The Book Abstracts

"Genetic Landscapes Series I" - Daniela Sirbu

© Sangeun Park, Eunjung Jo, Hyungjung Lee, Seongmin Mun4 and Kyungwon Lee
iV2015 & cgiv2015 - DIGITAL ART GALLERY Online Exhibition
July 2015- June 2016

VIRTUAL GALLERY VENUE
www.graphicslink.co.uk/DART.htm

Exhibiting Artists:

- LiQin Tan
- Anna Chupa
- Joohyun Pyune
- Santiago Echeverry
- Harvey Goldman
- Daniela Sirbu
- John Corbett
- Gabriele Peters
- Nancy Wood
- Heather Freeman
- Bogdan Soban
- Galt Tomasinio
- Gina Gibson
- Margie Labadie
- Dena Elisabeth Eber
- Corinne Whitaker
- Gloria DeFilipps Brush
- Chris Kitchener
- Matjuska Teja Krasek
- Olivia Koval
- Mike Kingan
- Jean Constant
- John Antoine Labadie
- Alan Singer
- Anna Ursyn
- Neil Howe
- Andras Szalai
- Chiara Passa
- Richard Merritt
- Mohammad Majid al-Rifaie
The Information Visualisation Conference (iV) is an international conference that aims to provide a foundation for integrating the human-centred, technological and strategic aspects of information visualisation in order to promote international exchange, cooperation and development. Building upon the reported success of last year’s workshop, IVS is pleased to announce the “8th Doctoral Research Workshop” which will run as part of the 19th International Conference on Information Visualisation (iV2015).

**Doctoral Research workshop**
This workshop focuses on the issues that doctoral students face during their studies and includes following interactive sessions – the theme for this year Visual Thinking for (PhD) researcher “How to think more clearly, have more engaging conversations, and create richer research

- what visual thinking is and why it is relevant for researchers
- the benefits and risks of visual thinking
- what to visualize (visual templates, basic shapes, symbols)
- how to visualize (abstract vs. pictorial/metaphorical)
• to sketch visual templates (diagrams, metaphors, knowledge maps), basic shapes, symbols
• to apply visual thinking for their own research projects (e.g. the story of your PhD)

Approach:
• value the (visual) process (concept of rapid prototyping from Design Thinking)
• value failure/mistakes as healthy part of that process
• think visually (automatically) when approaching future problems and challenges

The workshop will be hands-on with short inputs from the instructor and time to work on the exercises and own projects visually where the instructor and peers will operate as sparring partner in a friendly environment.
### Tuesday 21 July 2015

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>10:00</td>
<td>Registration</td>
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<tr>
<td>10:30</td>
<td><strong>Doctoral Research Workshop</strong></td>
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<tr>
<td>13:00</td>
<td>Chairs: Banissi, Prof. Ebad, London South Bank University, UK</td>
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<tr>
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<td>Facilitator: Sebastian Kernbach, Institute of Media and Communications Management at the University of St. Gallen</td>
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<tr>
<td>09:30</td>
<td>Registration</td>
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<tr>
<td>10:00</td>
<td>Opening &amp; Welcome from discussion Panel members</td>
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<tr>
<td>10:45</td>
<td>what visual thinking is and why it is relevant for researchers / the benefits and risks of visual thinking</td>
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<tr>
<td>11:00</td>
<td>Group Discussion</td>
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<tr>
<td>12:30</td>
<td>what to visualize (visual templates, basic shapes, symbols) / how to visualize (abstract vs. pictorial/metaphorical)</td>
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<tr>
<td>13:00</td>
<td>Lunch Break</td>
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<tr>
<td>14:00</td>
<td><strong>Doctoral Research Workshop</strong></td>
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<tr>
<td>17:00</td>
<td>to sketch visual templates (diagrams, metaphors, knowledge maps), basic shapes, symbols</td>
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<td></td>
<td>14:15 Group Discussion</td>
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<td></td>
<td>15:10 to apply visual thinking for their own research projects (e.g. the story of your PhD)</td>
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<td></td>
<td>15:30 Break</td>
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<tr>
<td></td>
<td>16:00 value the (visual) process (concept of rapid prototyping from Design Thinking) / value failure/mistakes as healthy part of that process / think visually (automatically) when approaching future problems and challenges</td>
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<tr>
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<td>16:45 Group Discussion</td>
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<td>17:00 Close</td>
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<td>Time</td>
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<tr>
<td>09:00</td>
<td>Registration</td>
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<tr>
<td>10:15</td>
<td>Opening &amp; Welcome</td>
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<tr>
<td>10:30</td>
<td><strong>Session iV2015_1.1: Information Visualisation</strong></td>
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<td><strong>&lt;keynote Lecture&gt;</strong></td>
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<td></td>
<td><strong>Gilles Venturini</strong></td>
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<tr>
<td>11:35</td>
<td>Break</td>
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<tr>
<td>12:00</td>
<td><strong>Session iV2015_1.2: Information Visualisation</strong></td>
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<tr>
<td></td>
<td><strong>Visual Analysis of Eye Movements by Hierarchical Filter Wheels</strong></td>
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<td><strong>Visual Analysis of Car Fleet Trajectories to Find Representative Routes for Automotive Research</strong></td>
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<td><strong>Visualization Support for Comparing Energy Consumption Data</strong></td>
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**Note:** The above schedule may be subject to change. Please check the official event website for the most up-to-date information.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session IV2015_1.3: Information Visualisation - Theory &amp; Techniques</th>
<th>Session IV2015_1.4: Applications of Graph Theory</th>
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<tbody>
<tr>
<td>14:15 - 15:30</td>
<td>Lunch Break</td>
<td>Lunch Break</td>
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<td>&lt; The University of Barcelona ● &gt;</td>
<td>&lt; The University of Barcelona ● &gt;</td>
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<tr>
<td>14:15 - 15:30</td>
<td>Directional Texture for Visualization</td>
<td>Fast Graph Drawing Algorithm Revealing Networks Cores</td>
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<td></td>
<td>Manil Maskey, Timothy Newman</td>
<td>Romain Giot, Romain Bourqui</td>
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<td></td>
<td>University of Alabama in Huntsville, United States of America</td>
<td>Univ. Bordeaux / LaBRI, France</td>
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<tr>
<td>14:15 - 15:30</td>
<td>Designing and Annotating Metro Maps with Circular Routes</td>
<td>Mental map models for edges</td>
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<tr>
<td></td>
<td>Hsiang-Yun Wu¹, Sheung-Hung Poon², Shigeo Takahashi¹, Masatoshi Arikawa¹, Chun-Cheng Lin¹, Hsu-Chun Yen¹</td>
<td>Jana Katreniaková, Martin Đuriš</td>
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<tr>
<td></td>
<td>¹The University of Tokyo, Japan; ²National Tsing Hua University, Taiwan; ³National Chiao Tung University, Taiwan; ⁴National Taiwan University</td>
<td>Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovak Republic</td>
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<tr>
<td>14:15 - 15:30</td>
<td>A Visualization Tool for Building Energy Management System</td>
<td>An Indented Level-Based Tree Drawing Algorithm for Text Visualization</td>
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<td></td>
<td>Takayuki Itoh¹, Masato Kawano², Shuji Kutsuna², Takeshi Watanabe²</td>
<td>Xi He, Ying Zhu</td>
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<tr>
<td></td>
<td>¹Ochanomizu University, Japan; ²NTT Facilities VISUS, Germany</td>
<td>Georgia State University, United States of America</td>
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<tr>
<td>14:15 - 15:30</td>
<td>Layer-Centered Approach for Multigraphs Visualization</td>
<td>Distributed Graph Layout with Spark</td>
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<td></td>
<td>Denis Redondo¹,², Arnaud Sallaberry¹,², Dino Ienco¹,², Faraz Zaidi¹,², Pascal Poncelet¹,²</td>
<td>Antoine Hinge, David Auber</td>
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<td>¹LIRMM; ²Université de Montpellier; ³Université Paul Valéry Montpellier; ⁴IRSTEIA Montpellier, UMR TETIS; ⁵City University of New York; ⁶Karachi Institute of Economics and Technology</td>
<td>LaBRI / Université de Bordeaux, France</td>
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</table>
### Session iV2015_1.5: Information Visualisation - Usability & Evaluation

**Chair:** Prof. Francis T. Marchese, Pace University, USA

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<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Authors</th>
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<tbody>
<tr>
<td>14:15</td>
<td>Simplified Stress and Simplified Silhouette Coefficient to a Faster Quality Evaluation of Multidimensional Projection Techniques and Feature Spaces</td>
<td>Danilo Medeiros Eler, Jaqueline Batista Martins Teixeira, Priscila Alves Macanhã, Rogério Eduardo Garcia (UNESP, Univ Estadual Paulista, Brazil)</td>
</tr>
<tr>
<td>14:45</td>
<td>Towards the Understanding of Interaction in Information Visualization</td>
<td>Ana Raquel Figueiras (FCSH - Universidade Nova de Lisboa, Portugal)</td>
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<tr>
<td>15:15</td>
<td>Plot Balalaika: Simple Chart Designs for Long-Tail Distributed Data</td>
<td>Mark Shovman¹ ² (²Eyewey Vision, Israel; ³Yahoo Labs Haifa)</td>
</tr>
<tr>
<td>15:20</td>
<td>Heuristic Evaluation of a t-Commerce Prototype</td>
<td>Nikolas Jorge Santiago Carneiro ¹, Carlos Gustavo Resque Santos ¹, Tiago Devi Oliveira de Araujo ¹, Brunelli Pinto Miranda ¹, Bianchi Serique Meiguins ¹, Anderson Gregorio Marques Soares ¹ ² (¹Universidade Federal do Pará, Brazil; ²Universidade Federal Rural da Amazônía)</td>
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**Break**
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<tr>
<th>15:50 - 17:00</th>
<th>Session iv2015_16: Information Visualisation Theory &amp; Practice</th>
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<tr>
<td></td>
<td>Chair: Prof. Feng Lin, Nanyang Technological University, Singapore</td>
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<td></td>
<td>Visual Analysis of Source Code Similarities</td>
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<td>Michael Burch, Julian Strotzer, Daniel Weiskopf</td>
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<td>VISUS, University of Stuttgart, Germany</td>
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<td>Indexed dataflow network: A multi-layer and programmable architecture to integrate both visualization pipelines and scene graphs</td>
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<td>Romain Guillemot, Stephanie Prevost, Laurent Lucas</td>
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<td>Université de Reims Champagne-Ardenne (URCA) - CReSTIC EA3804, France</td>
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<td>Visualizing the Evolution of Module Workflows</td>
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<td>Marcel Hlawatsch, Michael Burch, Fabian Beck, Juliana Freire, Claudia Silva, Daniel Weiskopf</td>
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<td></td>
<td>VISUS, University of Stuttgart, Germany; Polytechnic School of Engineering, New York University</td>
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<th>16:20 - 17:00</th>
<th>Session CGiV2015_1.7: Geometric Modeling &amp; Imaging</th>
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<tr>
<td></td>
<td>Chair: Prof. Chi Man PUN, University of Macau, Macau (S.A.R China)</td>
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<td>An Immersive and Interactive Visualization System by Integrating Distinct Platforms</td>
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<td>Mário Popolin Neto¹², Alessandro Moraes³, Danilo Medeiros Eler³, José Remo Ferreira Brega³</td>
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<td>¹IFSP - Registro, Brazil; ²UNESP - Bauru, Brazil; ³UNESP - Presidente Prudente, Brazil</td>
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<td>Image-based Hair Pre-Processing for Art Creation: A Case Study of Bas-Relief Modelling</td>
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<td>Wenshu Zhang, Meili Wang, Jian Chang, Ruofeng Tong, Jian J Zhang</td>
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<td>Bournemouth University, UK</td>
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<td>N-polar Visualization: Visual Analytics for Exploring Data Objects with Multiple Interactive Anchors</td>
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<td>Taeil Jeon, Jihyun Lee, Wonjong Rhee, Bongwon Suh</td>
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<td>Seoul National University, (South Korea</td>
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<td>Shape Preserving Positive Rational Trigonometric Spline Surfaces</td>
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<td>Muhammad Sarfraz, Farsia Hussain, Malik Zawwar Hussain</td>
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<td>Kuwait University, KW</td>
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<td>Interpolation of Discrete time Signals using Cubic Spline Function</td>
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<td>Malik Zawwar Hussain¹, Misbah Irshad³, Muhammad Sarfraz³, Nousheen Zafar¹</td>
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<td>¹University of the Punjab, Pakistan; ³Lahore College for Women University, Pakistan; ¹Kuwait University, Kuwait</td>
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</tbody>
</table>
Session iV2015_1.8: Information Visualisation – Applications
Chair: Prof. Shunsuke Kamijo, The University of Tokyo, Japan

A Concurrent Architecture proposal for Information Visualization Pipeline
Nikolas Jorge Santiago Carneiro, Carlos Gustavo Resque Santos, Tiago Davi Oliveira de Araujo, Brunelli Pinto Miranda, Bianchi Serique Meiguins
Universidade Federal do Pará, Brazil

Self-Organizing Map-Based Feature Visualization and Selection for Defect Depth Estimation in Oil and Gas Pipelines
Abduljalil Abdulrahman Mohamed¹, Mohamed Hamdi¹, Sofiene Tahar²
¹Ahmed Bin Mohamed Military College (ABMMC), Qatar; ²Concordia University/Electrical and Computer Engineering Department, Montreal, Canada

The Recommendation Dashboard: A System to Visualise and Organise Recommendations
Gerwald Tschinkel¹, Cecilia di Sciascio¹, Belgin Mutlu¹, Vedran Sabol¹ ²
¹Know Center GmbH, Austria; ²Graz University of Technology

Thursday 23rd July 2015 - Time: 18:30 – 22:00
Visualisation Social Networking Event
<details shortly>
## Thursday 23 July 2015

### Session iV2015_2.1: Information Visualisation – Theory & Techniques

**Chair:** Gilles Venturini, University Francois Rabelais of Tours, France

**A Color-based Visualization Approach to understand harmonic structures of Musical Compositions**

Delfina Malandrino, Donato Pirozzi, Gianluca Zaccagnino, Rocco Zaccagnino  
University of Salerno, Italy

**Edge Visual Encodings in Matrix-Based Diagrams**

Joris Sansen¹, Romain Bourqui¹, Bruno Pinaud¹, Helen Purchase²  
¹University of Bordeaux, France; ²University of Glasgow, UK

**Visualizing a set of multiple time series with an aggregate stacked graph**

Nicolas Greffard, Pascale Kuntz  
LINA-DUKe, University of Nantes, France

**FATuM - Fast Animated Transitions using Multi-Buffers**

Alexandre Perrot, David Auber  
Université de Bordeaux, France

**Natural User Interface Design in DA-TU: An Interactive Clustered Data Visualization System**

Shizhe He¹, Mao Lin Huang¹², Lin Zhu²  
¹University of Technology, Sydney, Australia; ²Tianjin University, China

### Session iV2015_2.2: Knowledge Visualization and Visual Thinking

**Chair:** Sebastian Kernbach, University of St. Gallen, Switzerland

**A Gesture Control Framework targeting High-resolution Video Wall Displays**

Bernhard Klein  
Future Cities Laboratory, Singapore-ETH Centre, 1 Create Way, Singapore 138602

**Value Lab Asia: A Space for Physical and Virtual Interdisciplinary Research and Collaboration**

Afian Anwar¹, Bernhard Klein², Matthias Berger³, Stefan Muller Arisona²  
¹Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, United States of America; ²Future Cities Laboratory, Department of Architecture, ETH Zurich, Switzerland

