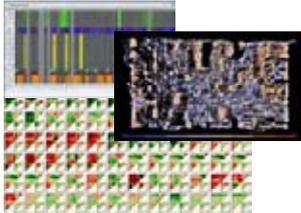


Solving Problems with Visual Analytics: Challenges and Applications



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Data Analysis and Information
Visualization Group
University of Konstanz, Germany



EGC, Bordeaux

February 2, 2012

Observations

- ▣ **Grand Challenges relate to Grand Problems!**
- ▣ **No solution to Grand Challenges without Computational Analysis!**
- ▣ **No solution to Grand Challenges without Interactive Exploration!**

Visualization needed for

- Interactive discovery in complex data
(→ experts)
- Communication of results to the masses
(→ public)

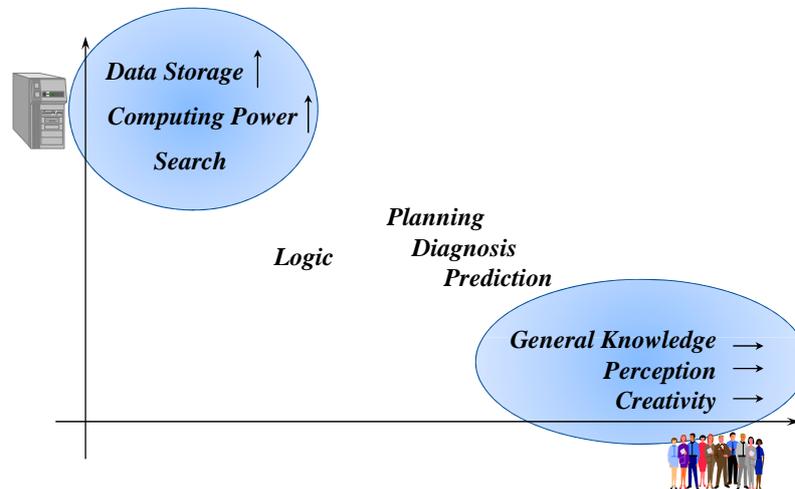


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***"Computers are incredibly fast,
accurate, and stupid: humans are
incredibly slow, inaccurate, and
brilliant; together they are powerful
beyond imagination."***

attributed to Albert Einstein

Abilities of Humans and Computers



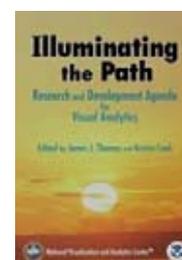
Definition of Visual Analytics

Definition:

Visual Analytics is the science of analytical reasoning facilitated by visual interfaces.

Visual analytics techniques are needed to

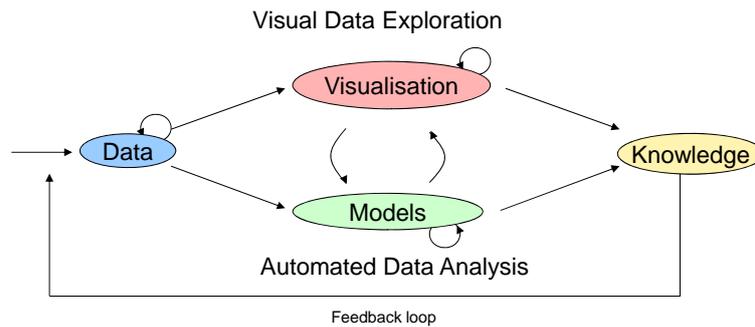
- integrate data from massive, dynamic, ambiguous, and often conflicting sources
- analyze the data to derive new insights
- make critical decisions in real-time.



Definition of Visual Analytics

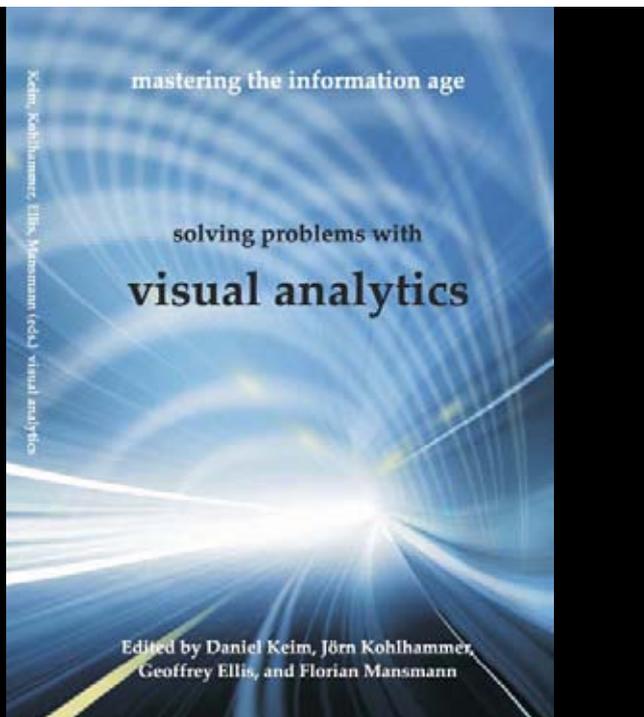
Visual Analytics

Tight Integration of Visual and Automatic Data Analysis Methods for Information Exploration and Scalable Decision Support



Roadmap from the
VisMaster EU Project

www.visual-analytics.eu

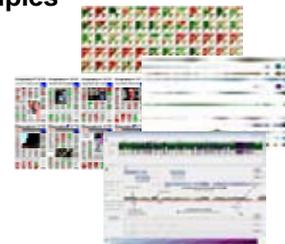
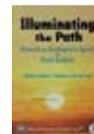


Technical Challenges

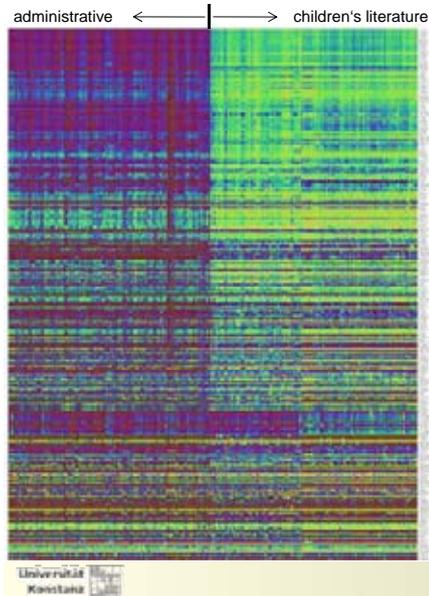
- When should we use automated techniques versus interactive techniques?
- When do we need both?
- How to best combine interactive visualizations with automated analysis techniques?

