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# Reaching the Boundaries of Context-Aware IR: Accepting Help from the User



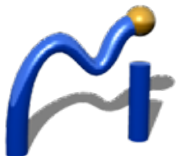
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**Dipl.-Wirtsch.Inf. Raiko Eckstein**

University of Bamberg

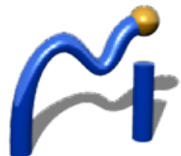
Chair for Media Informatics

96045 Bamberg



# Agenda

- Motivation & problem outline
- Complex information needs
- The visual approach
- Encountered difficulties



# The setting



- Bavarian Research Cooperation FORFLOW
  - 4 Universities
  - 12 Sub-Projects
  - 21 Industrial partners
- aims at
  - improvement of process & workflow support
  - improvement of provision of information for designing engineers
  - reuse of components and knowledge in the company
- Sub-Project:  
Context-based search for reusable components

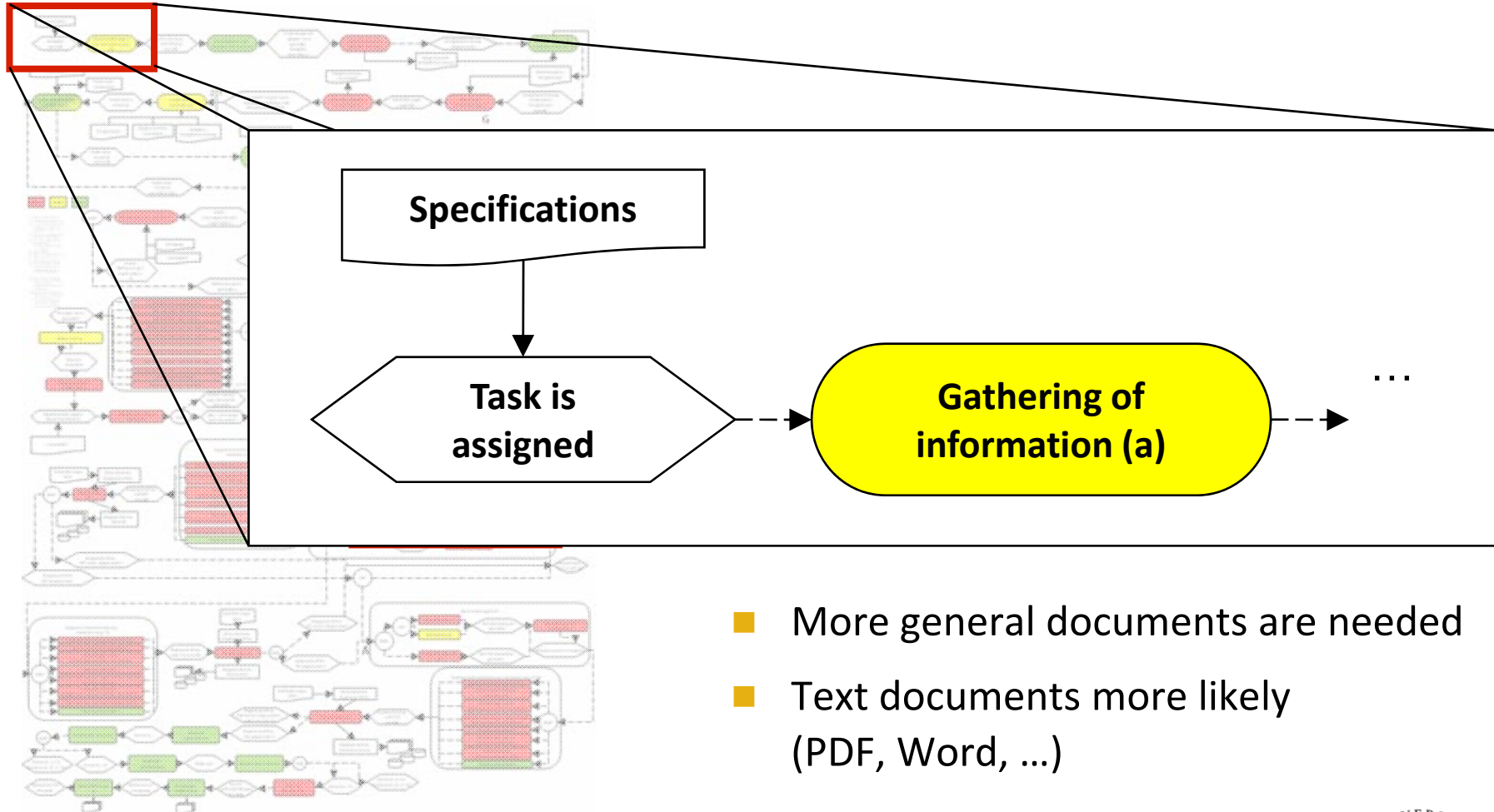


# Motivation

- Variety of documents
- Lack of comprehensive search
- Complex search situations