**The Design Process: A Visual Model**

Sabrina Bresciani  
University of St. Gallen, Switzerland

**Dynamic Multi-View, Multi-Format, Multi-User Visualizations: For Future Cities**

Bernhard Klein¹, Remo Burkhard¹, Christine Meixner², Lukas Treyer²  
¹Future Cities Laboratory, Singapore-ETH Centre, 1 Create Way, Singapore 138602; ²ETH Zurich, Chair of Information Architecture, 8093 Zurich, Wolfgang-Pauli-Str 27, Switzerland
Session  Mediviz2015_2.3: BioMedical Visualization
Chair: Prof. Urska Cvek, Louisiana State University Shreveport, USA

A Novel intensity normalization method on cervigrams in the detection of Cervical Cancer
Abhishek Das
Tripura University, India

Semi-automatic compartment extraction to assess 3D bone mineral density and morphometric parameters of the subchondral bone in the tibial knee
Rabaa Youssef1, Hamid Bouhadoun1, Jean Denis Laredo2, Christine Chappard2
1CEA-LIST CEA-LinkLab, Tunisia; 2Laboratoire de Bioingénierie et Bioimagerie Ostéo-articulaire (B2OA), UMR CNRS 7052, Université Paris Diderot, PRES Sorbonne Paris Cité, Paris, France

Web-based Information Retrieval and Visualization for Diagnostic Radiology
Ben Chua1, Xiuling Liu2, Bin Dong1, Feng Lin1,2
1Nanyang Technological University, Singapore; 2Heibei University, China

Augmented representations of clustered fiber bundles for interactive queries
Stefan Philips, Mario Hlawitschka, Gerik Scheuermann
Leipzig University, Germany

Enhancing Visual Perception and Directing Viewer's Attention in Interactive Direct Volume Rendering
AmirAli Sharifi, Pierre Boulanger
University of Alberta, Canada

A semantically adaptable integrated visualization and natural exploration of multi-scale biomedical data
Ricardo Millan1, Asan Agibetov2, Jan Rzepecki1, Marta Ondrčsk1, Alexander Vais1, Joaquim Miguel Oliveira1, Giuseppe Patané2, Karl-Ingo Fries1, Rui L. Reis3, Michela Spagnuolo1, Franz-Erich Wolter1
1Leibniz University of Hannover, Germany; 2Consiglio Nazionale delle Ricerche, Italy; 3Bs research Group, University of Minho, Portugal

Session  iV2015_2.4: Visualization, Art, and Design
Chair: Prof. Francis T. Marchese, Pace University, USA

User Interface Considerations for Browser-Based Just-in-Time-Retrieval
Christin Seifert, Jörg Schlötterer, Michael Granitzer
Passau University, Germany

Quick Vis: A Web-Based Visualization Delivering Flexible Exploration of User-Driven Analytics
Alessandro Simone Agnello, Haim Levkowitz
University of Massachusetts Lowell, United States of America

Visualizing Süleymaname: Analyzing and Visualizing Embedded Spatiotemporal Information in a 16th Century Illustrated Manuscript
Ferhat Şen
Aalto University School of Arts, Design and Architecture, Department of Media, Finland

Senescence: An Age-Based Character Simulation Framework
Suren Deepak Rajasekaran, Nicoletta Adamo-Villani
Purdue University, United States of America

Examining User Experiences Through A Multimodal BCI Puzzle Game
Fotis Liarokapis1, Athanasios Vourvopoulos1, Alina Ene2
1Masaryk University, Czech Republic; 2University of Madeira, Portugal

Perceived Realism of Crowd Behaviour with Social Forces
Stuart O’Connor1, Fotis Liarokapis1, Chrisina Jaye1
1Coventry University, United Kingdom; 2Masaryk University, Czech Republic
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<tr>
<th>Time</th>
<th>Event</th>
<th>Speaker</th>
<th>Institution</th>
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<tbody>
<tr>
<td>11:45</td>
<td><strong>Session iV2015_2.5: Visualisation</strong></td>
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<td></td>
<td>Chair: Prof. Randolph George Goebel, U. of Alberta, Canada</td>
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<tr>
<td>11:45</td>
<td><strong>keynote Lecture</strong></td>
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<td>Simulation and Visualization of Deformation with Anisotropic Materials</td>
<td>Feng Lin</td>
<td>Nanyang Technological U., Singapore</td>
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<td>13:00</td>
<td><strong>keynote Lecture</strong></td>
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<td>Recent Advances in Multimedia Forgery and Security</td>
<td>PUN, Chi Man</td>
<td>University of Macau, Macau S.A.R., China</td>
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<td>Lunch Break</td>
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- **Simulation and Visualization of Deformation with Anisotropic Materials**
  - Feng Lin
  - Nanyang Technological University, Singapore

- **Recent Advances in Multimedia Forgery and Security**
  - PUN, Chi Man
  - University of Macau, Macau S.A.R., China
14:15 - 15:30

**Session iV2015_2.6: Information Visualisation Application**
Chair: Prof. Marjan Trutschl, Louisiana State University Shreveport, USA

- **Visualization of Crowd-Powered Impression Evaluation Results**
  Erika Gomi, Yuri Saito, Takayuki Itoh
  Ochanomizu University, Japan

- **Web based Time-tunnel: An Interactive Multidimensional Data Visualization Tool Using Genetic Algorithm**
  Ryuya Akase, Yoshihiro Okada
  Kyushu University

- **ThreadCity: Combined Visualization of Structure and Activity for the Exploration of Multi-threaded Software Systems**
  Sebastian Hahn, Matthias Trapp, Nikolai Wuttke, Jürgen Döllner
  Hasso-Plattner-Institut, Germany

- **ConcentriCloud: Word Cloud Visualization for Multiple Text Documents**
  Steffen Lohmann, Florian Heimerl, Fabian Bopp, Michael Burch, Thomas Ertl
  University of Stuttgart, Germany

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**Session iV2014_2.7: Knowledge Visualization and Visual Thinking**
Chair: Bernhard Klein, Future Cities Laboratory, Singapore-ETH Centre, Singapore

- **The Role of Visual Templates on Improving Teamwork Performance**
  Marta Perez Garcia¹, Sabrina Bresciani²
  ¹Birmingham City University, United Kingdom; ²University of St. Gallen, Switzerland

- **What You See is What You Get: The Impact of Perceived Finishedness (PF) on Visual Contribution Fluency during Electronic Ideation**
  Lawrence McGrath
  University of St. Gallen, Switzerland

- **Knowminer Search - a Multi-Visualisation Collaborative Approach to Search Result Analysis**
  Manuela Rauch¹, Werner Klieber¹, Ralph Wozelka¹, Santokh Singh¹, Vedran Sabol¹²
  ¹Know Center, Austria; ²Graz, University of Technology

- **Navicons for collaboration: Navigating and augmenting discussions through visual annotations**
  Martin J. Eppler¹, Michael H.G. Hoffmann², Sebastian Kernbach¹³
  ¹University of St. Gallen; ²Georgia Institute of Technology; ³University of Lugano
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<tr>
<td>14:15</td>
<td><strong>Session iV2015_2.8: Information Visualization</strong></td>
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<td>Shortpapers:</td>
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<td><em>An experience of information visualization and interaction for aphasic persons</em></td>
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<td>Mariko Sasakura¹, Saori Iikuma¹, Yukihiro Izawa²</td>
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<td>¹Okayama University, Japan; ²Fukuyama City University, Japan</td>
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<td><em>Visualization on Agglomerative Information Bottleneck Based Trajectory Clustering</em></td>
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<td>Yang Fan, Qing Xu, Yuejun Guo, Sheng Liang</td>
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<td>Tianjin University, Tianjin, China, China, People's Republic of</td>
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<td><em>Service Oriented Architecture for Data Visualization in Smart Devices</em></td>
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<td>Nikolas Jorge Santiago Carneiro, Carlos Gustavo Resque Santos, Tiago Davi Oliveira de Áraujo,</td>
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<td>Brunelli Pinto Miranda, Jairo de Jesus Nascimento da Silva Junior, Bianchi</td>
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<td>Universidade Federal do Pará, Brazil</td>
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<td>*The Usefulness of the Virtual Speaking Head, as Well as 3D Visualization Tools in the New</td>
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<td>Communication, Teaching and Presentation Technologies is almost Unlimited.*</td>
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<td>Eva Pajorova</td>
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<td>Slovak Academy of Sciences, Slovak Republic</td>
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<td>Chair: Prof. Vineet Kamat, University of Michigan, USA</td>
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<td><em>Impact of Visual Cues on Climate Perception in Virtual Urban Environments: a User Study</em></td>
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<td>Toinon Vigier, Guillaume Moreau, Daniel Siret</td>
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<td><em>Development of a Computational Design Application for Interactive Surfaces</em></td>
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<td>Mariamthi Leon, Daniel Doolan, Richard Laing, Julian Malins, Huda Salman</td>
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<td>*Monuments Visualization: from 3D scanned data to a holistic approach, an application to the</td>
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<td>Richard Laing, Mariamthi Leon, John Isaacs</td>
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<td>15:45 - 17:00</td>
<td>Chair: Dr Fatma Bouali, University of Lille 2, France</td>
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<td>Hybrid Visualization: A New Approach to Display Instances and Attributes Relationships in a Single View Danilo Medeiros Eler, Renan Augusto Pupin de Oliveira, Lenon Fachiano Silva UNESP, Univ Estadual Paulista, Brazil</td>
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<td>A Visualization of Research Papers Based on the Topics and Citation Network Rina Nakazawa¹, Takayuki Itoh¹, Takaumi Saito² ¹Ochanomizu University, Japan; ²Tokyo University of Agriculture Technology, Japan</td>
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<td>Regularity Measure and Influence Weight for Analysis and Visualization of Consumer’s attitude Aki Hayashi, Masahiro Kohjima, Tatsushi Matsubayashi, Hiroshi Sawada NTT Service Evolution Laboratories, NTT Corporation, Japan</td>
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<td>A Visualization-Analytics-Interaction Workflow framework for Exploratory and Explanatory Search on Geo-Located Search Data using the Meme Media Digital Dashboard Jonas Sjöbergh¹, Xingkai Li², Randolph George Goebel², Yuzuru Tanaka¹ ¹Hokkaido University, Sapporo, Japan; ºUniversity of Alberta, Edmonton, Canada</td>
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<td>Panel member: Sebastian Kernbach, University of St. Gallen, Switzerland</td>
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<td>Prof. Wibke Weber, School of Applied Linguistics, Switzerland</td>
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<td><strong>Session IV2015_2.12: Information Visualisation</strong></td>
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<td>17:30</td>
<td><strong>Session IV2015_2.14: Animation, Special Effects and Multimedia Show</strong></td>
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**Friday 24 July 2015**

**Session iV2015_3.1: VA - Visual Analytics**
Chair: Dr Michael Burch, VISUS, University of Stuttgart, Germany

- **POIViz: a fast interactive method for visualizing a large collection of Open datasets**
  Tianyang Liu1, Fatma Bouali2, Gilles Venturini1
  1University Francois Rabelais of Tours, France; 2University of Lille2, France

- **A fast feature vector approach for revealing simplex and equi-correlation data patterns in reorderable matrices**
  Celmar Guimarães da Silva, Bruno Figueiredo Medina
  University of Campinas - School of Technology, Brazil

- **Towards ActionTrack 3.0: The Role of Usefulness, Usability and User Experience in a Startup Company Developing Location-Based Applications**
  Jukka Antero Holm, Kari Laurila
  Team Action Zone, Finland

- **Current Topics in the design of HCI courses with Computer Science Curricula**
  Minoru Nakayama
  Tokyo Institute of Technology, Japan

- **A Visualization Technique to Support Searching and Comparing Features of Multivariate Datasets**
  Hiroaki Kobayashi1, Hiroko Suzuki2, Kazuo Misue1
  1University of Tsukuba, Japan; 2Fujitsu Laboratories Ltd.

- **Detecting Criminal Relationships Through SOM Visual Analytics**
  Wen Bo Wang1, Mao Lin Huang1, Jinson Zhang1, Wei Lai3
  1University of Technology Sydney, Australia; 2Tianjin University; 3Swinburne University of Technology

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**Session iV2015_3.2: Information Visualisation – Applications**
Chair: Dr. Bernhard Klein, Singapore ETH Centre, Singapore

- **Interactively Uncluttering Node Overlaps for Network Visualization**
  Rie Ishida1, Shigeo Takahashi1, Hsiang-Yun Wu1
  1Graduate School of Frontier Sciences, The University of Tokyo, Chiba 277-8561, Japan; 2Graduate School of Information Science and Technology, The University of Tokyo, Tokyo 133-8565, Japan

- **Multiscale Visualization of Trajectory Data**
  Sheng Liang, Qing Xu, Yuejun Guo, Yang Fan
  Tianjin University, Tianjin, China, People's Republic of

- **Adjasankey: Visualization of huge hierarchical weighted and directed graphs**
  Joris SANSEØ, Frédéric LALANNE, David AUBER, Romain BOURQUI
  Université de Bordeaux, France

- **Literature Visualization and Similarity Measurement based on Citation Relations**
  HANADI HUMOUD ALFRSAIDI, WonSook Lee, David Sankoff
  University of Ottawa, Canada

- **3D Visualization of Multiscale Video Key Frames**
  Shihua Sun, Qing Xu, Yuejun Guo, Sheng Liang, Yang Fan
  Tianjin University, China, People’s Republic of
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<td><strong>Software Systems as Archipelagos of Atolls</strong> Giuseppe Scanniello, Ugo Erra, Maria Caulo University of Basilicata, Italy</td>
<td><strong>Reverse Engineering of Planar Objects using Imperialist Competitive Algorithm</strong> Misbah Irshad, Muhammad Sarfraz, Malik Zawwar Hussain</td>
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<td>09:45</td>
<td><strong>A Visual Tool Helping to Select Photogenic Spots</strong> Kouhei Hamada(^1), Kazuo Misue(^2)</td>
<td><strong>Analysis of Corporate Twitter Usage Types and Influence Visualization on Key Players</strong> Sangeun Park, Eunjung Jo, Hyungjung Lee, Seongmin Mun, Kyungwon Lee</td>
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<td><strong>Focus and Context Awareness Visualization Techniques for 3D Modelling Tasks using Multi-Layered Displays</strong> Masood Masoodian(^1), Azmi bin Mohd Yusof(^2), Bill Rogers(^1)</td>
<td><strong>CosMovis: Semantic Network Visualization by Using Sentiment Words of Movie Review Data</strong> Hyoj Ha, Wonjoo Hwang, Sungyun Bae, Hanmin Choi, Hyunwoo Han, Gi-nam Kim, Kyungwon Lee</td>
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<td>10:15</td>
<td><strong>Visualizations-based Analysis of Telco Data for Business Intelligence</strong> Sidra Ashraf Khan, Shoaib A. Khan National University of Sciences and Technology, Islamabad, Pakistan, Pakistan</td>
<td><strong>Automatic, Real Time, Unsupervised Spatio-temporal 3D Object Detection Using RGB-D Cameras</strong> Manal H. Alassaf, Kamran Kowsari, Jamed K. Hahn</td>
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<td><strong>Enhancing Software Visualization with Information Retrieval</strong> Rita Francese(^1), Michele Risil(^2), Giuseppe Scanniello(^2)</td>
<td><strong>Video Object Tracking Using Interactive Segmentation and Superpixel Based Gaussian Kernel</strong> GUOHENG HUANG, Chi Man PUN, Cong Lin University of Macau, Macau S.A.R., (China)</td>
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| 10:30  | **Break** | **Break** |

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\(^1\) Department of Computer Science, University of Tsukuba, Ibaraki, Japan; \(^2\) Faculty of Engineering, Information and Systems, University of Tsukuba, Ibaraki, Japan
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<td><strong>A Mobile Personal Residential Electricity Dashboard</strong></td>
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<td>Mark Apperley(^1), Jishaal Kalyan(^2)</td>
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<td>(^1)University of Waikato, New Zealand; (^2)Infinity, Auckland, New Zealand</td>
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<td><strong>Space, Time and Visual Analytics: a Multiple Perspectives Paradigm</strong></td>
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<td>Gennady Andrienko</td>
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<td>Fraunhofer Institute for Intelligent Analysis and Information systems (IAIS), Germany and City University London, UK</td>
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<td><strong>iV2016 - Committee Members Meeting</strong></td>
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<td>14:30</td>
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Session iv2015_1.1: Information Visualisation
Chair: Prof. Mark Apperley, University of Waikato, New Zealand

<keynote Lecture>
And the user said: “Don’t leave me alone
Gilles Venturini
University Francois Rabelais of Tours, France

Visual and interactive methods being user-centered approaches, one would expect users to have no difficulties to find a relevant visualization and to configure it. However, in practice, novice users (but not just them) can have problems to find an appropriate visualization that can reach the pursued objectives: users are often alone to solve such design/choice problems, and the consequences of a wrong design or choice can be disastrous. So did we forget something important about users and visualizations? For a given problem to solve (i.e., a dataset and objectives), I will show, with some examples, that the visualization « search space » can be very large and complex, and that finding an « optimal » visualization can be difficult. Then I will enumerate areas of research that aim at providing help to users (or designers) when they use (define) visual and interactive approaches. I will describe user assistants, which are like expert systems and which can be knowledge-based or behavior-based. I will describe history management systems. Then I will present the domain of « visualization optimization » (i.e., turning the design/choice problem into a mathematical optimization problem with automatic evaluation functions). In the conclusions and perspectives, I will discuss the trade-off between methods that entirely rely on the user and methods that are completely automatic. Both approaches can easily fail: with the first ones, the user will be alone, and with the second ones, the mathematical criteria may not encompass the user’s needs and objectives.

