to these, he completed three local funding projects and one NSFC project.

Prof Farzad Khosrowshahi

Dean, College of Engineering & Science, Victoria University, Australia



Professor Farzad Khosrowshahi was appointed Dean of the College of Engineering and Science at Victoria University in February 2017. He has an extensive understanding in University core business in a broad range of subjects, including the areas of: learning and teaching; research and innovation; academic engagement and enterprise.

He specialises in engineering and information technology that builds on environment, management and industrial relations. Prior to commencing at VU, Professor Khosrowshahi was the Dean of School of the Built Environment and Engineering at Leeds Beckett University England (2012-2017) and held

several senior positions in the UK including:

Professor of Construction Management and IT at the University of Salford (2003-2012)

Director of Construct IT (2003-2012)

Reader in Construction Management Information Technology at UCE (providing engineering services for telecommunications) (2001-2003)

Director of FAZTEC Software Consultants (1994-1999).

Professor Khosrowshahi's international standing is reinforced by his membership of several scientific and industry committees and as assessor of many international funding bodies.

He is also the founder of BIM Academic Forum (BAF), has served as the chair of the Association of Researchers in Construction Management (ARCOM), founded the Information Visualisation Society (IVS) and, in his capacity as the Director of Construct IT, secured funding to unite all IT organisations in the UK. This resulted in the creation of Uniting Construction Information (UCI). He is currently an Ambassador and Fellow member of the Chartered Institute of Building and has previously been a member of the International Association for Cybernetics.

Prof Lu Aye

Professor of Infrastructure Engineering, The University of Melbourne, Australia



Lu Aye is a Professor in the Department of Infrastructure Engineering at the University of Melbourne, Australia. Prof. Aye has more than 40 years of engineering experience in university teaching, research, development, demonstration and commercialisation of renewable energy and energy efficiency technologies.

He has been internationally recognised as an expert in low-carbon technologies for built environment applications. His research areas include heating, ventilation, air-conditioning and refrigeration systems, waste to resources, complex systems

modelling. Prof. Aye applied phenomenological modelling and simulation approaches for optimising energy systems. He also utilised computational and participatory approaches for modelling socio-ecological systems under deep uncertainty. These system models have been applied for identifying the effects of policy interventions and robust decision making. He has been recognised as a leading expert in modelling, simulation, optimisation and forecasting of complex systems behaviours

A/Prof Masa Noguchi

Associate Professor in Environmental Design, Faculty of Architecture, Building and Planning, The University of Melbourne, Australia



Dr Masa Noguchi is an Associate Professor in Environmental Design at the Faculty of Architecture, Building and Planning, University of Melbourne, Australia. He is a Chartered Engineer, Environmentalist, and Technological Product Designer registered respectively with the Engineering Council, Society for the Environment, and the Institution of Engineering Designers in the UK. In 2002, he also became a member of the Royal Architectural Institute of Canada, and today he serves as a Certified Passive House Designer registered with the Passive House Institute in Germany. Dr Noguchi is the founding coordinator of ZEMCH Network

(www.zemch.org) which consists of over 500 partners from nearly 40 countries and initiated a

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number of industry-academia knowledge transfer events. Before coming to Melbourne, he was a Reader at the Mackintosh School of Architecture, The Glasgow School of Art affiliated with the University of Glasgow, where he established a ZEMCH pathway within the Master of Architectural Studies program. His research is based on ZEMCH engineering design and socially, economically and environmentally sustainable housing community developments in developed and developing countries.

A/Prof Zora Vrcelj

Discipline Group Leader, Built Environment, Victoria University, Australia



As Head of Built Environment at Victoria University, Associate Professor Zora Vrcelj enjoys working across the built environment, engineering and construction sector to achieve impactful outcomes.

Prior to joining Victoria University in 2012 Associate Professor Vrcelj was an academic for 12 years within the School of Civil and Environmental Engineering at the University of New South Wales (UNSW).

Associate Professor Vrcelj has been working to bring about technological developments aimed at enhancing the functionalities of high-performance structures (smart buildings and civil infrastructure). She has worked on numerous research

projects with particular focus on structural engineering design, advanced composite structures and testing and evaluation of materials used in buildings and civil infrastructure. This experience, combined with her work in the fields of structural engineering, structural mechanics, materials science and smart buildings, enables her to extrapolate this expertise to built environment practice. Associate Professor Vrcelj has published over 90 refereed technical publications and has secured numerous competitive grants (including ARC DP and CRC grants). Since 2010, she has held a Visiting Professor position in Civil engineering at the University of Novi Sad, Serbia.