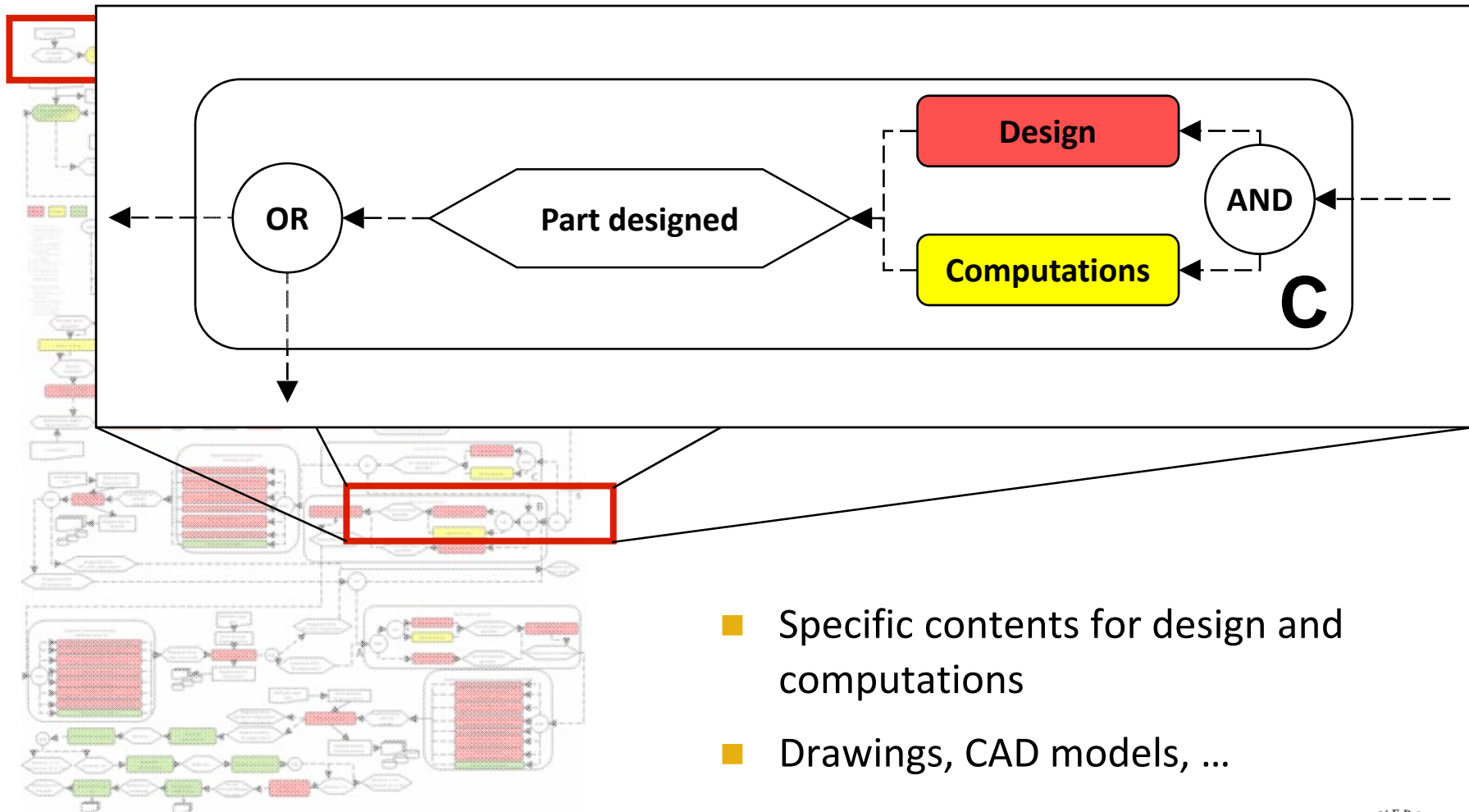
# Information needs in the construction process



- More general documents are needed
- Text documents more likely (PDF, Word, ...)