Outline

- **Visual Analytics**
 - Grand Challenges
 - Definition
 - Challenges
- **Visual Analytics Application Examples**
 - Document and News Analysis
 - Financial Analysis
 - Molecular Biology Analysis
- **Visual Analytics Perspectives**



Readability Analysis



→ text samples

Ground truth	1	1	1	0	0	0
Feature 1	■	■	■	■	■	■
Feature 2	■	■	■	■	■	■
...
Feature 479	■	■	■	■	■	■

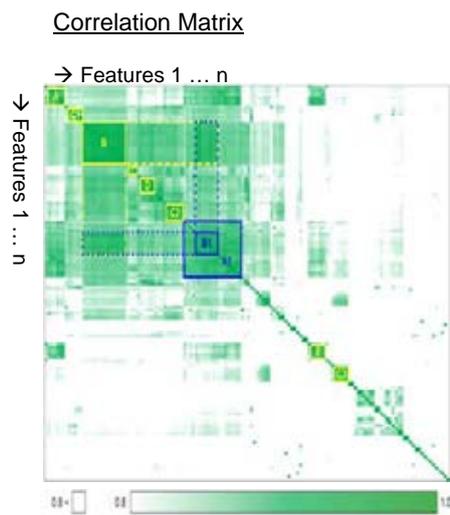
→ 479 feature vectors with one value for each text sample

- Method: Pearson Correlation Coefficient
- removed if correlation < 0.7



Readability Analysis

Selecting semantically meaningful, non-redundant features



Readability Analysis

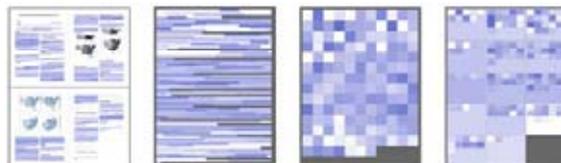
- Word Length
 - Vocabulary Complexity
 - Nominal Forms
 - Sentence Length
 - Sentence Structure Complexity
- ➔ Average = Overall readability score

Normalization with respect to:

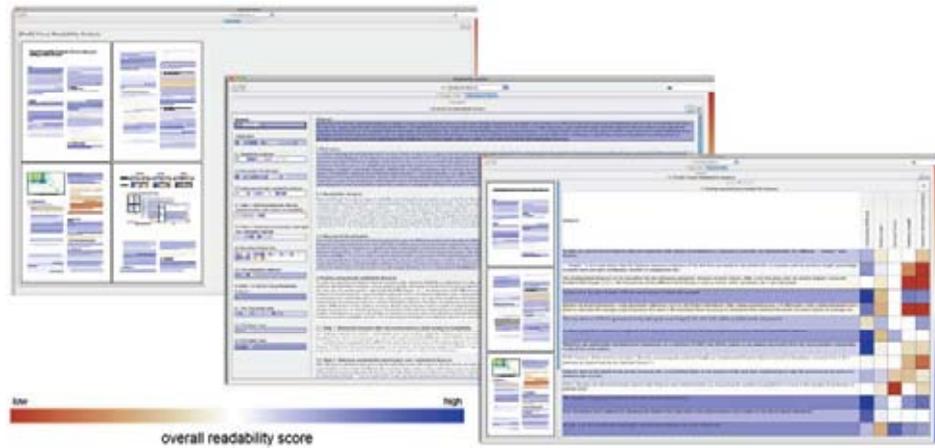
- Sentence length
- the ground-truth data set (mapping between 0 and 1)

Readability Analysis

- Conveying the transparency of the measure to the user:
Why is it difficult?
- Account for different meta-information:
availability of structural information, size of the documents, ...