Bio-sketch
Gilles Venturini is Professor of Computer Science at the University Francois-Rabelais of Tours in France. His research interests are visual data mining, 3D interfaces, 3D data acquisition and biomimetic algorithms for optimization and learning. He is the coeditor in chief of the French New IT Journal (Revue des Nouvelles Technologies de l’Information) and was recently pr

Session iv2015_1.2: Information Visualisation
Chair: Prof. André, Elisabeth, Universität Augsburg, Germany
Visual Analysis of Eye Movements by Hierarchical Filter Wheels

Marcel Hlawatsch, Michael Burch, Daniel Weiskopf
University of Stuttgart, Germany

The algorithmic and visual exploration of spatio-temporal eye movement data is a challenging task, especially if we are interested in the movement patterns of a large number of study participants. For example, if prominent visualization techniques like heat maps or gaze plots are used we either loose the temporal information or get lost in visual clutter. In this work, we propose an approach for filtering saccadic eye movement data called hierarchical filter wheels. It supports the analysis of sequences of saccades by filtering them with respect to direction and length. The hierarchical filters are interactively generated on users’ demand by creating a hierarchy of multiple filter wheels each filtering one element of the sequence. We use a bubble tree layout to represent the generated filter hierarchy. The node positions in our layout directly represent the spatial properties of the filter criteria allowing an intuitive incremental generation and understanding of filter hierarchies. We illustrate the approach by applying it to eye movement data formerly recorded in an eye tracking study investigating the readability of different node-link tree diagrams. We demonstrate how the hierarchical filter wheels can be used in combination with standard prominent gaze plots typically integrated into eye tracking software.

Visual Analysis of Car Fleet Trajectories to Find Representative Routes for Automotive Research

David Spretke¹, Manuel Stein¹, Lyubka Sharalieva¹, Alexander Warta², Valentin Licht², Tobias Schreck², Daniel A. Keim²
¹University of Konstanz, Germany; ²Robert Bosch GmbH, Germany

Testing is an important and wide spread practice in the development of automotive components. For the design of test methods two types of input data are often considered: (1) load data gathered from real life vehicle fleets, and (2) information of the driving routes based on road features. The development of new technologies is though complicated not only by the need to join those two data sources, but also by the too limited knowledge of the parameters and their useful combinations. As a result, information about representative driving profiles is needed. To address these problems we present a visual analytics approach for analyzing multivariate trajectories as a combination of vehicle’s location and road elevation data. Our system combines trajectory clustering, interval-based user-driven trip segmentation, and frequent sequences analysis, supported by contingency table and interval-based Parallel Coordinates visualization and enables the expert user to find representative driving profiles for the definition of very compact test courses.
Visualization Support for Comparing Energy Consumption Data
Masood Masoodian¹, Birgit Endrass², René Bühling², Elisabeth André²
¹The University of Waikato, New Zealand; ²Augsburg University, Germany

Providing effective feedback can empower users to change their behaviour and take the necessary actions to reduce their energy consumption. The types of feedback that allow comparison of energy usage seem to be particularly valuable. This paper introduces the time-stack visualization, which has been designed to support comparisons of individual and collective energy usage data. It also describes a user study conducted to compare the effectiveness of time-stack against a similar visualization called time-pie. The results show that although the two visualizations are generally comparable in their effectiveness, users rate time-stack more favourably.

Abstract

Visualizing energy consumption data from multiple sources is an increasingly important task. This paper introduces a new method to manage multiple types of relationships existing in the data, providing effective feedback that can empower users to change their behaviour and take the necessary actions to reduce their energy consumption. The types of feedback that allow comparison of energy usage seem to be particularly valuable. This paper introduces the time-stack visualization, which has been designed to support comparisons of individual and collective energy usage data. It also describes a user study conducted to compare the effectiveness of time-stack against a similar visualization called time-pie. The results show that although the two visualizations are generally comparable in their effectiveness, users rate time-stack more favourably.

A Visualization Tool for Building Energy Management System
Takayuki Itoh¹, Masato Kawano², Shuji Kutsuna³, Takeshi Watanabe²
¹Ochanomizu University, Japan; ²NTT Facilities

Many public offices and companies manage their energy consumption by Building Energy Management System (BEMS). It is not an easy task to determine whether the past energy consumption was really necessary or just wasted. Visualization for energy consumption is useful to understand the situations of energy consumption to determine their necessity. This paper presents a visualization tool for energy consumption with BEMS. The tool firstly divides the daily variation of the energy usage and environmental measurements (e.g. temperature and humidity) into the meaningful number of patterns. It displays long-term polyline chart to represent the frequency of the daily pattern so that users can easily focus on particular dates at particular places. It also displays one-day polyline chart to represent the daily variation of the recorded values of the particular dates and places specified by users’ click operations. The paper introduces the examples of visualization to demonstrate the effectiveness of the presented tool, with a real dataset of business office building.

Layer-Centered Approach for Multigraphs Visualization
Denis Redondo¹,², Arnaud Sallaberry¹,³, Dino Ienco⁴, Faraz Zaidi²,³, Pascal Poncelet¹,²
¹LIRMM; ²Université de Montpellier; ³Université Paul Valéry Montpellier; ⁴IRSTEA Montpellier, UMR TETIS; ⁵City University of New York; ⁶Karachi Institute of Economics and Technology

Recent advances in network science allows the modeling and analysis of complex inter-related entities. These entities are often connected with one another in different ways. Simple graphs fail to capture these multiple types of relationships involving more sophisticated mathematical structures. One such structure is multigraph, where entities (or nodes) can be linked to each other through multiple edges.

In this paper we describe a new method to manage multiple types of relationships existing in multigraphs. Our approach is based on the concept of pair of nodes (edges) and, in particular, we study how nodes on different layers interact which each other considering the edges they share. We propose a two level strategy that summarizes global/local multigraph features. The global view helps us to gain knowledge related to the characteristics of layers and how they interact while the local view provides an analysis of individual layers highlighting edge properties such as cluster structure. Our proposal is complementary to standard node-link diagram and it can be coupled with such techniques in order to intelligently explore multigraphs. The proposed visualization is tested on a real world case study and the outcomes point out the ability of our proposal to discover patterns present in the data.
**Abstract**

**Session IV2015_1.4: Applications of Graph Theory**

**Chair:** Prof. Richard Laing, Scott Sutherland School, RGU, UK

**Fast Graph Drawing Algorithm Revealing Networks Cores**

**Romain Giot, Romain Bourqui**

Univ. Bordeaux / LaBRI, France

Graph is a powerful tool to model relationships between elements and has been widely used in different research areas. Size and complexity of newly acquired graphs prohibit manual representations and urge a need for automatic visualization methods. We are interested with the node-links diagram which represents each node as a glyph and edge as a line between the corresponding nodes.

We present a novel layout algorithm that emphasizes the cores of very large networks (up to several hundred thousand of nodes and million of edges) in few seconds or minutes. Our method uses a hierarchical coreness decomposition of the graph and a combination of existing layout algorithms according to the clusters topologies. Area-aware drawing algorithms which produce node overlap-free drawings are used to reduce the visual clutter. Edges are bundled along the hierarchy of clusters to highlight the network communities and reduce edge visual clutter.

We validated our approach by comparing our method against one of the fastest method of the state of the art on a benchmark of 23 large graphs extracted from various sources. We have statistically proved that our method performs faster while providing meaningful results.

**Mental maps models for edges**

**Jana Katreniaková, Martin Duria**

Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovak Republic

When drawing a graph, the user's actions on the graph may lead to a drawing which is very different from the drawing before the interaction. The established aesthetic criteria are not sufficient to allow the users to fully track the changes to the graph. The mental map of nodes and edges is lost. We have taken the existing work, which focused on mental maps for nodes, and extended it naturally to the edges. We present two models that allow edges to be drawn to preserve the mental map as much as possible. Our preliminary tests indicate that the produced edge drawing is similar to the original one and the other aesthetic criteria have mostly been preserved.

**An Indented Level-Based Tree Drawing Algorithm for Text Visualization**

**Xi He, Ying Zhu**

Georgia State University, United States of America

Level-based tree drawing is a common algorithm that produces intuitive and clear presentations of hierarchically structured information. However, new applications often introduce new aesthetic requirements that call for new tree drawing methods. In this paper, we propose an indented level-based tree drawing algorithm for visualizing parse trees of English language.

**Distributed Graph Layout with Spark**

**Antoine Hinge, David Auber**

LaBRI / Université de Bordeaux, France

This paper presents a novel way to draw very large graph, especially those too big to fit the memory of a single computer. This new method uses the recent advancements in distributed computing, notably using the Apache MapReduce library called Spark. Our implementation of a force-directed graph drawing algorithm and the way to compute repulsive forces in MapReduced are exhibited. We demonstrate the horizontal scalability of this algorithm and how layout obtained with our method on a Hadoop cluster.

**Simplified Stress and Simplified Silhouette Coefficient to a Faster Quality Evaluation of Multidimensional Projection Techniques and Feature Spaces**

**Danilo Medeiros Eler, Jaqueline Batista Martins Teixeira, Priscila Alves Macanhã, Rogério Eduardo Garcia**

UNESP, Univ Estadual Paulista, Brazil

Several multidimensional projection techniques have been proposed in literature over the last years. The quality of those techniques can be evaluated based on the dimensionality reduction or the clusters quality. The first evaluation aim to verify if the similarities from multidimensional space are preserved in projected space. While the second evaluation aim to verify if instances from a same class are placed in a same cluster in projected space. Respectively, Stress and Silhouette Coefficient are the main measures to quality evaluations. In this paper we present two new approaches -- named Simplified Stress and Simplified Silhouette Coefficient -- to speed up the computation of measures, enabling a faster evaluation of multidimensional projection techniques and feature spaces. We present experiments showing the high correlation between results obtained using original approaches and results obtained with those proposed in this paper. In addition, we show how to use Simplified Silhouette Coefficient to perform a fast feature space evaluation and selection.
Abstract

Towards the Understanding of Interaction in Information Visualization
Ana Raquel Figueiras
FCSH - Universidade Nova de Lisboa, Portugal

Over the past few years the web has been responsible for the rise in popularity of visualizations and it seems that interactive or playable visualizations have become more popular and end up standing out more.

The use of interactivity and animation has been extensively discussed in information visualization research, but there has been some controversy in relation to its benefits.

Additionally, there is still little empirical evidence about its efficacy in terms of improving understanding of the data and there is few research that points out guidelines of how to incorporate it successfully and that proves that playable visualizations are indeed more enjoyable and popular among users.

In order to guide future research on the actual benefits of interactivity in visualization it is important to understand what types of interactivity are currently being used in the field and to have a framework to help discuss and evaluate interaction techniques.

After conducting an extensive review of popular visualizations and their interactive capabilities, we propose eleven categories of interaction techniques: filtering, selecting, abstract/elaborate, overview and explore, connect/relate, history, extraction of features, reconfigure, encode, participation/collaboration, and gamification.

Plot Balalaika: Simple Chart Designs for Long-Tail Distributed Data
Mark Shovman 1,2
1Eyeway Vision, Israel; 2Yahoo Labs Haifa

Current approaches to summarising large arrays of data for presentation and communication mostly comprise reporting means with, e.g., bar-charts. These methods are well-suited for unimodal, ideally normally distributed data, but are misleading for long-tail distributions that comprise most of the Big Data.

We propose a succinct visualisation format, parallel in simplicity to bar-charts, that is suitable for communicating the gist of long-tail distributions, and show its efficiency empirically.

Heuristic Evaluation of a t-Commerce Prototype
Nikolas Jorge Santiago Carneiro 1, Carlos Gustavo Resque Santos 1, Tiago Davi Oliveira de Araujo 1, Brunelli Pinto Miranda 1, Bianchi Serique Meiguins 2, Anderson Gregorio Marques Soares 2
1Universidade Federal do Pará, Brazil; 2Universidade Federal Rural da Amazônia

The current Brazilian context in television audiovisual communication is in transition from analogical to digital technology. One of the main reasons for this motion towards Interactive Digital Television (iDTV) is the improvement in the user experience over this platform. Considering this motion, this work applied suitable interaction design and usability concepts from the Nielsen's heuristics [5] into a visualization prototype to the support of visual analysis of products in electronic commerce over TV (t-commerce). In this work we conducted a usability check in an existing information visualization prototype, in order establish whether or not it follows usability standards and in order to make it more usable to the user.

Session iV2015_1.6: Information Visualisation Theory & Practice
Chair: Prof. Feng Lin, Nanyang Technological University, Singapore

Visual Analysis of Source Code Similarities
Michael Burch, Julian Strotzer, Daniel Weiskopf
VISUS, University of Stuttgart, Germany

Software systems typically consist of many lines of source code organized in several files hierarchically structured into directories and packages. Since the code is the key data in software development, in many scenarios an overview about it is required, in particular for similar code passages. In this paper we investigate the visual analysis of source code similarities for local as well as global code passages. To reach this goal we first compute all subsequence occurrence frequencies (support metric) and relative occurrence frequencies (confidence metric) in local as well as global code regions. The resulting textual data attached by their occurrence values is displayed in a triangular matrix. Several interaction techniques are integrated in our visualization tool which are illustrated in the corresponding case study illustrating similarities in source code written in Assembler consisting of 10,641 characters.