Dr Anne Jensen

Senior Scientist, European Politics and Policy, Senior Researcher



Dr Anne Jensen is a senior research Scientist at iCLIMATE Aarhus University Interdisciplinary Centre for Climate Change within the Department of Environmental Science - Environmental, social science and geography, Aarhus University, Denmark. Her research interest the multidisciplinary aspect of Climate change. She has been involved in numerous international projects in this field that resulted in more than 60 research publication

Session IV20_3.4: Information Visualisation

Chair/co-chair: Prof. João Moura Pires, Univ. NOVA de Lisboa, // Dr. Ana Paula Afonso, Univ. Lisboa, Portugal

pid118 - PCAPFunnel: A Tool for Rapid Exploration of Packet Capture Files

Juraj Uhlár¹, Martin Holkovic^{1,2}, Vit Rusnak³

¹Flowmon Networks, a.s.; ²Brno University of Technology, Czech Republic; ³Masaryk University, Czech Republic

Keywords: Data analysis, Data visualization, Network traffic analysis, Packet captures

Analyzing network traffic is one of the fundamental tasks in both network operations and security incident analysis. Despite the immense efforts in workflow automation, an ample portion of the work still relies on manual data exploration and analytical insights by domain specialists. Current state-of-the-art network analysis tools provide high flexibility at the expense of usability and have a steep learning curve. Recent -- often web-based -- analytical tools emphasize interactive visualizations and provide simple user interfaces but only limited analytical support.

This paper focuses on identifying network and security operators' needs and supporting their analytical work. We describe typical user tasks and requirements. We also present the filtering funnel metaphor for exploring packet capture (PCAP) files through visualizations of linked filter steps.

We have created PCAPFunnel, a novel tool that improves the user experience and speeds up packet capture data analysis. The tool provides an overview of the communication, intuitive data filtering, and details of individual network nodes and connections between them. The qualitative usability study with nine domain experts confirmed the usability and usefulness of our approach for the initial data exploration in a wide range of tasks and usage scenarios, from educational purposes to exploratory network data analysis.

pid 128 - Visualisation Tool to Support Fraud Detection

Pedro Nuno Silva, Catarina Maçãs, Evgheni Polisciuc, Penousal Machado

University of Coimbra, Centre for Informatics and Systems of the University of Coimbra,
Department of Informatics Engineering

Keywords: Information Visualization, Data Analytics, Fraud

Automatic fraud detection and prevention are challenging problems that have attracted the attention of many researchers in academia and industry. Over the last few years, many improvements have been achieved, especially in predictive models based on Machine Learning. However, a considerable amount of these models only provide a prediction score and a short explanation which may not be enough to make informed decisions. This paper presents a visualization tool that aims to assist fraud analysts in making informed decisions and increase their effectiveness in the detection of fraud. To this end, we designed three visualisation models that apply state-of-the-art techniques to support the analysis of fraudulent transactions. To demonstrate the analytic capabilities and benefits of the proposed tool, we discussed a real use case scenario and conducted user testing with real fraud analysts. Through the feedback from both studies, we were able to conclude that the tool is an asset to facilitate the detection of suspicious events as well to improve the analysis times of the fraud analysts' work process.

pid135

MediVis2021 - International Conference BioMedical Visualisation

Reconstruction and Visualization of Protein Structures by exploiting Bidirectional Neural Networks and Discrete Classes

Alessia Auriemma Citarella, Lorenzo Porcelli, Luigi Di Biasi, Michele Risi, Genoveffa Tortora

University of Salerno, Italy

Keywords: Protein Structure, Torsion Angle Prediction, Long Short-Term Memory, Deep Learning

