Introduction to GeoVisual Analytics

- Ship and Weather Information Monitoring
- Global Regional Development

**Agenda**
- Our research center NCVA;
- What is Visual Analytics?
- Multivariate Visual Analytics;
- GAV tools DirectX vs. Flash;
- Demos;
- GeoVisual Analytics;
- Communication and Collaboration;
- Conclusion

**Pioneer in Raster Technology**
Ink Jet Plotter System with Prof Hertz 1976-76

Resolution: 2000x2000x3

Lund 1972

**Pioneer in Raster Technology in the early 70s**

**Pioneer in Raster Technology in the 80s**

More than 200 scientific papers and many books
My academic and commercial background

- Ink Jet Color Plotter System – University Lund 1970-79
- Boston US Worked with Applicon Inc 1979-1980
- Spin-off into UNIRAS 1980-1993
  - Became the largest software visualization company in the world
- European Commission - Visualization Projects 1998-2006
- Professor at University Linköping since 1999
- Established National Center Visual Analytics 2008 with funding from Swedish Knowledge Foundation;
- Honored “Pioneer in Computer Graphics” at SIGGRAPH 93 for breaking new ground research in raster graphics

National Center for Visual Analytics – NCVA
LITH – Campus Norrköping

We are here
National Center for Visual Analytics - NCVA
Applications based on Visual Analytics in Close Collaboration with Industrial and Governmental Research Partners

Funding Group and Research Partners

- SMHI
- Ericsson
- VINNOVA
- KIWI
- VINNOVA
- Swedish Agency for Innovation Management

Visual Analytics expertise
- Advanced VA tools (DirectX & Flash)
- Applied Research
- Qualified PhD students
- Shared Partnership
- Basic Funding from the Knowledge Foundation

Domain expertise
- Geographic Information System
- Remote Sensing
- Earth Observation

Real Data
- Evaluation
- Project Funding

We develop advanced Visual Analytics tools in collaboration with Industrial and Governmental Partners

Moving Research into Practice
Bridging the Gap between Research and Industry

We develop advanced Geovisual Analytics tools for the Internet in close collaboration with our Partners

http://ncva.itn.liu.se/
From Computer Graphics to Geovisual Analytics
beginning of a new visualization era...

1974: Raster Graphics (ink jet plotter)
1985: Data Visualization and ... Scientific Visualization (3D)
1995: Information Visualization and Geographical Visualization
2005: Visual Analytics
2008: Geovisual Analytics

Current hot Visualization topics..

- Re-thinking visualization
  - Interaction and perception techniques
  - Multiple linked views instead of 3D
- User-centred visualization
  - Evaluation and assessment of techniques
  - Adaptable techniques
  - Relevance
- Multi-dimension data in visualization
  - Multivariate attribute data
  - Spatial dimension
  - Time
- GeoVisual Analytics – beginning of a new visualization era

NCAV do research within GeoVisual Analytics

- The science of analytical reasoning facilitated by interactive visual interfaces – e.g. dynamic linked multiple views;
- Exploring and analyzing spatial-temporal and multivariate data;
- Discern trends or patterns - derive insight and draw conclusions;
- Communicate discovery and knowledge effectively for action; NCAV with 100% Web compliant;
- NCAV is moving Visual Analytics Research into Practice;

Here are some successful examples
http://nvac.pnl.gov/

Multiple linked views and multivariate data
explore multivariate data from different perspectives simultaneously
**VA - Parallel Coordinates** - Find trends and similarities

- One axis per variable (indicator)
- One coloured line per data item
- Frequency histogram
- Profiles – Highlight and Compare selected regions
- Statistical filter operation using percentiles
- Toggle min and max on axis
- Mean values

**Advanced 100% Web compliant InfoVis technique**

1. One axis per variable (indicator)
2. One coloured line per data item
3. Frequency histogram
4. Profiles – Highlight and Compare selected regions
5. Statistical filter operation using percentiles
6. Toggle min and max on axis
7. Mean values

**VA - Table lens – super spreadsheet**

*focus & context* to analyze large data – sort, highlight and filter data

**Multivariate Visual Analytics**


**Visual Analytics of Self-Organizing Networks**

- Growth of cellular radio (mobile) networks
- Organizing network’s neighbor cell relations is more and more difficult
- Need of automatic algorithms
- Automatic Neighbour Relations (ANR) developed by ERICSSON but must be proven to gain network operators’ trust
- VoSON is developed by NCVA to show operators that ANR works.

A joint scientific paper is being presented at VAST IEEE in USA next month.
**Visual Analytics of Self-Organizing Networks**
Operated by the ANR Algorithm

**KEY FEATURES**
- Interactive dialogue between operators and system;
- Large-scale data are simultaneously analyzed using dynamic linked views;
- Spatial and multivariate data are analyzed and animated in a temporal context;
- Key information e.g. visual representations are combined with textual labels and symbols placed in separate map layers to avoid overwhelming the display;

**DEMO**

**Ship and Weather Information Monitoring**
Avoid this scenario using Geovisual Analytics

- Detailed monitoring of voyages based on planned and reported waypoints;
- Easy exploration of weather forecast according to both geographic positions and along routes;
- Using a PCP together with geographic map visualization to find interesting voyages according to weather parameters;
- Increase the awareness and requirement for more advanced GeoAnalytics methods;
- Presented at conference IV09 in Barcelona;
Multivariate and multiple-linked views Visualization

Ingredient mixture data which is multi-component data that includes ingredient and performance variables - find mixing proportions for optimal performance

Ternary Plot

NCVA develops advanced Visual Analytics tools for both .NET/DirectX and Flash/Flex

- Visual Studio .Net/DirectX (Microsoft) - 2002
  - Microsoft's library for GPU based graphics using C#
  - Optimized for 3D Visualization
  - Requires client-installation of NCVA’s GAV Player
- Flex/Flash based version (Adobe) - 2008
  - 100% Web compliant means accessible for all users
  - O-O ActionScript language
  - Adobe Flex is well-known user interface design
  - Architecture for multiple linked views
  - Introducing advanced Visual Analytics tools in Adobe Flash
  - Adobe Flash player and Adobe PDF are defacto standard tools

ORAL eXplorer developed by NCVA for Unilever spatial-time-multivariate data

Environmental Volume Data eXploration

3D spatial-temporal-multivariate data (16,000,000 cells)

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GAV Flash Architecture

- Research methods from Information and Geographical Visualization;
- Object-oriented Component toolkit;
- Optimized code in Adobe® ActionScript for Flash 10 and Flex 3;
- Interactivity and Time Animation using data cube architecture;
- Mechanism for Storytelling for creating dynamic documents;