Indexed dataflow network: A multi-layer and programmable architecture to integrate both visualization pipelines and scene graphs
Romain Guillemot, Stéphanie Prevost, Laurent Lucas
Université de Reims Champagne-Ardenne (URCA) - CReSTIC EA3804, France

Visualization pipelines and scene graphs are widely used paradigms in rendering applications, the former as a key concept in scientific visualization while the latter provides a powerful representation for 3D scenes in graphics applications. Despite an apparent disparity in usage, they show structural similarities by both using a graph-based architecture. Nevertheless, few attempts have been made to integrate both visualization pipelines and scene graphs in an unified design. This paper presents an architecture based on an extended dataflow network which allows implicit invocation of callbacks on network events. Events are then handled by programmable layers on top of the “dataflow layer” to dynamically build scene graph structures and define a multi-paradigm model interface, which forms what we call an “indexed dataflow network”. We show an implementation of our architecture using NVIDIA SceneX scene management engine and Qt’s model/view framework.
Visualizing the Evolution of Module Workflows

Marcel Hlawatsch1, Michael Burch1, Fabian Beck1, Juliana Freire2, Claudio Silva3, Daniel Weiskopf1
1VISUS, University of Stuttgart, Germany; 2Polytechnic School of Engineering, New York University

Module workflows are used to generate custom applications with modular software frameworks. They describe data flow between the modular components and their execution under certain parameter configurations. In many cases, module workflows are modeled in a graphical way by the user. To come up with the final result or to explore multiple solutions, they often undergo many iterations of adaptation. Furthermore, existing workflows may be reused for new applications. We visualize the evolution of module workflows with a focus-and-context approach and visualization techniques for time-dependent data. Our approach provides insight into user behavior and the characteristics of the underlying systems. As our examples show, this can help identify usability issues and indicate options to improve the effectiveness of the system. We demonstrate our approach for module workflows in VisTrails, a modular visualization system that allows building custom visualizations by combining different modules for processing and visualizing data.

Session CGiV2015_1.7: Geometric Modeling & Imaging
Chair: Prof. Chi Man PUN, University of Macau, Macau (S.A.R China)

An Immersive and Interactive Visualization System by Integrating Distinct Platforms
Mário Popolin Neto¹,², Alessandro Moraes², Danilo Medeiros Eler¹, José Remo Ferreira Brega²
1IFSP - Registro, Brazil; 2UNESP - Bauru, Brazil

Visualization applications can be performed on distinct platforms, such as mobile devices and multi-projection systems. Each platform offers specific features to provide further data understanding, and a system that integrates these platforms in a complementary manner is a real challenge. In this paper, we present an immersive and interactive visualization system that aims to explore data from relational databases using 3D graphs representations, where multiple simultaneous users can visualize and interact with the data through a multi-projection system and mobile devices. A single visualization application was created for both platforms using the Unity game engine, and an Unity external package for Virtual Reality applications development, that supports multi-projection system over a PC cluster and passive stereoscopy. Our visualization system aims to provide the users a better data understanding using a 3-screens multi-projection system as data overview, and mobile devices as display and interaction device for navigation and additional information visualization. We also introduce an user case, where the visualization system is used in order to support developers regarding structural problems in a large relational database.

Image-based Hair Pre-Processing for Art Creation: A Case Study of Bas-Relief Modelling
Wenshu Zhang, Meili Wang, Jian Chang, Ruoteng Tong, Jian J Zhang
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To better capture the shapes as well as the rich dynamics of hair, image based modelling techniques have been developed for reconstructing their 3D geometry and important visual features. Most hair images contain inevitable noises which impair reconstructed hair models. Therefore we propose to pre-process hair images and provide an orientation map of hair strands to enhance the follow-on modelling.

To demonstrate the usage of pre-processing techniques, we apply our pre-processing results for bas-relief stylisation and modelling of hair from image inputs. We compare different techniques to estimate hair orientations, adopting four types of filter mechanisms. Our analysis of their performance sheds insight on designing a suitable pre-processing technique for hair reconstruction from images. Several examples of bas-relief creation validate the effectiveness of the proposed approach.

N-polar Visualization: Visual Analytics for Exploring Data Objects with Multiple Interactive Anchors
Taek Jeon, Jihyun Lee, Wonjong Rhee, Bongwon Suh
Seoul National University, (South Korea

In this paper, we propose N-polar Visualization, an interactive visualization technique to graphically represent how the data objects are related to multiple anchors. This technique allows the users to place a particular set of data objects as anchors on a circle and radially move them around. It enables the users to control the arrangement of the anchors and interactively perform multiple comparisons of the dataset. To evaluate the feasibility and effectiveness of the technique, we performed a series of pilot studies by applying the technique on the UN General Assembly voting data. The exploration allowed us to identify a number of common patterns. In addition, we found that actual historical events can be successfully abstracted in corresponding visual layouts.

Shape Preserving Positive Rational Trigonometric Spline Surfaces
Muhammad Sarfraz, Farsia Hussain, Malik Zawwar Hussain
Kuwait University, KW

This paper concentrates on shape preservation of 3D positive data. A piecewise rational bi-cubic trigonometric function with six parameters has been built to preserve positive shape of 3D positive data. Four of the parameters are constrained to generate the positivity preserving surface through positive data, whereas, the remaining two parameters serve as free parameters for shape liveness of positive surface.
Interpolation of Discrete time Signals using Cubic Spline Function
Malik Zawwar Hussain¹, Misbah Irshad², Muhammad Sarfraz³, Nousheen Zafar²
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In this paper, a technique, which uses cubic spline, is proposed for the interpolation of discrete time signals and illustrated with examples. The results obtained are compared with the results of nearest neighbor interpolation and linear interpolation of discrete time signals. The analysis is made by calculating errors.

A Concurrent Architecture proposal for Information Visualization Pipeline
Nikolas Jorge Santiago Carneiro, Carlos Gustavo Resque Santos, Tiago Davi Oliveira de Araujo, Brunelli Pinto Miranda, Bianchi Serique Meiguins
Universidade Federal do Pará, Brazil

This paper identifies an opportunity to reduce the latency in information visualization (InfoVis) systems, exploring the parallelization of the visualization pipeline architecture. We propose a concurrent architecture where the visualization pipeline stages are modified to execute as producers and consumers threads. The threads synchronization is done by memory barriers and the data flow pass the pipeline through a unique data structure, called ring buffer, which reuses a contiguous space pre-allocated in memory. Two InfoVis prototypes were developed in java, the first one using sequential pipeline and the other using concurrent pipeline. The results obtained with concurrent architecture in comparison with sequential pipeline presented less execution time and memory allocation for data visualization rendering.

Self-Organizing Map-Based Feature Visualization and Selection for Defect Depth Estimation in Oil and Gas Pipelines
Abduljalil Abdulrahman Mohamed¹, Mohamed Hamdi¹, Sofiene Tahar²
¹Ahmed Bin Mohamed Military College (ABMMC), Qatar; ²Concordia University/Electrical and Computer Engineering Department, Montreal, Canada

Magnetic Flux Leakage (MFL) sensors are commonly utilized to detect defects in oil and gas pipelines and determine their depths and sizes. As a preprocessing step, MFL data are often reduced into a representative feature set that is capable of accurately estimating pipeline defect depths. However, this estimation capability may vary depending on the features used, which necessitates the need for selecting the most relevant ones. In this paper, self-organizing maps (SOMs) are used as feature visualization tool for the purpose of selecting the most appropriate features. First, a self-organizing map (SOM), i.e., a two-dimensional discretized representation of the input space of the training samples for the features, is produced. The SOM weights for each individual input feature (weight plane) are displayed then visually analyzed. Irrelevant and redundant features can be efficiently spotted and removed. The remaining "good" features (i.e., selected features) are then used as an input to a feedforward neural network for defect depth estimation. Experimental work has shown the effectiveness of the proposed approach. For instance, within ±5% error-tolerance range, the obtained estimation accuracy, using the SOM-based feature selection, is 86.7%, compared to 74% when all input features are used (i.e., no feature selection is performed); and within ±10% error-tolerance range, the obtained estimation accuracy, using the SOM-based feature selection, is 97%, compared to 86% when all the input features are used (i.e., no feature selection is performed).

The Recommendation Dashboard: A System to Visualise and Organise Recommendations
Gerwald Tschinkel¹, Cecilia di Sciascio¹, Belgin Mutlu¹, Vedran Sabol¹²
¹Know Center Gmbh, Austria; ²Graz University of Technology

Recommender systems are becoming common tools supporting automatic, context-based retrieval of resources. When the number of retrieved resources grows large visual tools are required that leverage the capacity of human vision to analyse large amounts of information. We introduce a Web-based visual tool for exploring and organizing recommendations retrieved from multiple sources along dimensions relevant to cultural heritage and educational context. Our tool provides several views supporting filtering in the result set and integrates a bookmarking system for organising relevant resources into topic collections. Building upon these features we envision a system which derives user's interests from performed actions and uses this information to support the recommendation process. We also report on results of the performed usability evaluation and derive directions for further development.
**Abstract**

**Session iV2015_2.1: Information Visualisation – Theory & Techniques**  
Chair: Gilles Venturini, University Francois Rabelais of Tours, France

A Color-based Visualization Approach to understand harmonic structures of Musical Compositions  
Delfina Malandrino, Donato Pirozzi, Gianluca Zaccagnino, Rocco Zaccagnino  
University of Salerno, Italy

Music expertise is the ability to understand the structural elements of music compositions by reading musical scores or even by simply listening to music performance. Although the most common way to learn music is through the study of musical scores, this approach is demanding in terms of learning ability, given the required implicit knowledge of music theoretical notations and concepts.

In this work we define a two-level color-based approach, that exploits graphical visualization techniques to represent data structures of classical music, and to perform harmonic analysis of musical compositions. Our main goal is to make easier and very quick the study of classical notations (recognized as a tedious and difficult task in the field), by providing individuals with a mechanism that clarifies complex relationships in music using visual clues.

We performed a preliminary study to evaluate the effectiveness of our approach as well as participants’ perceptions about its usefulness and pleasantness. The results of the study provided us with positive and useful feedback on the effectiveness of our approach as well as further directions to explore.

**Edge Visual Encodings in Matrix-Based Diagrams**  
Joris Sansen¹, Romain Bourqui¹, Bruno Pinaud¹, Helen Purchase²  
¹University of Bordeaux, France; ²University of Glasgow, UK

The most common depictions of graphs are node-link diagrams (NLDs) and matrix-based diagrams (MBDs). Making valid comparisons between these two visualisation techniques is difficult because they are each subject to a variety of representation parameters with respect to graph layout (NLD) and node ordering (MBD), meaning that any given choice of layout and order (even if they fulfil some aesthetic criteria) may influence experimental results. To overcome this problem, we propose a MBD-based technique which hybridises the entity visual encoding of a MBD with the edge visual encoding of a NLD. Using a typical MBD, we propose three edge visual encoding evolutions to ultimately render edges like in a NLD while preserving nodes depiction and order. Such encoding evolutions allow us to perform an experimental evaluation of user performances for a path finding task without the above limitations.

We show that for a path finding task, our edge visual encoding evolutions tend to improve the user experience when analysing and interacting with a MBD.

Visualizing a set of multiple time series with an aggregate stacked graph  
Nicolas Greffard, Pascale Kuntz  
LINA-Duke, University of Nantes, France

Time series analysis is the centerpiece of numerous research fields from stock analysis to topic mining. While the univariate case is still commonplace, there is an increasing need for tools providing features to study the relationships between multiple time series.

Initially motivated by an interdisciplinary research agenda with sociologists and musicologists, we propose an extension of the famous stacked graph to display an overview of a set of multiple and item-set time series. This visualization allows the exploration of the general tendencies observed on a population and the comparison of patterns between groups. A proof-of-concept is presented on real-life data extracted from a recent study on the daily music listening behavior.

FATuM - Fast Animated Transitions using Multi-Buffers  
Alexandre Perrot, David Auber  
Universite de Bordeaux, France

The rise of Big Data and powerful mobile devices calls for libraries able to render a large number of visual elements and make fast animations without loss of frame rate. We introduce the FATuM library as a middleware for visual animation. With a single abstraction for visual elements based on the work of Bertin and adaptation of the double buffering technique, we enable animated visualization of large datasets in native applications and in the browser using the same codebase. Our system does not differentiate animated from static rendering, thus reducing code complexity and guaranteeing smooth animation. We show that our system maintains 60fps for up to 200.000 visual elements in a native application and 30fps for 100.000 visual elements in a web browser.

Natural User Interface Design in DA-TU: An Interactive Clustered Data Visualization System  
Shizhe He¹, Mao Lin Huang¹², Lin Zhu²  
¹University of Technology, Sydney, Australia; ²Tianjin University, China

Clustered Graph Visualization, such as DA-TU [2], has been successfully applied in the field of large scale relational data visualization for data analytics. However, it was very inefficient in interactions by using WIMP based HCI in DA-TU, in which a Control Panel was required to swap among eight different modes of operation. In this paper, we attempt to use a new multi-touch enabled NUI method for supporting interactions in DA-TU. We aim to increase the efficiency of HCI process in DA-TU. To achieve this, we first transplanted DA-TU from WIMP based PC to NUI based iPad. We then designed a set of new multi-finger gesture vocabularies to support DA-TU navigations in tablet environment. Adopting such set of rich HCI vocabularies achieves better efficiency and user experience in data exploration. We have conducted usability studies that demonstrated our hypothesis.

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1. University of Bordeaux, France; 2. University of Nantes, France
Abstract

Session IV2015_2.2: Knowledge Visualization and Visual Thinking
Chair: Sebastian Kernbach, University of St. Gallen, Switzerland

A Gesture Control Framework targeting High-resolution Video Wall Displays
Bernhard Klein
Future Cities Laboratory, Singapore-ETH Centre, 1 Create Way, Singapore 138602

Recent advances in display and user interface technologies create new opportunities for participatory urban planning. Whereas touch screens enable direct screen interactions for intuitive remodeling of urban simulations, high resolution video walls offer true-to-life or human-scale scenario visualizations. Multi-touch screen environments finally function as an interactive user interface for the entire urban simulation pipeline. However intuitive and preferably natural interactions for simple reconfiguration, overarching tool management or complex tool interaction remain a major challenge.

For this reason we have implemented a gesture control framework that uses multi-modal input devices to satisfy all gesture use cases and integrates a display management system for seamless interaction with our multi-screen infrastructure.

To understand the implications of this novel approach, we conducted preliminary user trials with urban planning experts and technicians. The results indicated that the system provides a fluid and natural user experience for exploring and analyzing urban planning data.

Value Lab Asia: A Space for Physical and Virtual Interdisciplinary Research and Collaboration
Alian Anwar1, Bernhard Klein2, Matthias Berger2, Stefan Muller Arisona2
1Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology, United States of America; 2Future Cities Laboratory, Department of Architecture, ETH Zurich, Switzerland

Many contemporary research tasks require complex decision making and interdisciplinary collaboration among different groups of experts and stakeholders. Nowhere is this more apparent than in the planning and design of future cities - rapidly growing cities where the development and allocation of energy, housing, transportation and other scarce resources require the active participation of architects, urban planners, government stakeholders and private citizens. In this paper, we show how recent advances in display technology can facilitate such collaboration and create new opportunities for participatory urban planning. We introduce the Value Lab Asia as a model for cooperative planning and value creation, and show how a multi-screen display management framework called the Tool Library integrates the laboratory’s physical and software infrastructure with the planning process.