In recent years, Deep Learning techniques have achieved some success in bioinformatics tasks, including protein conformation prediction. In this work, we propose a Bidirectional Long Short-Term Memory (BLSTM) network system, called Human Proteins Angles Prediction (HPAP), in order to improve the prediction of dihedral angles of proteins. We have introduced

a discrete subdivision classes of 5° for protein torsion angles and four new features related to accessible surface area and volume. In total there are 73 classes (72 classes include the angles between -180° and 180° , a further class is used to code the free angles at the beginning of the sequence) with a maximum expected error of $\pm 2.5^\circ$. We have tested three model variants in several parameter combinations. With our model, we have obtained a decrease of

the mean absolute error of about 2° for the angle. Although our dataset is reduced in size, the accuracy of ϕ and ψ angles is comparable to the existing methods. Predicting angles accurately is useful for accurately reconstructing the three-dimensional structure of a protein. In this context, the prediction is limited to the ϕ and ψ angles and we will visualize what happens locally

when a prediction is correct. In case the prediction is far from true angles, even a small error can deconstruct the backbone.

SPOSTER PAPER

pid136 - Visualization Resources: A Starting Point

Xiaoxiao Liu¹, Mohammed Alharbi², Joseph Best³, Jian Chen⁴, Alexandra Diehl⁵, Elif Firat³, Dylan Rees⁶, Qiru Wang³, Robert S Laramée³

¹Bournemouth University; ²Swansea University; ³University of Nottingham; ⁴The Ohio State University; ⁵University of Zurich; ⁶Zuken UK Ltd.

Keywords: visualization resources, surveys

Visualization, as a vibrant field for researchers, practitioners, and higher educational institutions, is growing and evolving very rapidly. Tremendous progress has been made since 1987, the year often cited as the beginning of data visualization as a distinct field. As such, the number of visualization resources and the demand for those resources are increasing at a very fast pace. We present a collection of open visualization resources for all those with an interest in interactive data visualization and visual analytics. Because the number of resources is so large, we focus on collections of resources, of which there are already very many ranging from literature collections to collections of practitioner resources. We develop a novel classification of visualization resource collections based on the resource type, e.g. literature-based, web-based, etc. The result is a helpful overview and details-on-demand of many useful resources. The collection offers a valuable jump-start for those seeking out data visualization resources from all backgrounds spanning from beginners such as students to teachers, practitioners, and researchers wishing to create their own advanced or novel visual designs.

Session IV20_3.5: Visualisation

Chair/co-chair: John Counsell, Counsell Consultancy, FR // Dr. Gehan Ahmed Nagy, British University in Egypt, EG

pid151 - Development of a visual tool for the design of aggregate-oriented NoSQL databases

Antonio Sarasa

Universidad Complutense de Madrid, Spain

Keywords: NoSQL database, visual design tool, aggregation model, web application.

The aggregation model is the foundation of some of the main NoSQL databases. This model is characterized because the basic element of management is the concept of aggregate. Furthermore, another characteristic is that it is not necessary to create a definition schema in the database to store information as in the case of relational databases. It is for this reason that in general there are no sophisticated design tools for databases oriented towards aggregates since the schema is implicit in the stored information. However, a design tool allows better management of the information to be stored and especially the maintenance of the database. This article presents a visual tool that allows you to design a NoSQL database oriented towards aggregates, as well as manage different designs. On the other hand, the tool allows generating instances of the design containing data for a MongoDB-type document database.

pid110

VIS2021: Dart - Symposium of Digital Art and Gallery

MicroWorlds: A macro study of microbial interactions informs a bio-art series**Courtney Brake, Yongjin Liu, Paul Straight, Carol LaFayette**

Texas A&M University, United States of America

Keywords: Bio-art, "Art and Science", Bacillus subtilis, Streptomyces, time-lapse, photography, bioluminescence, collaboration, "bacterial interactions"

A collaboration between an artist and a team of microbiologists aimed to capture interactions between microbial communities as a whole to better understand the biological bases of interactions that take place within them. This required building a time-lapse imaging system from off-the-shelf components and optimizing image capture at the macroscale of centimeters. Biological discoveries during the course of the research gave rise to a new series of artworks leveraging the complex interactions of line, form, and color as bacteria react to stressors in the environment. The work in progress shifts to capturing the motion of light observed in bioluminescent bacteria.