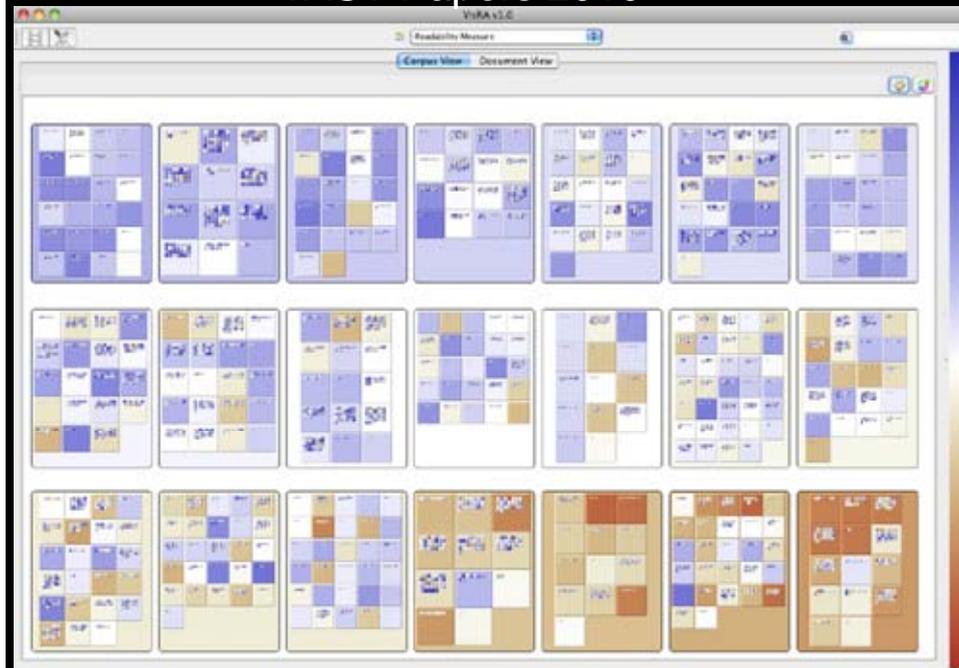
Readability Analysis



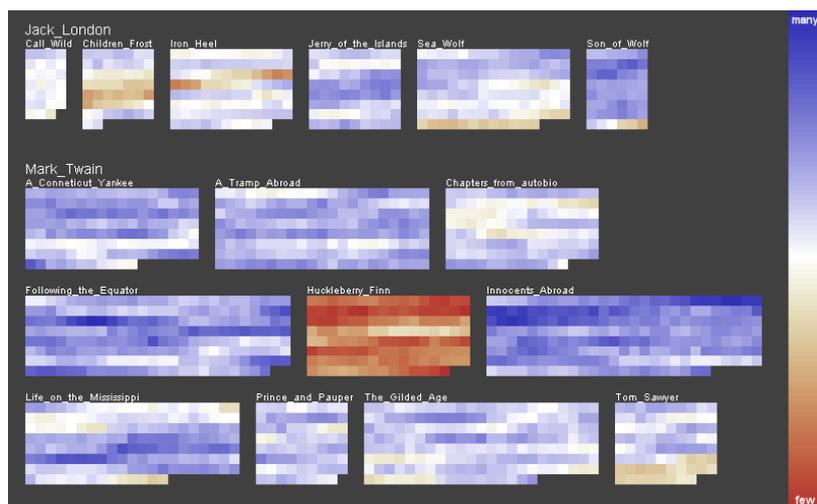
VAST-Papers 2009



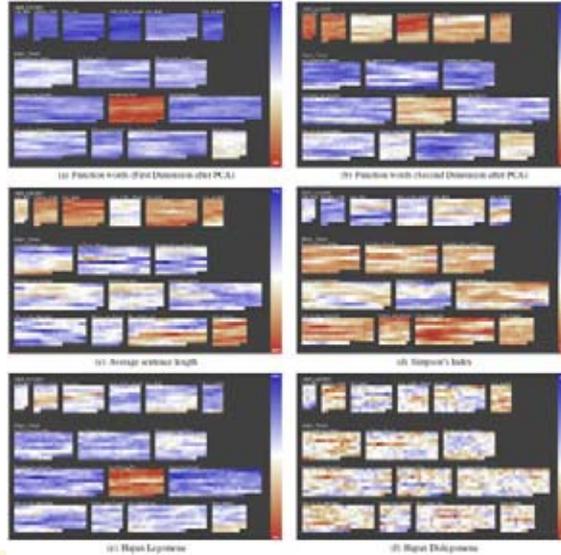
VAST-Papers 2010



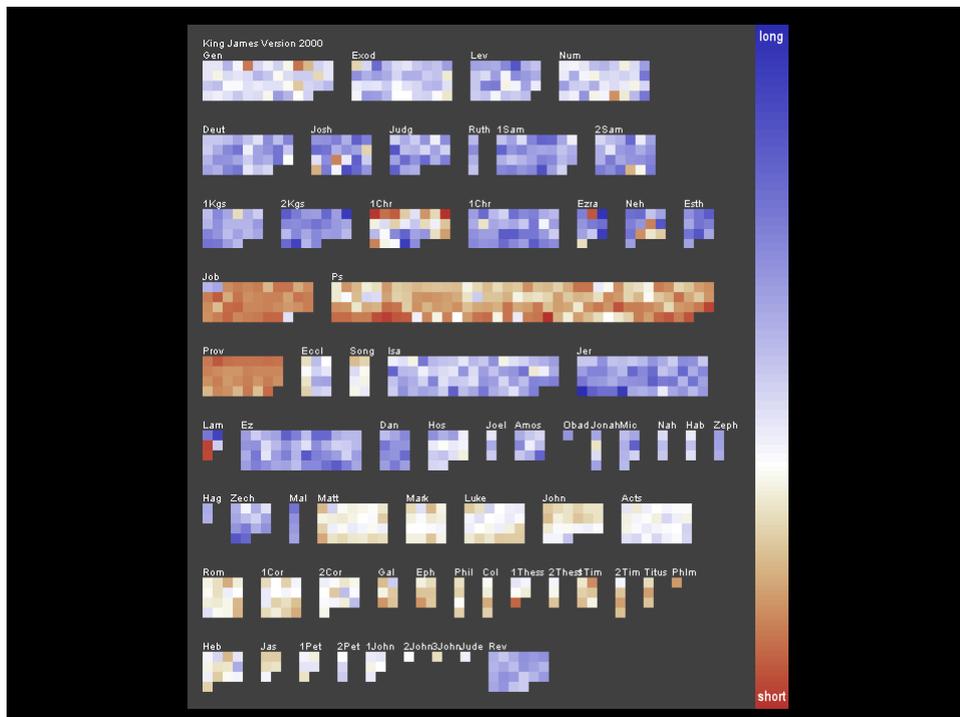
Literature Fingerprinting

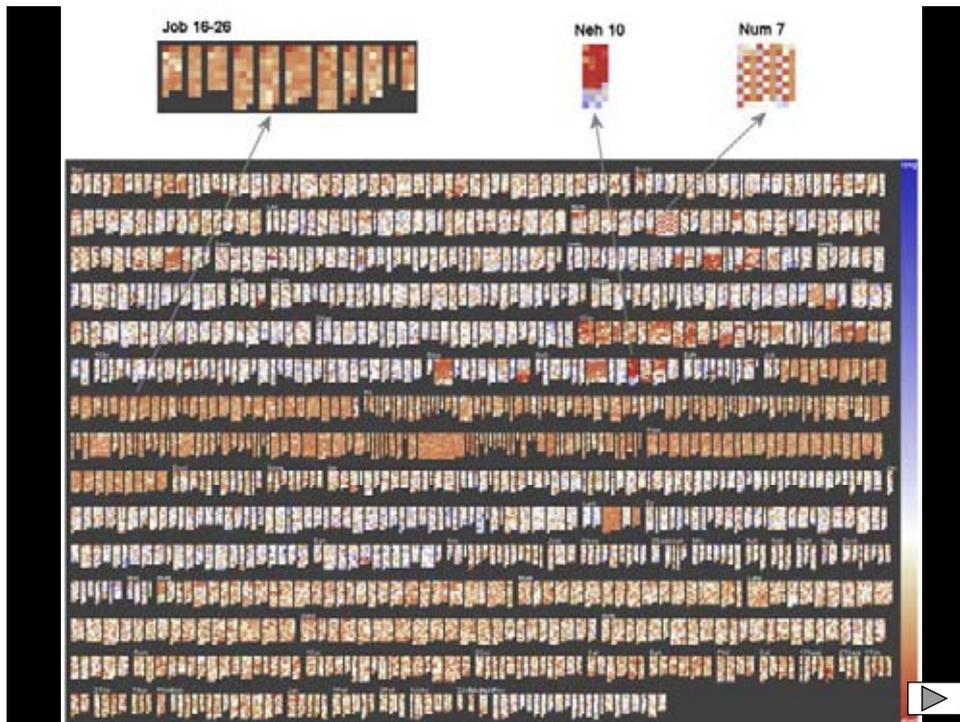


Literature Fingerprinting



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Europe Media Monitor

Europe Media Monitor

- collects news documents from 2,500 news sources: media portals, government websites, and news agencies
- processes 80,000-100,000 articles per day
- in 46 languages
- classifies the news according to countries and subjects
- extracts information about entities: people, places, and organizations

NewsBrief



NewsExplorer



Drink killed Sally Clark

By Caroline Crockett

THE sinister threat of suffocation has been taken away from Sally Clark. The death after seven months in hospital has been ruled as natural, the Coroner has said.