The Design Process: A Visual Model
Sabrina Bresciani
University of St. Gallen, Switzerland

Knowledge visualizations are often created by practitioners and managers, not necessarily by expert graphic designers. Non-experts – as well as novice designers – can be puzzled and overwhelmed by the complexity of the design process: it is unclear how to start and which are the main phases and their sequence. Often times even experienced designers mistakenly start by selecting a tool or a solution, instead of considering the audience and its needs. The aim of this conceptual piece is to assemble the main phases (and related procedures and tools) of the design process to provide a pragmatic visual guide for students and practitioners. It also highlights the highly cyclical nature of designing through a structured iterative process of prototyping and testing. The model can be utilized for a broad spectrum of applications, including the creation of knowledge visualization, information visualizations, graphic design or other types of product. The examples provided in this paper are specifically related to knowledge visualization.

Dynamic Multi-View, Multi-Format, Multi-User Visualizations: For Future Cities
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1Future Cities Laboratory, Singapore-ETH Centre, 1 Create Way, Singapore 138602; 2ETH Zurich, Chair of Information Architecture, 8093 Zurich, Wolfgang-Pauli-Str 27, Switzerland

This paper introduces the concept of a dynamic Multi-View, Multi-Format, Multi-User Visualizations. It also suggests aligning all visualization branches to a common problem, namely the design and implementation of future cities, such as Jakarta.

While a lot of visualization research has extensively discussed the emotional, cognitive and coordinative benefits of visual representations, the application of such tool to solve a grand societal problem has been neglected. We suggest focusing on Future Cities, since they need solutions and because the field seems to be ideal to align the various subgroups of visualization research. We derived this insight from about 1000 events in our physical value lab and our own software developments, the Visual Manager and the Shuffler, a framework to put together complementary coordinated views. The innovative part of this framework is that different visual representations, complementary business logics and datasets can be distributed to different views, which calls for more transdisciplinary work in the design of dynamic multi-view, multi-format and multi-user software.

This paper is relevant for researchers in all subgroups of visualization research, especially Knowledge Visualization and Information Visualization.
Session Mediviz2015_2.3: BioMedical Visualization

Chair: Prof. Urska Cvek, Louisiana State University Shreveport, USA

A Novel intensity normalization method on cervigrams in the detection of Cervical Cancer

Abhishek Das
Tripura University, India

Cervical Cancer is one of the ubiquitous forms of cancer afflicting the female population worldwide. A Digital Colposcope is a self-illuminated powerful microscope which acquires the image of the affected cervix. The raw cervix image acquired by the colposcope is known as a cervigram. The raw cervigram is preprocessed by removing the specular reflections and then the region of interest is sought. Before the image is made ready for implementing further image processing algorithms, our novel illumination correction and intensity normalization methods are applied. In the current paper we propose a novel method where we use the polynomial-type Newton’s divided difference interpolation for illumination correction. Based on our research findings, we conclude that the peak of the entire cervix region intensity distribution is strongly correlated with the peak of the SE region intensity distribution.

Semi-automatic compartment extraction to assess 3D bone mineral density and morphometric parameters of the subchondral bone in the tibial knee

Rabaa Youssef1, Hamid Bouhadoun2, Jean Denis Laredo3, Christine Chappard4
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We present a new semi-automatic method to extract the bone mineral density (BMD) and bone proportion (BV/TV) with the aim to analyze subchondral bone changes due to knee osteoarthritis in clinically relevant compartments (medial versus lateral) and (anterior versus posterior). This method based on convex hull is developed initially on high resolution peripheral computed tomography but can potentially be applied in clinical CT with sufficient resolution.

Web-based Information Retrieval and Visualization for Diagnostic Radiology

Ben Chua1, Xiuling Liu2, Bin Dong3, Feng Lin4,5
1Nanyang Technological University, Singapore; 2Hebei University, China

To improve safety and ease operations in using the medical imaging devices and increase the influx of digital imagery, there is a need for Radiology Information System (RIS) and Picture Archiving and Communication System (PACS) to be used in conjunction to establish a secure network for transmission of patient information. We present a web-based RIS and PACS information retrieval and visualization system implemented for diagnostic radiology, addressing its benefits in workflow improvements, operational efficiencies and convenience for the users. The web application is based on the functional and non-functional requirements elicited on three major user groups, namely, patient, referring physician and radiologist. Novel methodology in the system design and visual analytics is also reported, including Use Case Design, Use Case Descriptions, Database Design, Web Navigation and Activity Diagrams. Experimental results are given to show its effective applications in a clinical setup.

Augmented representations of clustered fiber bundles for interactive queries

Stefan Philips, Mario Hlawitschka, Gerik Scheuermann
Leipzig University, Germany

Hierarchical fiber clustering is a promising way to analyze brain connectivity. A disadvantage of hierarchical fiber clustering is its difficult visualization. The simple presentation as a 2D tree is because of the amount of several thousand leaves visually too complex. We present a framework that allows the modification of the dendrogram visualization in a flexible way. The modified dendrogram visualization can convey additional information that grant an easier orientation within the hierarchical clustering. Beside the interaction with the dendrogram itself, it is also possible to make use of a 3D view and a clustering preview. To illustrate potential use cases, we present two usage examples that show the versatility of our framework.

Enhancing Visual Perception and Directing Viewer’s Attention in Interactive Direct Volume Rendering

AmirAli Sharifi, Pierre Boulanger
University of Alberta, Canada

Interactive visualization of medical data plays an increasingly vital role in clinical diagnosis. Cluttered views, lack of visual cues, etc. are some of the problems that exist especially when projecting a 3D rendering of a Computed Tomography data on a 2D screen. In this paper we proposed two synthetic visual cues. They facilitate perception by removing visual clutter while maintaining context, directing viewers’ attention to the object of interest, and consequently enhancing clinical diagnosis. Our proposed cues can be used both individually or combined with any other existing cues. Although our methods have been created with medical visualization in mind, it is possible to use them in other volume rendering applications as well.

A semantically adaptable integrated visualization and natural exploration of multi-scale biomedical data

Ricardo Millan1, Asan Aqibetov2, Jan Rzejpecki1, Marta Ondrésik2, Alexander Vais1, Joaquim Miguel Oliveira1, Giuseppe Patané2, Karl-Ingo Friese2, Rui L. Reis1, Michela Spagnuolo1, Franz-Erich Wolter1
1Leibniz University of Hannover, Germany; 2Consiglio Nazionale delle Ricerche, Italy; 1Bs research Group, University of Minho, Portugal

The exploration of biomedical data which involves heterogeneous sources coming from different spatial scales and medical domains is a challenging topic in current research. In this work, we combine efforts regarding multi-scale visualization, multimodal interaction and knowledge formalization for the exploration of multi-scale biomedical data. The knowledge formalization stores and organizes the information sources, the integrated visualization captures all relevant information for the domain expertise of the user and the multimodal interaction provides a natural exploration. We present a concrete example of use of the proposed exploratory system for a biologist investigating multi-scale pathologies.
Session iV2015_2.4: Visualization, Art, and Design
Chair: Prof. Francis T. Marchese, Pace University, USA

User Interface Considerations for Browser-Based Just-in-Time-Retrieval
Christin Seifert, Jörg Schlöterer, Michael Granitzer
Passau University, Germany

With the availability of free online enrichment services injection of additional, external resources in existing Web content becomes more and more widespread. For the specific area of just-in-time retrieval of digital resources based on web page content, there are no specific guidelines of how to design and integrate the additional user interface components. In this paper, we conceptualize related user interface issues, investigating the central questions: (i) how can a user be visually notified that additional results are available, and (ii) with which user interface elements should the results be presented. Concretely, we identified four different notification styles and six different result presentation styles. In a survey-based study with 75 participant we elicited the users’ preferences, revealing a clear preference for the representation style (split pane) and a strong preference for three notification styles (notification bubble, icon appearance and change of icon’s appearance). The latter preferences are related to the preferred browser. The results can serve as guideline for designing web-based user interfaces for just-in-time retrieval.

Quick Vis: A Web-Based Visualization Delivering Flexible Exploration of User-Driven Analytics
Alessandro Simone Agnello, Haim Levkowitz
University of Massachusetts Lowell, United States of America

Web visualizations have become an integral tool for representing data in an accessible and intelligible format. This paper presents a new workflow, Quick Vis, which enables an analyst to inspect data sets and manipulate properties within any data set. This subsequently engages our analytic engine, saves each property set as a profile, and allows comparisons between profiles for further findings. In addition to describing our proposed techniques, we provide a case study that demonstrates the usefulness of Quick Vis for real life problems.

Visualizing Süleymanname: Analyzing and Visualizing Embedded Spatiotemporal Information in a 16th Century Illustrated Manuscript
Ferhat Şen
Aalto University School of Arts, Design and Architecture, Department of Media, Finland

In this paper, we present the analysis and the visualization process of spatiotemporal information in a 16th century illustrated manuscript. The purpose of this research is to find alternative ways of exploring the illustrations of a 16th century manuscript. Using the artifact analysis methods, we analyzed 69 illustrations in the manuscript of Süleymanname from the point of view of time and space. Employing media visualization techniques, we generated three visualizations based on the created dataset containing the metadata about the illustrations. In the visualizations, we used the actual media artifacts as representation of data instead of the graphical primitives like points. The resulting visualizations enable to explore the collection of the illustrations in historical and geographical contexts.

Senescence: An Age-Based Character Simulation Framework
Suren Deepak Rajasekaran, Nicoletta Adamo-Villani
Purdue University, United States of America

The paper presents the development and initial validation of the Senescence character framework, a simulation tool that can be used for rigging muscle deformor-based humanoid characters, with support for age. The senescence framework allows the user to rig any bipedal 3D character and manipulate skeleton and muscle parameters in order to render the age of the character realistically. The framework was developed using Python, Maya Embedded Language and PyQt. A study with 100 subjects was conducted to determine whether participants were able to perceive the age of the characters simulated with the Senescence framework. Findings show that while subjects were able to perceive age differences, they were not able to identify the age of the simulated characters with high level of accuracy. Results also show that subjects with animation expertise were able to identify the age of the characters more accurately than subjects without animation experience.

Examining User Experiences Through A Multimodal BCI Puzzle Game
Fotis Liarokapis1, Athanasios Vourvopoulos2, Alina Ene3
1Masaryk University, Czech Republic; 2University of Madeira, Portugal; 3Coventry University, UK

This paper presents a study of user’s experiences in low cost multimodal brain-computer interface (BCI) games. A 2D puzzle game (Tetris) was designed featuring two modes (non-BCI and BCI input) which require users to meditate in order to change the game difficulty. Thirty participants were asked to report on the two modes separately. Results indicate that a one-sensor BCI device in games positively contributes to enjoyability but raises mental demand. There was no reported drop in performance in a hybrid system where direct control is not handled by BCI input. It was found that meditation could not be self-regulated making short-term direct control a bad design decision in future BCI gaming scenarios for one-sensor headsets.

Perceived Realism of Crowd Behaviour with Social Forces
Stuart O’Connor1, Fotis Liarokapis2, Chrisina Jayne1
1Coventry University, United Kingdom; 2Masaryk University, Czech Republic

This paper investigates the development of an urban crowd simulation for the purposes of psychophysical experimentation. Whilst artificial intelligence (AI) is advancing to produce more concise and interesting crowd behaviours, the number of sophisticated algorithms implemented within a system does not necessarily guarantee its perceptual realism. Human perception is highly subjective and does not always conform to the reality of the situation. Therefore it is important to consider this aspect when dealing with AI implementations within a
The deformation region; however, which can increase the difficulties of forgery greatly. The more general anisotropic materials less studied. We look into the existing deformable models by element transformations along the given directions, which invertible, and total approximation by the Finite Element Method, and different approaches such as Laplacian finite element method and corotational properties. A linear FEM corotated, and a positive definite elasticity tensor is derived for an anisotropic material. The orientation information is combined into the existing deformable models by element transformations along the given directions, which provide a control of the desired deformation. Thirdly, constraints for the strain density in linear elastic models are analyzed, and a positive definite elasticity tensor is derived for an anisotropic material. Fourthly, an orthotropic deformation controlling frame-field is conceptualized and the frame construction tool is developed for the user to define the desired material properties. A quaternion Laplacian smoothing algorithm is designed for propagating the rotation minimization frames into the entire object. And finally, the corotational linear FEM model is coupled with the orthotropic frame-field to realize a dynamics system, which can deal with large anisotropic deformations.

Abstract

Simulation and Visualization of Deformation with Anisotropic Materials

Physically based deformable models have been a hot topic in the computer graphics and visualization community. However, most of the implemented models work only for isotropic materials, leaving the more general anisotropic materials less studied. We look into the challenging issues in dynamics simulation and realtime visualization for anisotropic materials, and present our theoretic and practical work along the way to provide an ultimate solution to deformation with such materials. First, our models are based on continuum mechanics and approximated by the Finite Element Method, and different approaches such as corotated, invertible, and total Lagrangian explicit dynamic. Secondly, for controls of the deformation, we have focused on materials that have their own internal structures (fibers) that determine the dynamics behaviors. We propose a fibers incorporated deformable model that can approximate the anisotropic elastic material properties. The orientation information is combined into the existing deformable models by element transformations along the given directions, which provide a control of the desired deformation. Thirdly, constraints for the strain density in linear elastic models are analyzed, and a positive definite elasticity tensor is derived for an anisotropic material. Fourthly, an orthotropic deformation controlling frame-field is conceptualized and the frame construction tool is developed for the user to define the desired material properties. A quaternion Laplacian smoothing algorithm is designed for propagating the rotation minimization frames into the entire object. And finally, the corotational linear FEM model is coupled with the orthotropic frame-field to realize a dynamics system, which can deal with large anisotropic deformations.

Keywords - Deformable Models, Anisotropic Materials, FEM, Dynamics Simulation, Visualization

Bio-sketch

Dr Lin Feng is currently an Associate Professor at School of Computer Engineering, Nanyang Technological University. His research interest includes biomedical informatics, imaging and visualization, computer graphics, as well as high-performance computing. He has worked for more than twenty funded research projects since joining NTU twenty years ago and has published about 200 technical papers. He has also won several prestigious research awards. Dr Lin is a Senior Member of IEEE.

Session IV2015_2.5: Visualisation

Chair: Prof. Randolph George Goebel, University of Alberta, Canada

<keynote Lecture>

Recent Advances in Multimedia Forgery and Security

Prof. Chi Man PUN
University of Macau, Macau S.A.R., China

Along with the development of computer technology and the popularity of software for multimedia information processing, digital forgery is increasingly easily to achieve, which reduces the credibility of the multimedia data such as digital images, videos and audios greatly. Therefore, multimedia forgery detection and information security have been becoming more and more important in recent years. Among the existing kinds of digital forgeries, copy-move forgery is one of the most common ones, which is to paste a copied region of an image into another part of the same image. During the copy and move operation, some image processing methods such as rotation, scaling, blurring, compression, and noise addition are applied to ensure the imperceptibility of the copied region; however, which can increase the difficulties of forgery detection at the same time. In this talk, we will study the recent advances of multimedia forgery and the related detection methods such as copy-move or splicing forgeries, and multimedia security techniques such as digital watermarking methods.