POSTER - IV2021: GVA GeoAnalytics

pid167 - A Taxonomy and Interactive Survey of Integrated Spatial-Temporal Data Visualization**Ying Zhu**

Georgia State University, United States of America

Keywords: visualization, spatial-temporal analysis, taxonomy, survey

Spatial-temporal data visualization is an important sub-field of data visualization. Many spatial-temporal data visualization techniques have been developed and published. Although there are several surveys on this subject, some are based on a task-centric or data-centric framework. Some surveys focus on the temporal data visualization for a particular type of spatial data visualization, such as a map or space-time cube. In this paper, we present a new taxonomy and interactive survey of spatial-temporal data visualization. Based on our taxonomy, a wide variety of spatial-temporal data visualization techniques can be described by a small set of visualization elements. This is the first step towards creating a grammar for spatial-temporal visualization.

pid117 - Visual analytics to support industrial vehicle fleet planning**Guilherme Xavier Ferreira¹, Melise Maria Veiga de Paula¹, Rafael Perez Pagan², Bruno Guazelli Batista¹**¹Federal University of Itajubá, Brazil; ²DDMX - Smart Productivity, Brazil*Keywords:* visual analytics, information visualization, fleet planning, fleet management

Data analytics is becoming more important due to the data generated by the immensity of systems driven by widespread use of internet and mobile devices. Getting useful information from a lot of data is a challenge that visual analytics can be an alternative to. Visual analytics promotes information visualization and data mining techniques to consolidate and extract insightful information from databases. This paper aims to apply visual analytics concepts to help

new logistic solutions prospecting for optimization of industrial vehicles fleet. As a result, an artifact prototype able to assess the fleet behavior in terms of operational and available vehicles was developed. The prototype was evaluated based on information visualization and visual analytics practices.

Session IV20_3.6: The 20th Annual Animation and Digital Effects FilmChair: Prof. Mark Bannatyne, USA

Session IV2021_4.1: Information Visualisation

Chair/co-chair: Prof. Tony (Weidong) Huang, /prof. Mao Lin Huang, UTS, AUS

pid166 - Visualization of trajectory-based queries in images database

Roseval Donisete Malaquias Junior, Renato Bueno

Federal University of São Carlos, Brazil

In image databases, queries are usually carried out by comparing the similarity of features extracted from the images, such as texture, shape and color in order to find the images most similar to the defined query center. However, we propose in this work a trajectory-based query, where instead of defining a single image as the query center, a set of temporal instances of images ("query trajectory") is defined, retrieving the trajectories belonging to the delimited search area surrounding this "query trajectory". This work proposes techniques for visualization of complex data trajectories, considering similarity. The attribution of visual context in the visualization of these trajectories may help in the perception of knowledge in the hidden structures of the data. We developed techniques to summarize related trajectories of classified data and rendering options to improve the visual context of the query in a virtual reality visualization environment. Also, we present examples of visualization in order to show its usefulness in the visualization of data for the perception of knowledge.

pid 129 - Real-time visualization reconstruction in a real-world environment using Augmented Reality.

Tiago Davi Oliveira de Araújo¹, Beatriz Sousa Santos², Carlos Gustavo Resque dos Santos¹, Bianchi Serique Meiguins¹

¹Universidade Federal do Pará, Brasil; ²Universidade de Aveiro, Portugal

Keywords: augmented reality, real-time visualization, interaction, chart recognition, chart reconstruction

Even with the growth of digital data sources and support for the creation of visualizations, much information disseminated in chart format is still static, whether printed or digital. Some of the common problems using visualization components can be easily corrected on design of the chart using a charting tool, but in the real-world, mainly in the printed media, it is not a simple task. We investigate a method to reconstruct real-time visualizations in a real-world environment using Augmented Reality. We propose a prototype that interacts with extracted data from a bitmap chart in the real-world and evaluated it with usability experts. Results shows high degree of satisfaction on many factors, mainly filter usage, and promising feedback about interaction.

pid 131 - Visually exploring a Collaborative Augmented Reality Taxonomy

Bernardo Marques¹, Tiago Araújo², Samuel Silva¹, João Alves¹, Paulo Dias¹, Beatriz Sousa Santos¹

¹IEETA, DETI, University of Aveiro, Portugal; ²PPGCC, Federal University of Pará

Keywords: Visualization Tool, User study, Collaboration Taxonomy, Augmented Reality, Remote Collaboration