Sally Clark, 34, was found dead in her bed by her husband on March 16 at her home in Southgate, London. She had been in hospital for 10 months after the death of her first child, a 12-month-old boy, who died of Sudden Infant Death Syndrome (SIDS) in 1996.

A SIDS researcher said it was "highly unlikely" that the child died of SIDS. "It is more likely that he died of suffocation," said Dr. David Goldacre, a paediatrician and the father of the boy who died. "The fact that the child was in hospital for so long before he died is a strong indication that he was not a SIDS case."

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ELDERLY VICTIMS

THE number of elderly victims of crime has risen sharply in the last five years, according to a report by the Home Office. The report, published in July, says that the number of elderly victims of crime rose from 1.2 million in 2006 to 1.5 million in 2010. The report also says that the number of elderly victims of crime who were injured or killed rose from 10,000 in 2006 to 12,000 in 2010.

GEORGE PACES PAID

George Paces has a right to bail if the appeal against his conviction for the murder of 12 people, the judge has ruled. The judge, Lord Justice Leach, said that the appeal against the conviction of George Paces, who was convicted of the murder of 12 people in 1999, should be allowed. The judge said that the conviction was unsafe and that Paces should be granted bail.

PELTON PRINCE

William Prince is to become the patron of the 2012 London Olympic Games. The Prince of Wales, who is the Duke of Cornwall, will be the patron of the Olympic Games. The Prince of Wales is the son of Queen Elizabeth II and Prince Philip, Duke of Edinburgh. He is the fourth in line to the British throne.

Army failure led to death of fusilier

THE failure of the British Army to protect a soldier from a sniper's bullet has led to his death, a court has ruled. The court found that the Army was negligent in its duty to protect the soldier from the sniper's bullet.

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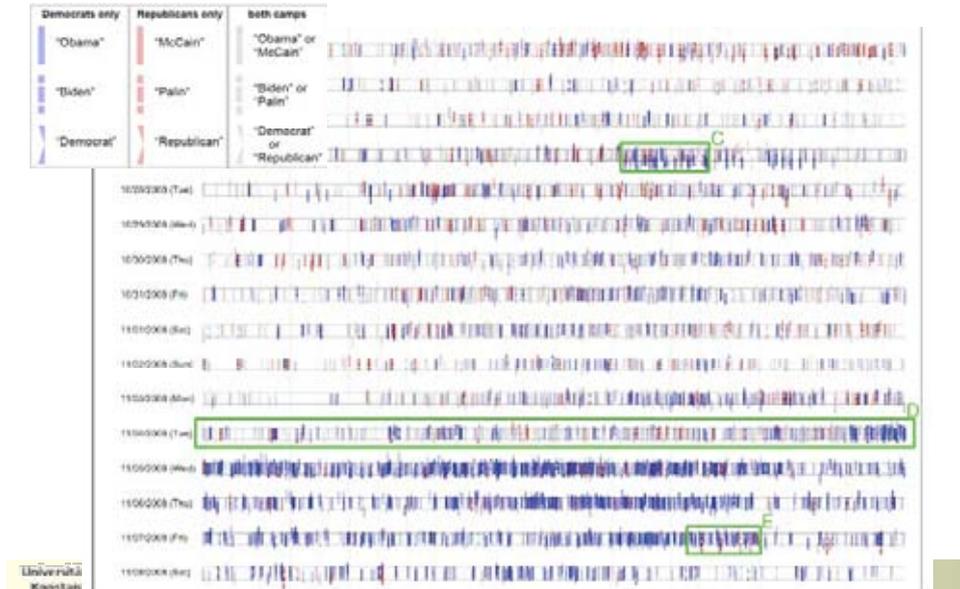
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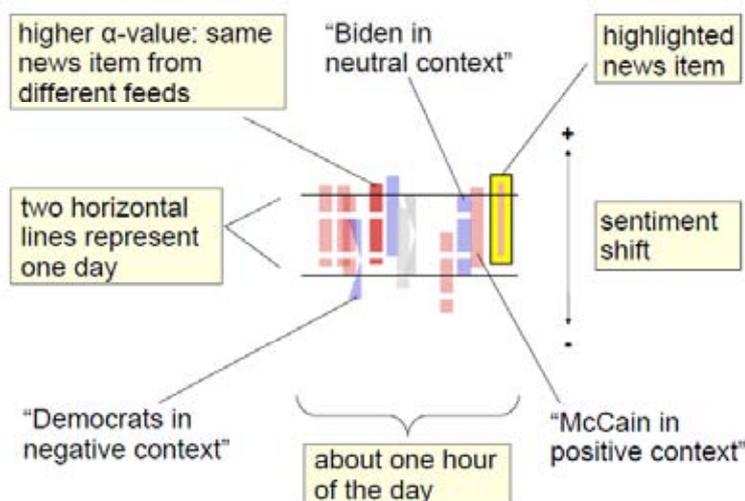
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Sentiment Explorer



Sentiment Explorer



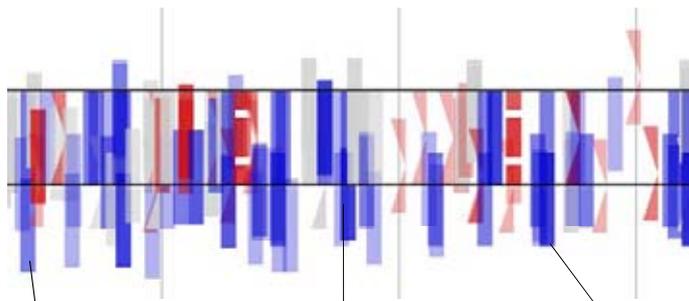
Fri Oct 10 19:41:49 CST 2008 (Feed 19):
 Palin abused power Alaska 'Troopergate' probe finds: AFP - Republican vice-presidential nominee Sarah Palin abused her position as Alaska Governor by pressuring officials to dismiss a state trooper, an investigator's report said.