Bio-sketch

Prof. Pun received his B.Sc. and M.Sc. degrees in Software Engineering from the University of Macau in 1995 and 1998 respectively, and Ph.D. degree in Computer Science and Engineering from the Chinese University of Hong Kong in 2002. He is currently an Associate Professor and Head of the Department of Computer and Information Science of the University of Macau. He has investigated several funded research projects and published more than 150 refereed scientific papers in international journals, books and conference proceedings. He has also served as the editorial member / referee for many international journals such as IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Image Processing, Pattern Recognition, etc. His research interests include Digital Image Processing; Multimedia Security and Digital Watermarking; Pattern Recognition and Computer Vision. He is also a senior member of the IEEE and a professional member of the ACM.
Session iV2015_2.6: Information Visualisation - Application
Chair: Prof. Marjan Trutschl, Louisiana State University Shreveport, USA

Visualization of Crowd-Powered Impression Evaluation Results
Erika Gomi, Yuri Saito, Takayuki Itoh
Ochanomizu University, Japan

There has been much collective knowledge on the Web, such as evaluation of restaurants, hotels, and manufactured products. Even though each of the participants on such Web sites usually just evaluate the small number of contents, these kinds of crowd-powered contents evaluation services bring us fruitful information. Visualization is a useful tool to carefully observe the evaluation results and discover complex trends of the evaluation. This paper presents our study on visualization of the crowd-powered contents evaluation. Firstly we developed a contents evaluation technique applying an interactive genetic algorithm, which presents contents estimated to be highly or poorly evaluated. Then we had a case study with various appearances of female face images to collect the evaluations. Finally, we visualized the result by applying an image browser CAT. This paper discusses how the visualization result depicts the trends of the evaluation on appearance of women.

Web based Time-tunnel: An Interactive Multidimensional Data Visualization Tool Using Genetic Algorithm
Ryuya Akase, Yoshhiro Okada
Kyushu University

We present web based Time-tunnel that renders 3D charts of time series multidimensional data in a browser. The system supports to find differences and similarities between charts by overlapping some charts. Nonetheless, it can be difficult to distinguish the charts if we overlap many charts. Therefore, our system optimizes data selection by using genetic algorithm, and it visualizes some charts that has a strong relation between data. In addition, users can share the visualized result with other users by using a specific URL generated by the system. Finally, we analyze actual data sets in order to test usability of the system.

ThreadCity: Combined Visualization of Structure and Activity for the Exploration of Multi-threaded Software Systems
Sebastian Hahn, Matthias Trapp, Nikolai Wuttke, Jürgen Döllner
Hasso-Plattner-Institut, Germany

This paper presents a novel visualization technique for the interactive exploration of multi-threaded software systems. It combines the visualization of static system structure based on the EvoStreets approach with an additional traffic metaphor to communicate the runtime characteristics of multiple threads simultaneously. To improve visual scalability with respect to the visualization of complex software systems, we further present an effective level-of-detail visualization based on hierarchical aggregation of system components by taking viewing parameters into account. We demonstrate our technique by means of a prototypical implementation and compare our result with existing visualization techniques.

ConcentriCloud: Word Cloud Visualization for Multiple Text Documents
Steffen Lohmann, Florian Heimerl, Fabian Bopp, Michael Burch, Thomas Ertl
University of Stuttgart, Germany

Word clouds provide a simple and effective means to visually communicate the most frequent words of text documents. However, only few word cloud visualizations support the contrastive analysis of multiple texts. This paper introduces ConcentriCloud, a structured word cloud that merges the words from several text documents into a single visualization. The weighted words are arranged in a concentric layout, with those representing the individual documents on the outer circle and the merged ones on inner circles. Interaction techniques allow to further analyze the word cloud and to provide details on demand. The approach has been implemented and tested on several examples. A qualitative evaluation confirms the general value of ConcentriCloud and reveals benefits and limitations.

Session iV2014_2.7: Knowledge Visualization and Visual Thinking
Chair: Bernhard Klein, Future Cities Laboratory, Singapore-ETH Centre, Singapore

The Role of Visual Templates on Improving Teamwork Performance
Marta Perez Garcia¹, Sabrina Bresciani²
¹Birmingham City University, United Kingdom; ²University of St. Gallen, Switzerland

Knowledge Visualization can be a valuable support for facilitating a number of cognitive and collaborative tasks in organizations. The aim of this paper is to provide concrete evidence of how visual templates provide useful support for teams, which lead to higher quality of idea generation and sharing, compared to unstructured meetings. Evidence is provided through the illustration of a field study conducted in a multinational telecommunication company and a series of laboratory experiments. Results show that visually structuring meetings improves the number of high quality ideas developed, and increased knowledge shared and remembered.

What You See is What You Get: The Impact of Perceived Finishedness (PF) on Visual Contribution Fluency during Electronic Ideation
Lawrence McGrath
University of St. Gallen, Switzerland

Micro-level visual phenomena significantly impact visually-supported interactions, and require further exploration. This study uses a laboratory experiment with managerial participants to examine the impact of the perceived finishedness (PF) of an electronic ideation platform on participant contributions. Lowered PF was expected to lead to a rise in contributions as a result
of an increase in on-task social metacognitive interaction. Contrary to expectations, this study found that low PF significantly lowered the amount of on-task contributions made by participants. In contrast, ideation fluency was unaffected by PF levels. This study examines the complementary new ideation metric of contribution fluency in light of the social metacognitive process structuring benefits.

**Knowminer Search - a Multi-Visualisation Collaborative Approach to Search Result Analysis**

*Manuela Rauch*, *Werner Klieber*, *Ralph Wozela*, *Santokh Singh*, *Vedran Sabol*  

The amount of information available on the internet and within enterprises has reached an incredible dimension. Efficiently finding and understanding information and thereby saving resources remains one of the major challenges in our daily work.

Powerful text analysis methods, a scalable faceted retrieval engine and a well-designed interactive user interface are required to address the problem. Besides providing means for drilling-down to the relevant piece of information, a part of the challenge arises from the need of analysing and visualising data to discover relationships and correlations, gain an overview of data distributions and unveil trends. Visual interfaces leverage the enormous bandwidth of the human visual system to support pattern discovery in large amounts of data.

Our Knowminer search builds upon the well-known faceted search approach which is extended with interactive visualisations allowing users to analyse different aspects of the result set. Additionally, our system provides functionality for organising interesting search results into portfolios, and also supports social features for rating search results and for sharing and annotating portfolios.

**Navicons for collaboration: Navigating and augmenting discussions through visual annotations**

*Martin J. Eppler*, *Michael H.G. Hoffmann*, *Sebastian Kernbach*  

As discussions move online, we need means that compensate for what we take for granted in face-to-face meetings: voice modulation, mimics, or gestures. There are three functions of these ‘metadiscursive’ expressions: 1) to navigate conversations and to direct the attention of our interlocutors, deciding what to discuss, reviewing what has been said, or how things are framed 2) to signal attitudes such as agreement or disagreement, or the level of certainty or commitment and 3) to annotate (visual) content with comments. These functions are crucial for the quality of discussions and can benefit from information visualization. To do this, we propose a classification of navigational moves and attitudes and their visual representation in form of ‘Navicons’ and ‘Atticons’. These icons help to improve the quality of online or face to face discussions, to plan conversations in advance, or to analyze past discussions. An example and outlook conclude the paper.

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**Short Papers**

**Session IV2015_2.8: Information Visualization**

Chair: Prof. Mark Bannatyne, IUPUI, USA

**An experience of information visualization and interaction for aphasic persons**

*Mariko Sasakura*, *Saori Ikuma*, *Yukihiro Izawa*  

Aphasia is a collection of language disorders, which are about speaking, listening, reading and/or writing. The cause of aphasia is damages of brain mainly by cerebral stroke. Language therapy with speech therapists (ST) can be a rehabilitation for aphasia persons to recover their language skills.

Our interests are in the method to achieve language therapy for aphasia persons by using a tablet computer. In this paper, we report a prototype of rehabilitation system and the evaluation of the system by aphasia persons and speech therapists (STs). Aphasia persons have troubles to understand language. Most of them have troubles to read sentences, and a feature of paralysis in right side of body because the cause of aphasia is damages to the left part of brain. Therefore most of them have troubles to write characters and also lines in hand. The proposed rehabilitation system allows aphasia persons to undergo treatment without writing characters or lines. Since they are not good at reading sentences, the user interface is designed especially using information visualization, as few characters. The evaluation of the system by aphasia persons and STs result good grade and both of them want to use the rehabilitation system by tablet computers much further.

**Visualization on Agglomerative Information Bottleneck Based Trajectory Clustering**

*Yang Fan*, *Qing Xu*, *Yuejun Guo*, *Sheng Liang*  

Tianjin University, Tianjin, China, China, People's Republic of China

Undoubtedly, visualization of the trajectory clustering outputs is very important and some researches have been done on visualization of the clustering results. Still importantly, the research on visualizing the procedure of clustering, which is also of great value, is little touched. In this paper, we propose a novel 3D visualization tool, which comprehensively illustrates the Agglomerative Information Bottleneck (AIB) based clustering scheme, to help users understand the clustering approach vividly and clearly. The point of the proposed metaphor makes use of the visualization, together with rich interactions, to demonstrate the iterative clustering procedure, the corresponding results and the clustering results. The experiment demonstrates the effectiveness of our 3D visualization tool for trajectory analysis.
**Abstract**

**Service Oriented Architecture for Data Visualization in Smart Devices**
Nikolas Jorge Santiago Carneiro, Carlos Gustavo Resque Santos, Tiago Davi Oliveira de Araujo, Brunelli Pinto Miranda, Jairo de Jesus Nascimento da Silva Junior, Bianchi Serique Meiguins
Universidade Federal do Pará, Brazil

The Internet has played an important role as a knowledge-sharing network and in this context some service oriented architecture (SOA) applications have emerged in all kind of study fields. Therefore, this work aims the design and development of a service aggregation that will favor ubiquity and pervasiveness in data visualization applications, allowing users to build domain-specific data visualizations in an easy and intuitive way. With this kind of service, it is possible to build data visualization applications for different smart devices such as smartphones, tablets, desktop, smart TV's, etc. A Web API that supports the main functionalities of an information visualization tool in different platforms has been proposed to reaches these purposes. The REST (REpresentational State Transfer) Style has been employed in the service conception as the architectural communication model. Client-side and server-side applications were developed using Java with a data visualization generator engine called PRISMA.

**The Usefulness of the Virtual Speaking Head, as Well as 3D Visualization Tools in the New Communication, Teaching and Presentation Technologies is almost Unlimited.**
Eva Pajorova
Slovak Academy of Sciences, Slovak Republic

The usefulness of the Slovak-speaking virtual head as well as 3D visualization tools in the new communication, teaching and presentation technologies, as well as in a variety of audiovisual communications software technologies is almost unlimited. One of the options is the learning through technologies for hearing impaired people. Other, which is a most desired technology, is the use of a virtual head in the field of different communication forms. In the field of crisis management, where the virtual head present the warning messages and navigates during the evacuation of people from reproducing the public institutions such as schools, theatres, etc. 3D visualization tools, as well as Slovak-speaking head and Slovak speech visemas have been designed and tested in our Institute.

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**Session iv2015_2.9: Visualisation in Built & Rural Environments**
Chair: Prof. Vineet Kamat, University of Michigan, USA

**Impact of Visual Cues on Climate Perception in Virtual Urban Environments: a User Study**
Toinon Vigier, Guillaume Moreau, Daniel Siret

Virtual reality is a good tool to design and assess urban projects and to study perception in cities. Climate perception significantly influences the perception and use of urban spaces; however, virtual urban environments are scarcely represented with different climatic aspects.

In this paper, we study the role that visual cues (sky aspect, shadows, sun location, and light effects) specifically play in climate perception (season, daytime and temperature) in virtual urban environments. We present and discuss the data we collected from a recent virtual reality experiment in which ten variations of the climatic context in the same urban space were assessed.

The results prove the feasibility of suggesting complex climatic perceptions and thermal feelings by processing only sky, shadow and lighting effects. Furthermore, our results highlight the role of subjective interpretation, personal background and current real-world environment in interpretation and understanding of visual cues. Finally, we show that perceived climate influences global perception of virtual urban environments.

**Development of a Computational Design Application for Interactive Surfaces**
Marianthi Leon, Daniel Doolan, Richard Laing, Julian Malins, Huda Salman
RGU, United Kingdom

This paper presents the development and testing of a computational design tool applicable on a Tangible User Interface for conceptual design stages. Drawing and sketching are spatial and haptic processes for conceptualizing and communicating ideas especially within design teams of Architecture, Engineering and Construction Industry. Therefore, the application of interactive surfaces within co-located collaborative design teams provides an integration of different sensory modalities, including visual and haptic, thus resulting into a richer and more coherent design experience. The paper explores the evolution of technology related to design systems and describes the development of a conceptual design application for a M.S. PixelSense. This development was part of an action-based research and the evolution of the software during a number of tests with design professionals is presented accordingly. Eventually, the paper concludes with suggestions for further research on augmented reality applications for design processes within the built environment.

Keywords--- Tangible User Interfaces, Conceptual Design Stages, Architecture, Engineering and Construction Industry.
Monuments Visualization: from 3D scanned data to a holistic approach, an application to the city of Aberdeen
Richard Laing, Marianthi Leon, John Isaacs
RGU, United Kingdom

This paper aims to present the process of visualizing historic statues of the city of Aberdeen. 3D laser scanning was the main method utilized to obtain the 3D data, which was then transformed into a series of 3D surface models. A laser scanner typically has a range of over 100m (300m for the equipment used here), and records data to levels of accuracy almost impossible to achieve using 'traditional' surveying techniques. The data recorded by a scanner takes the form of a 'point cloud', which can be combined with on-site photographs to build up a realistic and accurate virtual model.

The paper concludes with discussion of how such data can be readily transferred into industry-standard Architecture, Engineering and Construction (AEC) models, thus, allowing the compilation of a buildings and monuments 'library' available to the city council and to the public for future urban projects and city regeneration. It is argued that the ability to incorporate data extracted from 3D scan-based models will promote the easier implementation of the 3D information within digital arts, architecture, structural engineering or other purposes.

The paper represents an interesting collaboration between disciplines from architecture and computing, and provides a practical and innovative case study which sits between technical advances, and electronic and visual arts.

Session iV2015_2.10: VA - Visual Analytics
Chair: Dr Fatma Bouali, University of Lille 2, France

Hybrid Visualization: A New Approach to Display Instances and Attributes Relationships in a Single View
Danilo Medeiros Eler, Renan Augusto Pupin de Oliveira, Lenon Fachiano Silva
UNESP, Univ Estadual Paulista, Brazil

Visualization techniques have been widely used in dataset exploration. A common strategy is to employ different techniques to facilitate the exploratory process, enabling different perspectives from the same dataset. In case, a coordination mechanism helps the user in the context changing among different views. However, to keep track of the highlighted data elements among multiple views is an unclear task. To reach a better exploration by using distinct visualization techniques and graphical representations, some approaches have adopted the strategy of combining different techniques in a single view, creating a Hybrid Visualization which can avoid the use of coordination. This paper proposes a new Hybrid Visualization approach that integrates Multidimensional Projection and Parallel Coordinates to display the instances and attributes relationships in a single view. As presented in this paper applications, this approach enables a better feature space exploration, aiding users to understand why instances from the same or distinct classes are grouped.

A Visualization of Research Papers Based on the Topics and Citation Network
Rina Nakazawa¹, Takayuki Itoh¹, Takafumi Saito²
¹Ochanomizu University, Japan; ²Tokyo University of Agriculture Technology, Japan

Novice researchers are not good at finding all appropriate keywords for the survey of their own research fields. Moreover, it is not easy for them to understand positions of papers in their research fields instantly even when they use a search engine like Google Scholar; it may often take a long time for them to find scholarly literature.

On the other hand, many researchers have presented citation visualization techniques for surveying research papers. However, it is still often difficult to observe the complicated relations across multiple research fields or traverse the entire relations in their interest. In this paper, we proposed a visualization technique for citation networks applying topic-based paper clustering. Our technique categorizes papers applying LDA (Latent Dirichlet Allocation), and constructs clustered networks consisting of the papers.