Augmented Reality (AR) has been explored with the objective to assist in scenarios of co-located or remote collaboration. To help understand how well collaborative work can be addressed with AR, it is important to foster harmonization of perspectives and create a common ground for systematization and discussion. In this vein, understand relationships among existing dimensions of collaboration, as well as identify research opportunities, is of paramount importance and thus tools that allow visually exploring information associated with Collaborative AR may be most valuable. In this paper, we present a first effort towards the creation of such an interactive visualization tool for exploration and analysis of collaborative AR research. It allows visualize data of selected papers organized according a human-centered taxonomy on collaborative AR. In order to get insights into whether the structure was understood and if the representation was clear and efficient to use, we evaluated the proposed tool through a user study with 40 participants. Results suggest the tool has potential towards the creation of a shared understanding and identification of existing patterns, trends and opportunities within the field of collaborative AR.

pid139 - A brief review of dashboard visualizations employed to support management or business decisions

Davi Augusto Galúcio Frazão, Thiago Sylas Antunes da Costa, Tiago Davi Oliveira de Araújo, Bianchi Serique Meiguins, Carlos Gustavo Resque dos Santos

Federal University of Pará, Brazil

Keywords: Information Visualization, Dashboard, Business, Management, Literature Review.

This work aims to review the academic literature on information visualization techniques used in dashboards applied to strategic business or management decision-making. The review used the snowballing method to obtain academic works and applied a filter to focus on papers published in journals, magazines, or conference proceedings, reaching 44 papers. We propose four research questions and one taxonomy to classify the works, carry out the analyses, and later a research agenda to address the identified gaps. For instance, this review revealed a lack of academic papers that discuss the subject involving state-of-the-art information visualization and machine learning techniques. This paper represents our initial effort to examine academic works that use information visualization techniques and theory applied to dashboards that support decision-making in business or management areas.

pid 140 - Visual exploration of the inner representation learned by a convolutional neural network

Barthelémy Serres^{1,3}, Fatma Bouali^{1,2}, Christiane Guinot¹, Gilles Venturini^{1,3}

¹University of Tours, LIFAT, France; ²University of Lille, IUT C, Dpt STID, France; ³University of Tours, ILIAD3, France

Keywords: Visualization, deep learning, internal representation, proximity graphs

We present in this paper a visual method to explore the properties of an image dataset and its internal representation learned by a convolutional neural network. We consider the inner characteristics extracted by the network just before the classification layers. We build a neighborhood graph from this vector space by connecting data together according to specific topological properties. We define typical examples of topological anomalies to be detected (isolated points, erroneous points, class boundaries). Then we propose a visualization of this graph highlighting this information and offering an overview of the graph (groups of data) as well

as local details (fine topological properties). This visualization includes a representation of the images in order to let the user understand what can cause an error (errors during image acquisition, pre-processing or labeling, or errors due to the choice of the network or the learning parameters, etc.). We perform several tests with the VGG16 network on samples of standard datasets.

Session IV21_4.2: Learning Analytics

Chair/co-chair: Prof. Marco Temperini, Sapienza University in Rome, Italy // Tania Di Mascio, University of L'Aquila, Italy

pid104 - Enhancing Situational Awareness for Tutors of Cybersecurity Capture the Flag Games

Karolína Dočkalová Burská¹, Vít Rusňák², Radek Ošlejšek¹

¹Faculty of Informatics, Masaryk University, Czech Republic; ²Institute of Computer Science,

Masaryk University, Czech Republic

Keywords: cybersecurity education, hands-on training, situational awareness

Supervised Capture the Flag games represent a popular method of practical hands-on training in cybersecurity education. However, as cybersecurity training sessions are process-oriented, tutors have only a limited insight into what trainees are doing and how they deal with the tasks. From their perspective, it is necessary to have situational awareness, enabling them to identify and react to any issues during a training session as soon as they emerge. We propose a tool designed in collaboration with cybersecurity educators. Based on user requirements, we developed the Progress VisualizationTool, which provides educators with timely feedback through the session. More specifically, the tool informs educators of the training progression, helps identify the students who might struggle with their tasks, and reveals overall deviation from the schedule. We validated the tool through formative and summative qualitative in-lab evaluations. The participants appraised the impact on the training workflow and gave further insights regarding the tool. We discuss the insights and recommendations that arose from the evaluations as they could aid the design of future tools for supporting educators, not only of CTFs but also in other domains.

pid134 - Development of critical thinking skills during online learning

Minoru Nakayama¹, Satoru Kikuchi², Hiroh Yamamoto²

¹Tokyo Institute of Technology, Japan; ²Shinshu University

Keywords: Blended learning, Fully online learning, critical thinking, student's characteristics

The progress of development of the disposition toward critical thinking in blended and fully online learning environments is compared. Participant's individual characteristics, including responses to a questionnaire about critical thinking disposition, were measured during a bachelor level university course.

