About
Visual Computing

Helwig Hauser,
UiB Dept. of Informatics,
http://www.ii.UiB.no/vis/
2014-04-08

Today's Plan

- **Visual Computing** – books, education, events
- **Visual Computing Examples** – visualization, virtual reality, computer vision, perceptually-based rendering
- **Visual Computing** – selected centers
- **Visualization Research @ UiB**

Books about
Visual Computing

Visual Computing Books (1)

- T. Kunii: **Visual computing: integrating computer graphics with computer vision** (Springer, 1992)
  - all aspects of computer graphics and its applications
  - integration of computer graphics with computer vision through data structures
- M. Gross: **Visual computing: the integration of computer graphics, visual perception, and imaging** (Springer, 1994)
  - Visual Computing addresses the principles behind "visual technology" and it is about the *integration of*
    - *Computer Graphics*,
    - *Visual Perception* and
    - *Imaging*

Visual Computing Books (2)

- Fr. Nielsen: **Visual Computing: Geometry, Graphics, and Vision** (Cengage Learning, 2006)
  - Introduction, Data Structures, Coordinates,
  - Images, Meshes, Animation, Randomization,
  - Higher Dimensions for «3D», Robustness

- Fr. Nielsen (ed.): **Emerging Trends in Visual Computing** (Springer, 2009)
  - Geometric Computing
  - Information Geometry and Applications
  - Computer Graphics and Vision
  - Information Retrieval
  - Medical Imaging and Computational Anatomy

Visual Computing Books (3)

- B. Preim, Ch. Botha: **Visual Computing for Medicine: Theory, Algorithms, and Applications** (Morgan Kaufmann, 2nd ed., 2013)
  - Acquisition, Analysis, and Interpretation
  - Visualization and Exploration
  - Advanced Visualization Techniques
  - Visualization of High-dimensional Data
  - …

Visual Computing Education (1)

- Bachelor program in **Media Informatics and Visual Computing**
  (TU Wien, Austria)
  - computer vision, computer graphics, visualization
  - augmented/mixed/virtual reality
  - human—computer interaction
  - …
- Bachelor/Master program in **Visual Computing**
  (RWTH Aachen, Germany)
  - computer graphics, game programming, virtual reality
  - computer vision, global illumination, geometric processing
  - …

Visual Computing Education (2)

- Master program in **Computer Science, Visual Computing** track
  (ETH Zürich, Switzerland)
  - VC connects the areas of computer graphics, computer vision, and geometry processing to classical disciplines such as optics, robotics, human-machine and interaction
- Master program in **Visual Computing**
  (Konstanz, Germany)
  - create, process and analyse pictures
  - simulation, data analysis, visualisation and human computer interaction are combined
- Master program in **Visual Computing**
  (Saarland, Germany)
  - acquiring, analysing and synthesising visual data
  - and related fields

Visual Computing Events (1)

- **ISVC: Int'l Symp. on Visual Computing**
  (annually since 2005, ISVC.net)
  - computer vision
  - computer graphics
  - virtual reality
  - visualization
- **VCBM: Eurographics Workshop on Visual Computing for Biology and Medicine**
  (bi-annually since 2008, VCBM.org)
  - computer graphics
  - visualization
  - computer vision
  - visual analytics
  - human computer interfaces

Visual Computing Events (2)

- **VCT: Visual Computing Trends**
  (bi-annually since 2009, www.VRVis.at/about/events/vct)
  - VC is the discipline of computer science which deals with the
    - acquisition, representation,
    - manipulation, analysis,
    - synthesis and application
  - of visual information, i.e. images and image sequences in a spatial and temporal context.
  - VC has evolved from the methodological merging of
    - image processing,
    - computer vision,
    - computer graphics and
    - visualisation.

Examples from
Visual Computing

from the Visual Computing Trends,
www.VRVis.at/about/events/vct
(most slides are online there)

Visual Computing Trends

- **VCT 2009**
  - computer vision (H. Bischof, TU Graz)
  - **scientific visualization** (Th. Ertl, Uni Stuttgart)
  - **augmented & virtual reality** (St. Feiner, Columbia)
  - graphics hardward (D. Luebke, NVIDIA)
- **VCT 2011**
  - **computer vision** (B. Schiele, MPII Saarbrücken)
  - visual analytics (P. Hanrahan, Stanford)
  - rendering (J. Stam, Autodesk)
  - geometric modeling (H. Pottmann, KAUST)
- **VCT 2013**
  - computer animation (M. Gross, ETH & Disney)
  - **perceptually-based rendering** (H. Rushmeier, Yale)
  - information visualization (B. Shneiderman, UMaryland)
  - mutimedia interfaces (J. Jorge, TU Lisbon)

Visual Computing Centers (1)

- **Visual Computing Center**
  (@King Abdullah University of Science and Techn., SA)
  - geometric modeling, geometry processing,
  - scientific visualization, virtual reality, rendering,
  - simulation, computational geometry & topology,
  - computer vision, and imaging science
- **Max Planck Center for Visual Computing and Comm.**
  (in collab. with Stanford)
  - people detection & tracking, geometry & semantics,
  - geometry processing, applied geometry, discrete opt.,
  - topological and geometric computing, semantic reconstr.
  - …

