Context Sensitive Visual Analytics for Energy Production Processes

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1 Motivation
   - Challenges
   - Application area

2 Theory
   - Visual Analytics
   - Context sensitivity

3 Context Sensitive Visual Analytics
   - Structure of the Architecture
   - Application Methods

4 Summary
PhD study summary

- Topic: Context Sensitive Visual Analytics (working title)
- Format: collection of papers
- Supervisors: Tommi Kärkkäinen, Anneli Heimbürger
- Started in 1.1.2011
- Status: 2 paper published, 3 planned
- Expected finishing time: end of 2014
- Application area: energy production
- Goal: method development
Motivation

- Digital data can be gathered from everywhere
- Datamasses are not consistent in real life
- Dynamic environment
- Framework is needed for the whole process

Figure: Situation [Järvinen et.al, 2009]
Energy Production

Figure: BFB boiler [Metso Power].

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Visual Analytics
Visual Analytics

Definition

Visual analytics combines automated analysis techniques with interactive visualizations for an effective understanding, reasoning and decision making on the basis of very large and complex datasets [Keim et. al, 2010].

- Way of solving problems
- Data mining, visualization and user interaction
- Many application areas
Model of Visual Analytics

Visual Data Exploration
- Visualisation
  - User interaction
  - Model visualisation
- Visual Data Exploration
- Transformation
- Mapping
- Model building
  - Data mining
  - Parameter refinement

Automated Data Analysis
- Feedback loop

Figure: Process from data to knowledge [Keim et.al, 2010].
Context Sensitive Approach

- Background information
- Process context
  - Time, space, measurement equipment, input, output, ...
- Analysis context
  - Window size in analysis, delay, user interface profiles, 
    ...

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Visual Analytics

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Context Sensitive Visual Analytics

Figure: Process Model [Wartiainen et al., 2012].
Change Point Detection

- Detecting changes in time series
- Online methods
- Statistical detectors
  - Mean, variance, trend, ...
- Classifying detectors
  - Supervised learning
  - Neural network
- Pattern recognition

**Figure:** Detector example.
Interactive UI

- Scalable interface
- Modular structure for detectors
- Versatile interaction possibilities
- Visualization methods
  - Chatter plots, histograms, map
- Supportive usage of colors
- Context information combined
- Real time performance
Visual Analytics for solving big problems
Tools for multidisciplinary projects
Context information cannot be ignored
Sensing, processing and actuation are part of analysis process
Online change point detection
References