Though the measured scores are comparable, the relationships between the scores in the two surveys during the course are different according to learning style. The contributing variables were extracted using linear regression analysis, and the weights assigned to them depended on

the style of learning. In particular, variables which contributed to transforming the participant's ability are discussed.

Also, cluster patterns of scores of literacy of science and technology were extracted, and the contributions of the cluster scores was discussed.

pid162 - Nudging students to reduce procrastination in office hours and forums

Eric Fouh, Wellington Lee, Baker Ryan

University of Pennsylvania, United States of America

Keywords: Nudge; Learning Behavior; Procrastination

The impact of email nudge notification on students' procrastination in office hours, and Piazza (QA forum) in a CS1 course at a large research university. With this study, we sought to understand if email nudges can be an effective tool in improving learning behaviours especially procrastination of CS1 students. After the first two homework, we randomly split students into two groups: the treatment group received the email, and the control group did not.

The treatment group was further divided into two groups: one for the students who performed above the median (of the combined grades of homework 1 and 2), and those who performed below the median. Each sub-group received a slightly different version of the email. We found that students in the treatment group did not change their office hours' attendance, and interactions on Piazza.

We also found no difference in homework grades. However, students in the treatment group used more free late days on the following (third) homework. However, the change was short-lived, and they reverted to the pre-email level of late days usage on the fourth homework.

pid165 - A visual method to identify and characterise students suspected of collaboration during remote quizzes submissions in Learning Environments

Riccardo Mazza

University of applied sciences and arts of southern Switzerland, Switzerland

Keywords: remote exams, quizzes, cheating detection

The recent spread of COVID-19 pandemic and the consequent restrictions to class presence in universities has forced instructors to rely on online evaluation tools, such as quizzes and assignment, to run summative and formative assessments at distance. But these remote activities raises the question of how to ensure academic honesty, since the lack of control facilitates the peer collaboration and cheating during the examinations. To this end, we implemented a visual analytic tool to explore submissions in online quizzes assessments and help in the detection of dishonest behaviours. We use two metrics as indication of potential illicit activity: the submission of same answers and how much these submissions are close in time. A visual analysis tool allows instructors to explore and make sense of quiz submission data. We applied this approach on three case studies performed in our university in year 2020. The analysis revealed how having access to this type of information could be indicative and may reveal potential dishonest behaviour while performing online quizzes at distance.

Session IV21_4.3: Information Space

Chair/Co-chair: Dr Andrew Agapiou, Strathclyde University, UK // John Counsell, Counsell Consultancy, FR

KEYNOTE LECTURE

Accelerating the Innovation Uptake in Advanced Digital and Data-driven Processes in the Built Environment

Associate Professor Ajibade Ayodeji Aibinu, Faculty of Architecture, Building and Planning, The University of Melbourne, Australia

Abstract

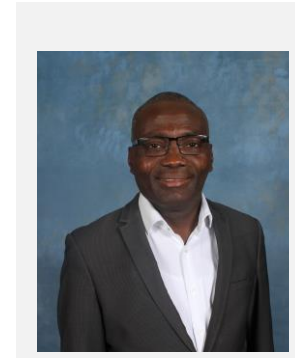
The application of advanced digital and data-driven processes is an emerging and growing area in the built environment sector. The increasing adoption of digital tools and platforms and the rapid proliferation of data have spurred interest in data-driven processes to drive smart project and asset management. Transforming data and information into intelligence and knowledge would change the way projects and assets are managed and will facilitate optimal solutions. With increasing data capture, organizations are increasingly questioning how they can leverage all the data that they have to generate substantial benefits, particularly, by enhancing efficiency and value for money in the capital delivery of projects and saving asset operations costs, and promote better, healthier, and safer environments as well. However, despite its significance, and proliferation of research, the applications of data-driven processes and tools, and approaches are still lagging and or limited in practice. Accelerating the uptake of these processes will require proactive effort by organizations as well as a non-traditional research approach in which ideas and concepts can be effectively translated into the real world.

