Data Visualization Concepts BINF4234

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Department of Informatics
University of Zürich

Organization BINF4234

- Lecture: Thu 14 - 15:45 in BIN 2.A.01
- Assistant: Haiyan Yang (haiyan@ifi.uzh.ch), Lizeth J. Fuentes, Gaudenz Halter
- Web page: http://www.ifi.uzh.ch/en/vmml/teaching/lectures/visualization-hs20.html
- Exercises: Distribution and submission via OLAT, Q&A session in lecture
- Standing assignment is to read book chapters corresponding to the topics covered in the lecture
  - In required textbooks, plus selected chapters from additional books, and reading assignments

Literature

Required textbooks:

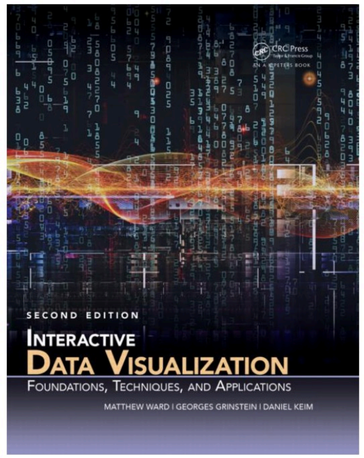
- [1] Matthew Ward, Georges Grinstein and Daniel Keim. ***Interactive Data Visualization: Foundations, Techniques, and Applications***. AK Peters, 2010. (newer version available)
  - Fundamental techniques for interactive data visualization, data and visualization foundations

Selected chapters:

- [2] Gerald Farin and Dianne Hansford. ***Mathematical Principles for Scientific Computing and Visualization***. AK Peters, 2008.
  - Sampling, interpolation, data fitting, scientific data visualization, 2D and 3D raster and vector graphics
- [3] Colin Ware, ***Information Visualization: Perception for Design***. Morgan Kaufmann, 2012.
  - Information visualization, perception, presentation, interaction and design
- [4] Christian Tominski and Heidrun Schumann, ***Interactive Visual Data Analysis***. AK Peters, 2020.
  - Visualization methods and techniques, interacting with visualizations

Further literature:

- Edward R. Tufte, *The Visual Display of Quantitative Information*. Graphics Press, 2001.
  - History and example visualization, fundamental concepts of quantitative graphs and graphical excellence
- Various research articles on information visualization and related topics



Preview this Book

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Interactive Data Visualization: Foundations, Techniques, and Applications, Second Edition

Matthew O. Ward, Georges Grinstein, Daniel Keim

Hardback	eBook	eBook Rental
£72.99	£47.59	from £29.00

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What are VitalSource eBooks?

May 26, 2015 by A K Peters/CRC Press
Reference - 578 Pages - 302 Color
ISBN 9781482257397 - CAT# KE27188

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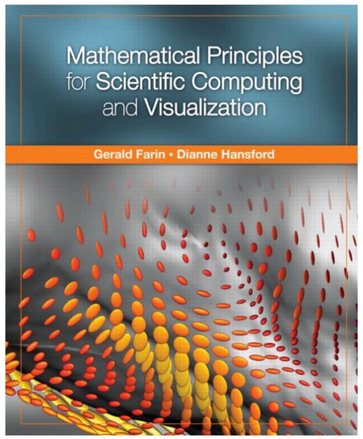
Features

- Covers the full range of data visualizations, including mathematical and statistical graphs, cartography for displaying geographic information, two- and three-dimensional scientific displays, and general information visualization techniques
- Discusses implementation and language issues, performance demands and limitations, and application requirements and results
- Describes how visualizations are used in knowledge discovery, problem solving, visual analytics, and other application areas, enabling visualization system users to select appropriate tools for their tasks
- Explores directions for current and future research
- Includes many exercises and programming projects at the end of each chapter
- Offers a wealth of ancillary materials for instructors, students, and professionals on the book's website

Summary

An Updated Guide to the Visualization of Data for Designers, Users, and Researchers

Interactive Data Visualization: Foundations, Techniques, and Applications, Second Edition provides all the theory, details, and tools necessary to build visualizations and systems involving the visualization of data. In color throughout, it explains basic terminology and concepts, algorithmic and software engineering issues, and commonly used techniques and high-level algorithms. Full source code is provided for completing implementations.