Visual Computing Centers (2)

- **Shenzhen Key Lab. for Visual Computing and Analytics**
  (Shenzhen, China)
  - computer graphics, computer vision and visualization
  - 3D acqu./understanding/modeling, analytics/computing
- **Center for Visual Computing**
  (@Ecole Centrale de Paris, France)
  - computer vision & 3D modeling
  - machine learning & optimization
- **Intel Visual Computing Institute**
  - acquisition, processing, transmission, and rendering/display of visual and associated data
- **Norwegian Color and Visual Computing Lab** (Gjørvik)
- **Visual Computing Forum, www.ii.UiB.no/vis/vcf**
  (Bergen, UiB)

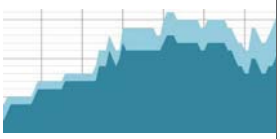
About
Visualization Research @ UiB

At UiB's Dept. of Informatics, http://www.ii.UiB.no/vis/

Visualization Research @ ii.UiB.no

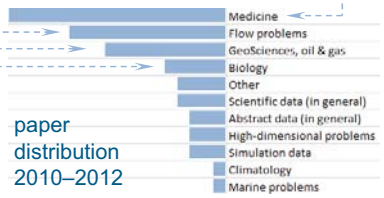
The purpose of visualization is insight, not pictures!
– Ben Shneiderman, 1999

- **Still a relatively new group** at UiB Informatics,
  today 13 heads (2 faculty, 2 PostDocs, 4 PhD studs., *et al.*)



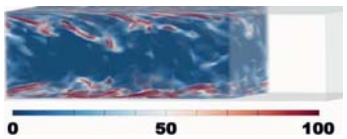
➢ **Application-oriented basic research** in visualization:

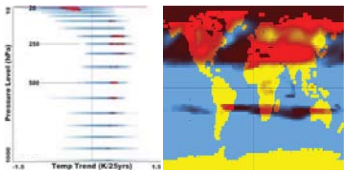
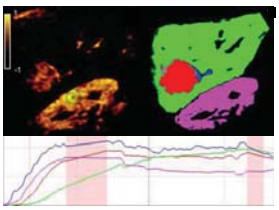
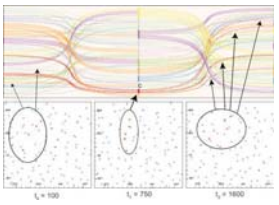
1. Researched **visualization methodology** (how to visualize)
   - ➢ **Interactive Visual Analysis, *n*D data** (H. Hauser *et al.*)
   - ➢ **Visual Knowledge Discovery, 3D data** (St. Bruckner *et al.*)
   - ➢ **Illustrative Visualization** (I. Viola *et al.*)
2. **Applications** at which this research is oriented (for whom)
   - ILLUSTRA SOUND ➢ **Medical Visualization** (partner in MedViz Bergen, *etc.*)
   - GEO ILLUSTRATOR ➢ **GeoSciences / Oil & Gas** (*e.g.*, financed by Statoil's Akademiaavtale)
   - ➢ **Biology / Bioinformatics** (with CBU@ii *et al.*)
   - Sem Seg ➢ **Fluid Dynamics** (in collab. with FFI.no, for ex.)
   - ➢ **Engineering** (visual analysis of simulation data)



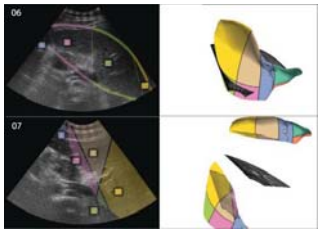
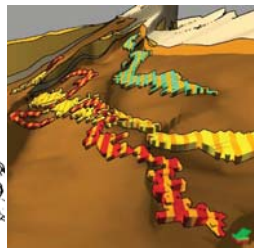
Visualization Research @ ii.UiB.no

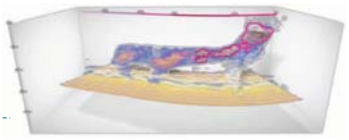
- Examples from **Interactive Visual Analysis (IVA)**:
  - **IVA** of **Flow Simulation Data** (with nat.&int'l partners)
  - **IVA** of **Medical Perfusion Data** (with nat.&int'l partners)
  - **IVA** of **Climate Simulation Data** (with nat.&int'l partners)
  - **IVA** of **Bioinformatics Data** (with N. Reuter *et al.*)



- Examples from **Illustrative Visualization**:
  - **Illustr. Vis.** of **Medical Ultrasound Data** (with nat. partners)
  - **Illustr. Vis.** of **Geological Models** (with nat. partners)
  - **Illustr. Vis.** of **Molecules** (with nat. partners)
  - **Illustr. Vis.** of **Fish** (with nat. partners)