In this keynote, drawing on his experience working with construction organizations in Europe and an R&D project in Australia, Ajibade will present some important lessons learned by some organizations when implementing advance digital technology. He will also highlight some tips for accelerating the uptake of data-driven processes via R&D activities.

Speaker biography

Associate Professor Ajibade Ayodeji Aibinu

The University of Melbourne, Australia



Ajibade has extensive experience in Australia, Southeast Asia, and Africa, and he has published over 80 research articles, and a book and has spoken at numerous conferences. His research interest cut across the built environment project and asset management from design, construction to operations. He founded the Intelligent Cost Manager (ICM), an AI-based cost management solution that leverages deep learning and predictive modeling to generate cost estimates with greater accuracy using historical data. His work uses design science research methodology grounded in knowledge management theory, innovation adoption theories, and theories in human-computer interaction. In 2013 and 2018, he was an academic visitor to the Delft University of Technology, The Netherlands, where he researched best

practices for efficient adoption and effective deployment of digital technology. The research involves a longitudinal study of construction organizations in the Netherlands and Finland. In 2017, a paper co-authored and published won the Outstanding Paper Award in the Emerald Literati Network Awards for Excellence. Ajibade is the Lead Guest Editor of, Built Environment Project and Asset Management [BEPAM] journal special issue on Data analytics and big data in construction and asset management. He won the Melbourne School of Design Teaching Excellence Award in 2012. He is currently a Member of, Australian Institute of Quantity Surveyors (MAIQS) and Associate, Chartered Institute of Arbitrators (2008-2013).

KEYNOTE LECTURE

Learning and Teaching Analytics: a Winning Combination

Prof Filippo Sciarrone, The Roma Tre University, Italy

The demand for Distance Education has been dramatically growing in recent years. People, geographically and culturally spread across the globe, companies, practitioners, students, are involved in networked learning programs. Especially in the last two years, the COVID-19 pandemic has forced schools and universities to provide distance learning only. As a consequence, an extraordinary transformation is taking place in the way of building courses and above all in the way of monitoring the learning processes. Teachers, students, administrators of e-learning web platforms and companies are involved in the success of distance education. Thanks to all this, two very interesting research fields have developed in recent years: Learning Analytics

(LA) and Teaching Analytics (TA). LA aims to provide all process stakeholders with valid IT tools to support the control of learning processes to improve all learning and delivering aspects. TA aims to provide teachers with IT tools, mainly based on Machine Learning, to improve the learning process from the point of view of the specific learning outcomes of a course. Moreover, a course produces (big) data concerning its specific learning process, which, when properly analyzed, could provide valuable information regarding the progress of the learning processes followed by each student or by a whole community of learners. In my talk I will review the main models and tools of both LA and TA, with particular focus to e-learning (big data) analysis and visualization, showing interesting examples and research results.

Speaker biography:

Prof. Filippo Sciarrone

The Roma Tre University, Italy



Professor Filippo Sciarrone is a fellow researcher since 1994, at the Roma Tre University, where he has been collaborating in many research projects of the Artificial Intelligence research group and received his Ph.D. with a dissertation on user modeling. Since several years he has also been collaborating with Sapienza University in Rome, giving his main contribute in the application of Machine Learning techniques to educational research projects. He has led several research laboratories of private companies for the production of algorithms and innovative systems for human resource management and for teaching-oriented recommendation systems. His research interests are in the design of hybrid architectures, machine learning and systems to support learning and teaching. In recent years he has been

involved in several research projects concerning Teaching Analytics applied to MOOCs. He has led special issues concerning Artificial Intelligence and e-learning topics and currently is board member of several international journals.

Session IV21_4.4: Mapping Data

Chair/Co-chair: Dr Andrew Agapiou, Strathclyde University, UK // John Counsell, Counsell Consultancy, FR

KEYNOTE LECTURE

Visualising non-geospatial data as maps: how maps can communicate the richness of human data

Chuan Jia (Jack) Zhao, Small Multiples, NSW, Australia

Maps are not only useful for geospatial data, they can also be used for visualising data about people and culture. Modern map interfaces natively support the information seeking mantra: overview first, zoom and filter, then detail on-demand, and this makes them ideal for visualising human data. Real-life is often messy, contradictory and multifaceted, maps can help us embrace this complexity, demonstrate the beauty of data and make data useful. In this talk, data visualisation designer, Chuan Jia (Jack) Zhao will present non-geospatial mapping case studies that provide unique perspectives on people and culture. Jack will also cover techniques and design best practices stemmed from these projects.