Regularity Measure and Influence Weight for Analysis and Visualization of Consumer’s attitude
Aki Hayashi, Masahiro Kohjima, Tatsushi Matsubayashi, Hiroshi Sawada
NTT Service Evolution Laboratories, NTT Corporation, Japan

Recently, analysis of massive purchase histories is thought to be effective for marketing science. For successful sales strategies and advertisements, understanding of consumer’s attitude (motivation toward purchasing) is important. However, marketers could obtain merely static attitude for the limited consumers using subjective questionnaires. We focus on purchase rhythm (regularity) as one approach to automatically extracting dynamic attitude transition.

We propose “regular behavior measure” which quantifies how well each purchase corresponds to the user’s own daily habits. It considers non-periodic habits as well as periodic habits using multiple probabilistic models; we consider purchase probability and the number of purchased dates simultaneously. We also define “influence weight” to quantify whether each item is purchased on a fixed day of the week (DoW) or year-month (YM) using Normalized Mutual Information. We analyze actual purchase data to show the effectiveness of our visualization that considers consumer’s regularly transitions.

A Visualization-Analitics-Interaction Workflow framework for Exploratory and Explanatory Search on Geo-Located Search Data using the Meme Media Digital Dashboard
Jonas Sjöbergh¹, Xingkai Li², Randolph George Goebel³, Yuzuru Tanaka¹
¹Hokkaido University, Sapporo, Japan; ²University of Alberta, Edmonton, Canada

Modern geo-position system (GPS) enabled smart phones are generating an increasing volume of information about their users, including geo-located search, movement, and transaction data. While this kind of data is increasingly rich and offers many grand opportunities to identify patterns and predict behaviour of groups and individuals, it is not immediately obvious how to develop a framework for extracting plausible inferences from these data. In our case, we have access to a large volume (more than half a billion individual records) of real user data from the
Abstract

Poynt smart phone application, and we have developed a generic and layered system architecture to incrementally find aggregate items of interest within that data. "Interest" is based on the semantics of the data, so include time and space correlations, e.g., are people searching for dinner and a movie; distributions of usage patterns and platforms, e.g., geographic distribution of Android, Apple, and Black-Berry users; and clustering to identify interesting and relatively complex search and movement patterns, e.g., consumer trajectories from key word searches.

Our integration of a variety of modern visualization tools is thus guided top-down, by semantic concepts in the domain from which data is extracted, rather than by bottom-up tool development. Our presentation here is preliminary in that we provide sketches of case-studies that demonstrate the integration of the three major components of modern visual analytics: visualization, analytics, and interaction (VAI).

Our development of a variety of VAI workflows is driven by the classes of patterns we expect to emerge from the Poynt geo-spatial data records. This approach has helped guide our choice of both conceptual and visual tools to aid our investigation of the geo-located data, and to use a hypothesis-driven process to find both interesting and useful patterns in that data. Included in our VAI workflow system architecture is the ability to consider the difference between exploratory and explanatory searches on data patterns, as well as the ability to simultaneously exploit visualization alternatives to help expose patterns. Unlike previous work that has distinguished "exploratory" and "explanatory" visualization interaction, ours is based on a foundation where visual inference is characterized in a logical way, to provide the interactor with the alternatives of generating new abstract visual inferences to expose visual hypotheses, as well as visual querying to confirm hypotheses with visual explanations.

Our case-study sketches show how an interactive system for visual data exploration can be used to alternate between exploratory search – looking for ideas and new hypothesis in data – and explanatory search – looking for evidence to support a hypothesis. While we have not yet formulated experiments to directly measure the cognitive efficacy of our experimental system, we believe that our development of a variety of VAI workflows and the integration of visual methods and interaction provides some useful ideas about how to extend current visual analytics systems.

Session iV2015_2.11: Knowledge Visualization and Visual Thinking

Workshop & Panel session

Chair:

Panel member:
Sebastian Kernbach, University of St. Gallen, Switzerland
Prof. Wibke Weber, School of Applied Linguistics, Switzerland

Poster Papers

Session iV2015_2.12: Information Visualisation

Chair: Prof. Mao Lin Huang, University of Technology, Sydney, Australia; Tianjin University, China

University E-Learning System Evolution for Enhancing Higher Education Teaching Environment
Zhe Wang¹, Long Wang²
¹Edinburgh Napier University, United Kingdom; ²Shanghai University, China

This paper proposed an insight on how the e-learning system evolution can enhance higher education teaching methodology, which is an innovative approach on improving the current university teaching environment for teachers and students. The core methodology for pushing the enhancement forward is the service evolution approach in clouds proposed by Edinburgh Napier University, UK, which has been used as the foundation stone and platform for further analyzing the positive affection on higher education teaching based on e-learning system evolution. This paper balanced software engineering and teaching methodology in a brand new view sight on technology enhanced modern University teaching reform which shows it value for service based e-learning system construction, evolution and modern university teaching environment enhancement.

A Survey of Visual and Interactive Methods for Air Traffic Control Data
Linda Pfeiffer, Nicholas Hugo Müller, Paul Rosenthal
Technische Universität Chemnitz, Germany

The StayCentered project at Technische Universität Chemnitz has the goal to improve the overall security of air traffic controllers. Therefore, we attempt to empirically comprehend the usual controller workspace and their dyadic team structure. Within this context, the following
An investigation of the environment of schizophrenia genes using Multi-Dimensional Scaling

Aparna Basu, Suman Ray, Frizo Janssens

DiagrammaticCHR: A Diagrammatic Representation of CHR Programs

Nada Ahmed Hamed Sharaf, Slim Abdennadher, Thom Frühwirth

Visualizing Timed, Hierarchical Code Structures in AscoGraph

Grigore Burloiu, Arshia Cont

Visual Analysis of Source Code Similarities

Michael Burch, Julian Strotzer, Daniel Weiskopf
code passages. In this paper, we investigate the visual analysis of source code similarities for local as well as global code passages. To this end, we first compute all subsequence occurrence frequencies (support metric) and relative occurrence frequencies (confidence metric) in local as well as global code regions. The resulting textual data attached by its occurrence values is displayed in a triangular matrix. Several interaction techniques are integrated in our visualization tool which are illustrated in the corresponding case study illustrating similarities in source code written in Assembler consisting of 10,641 characters.

Session iV2015_3.1: VA - Visual Analytics
Chair: Dr Michael Burch, VISUS, University of Stuttgart, Germany

POIViz: a fast interactive method for visualizing a large collection of Open datasets
Tianyang Liu\textsuperscript{1}, Fatma Bouali\textsuperscript{2}, Gilles Venturini\textsuperscript{1}
\textsuperscript{1}University Francois Rabelais of Tours, France; \textsuperscript{2}University of Lille2, France

We study in this paper the visualization of large multidimensional datasets with a focus on Open Data. Starting from our early work in which we defined a visualization based on points of interest, we improve this method in several ways with the aim of dealing with larger datasets and especially Open datasets. We propose the parallelization, using CPU and GPU, of the most costly steps of our method, like the computation of the data layout. We improve the visualization with a density rendering so as to keep the display informative for large datasets and for Open Data. We propose a layered visualization with interactions that can support several users tasks such as data filtering and labeling. We show that, even with common hardware, the performances of our approach are such that any user graphical queries can be processed in a few seconds. We detail how we were able to visualize and explore a collection of 300,000 Open datasets from the French Open Data web site. With the resulting visualization, we were able to improve our previous results.

A fast feature vector approach for revealing simplex and equi-correlation data patterns in reorderable matrices
Celmar Guimarães da Silva, Bruno Figueiredo Medina
University of Campinas - School of Technology, Brazil

Some matrix reordering algorithms permute directly the data matrix, instead of its row- and column-proximity matrices. We present a data matrix reordering method (Feature Vector-based Sort – FVS), which reorder a data matrix aiming to reveal Simplex and Equi patterns. Our approach extracts feature vectors from data matrix and uses it to calculate row and column permutations to data matrix. We observed that FVS is faster than other known matrix reordering algorithms and produces results with approximately the same quality (in terms of stress function) when these patterns are hidden in data matrix.

Towards ActionTrack 3.0: The Role of Usefulness, Usability and User Experience in a Startup Company Developing Location-Based Applications
Jukka Antero Holm, Kari Laurila
Team Action Zone, Finland

This paper discusses the role of usefulness, usability, and user experience in a startup company focusing on location-based applications. In just three years, the emphasis of design moved from usefulness to UX, resulting in opening new market segments, getting several new licensees, and learning quite a lot along the way. The learning process is discussed by the means of ActionTrack, a versatile but user-friendly authoring tool for developing location-based activities.
IV2015 / CGI2015 _ Abstract

Current Topics in the design of HCI courses with Computer Science Curricula

Minoru Nakayama
Tokyo Institute of Technology, Japan

The Human-Computer Interaction (HCI) environment, which includes topics taught, teaching resources and evaluation procedure, is changing rapidly. As the body of knowledge about HCI is periodically redefined, course content should be adapted in response to these changes. This position paper presents trends in topics taught, course content and assessment procedures using examples of HCI courses. Methods which encourage students to develop their learning activities and the assessment procedures are discussed in regards to course content and the current situation in the HCI learning environment.

A Visualization Technique to Support Searching and Comparing Features of Multivariate Datasets

Hiroaki Kobayashi1, Hiroko Suzuki2, Kazuo Misue1
1University of Tsukuba, Japan; 2Fujitsu Laboratories Ltd.

In exploratory analysis of multivariate datasets, it is often necessary to perform an analytical task such as to extract some characteristic subsets and to compare these subsets. So we supported searching and comparing features of multivariate datasets. We developed Blade Graph that is the visualization technique for comparing distributions by emphasizing coloring according to the size of the difference. In addition, we developed the visual analysis tool with the representations for comparing the data distributions. In a case study of the analysis tool, we analyzed the collective tendency from a social media dataset.

Detecting Criminal Relationships Through SOM Visual Analytics

Wen Bo Wang1, Mao Lin Huang1,2, Jinson Zhang1, Wei Lai3
1University of Technology Sydney, Australia; 2Tianjin University; 3Swinburne University of Technology

Feature analysis is always beneficial to the detection of anonymous criminals in digital forensics, including people and activities, where vast amount of features extracted from databases are involved. Not all features extracted are continuous or different; some of them are discrete or have the same value with others. We discovered that using visual analytics to select features for forensic investigations is not only improve the analysis time of selection, but can also deeply and obviously display the slight changes of features and criminals and also the relationship between features and criminals in order to find the target with significant difference with others, and also predict the more active features to be used in the future. Experiments show that visual feature analysis can help to catch the desire results quickly and clearly.

Session iV2015_3.2: Information Visualisation – Applications

Chair: Dr. Bernhard Klein, Singapore ETH Centre, Singapore

Interactively Uncluttering Node Overlaps for Network Visualization

Rie Ishida1, Shigeo Takahashi2, Hsiang-Yun Wu2
1Graduate School of Frontier Sciences, The University of Tokyo, Japan; 2Graduate School of Information Science and Technology, The University of Tokyo, Japan

Visual interaction with networks have been promising in the sense that we can successfully elucidate underlying relationships hidden behind complicated mutual relationships such as co-authorship networks, product co-purchasing networks, and scale-free social networks. However, it is still burdensome to alleviate visual clutter arising from overlaps among node labels especially in such interactive environments as the networks become dense in terms of the topological connectivity. This paper presents a novel approach for dynamically rearranging the network layouts by incorporating centroidal Voronoi tessellation for better readability of node labels. Our idea is to smoothly transform the network layouts obtained through the conventional force-directed algorithm to that produced by the centroidal Voronoi tessellation to seek a plausible compromise between them. We also incorporated the Chebyshev distance metric into the centroidal Voronoi tessellation while adaptively adjusting the aspect ratios of the Voronoi cells so that we can place rectangular labels compactly over the network nodes. Finally, we applied the proposed approach to relatively large networks to demonstrate the feasibility of our formulation especially in interactive environments.

Multiscale Visualization of Trajectory Data

Sheng Liang, Qing Xu, Yuejun Guo, Yang Fan
Tianjin University, Tianjin, China, People's Republic of

This paper proposes a novel 3D visualization tool for the trajectory analysis, helping users understand the trajectory data from different perspectives. The details of a single and a set trajectories are well covered in multiscale views by the four main linked windows, namely TrajView, ColorBar, MultiProperty and TrackMap. We take advantage of the color bar and the parallel coordinates and further improve them to present the important attributes and their relationships of trajectories. In addition, the iterative actions, such as keyboard and mouse operations, provide a rich and wonderful user experience.

Adjasenkey: Visualization of huge hierarchical weighted and directed graphs

Joris SANSEEN, Frédéric LALANNE, David AUBER, Romain BOURQUI
Université de Bordeaux, France

Visualization of hierarchical weighted and directed graphs are usually done with node-link or adjacency matrix diagrams.

However, these representations suffer from various drawbacks: low readability in a context of Big Data, high number of edge crossings, difficulty to efficiently represent the weighting. With
Abstract

the stated goal of reducing these drawbacks, we designed Adjasankey, a hybrid visual representation of weighted and directed graphs using hierarchical abstraction.

This technique combines adjacency matrices readability of large graphs and flow diagrams visual design efficiency for weighting depiction. Associated to Big Data computing and light-weight web rendering, our tool allows to depict and to interact in real time on huge dataset and supports user multi-scale exploration and analysis. To show the efficiency of Adjasankey, we present a case study on the analysis of a Customer to Customer website.

Literature Visualization and Similarity Measurement based on Citation Relations

HANADI HUMOUD ALFRAIDI, WonSook Lee, David Sankoff
University of Ottawa, Canada

While similar documents are, traditionally, found using Natural Language Processing, we observe citation/reference information by authors indicates better insight of similarity. Our system is to retrieve publications from Google Scholar (GS) and visualize them as a 2D graph using the citation relation, where the nodes represent the documents while the links represent the citation/reference relation between them. We measure the similarity score between each pair of papers based on both the number of paths and the length of each path. More paths and shorter the lengths higher the similarity score. We compared them with another similarity scores from Scurtu’s Document Similarity API [1] that uses Natural Language Processing. We use the average of the similarity scores collected from 15 users as a ground truth to determine how good the scores from two methods are. The result shows that our citation network approach gives better results than the ones by Scurtu’s.

3D Visualization of Multiscale Video Key Frames

Shihua Sun, Qing Xu, Yuejun Guo, Sheng Liang, Yang Fan
Tianjin University, China, People's Republic of

In this paper, an innovative 3D visualization tool is proposed to facilitate the quickly browsing and understanding of the video sequence for users. Taking advantage of the major windows, our tool presents the multiscale key frames and the video content clearly and effectively. Namely, KFView provides a wonderful navigation of the video key frames with different levels of details. FrameView presents an interesting view of the whole video content. SIMView allows an expressive exploration of the similarities between key frames and also between key frames and the video frames. Importantly, together with many convenient and attractive interactions, this tool is quite efficient to help users grasp the video information soundly.

Session iV2015_3.3: Information Visualisation – Applications

Chair: Bannatyne, Prof. Mark, IUPUI, USA

Software Systems as Archipelagos of Atolls

Giuseppe Scanniello, Ugo Erra, Maria Caulo
University of Basilicata, Italy

We present a new metaphor that takes advantages of concepts such as archipelagos, atolls, and palms. Each package of a software system is represented as an atoll that maintainers can navigate and interact with. Atolls that form an archipelago represent the entire system. Maintainers can pass from an atoll to another one, so understanding how the entire software and its packages are related with one another. Palms on an atoll graphically depict salient information of the classes contained in the package associated to that atoll. The metaphor has been implemented as a 3D interactive environment tool to allow a fine- and large-grained understanding of a subject software system implemented in Java. Finally, we have used our 3D environment on a number of open-source object-oriented software systems and the obtained results are preliminarily presented in this paper.