Fri Oct 10 22:15:22 CST 2008 (Feed 39):
 Palin says report says she acted lawfully (Reuters): Reuters - Alaska Gov. Sarah Palin acted "within proper and lawful authority" in removing the state's public safety commissioner, the McCain-Palin Republican presidential ticket said on Friday in response to a state report.

Fri Oct 10 19:24:20 CST 2008 (Feed 49):
 Alaska panel finds Palin abused power in firing: ANCHORAGE, Alaska (AP) -- A legislative committee investigating Alaska Gov. Sarah Palin has found she unlawfully abused her authority in firing the state's public safety commissioner. The investigative report concludes that a family grudge wasn't the sole reason for firing Public Safety Commissioner Walter Monegan but says it likely was a contributing factor....

Fri Oct 10 21:50:40 CST 2008 (Feed 32):
 Alaska ethics probe says Palin abused her power: CHILLICOTHE, Ohio (Reuters) - An Alaska ethics inquiry found on Friday that U.S. Republican vice presidential candidate Sarah Palin abused her power as the state's governor, casting a cloud over John McCain's controversial choice of running mate for the November 4 election.

Fri Oct 10 21:06:44 CST 2008 (Feed 18):
 Probe accuses Palin of abuse of power (AFP): AFP - Investigators found vice presidential nominee Sarah Palin abused her powers as Alaska governor, dealing another blow to Republican John McCain's struggling White House bid.



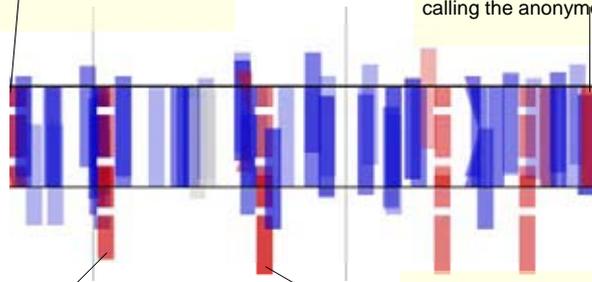
Mon Oct 27 14:24:25 CST 2008 (Feed 37):
 ATF disrupts skinhead plot to assassinate Obama (AP): AP - The ATF says it has broken up a plot to assassinate Democratic presidential candidate Barack Obama and shoot or decapitate 102 black people in a Tennessee murder spree.

Mon Oct 27 15:45:26 CST 2008 (Feed 38):
 Assassination plot targeting Obama disrupted (AP): AP - Law enforcement agents have broken up a plot by two neo-Nazi skinheads to assassinate Democratic presidential candidate Barack Obama and shoot or decapitate 88 black people, the Bureau of Alcohol, Tobacco Firearms and Explosives said Monday.

Mon Oct 27 16:45:39 CST 2008 (Feed 31):
 Skinheads held over Obama death plot: WASHINGTON (Reuters) - Two white supremacist skinheads were arrested in Tennessee over plans to go on a killing spree and eventually shoot Democratic presidential candidate Barack Obama, court documents showed on Monday.

Fri Nov 07 15:40:35 CST 2008 (Feed 23):
 GOP tries to sort out Palin's donor-funded
 duds: WASHINGTON (AP) -- Republican
 Party lawyers are still trying to determine
 exactly what clothing was purchased for
 Alaska Gov. Sarah Palin, what was
 returned and what has become of the
 rest.....

Fri Nov 07 17:56:01 CST 2008 (Feed 31):
 Palin fires back at leaks questioning her
 smarts: WASHINGTON (Reuters) -
 Alaska Gov. Sarah Palin fired back on
 Friday against post-election claims by
 aides to Republican presidential
 candidate John McCain that she thought
 Africa was a country, not a continent,
 calling the anonymous sources "jerks."

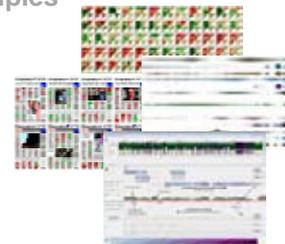


Fri Nov 07 16:01:19 CST 2008 (Feed 37):
 Palin denounces her critics as cowardly
 (AP): AP - Alaska Gov. Sarah Palin is
 striking back at critics of the high-priced
 wardrobe she wore as the Republican
 vice presidential candidate....

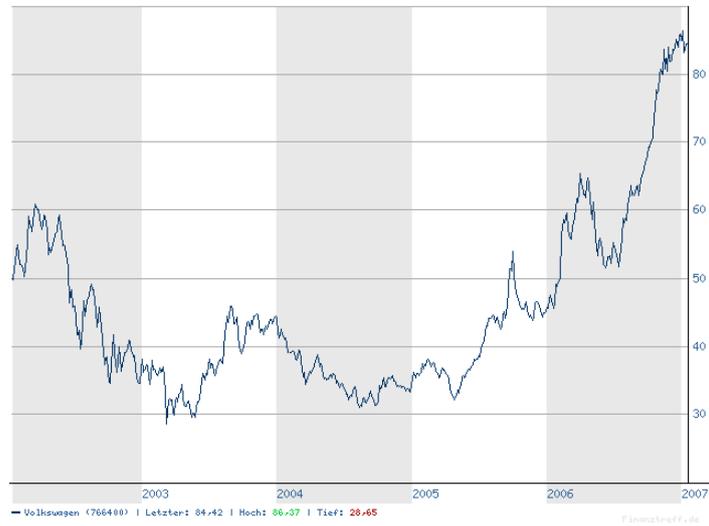
Fri Nov 07 16:38:59 CST 2008 (Feed 39):
 Palin denounces her critics as cowardly
 (AP): AP - Alaska Gov. Sarah Palin called
 her critics cowards and jerks Friday for
 deriding her anonymously and insisted
 she never asked for the expensive
 wardrobe purchased for her use on the
 presidential campaign.