Speaker biography:

Chuan Jia (Jack) Zhao,

Small Multiples, NSW, Australia



Chuan Jia (Jack) Zhao is a data visualisation designer and co-founder at Small Multiples. In his role, Jack leads the creative direction and delivery of projects for Small Multiples' government, media and innovative businesses. He is responsible for investigating new ways to communicate stories through data. Jack brings over ten years' experience in digital services. With a particular interest in genetics and cartography, he has been guest lecturing at the University of Sydney, University of Technology Sydney and Melbourne Business School.

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IMAGE CREDIT



Beijing Suite 16

Jen Grey

Beijing Suite 16 is based on a digital photo archive Prof. Jen Grey created while visiting famous landmarks in Beijing, China. The images were re-processed and archived by the artist before beta testing in VIA, the proprietary software program developed by Sherianne Ki Sun Burnham. The program is set to run continuously, recombining elements of pictures developed in a photo archive. Images never repeat. Jen ran the program using her own image archive, and

saved random sequences she liked best. Afterwards, specific images were selected and further enhanced in PhotoShop as individual, artworks. These can be printed, or viewed exclusively online.



Anthro-eco Mental Scotoma

Bonnie Mitchell

A 'Mental Scotoma' is a figurative blind spot in a person's psychological awareness. This phenomenon typically arises because of cognitive dissonance and affects how we view

reality. If a fact is deemed inconvenient, or not easily understood, or conflicts with our belief system, we dismiss it and do not recognize that it exists. This unconscious denial often occurs in an effort to protect the ego or one's way of life from change. As sentient beings, many of us sense the negative impact we are having on the environment yet we continue to live unsustainable live styles. Our ability to feel the direct impact of our actions is dampened by our desires. Why do we, as a society, not all sense this connection and act to rectify the situation? Click the image to go to the full project.



Forest Bathing

Nancy Wood

I take digital photos in scenic areas and then manipulate the photos in the computer: intensify and adjust colors, abstract and "paint" forms, create multiple overlays that I combine at various levels of transparency. The final images can be displayed virtually as projections, published

online, or printed onto various substrates. The theme of these works is forest-bathing or connecting with nature through the senses. There have been many scientific studies regarding the healing effects of simply being in wild and natural areas. These include stress reduction, increase in immune systems, improved mental performance, creativity, and better mood. It's been noted that office workers display happier moods when surrounded by visuals of beautiful flowers. Recent research indicates that the color green has a positive effect on emotions and health.

[ONLINE PROCEEDINGS]

Information Visualisation

- AI & Visual Analytics & Data Science -

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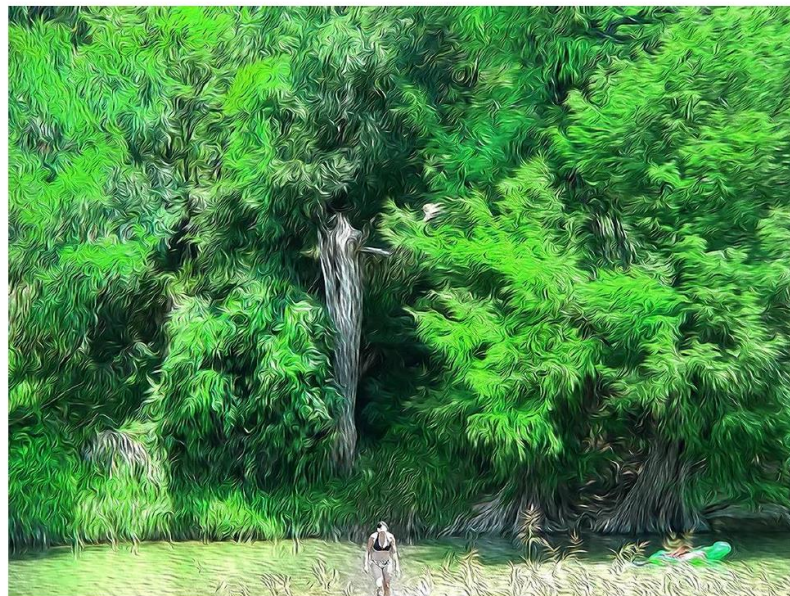


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