A Visual Tool Helping to Select Photogenic Spots

Kouhei Hamada1, Kazuo Misue2
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A photogenic location is a good place to take photos. It generally has beautiful scenery, historical structures, etc. When amateur photographers plan a photo trip, they often decide beforehand on photogenic locations to visit. They collect information about the locations and consider various aspects.

The aim of the authors is to assist amateur photographers in planning a photo trip. Information and procedures have been organized to help select photogenic locations from the perspective of information design. In addition, an interactive visual tool has been developed to help select photogenic locations. The tool displays information on photogenic locations extracted from a large collection of geotagged photos, provided by a photo-sharing site. The tool allows us to select locations while referring to their geographic relationships. Consequently, the process of selecting photogenic locations becomes easy.
Focus and Context Awareness Visualization Techniques for 3D Modelling Tasks using Multi-Layered Displays
Masood Masoodian\(^1\), Azmi bin Mohd Yusof\(^2\), Bill Rogers\(^1\)
\(^1\)The University of Waikato, New Zealand; \(^2\)Universiti Tenaga Nasional, Malaysia

Creating complex 3D polygonal models using existing modelling software can be challenging. Most 3D Modelling software have been designed for 2D displays and lack support for effective perception of depth ordering. Studies have shown that users of these types of software encounter a range of focus and context awareness problems while performing their 3D modelling tasks. We have previously developed a number of visualization and interaction techniques to better support focus and context awareness using multi-layered displays. A user study of these techniques has demonstrated that they need further improvements. Here, we present three modified visualization techniques, which as shown by a user study, improve the effectiveness of these previous alternatives.

Visualizations-based Analysis of Telco Data for Business Intelligence
Sidra Ashraf Khan, Shoaib A. Khan
National University of Sciences and Technology, Islamabad, Pakistan., Pakistan

With more companies investing in analytics to obtain a competitive edge in the market, decision makers require better identification of valuable metrics from among their data and to be able to interpret those complex patterns more easily. The area of data mining has been heavily invested in by the research community; however there remains a gap between the visualization efforts of this newly mined complex patterns and data. The telecom industry is one that is an ideal source of data for mining and many mining efforts are and have been undertaken by this industry. This research paper defines the key metrics to include in BI Dashboards to help visualize the right metrics accurately to decision makers for effective market edge. It proposes 3 business measures: indices followed by a grading criterion for valued subscribers based on call detail records and displays the results in an effective visualization.

Enhancing Software Visualization with Information Retrieval
Rita Francesc\(^1\), Michele Risi\(^1\), Giuseppe Scanniello\(^2\)
\(^1\)University of Salerno, Italy; \(^2\)University of Basilicata, Italy

We have enhanced MetricAttitude. It is a visualization tool based on static analysis that provides a mental picture by viewing an object-oriented software system by means of polymetric views. In particular, we have integrated an Information Retrieval engine and named this new version of visualization tool as MetricAttitude++. It allows the user to formulate a textual query and to show on the visual representation of the subject software the elements that are more similar to that query. This could be useful in all those cases in which a user needs to identify (or to localize) features implemented in the source code. Several filters are also available to hide possibly irrelevant details and to ease the browsing and then the comprehension of a software system. Finally, we have applied MetricAttitude++ on a number of object-oriented software systems. In this paper, we report preliminary results of a quantitative study on a widely studied open-source software, namely JEdit. On the basis of our results it seems that MetricAttitude++ can be effectively applied to different kinds of source code comprehension tasks and to concept location in source code, in particular.
Abstract

2) Designed a Heatmap visualization to effectively discover the main emotions on each online movie review.
3) Formed a Sentiment-Movie Network combining the MDS Map and Social Network in order to fix the movie network topology, while creating a network graph to enable the clustering of similar nodes.
4) Applied the asterism graphic in order to impart the meaning in accordance with the characteristics of clustering for better cognitive interpretation.
5) Progressed pilot test: a cognition level pilot test varying with whether the sentiment words asterism is fixed.

Automatic, Real Time, Unsupervised Spatio-temporal 3D Object Detection Using RGB-D Cameras
Manal H. Alassaf, Kamran Kowsari, Jamed K. Hahn

The evolution and affordability of depth cameras like Microsoft Kinect make it a great source for object detection and surveillance monitoring. Information available from depth cameras includes depth in addition to color. Using depth cameras, the provided depth information can be incorporated for object detection in still and video images, but needs special care to pair it with color information. In this work, we propose a simple, yet novel real time unsupervised object detection method in spatio-temporal videos. The RGB color frame is mapped into HunterLab color space to reduce emphasis on image illuminations, while the depth frame is back-projected into the 3D real world coordinate in order to distinguish between objects in space. Once combined, the mapped color information and the back-projected depth information are fed into automatic, unsupervised clustering framework in order to detect scene objects. The framework runs in parallel to provide real time spatio-temporal object detection.

Video Object Tracking Using Interactive Segmentation and Superpixel Based Gaussian Kernel
GUOHENG HUANG, Chi Man PUN, Cong Lin

A novel non-rigid video object tracking based on interactive segmentation and superpixel Gaussian Kernel is proposed in this paper. In the initialization stage, instead of using the traditional bounding box to locate the targeted object, we employed an interactive segmentation with user-defined marker to segment the object accurately in the first frame of the input video to avoid the background influence in the traditional bounding box. During the tracking stage, using a Gaussian kernel as movement constraint, each superpixel is tracked independently to locate the object in the next frame. Experimental results show that the proposed method compared to state of the art methods can achieve better robustness and accuracy for various challenging video clips.

Session IV2015_3.5: Information Visualisation
Chair: Prof. Francis T. Marchese, Pace University, USA

A Mobile Personal Residential Electricity Dashboard
Mark Apperley¹, Jishaal Kalyan²
¹University of Waikato, New Zealand; ²Infinity, Auckland, New Zealand

The growing use of smart electricity meters means that real-time information relating to residential electricity consumption is readily available. The globally recognized need to manage and improve the efficiency of our use of electricity, and the need in most jurisdictions to increase the integration and utilization of non-dispatchable renewable energy sources, provides a strong motivation for individuals to be aware of their electricity consumption in real-time, and to manage that consumption according to need (imperative or discretionary activities) and availability of energy. This paper describes the development and preliminary evaluation of a dashboard-like display, implemented on a mobile platform (phone or tablet), which provides both an instant overview and awareness of consumption and availability, and facility to drill down to determine detail, and potentially to control individual appliances.

Space, Time and Visual Analytics: a Multiple Perspectives Paradigm
Gennady Andrienko
Fraunhofer Institute for Intelligent Analysis and Information systems (IAIS), Germany and City University London, UK

Visual analytics aims to combine the strengths of human and computer data processing. Visualization, whereby humans and computers cooperate through graphics, is the means through which this is achieved. Sophisticated synergies are required for analyzing spatio-temporal data and solving spatio-temporal problems. It is necessary to take into account the specifics of the geographic space, time, and spatio-temporal data.

While a wide variety of methods and tools are available, it is still hard to find guidelines for considering a data set systematically from multiple perspectives. To fill this gap, we systematically consider the structure of spatio-temporal data, possible transformations, and demonstrate several workflows of comprehensive analysis of different data sets, paying special attention to the investigation of data properties.

Bio-skitche
Gennady Andrienko (www.geoanalytics.net/and) is lead scientist responsible for the visual analytics research at Fraunhofer Institute for Intelligent Analysis and Information systems (IAIS) and full professor (part time) at City University London, UK.

He co-authored monographs Exploratory Analysis of Spatial and Temporal Data (Springer, 1996) and Visual Analytics of Movement (Springer, 2013) and more than 70 peer-reviewed journal papers and 20 book chapters. Since 2007, Gennady Andrienko is chairing the...
Abstract

Information visualisation is the field of study that is concerned with the development of methods for transforming data into visual representations in order to make data more easily communicable and understandable. This volume reviews recent developments in information visualisation techniques, their application, and methods for their evaluation. It offers a wide range of examples of applied information visualisation from across disciplines such as history, art, the humanities, science and technology. Beginning with an examination of its medieval origins, it presents theoretical and applied approaches to information representation, including two and three-dimensional cartographic rendering and navigation techniques. In addition, it explores the language of shapes and how it can be employed to further the visualisation of multidimensional data. As a whole, this collection emphasizes the important role that the visualisation process plays in extracting, analysing, and presenting the hidden layers of meaning found within large and complex data sets.

Topics and Features:
- Contributions from an international collection of researchers and authors.
- An introduction to the discipline of information visualisation, its current state of affairs, and its future trends.
- A discussion of information visualisation’s origins, providing an important historical context for the field.
- A comprehensive review of methods for shaping and rendering two and three-dimensional representations of abstract information.
- The visualisation of interconnected networks of data in order to extract their causal relationships.
- An approach to hierarchical structuring and re-structuring of information by applying methods of two-dimensional data mapping.
- Applications of common metaphors for visualising computer code.
- Visualisation analysis of historical events and their relationships.
- A review of methods for evaluating information visualisation tools, concepts, and methodologies, and recommendations for their application.

Dr Ebad Banissi is Professor of Informatics at London South Bank University, UK, where he heads the Visualisation and Graphics Research Unit.

Dr Francis T. Marchese is Professor of Computer Science at Pace University, New York, USA, where he is founder and director of Pace’s Center for Advanced Media, and founder and co-director of the Pace Digital Gallery.

Dr Camilla Forsell and Dr Jimmy Johansson are researchers and academics at the Knowledge Visualisation Centre, and members of the Department of Science and Technology, Linköping University, Sweden.

Cover image: SMU Companions, a glyph created by stock photo studio with area indicating correlations to museum objects found by visitor with small efforts to aid visual discrimination © Richard Smith, 2014

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www.cambridge.org/corp
F.T. Marchese, E. Banissi (Eds.)

Knowledge Visualization Currents
From Text to Art to Culture

- Presents the state of the art in visualization research and development
- Highlights research developing at key intersections with other disciplines and its applicability to addressing complex real-world problems
- Discusses how visualization researchers are addressing complex issues of representation in knowledge, art, and culture

Lying at the intersection of education, art, and cultural heritage, visualization is a powerful tool for representing and interpreting complex information.

This unique text/reference reviews the evolution of the field of visualization, providing innovative examples of applied knowledge visualization from disciplines as varied as law, business management, the arts and humanities. With coverage of theoretical and practical aspects of visualization from ancient Sumerian tablets through to twenty-first century legal contracts, this work underscores the important role that the process of visualization plays in extracting, organizing, and crystallizing the concepts found in complex data.

Topics and features:

- Contains contributions from an international selection of preeminent authorities
- Presents a thorough introduction to the discipline of knowledge visualization, its current state of affairs and possible future developments
- Examines how tables have been used for information visualization in historical textual documents
- Discusses the application of visualization techniques for knowledge transfer in business relationships, and for the linguistic exploration and analysis of sensory descriptions
- Investigates the use of visualization to understand orchestral music scores, the optical theory behind Renaissance art, and to assist in the reconstruction of an historic church
- Describes immersive 360 degree stereographic visualization, knowledge-embedded embodied interaction, and a novel methodology for the analysis of architectural forms

This interdisciplinary collection of the state of the art in knowledge visualization will be of considerable interest to researchers from a broad spectrum of backgrounds in both industry and academia.
Objective

Font attributes, such as bold and italic, can be used to encode data in visualization.

Some visual attributes have been researched extensively but typography has not; until now, it has been usually considered a single attribute.

Novel attributes are important because they expand the design space of potential visualizations representations:

- We shape our books from our tools shape it.
  - Marshall McLuhan

Hypotheses

Typography has a variety of different visual attributes that can be used, separately or together to encode categoric and quantitative data. As a result, unique new kinds of visualizations can be created.

Method

1. **Classify.** Many fields use shape and type. What attributes do they use?
2. **Encode.** Can these attributes go beyond differentiating between categories, e.g., encode quantities?
3. **Relate.** What are the similarities between the font attributes and well-researched attributes? This provides insight into potential effectiveness of the attribute.
4. **Explore.** How can these attributes be applied? What are some potential novel encodings?

## Table of Visual Attributes

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Samples</th>
<th>Qualitative Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>Glyph A B</td>
<td>characters, words (but alpha-numeric)</td>
</tr>
<tr>
<td>Symbols</td>
<td>X.X</td>
<td>marks</td>
</tr>
<tr>
<td>Declarator</td>
<td>X.X</td>
<td>container (project, note, etc.)</td>
</tr>
<tr>
<td>Font weight</td>
<td>X.X</td>
<td>light, medium, bold, black, etc.</td>
</tr>
<tr>
<td>Case</td>
<td>lower/upper case</td>
<td></td>
</tr>
<tr>
<td>Oblique</td>
<td>italic A</td>
<td>normal/italic/every</td>
</tr>
<tr>
<td>Underline</td>
<td>A.A</td>
<td>normal/underline/very</td>
</tr>
<tr>
<td>Condensed</td>
<td>A.A</td>
<td>condensed, expanded, etc.</td>
</tr>
<tr>
<td>Font family</td>
<td>A.A</td>
<td>Arial, Times, Courier, etc.</td>
</tr>
<tr>
<td>Spacing</td>
<td>A.A</td>
<td>tracking/leading</td>
</tr>
</tbody>
</table>

## 2. Encode

Many font attributes encode categoric data, and some attributes support quantities:

<table>
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</tr>
</tbody>
</table>

Text labels also support other encodings:

- Type encoding, i.e., the literal text
- Outline encoding, i.e., alphabetic order
- Proportional encoding, i.e., modifying elements of the character sequence to encode data [4, 14]

## 3. Relation to Visual Channels

The encoding of visual channel aesthetics must be applied to the type attributes, e.g., such as ranking alternative attributes, or inducing potential relationships between visualizations of multiple attributes.

## 4. Explore Applications

The study of the eight glider had demonstrated the efficiency of our system for maintaining equitability, and the accuracy of the laboratory work-up which was based on the belief that all names could be extended to calculate the performance of machines with the same degree of cost that was not possible with the data tables possessed by the preprocessors. The large number of machine-allocated products required a special effort to be marked with a meter.

Text formatted for kerning, weighting, and more on serif.

## Discussion

There are at least ten font-specific attributes to be exploited by information visualization:

- A. Bold Attributes: Many possibilities to consider, such as search facets, proportional encoding of quantities along strings, knowledge maps, enhanced labeling such as cartograms.
- B. Italic: While visual channel mapping may help short-term memory evaluation is required, such as user testing or visual memory.
- C. Background: There is 50+ years of typographic history to explore.

## References


The study of the eight glider had demonstrated the efficiency of our system for maintaining equitability, and the accuracy of the laboratory work-up which was based on the belief that all names could be extended to calculate the performance of machines with the same degree of cost that was not possible with the data tables possessed by the preprocessors. The large number of machine-allocated products required a special effort to be marked with a meter.

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© “Last Protestor” - Neil Howe

© “Andante Spianato” - Santiago Echeverry

“002- Anaglyph Tiling” © Jean Constant

“Anaglyph, conformal map, homographic effect with Fibonacci sequence. An anaglyph picture is a two color composite that produces a three-dimensional image when viewed through spectacles having lenses of corresponding colors.”

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