Preview this Book

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Mathematical Principles for Scientific Computing and Visualization

Gerald Farin, Dianne Hansford

Hardback	eBook	eBook Rental
£47.99	£33.59	from £20.00

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October 21, 2008 by A K Peters/CRC Press
Textbook - 280 Pages
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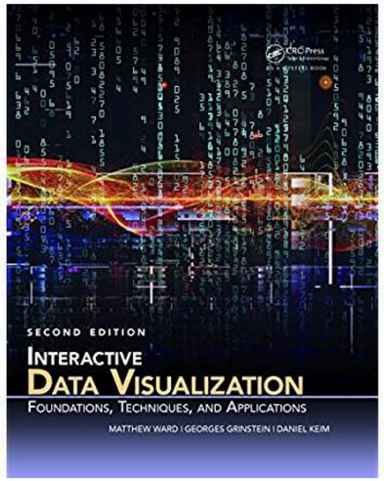
Summary

This non-traditional introduction to the mathematics of scientific computation describes the principles behind the major methods, from statistics, applied mathematics, scientific visualization, and elsewhere, in a way that is accessible to a large part of the scientific community. Introductory material includes computational basics, a review of coordinate systems, an introduction to facets (planes and triangle meshes) and an introduction to computer graphics. The scientific computing part of the book covers topics in numerical linear algebra (basics, solving linear system, eigen-problems, SVD, and PCA) and numerical calculus (basics, data fitting, dynamic processes, root finding, and multivariate functions). The visualization component of the book is separated into three parts: empirical data, scalar values over 2D data, and volumes.



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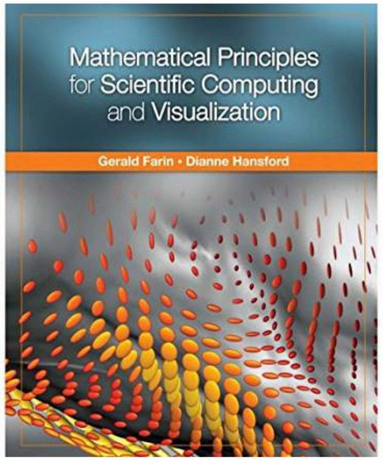

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by Gerald Farin and Dianne Hansford

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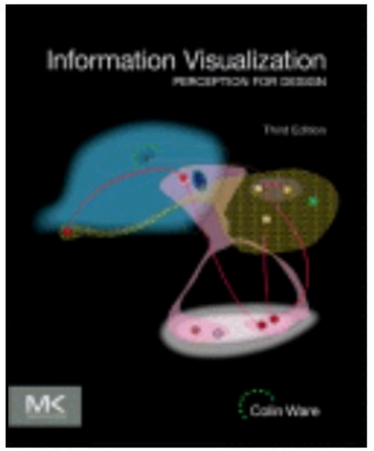

Information Visualization (Third Edition)

Perception for Design

A volume in Interactive Technologies

Author(s):

Colin Ware

ISBN: 978-0-12-381464-7

Add to Favorites

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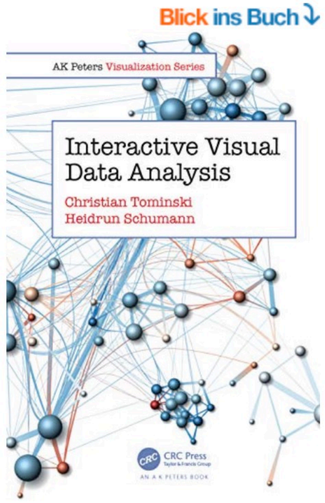


Interactive Visual Data Analysis (AK Peters Visualization Series) (English Edition) 1. Auflage, Kindle Ausgabe