Outline

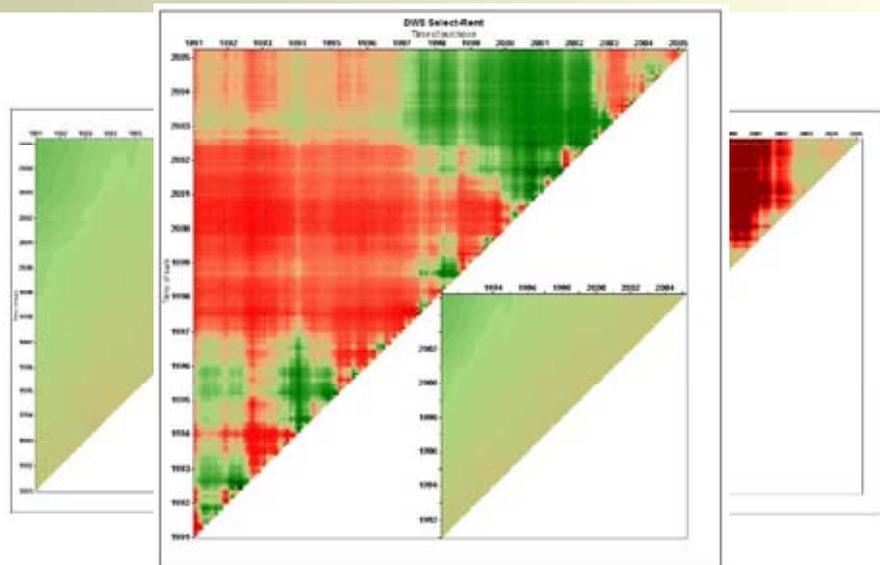
- **Visual Analytics**
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 - **Financial Analysis**
 - Molecular Biology Analysis
- **Visual Analytics Perspectives**