Visualization PhDs from UiB


Daniel Patel (Oct. 2009):
Expressive Vis. & Rapid Interpr. of Seismic Volumes


Jean-Paul Balabanian (Jan. 2010):
Multi-Aspect Vis.: from Linked to Integrated Views


Johannes Kehrer (May 2011):
IVA of Multi-faceted Scientific Data


Ove Daae Lampe (Nov. 2011):
IVA of Process Data


Armin Pobitzer (June 2012):
IVA of Time-dependent Flows

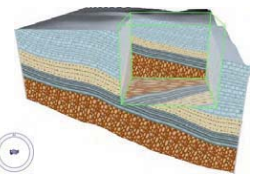
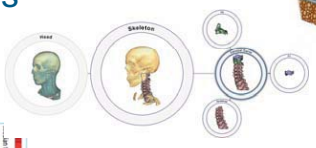
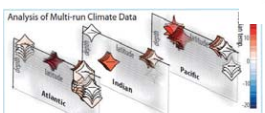
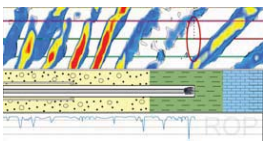
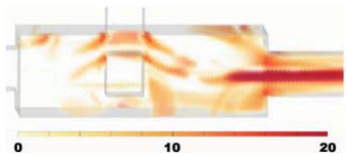

Paolo Angelelli (June 2012):
Visual Expl. of Human Physiology

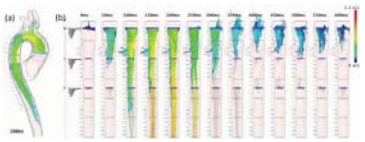

Veronika Šoltészová (Oct. 2012):
Perception-Augmenting Illumination

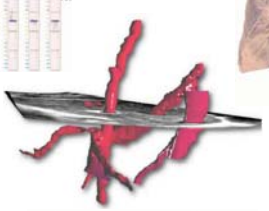
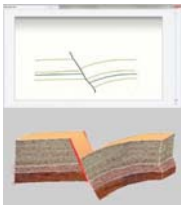
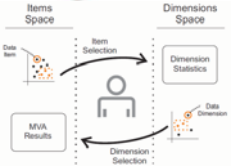

Åsmund Birkeland (May 2013):
Ultrasonic Vessel Vis.: From Extraction to Perception


Endre Lidal (May 2013):
Sketch-based Storytelling for Cognitive Problem Solving


Çağatay Turkay (Nov. 2013):
Interactive Visual Analysis of High-dimensional Data

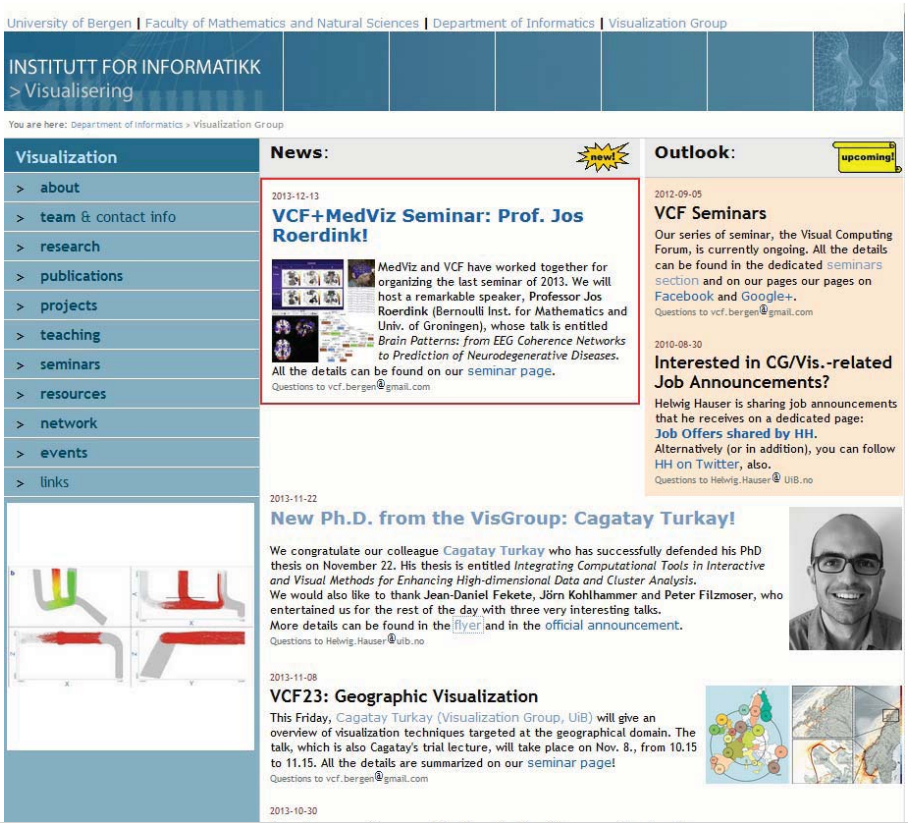








Thank you!

Questions?



www.ii.UiB.no/vis