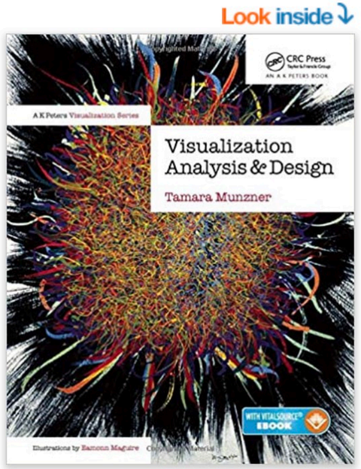
von Christian Tominski (Autor), Heidrun Schumann (Autor) | Format: Kindle Ausgabe

Andere Formate und Ausgaben ausblenden

	Preis	Neu ab	Gebraucht ab
Kindle	36,45 €	—	—
Gebundenes Buch	102,20 €	102,20 €	151,22 €
Taschenbuch	62,26 €	62,26 €	63,50 €

In the age of big data, being able to make sense of data is an important key to success. ***Interactive Visual Data Analysis*** advocates the synthesis of visualization, interaction, and automatic computation to facilitate insight generation and knowledge crystallization from large and complex data.

Available online https://1lib.eu/book/5462095/fbcbbf



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Lecture Topics

• Introduction and history of data visualization	General concepts
• Fundamental data processing	Theoretical foundations and techniques
• Visualization foundations	Principles and concepts
• Visualization for data science	Basic visualization examples
• Interaction techniques	Principles and concepts
• Clustering and dimensionality reduction	Theoretical foundations and techniques
• Multivariate data visualization	Visualization techniques and examples
• Spatial data visualization	Visualization techniques and examples
• Geographic data visualization	Visualization techniques and examples
• Color and perception	Theoretical foundations
• Visualization guidelines	Principles and concepts

Further Notes

- Reading of textbook chapters in ***Interactive Data Visualization: Foundations, Techniques, and Applications*** implicitly assumed
  - Corresponding to topics covered in lecture
- Compulsory reading includes chapters from the required textbook as well as selected book chapters from additional literature as indicated on the course's web page

Exercises

- Four practical exercises scheduled for out-of-class completion and online submission in OLAT
- In-class Q&A sessions during lecture slots

Final Exam

- Final exam includes all content from lecture slides *AND* corresponding textbook chapters as well as any selected book chapters from indicated readings

Programming Exercises

- Experience with hands-on implementation of visualization examples and tools
- We expect you to be able to create and find solutions
  - Be flexible and inventive in case of project tasks with loosely defined targets
    - do not want to over-specify details, clearly indicate your assumptions
- Use of Python and its packages for its general data analytics and visualization purposes
  - Ability to (learn to) read and extract data out of CSV files or formatted text files is expected
  - Simple data cleaning or preprocessing may implicitly be needed as well
- Getting used to Python is expected, also exploiting add-on packages
  - Using appropriate packages is a skill to be trained
- Use the OLAT discussion forum to exchange experience and hints about programming problems and solution ideas

Exercise Schedule

- Exercises will be **distributed online in OLAT** without introducing them first in the lecture
- A **Question & Answer** (Q&A) session will be held during the lecture one week before the submission deadline
- Example schedule for the first exercise:
  - Handout: Thursday, Oct. 1.
  - Q&A: Thursday, Oct. 8.
  - Submission: Thursday, Oct. 15.

Completion Requirements

- **All** programming exercises are **mandatory** and must be processed
  - Incomplete or partially working solutions are accepted but will not result in any points
- Every **fully solved** programming exercise will earn you **points, up to 15 in total**
- A **minimum of 7** points must be achieved to pass the module
  - Failure to achieve this minimum in the programming exercises will result in a failing grade irrespective of the outcome in the final exam
- The four exercises give rise to the following point distribution: 2 – 3 – 5 – 5
  - Hence at least two have to be fully solved
- If **more than 8 points** are achieved, the additional points on top of that will count as **bonus points** for the final exam
  - 7 is required, 8 is still normal passing, 9 and above will give 1 or more extra points