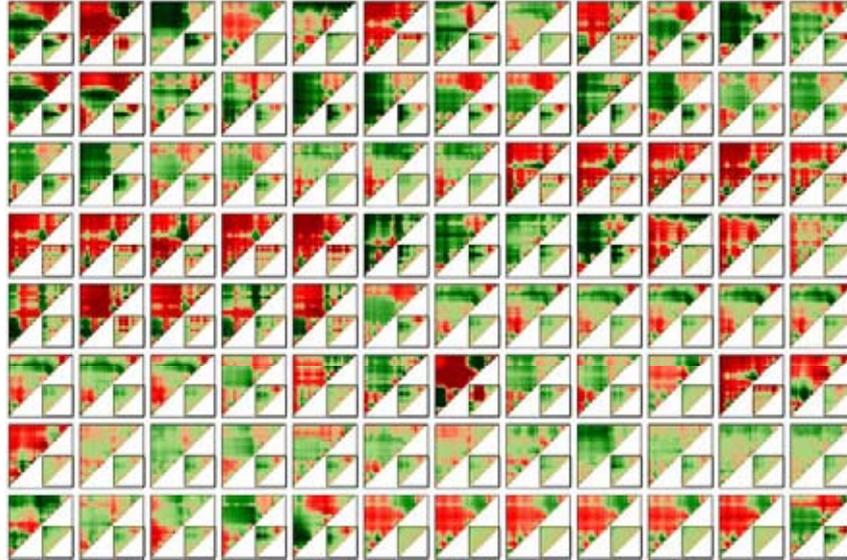
Line Charts



Financial Data Analysis

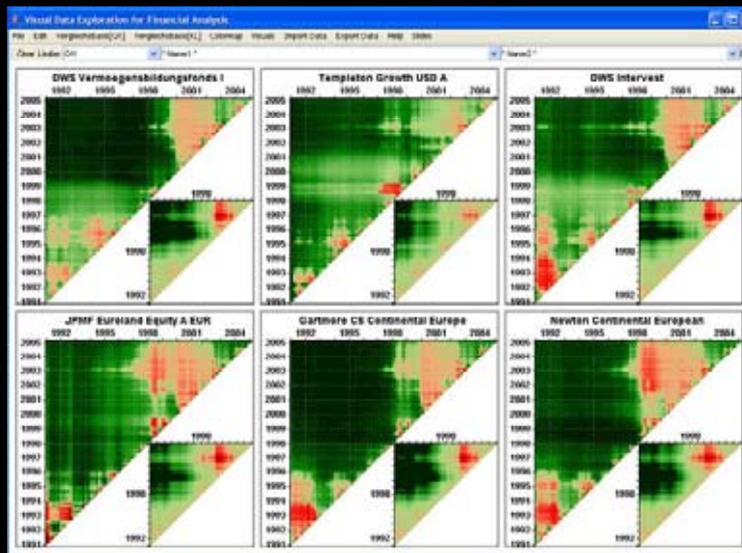


Financial Data Analysis

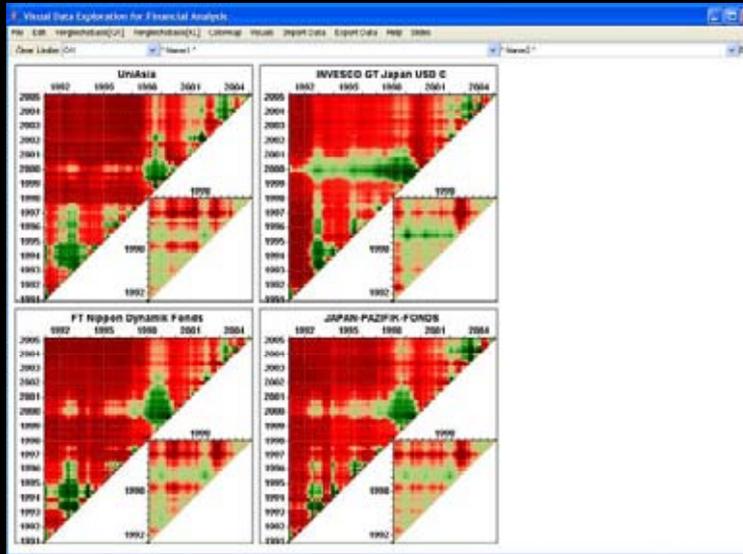


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Winning Funds



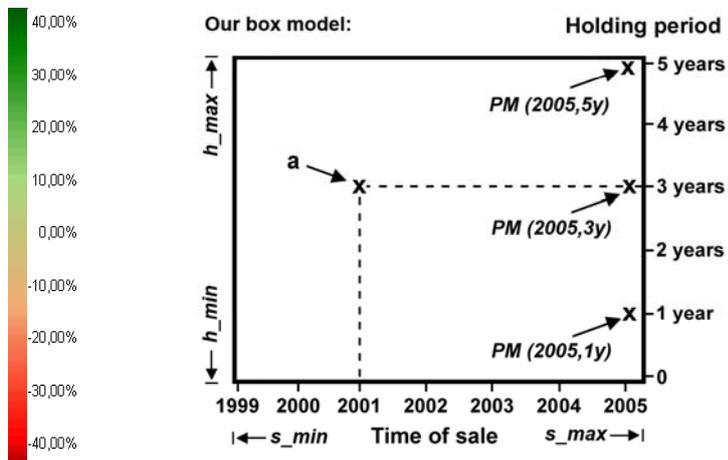
Loosing Fonds



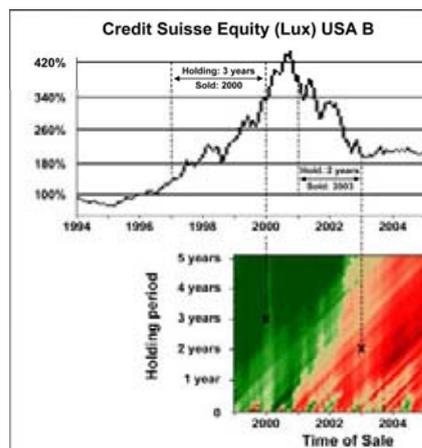
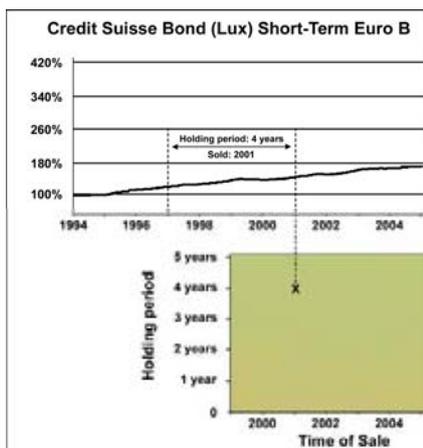
Financial Data Analysis



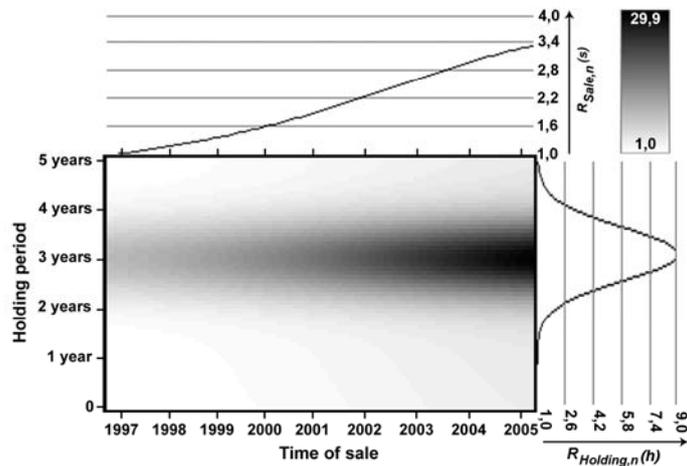
Financial Data Analysis



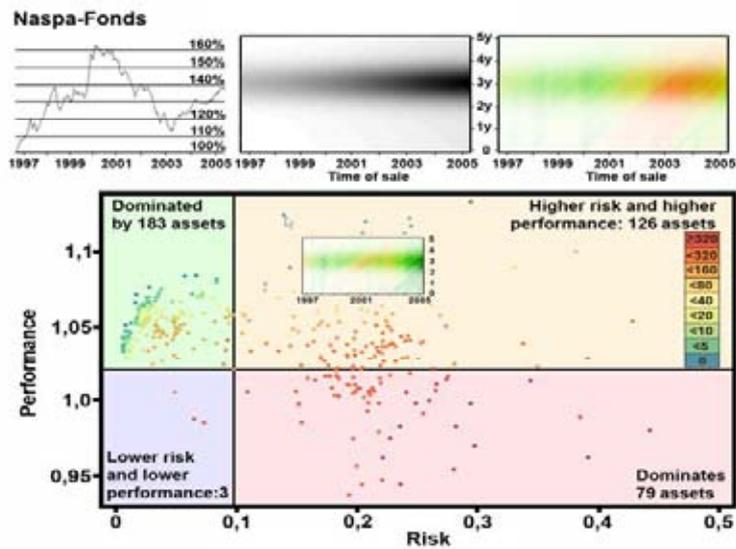
Financial Data Analysis



Financial Data Analysis

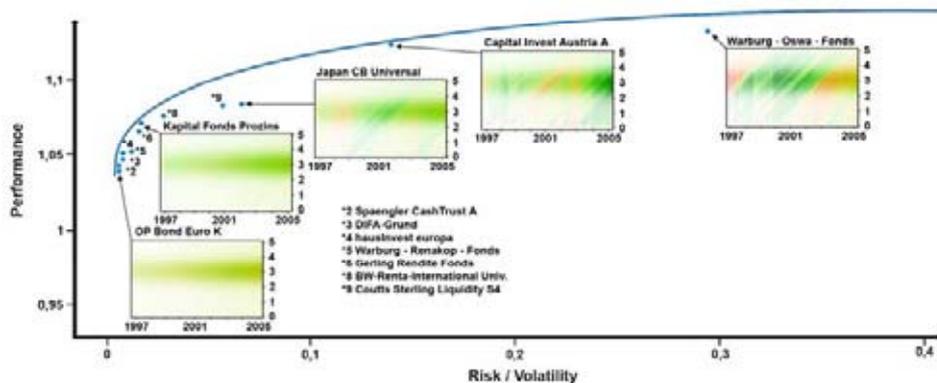


Performance - Risk Analysis



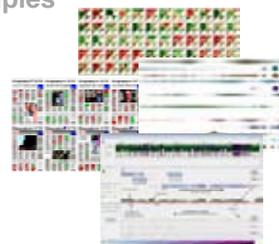
Performance – Risk Analysis

Efficient Fonds

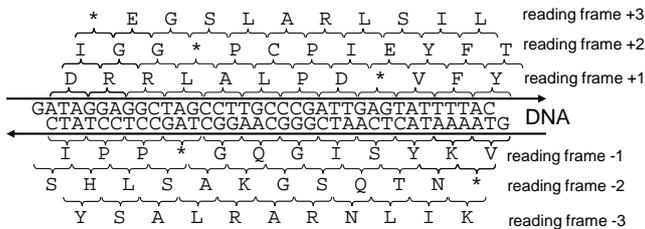


Outline

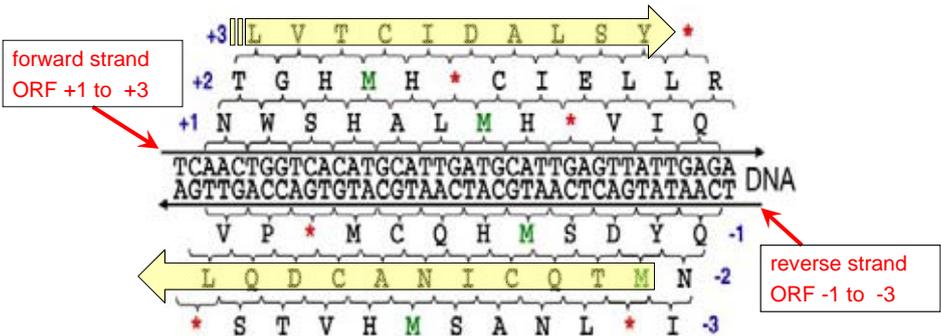
- Visual Analytics
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 - **Molecular Biology Analysis**
- Visual Analytics Perspectives

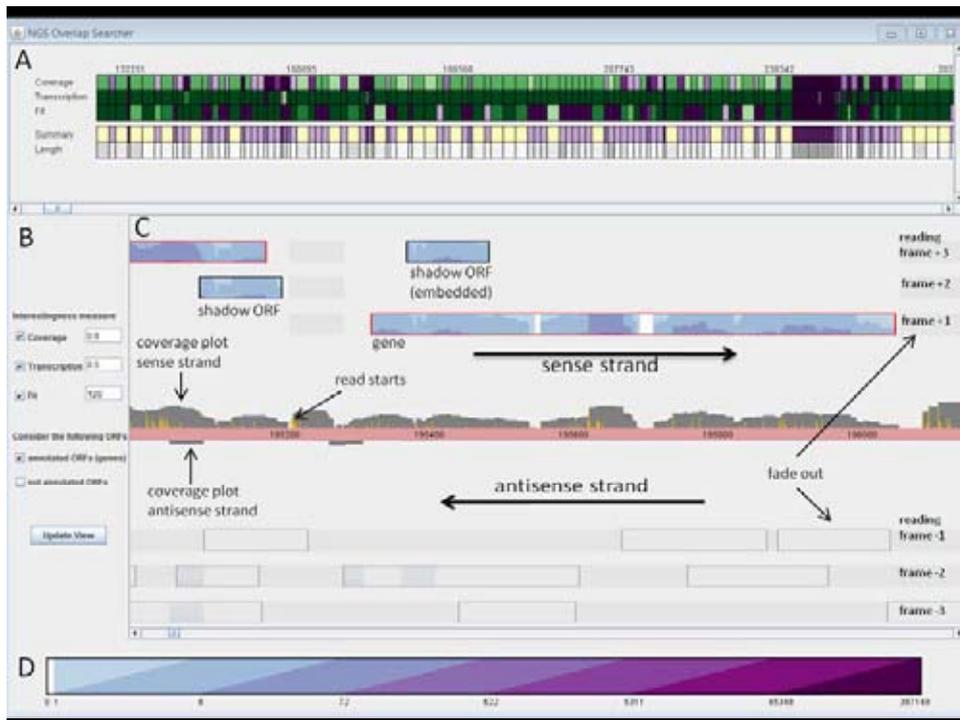


Overlapping genes

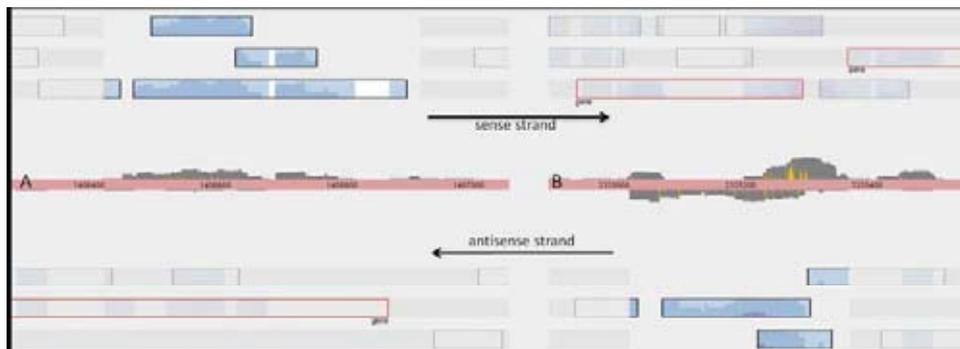


Overlapping genes



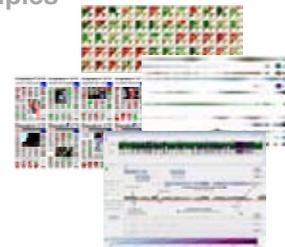


Example Results



Outline

- **Visual Analytics**
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 - Molecular Biology Analysis
- **Visual Analytics Perspectives**



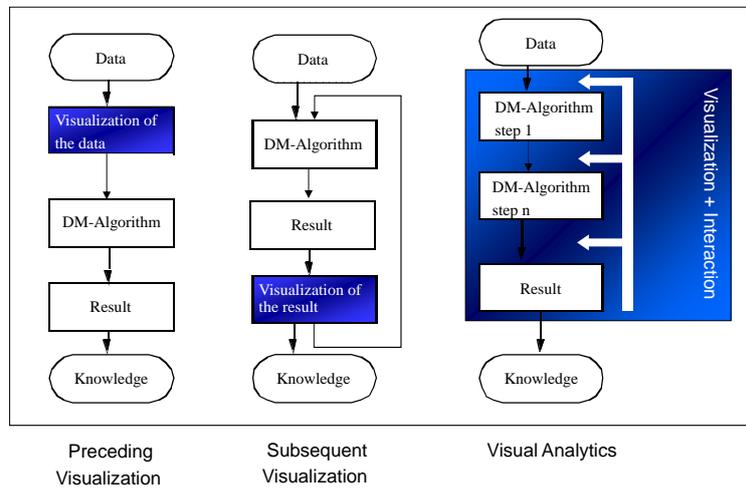
Future Visual Analytics Topics

Visual Analytics of

- Knowledge
- Streaming Data
- Data with Uncertainty
- Multimedia Data ...

Evaluation of Visual Analytics

Visual Analytics



Visual Analytics
is the
scientific discovery method
needed to solve some of
the **Grand Challenge problems!**

Conclusion

“All truths are easy to understand once they are discovered; the point is to discover them.”

Galileo Galilei (1564-1642)

Questions?

infovis.uni-konstanz.de