# Information needs in the construction process



- Specific contents for design and computations
- Drawings, CAD models, ...

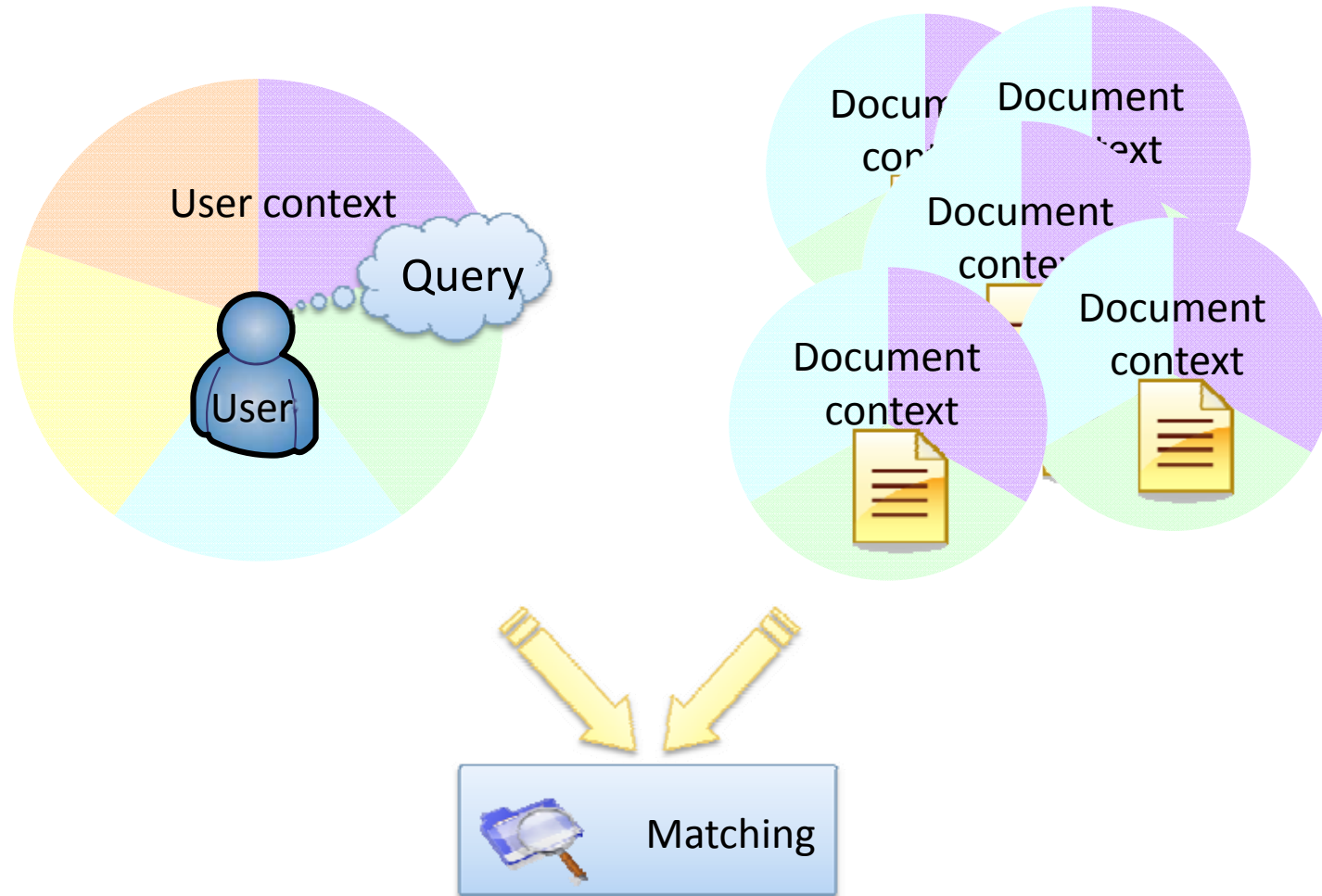


# Complexity due to ...

- Different artefact types
- Different document types
- Diversity of metadata
  - PLM, PDM, ERP, DMS, WFMS, ...



# The influence of context





# Multi-criteria matching

- Problem:
  - Many factors for „relevancy“
  - Which weighting is correct?
  - Which dependencies exist between the criteria?
  
- Which criteria are
  - Filter criteria
  - Best-Match criteria
  - ...?



# How to use the contextual information?

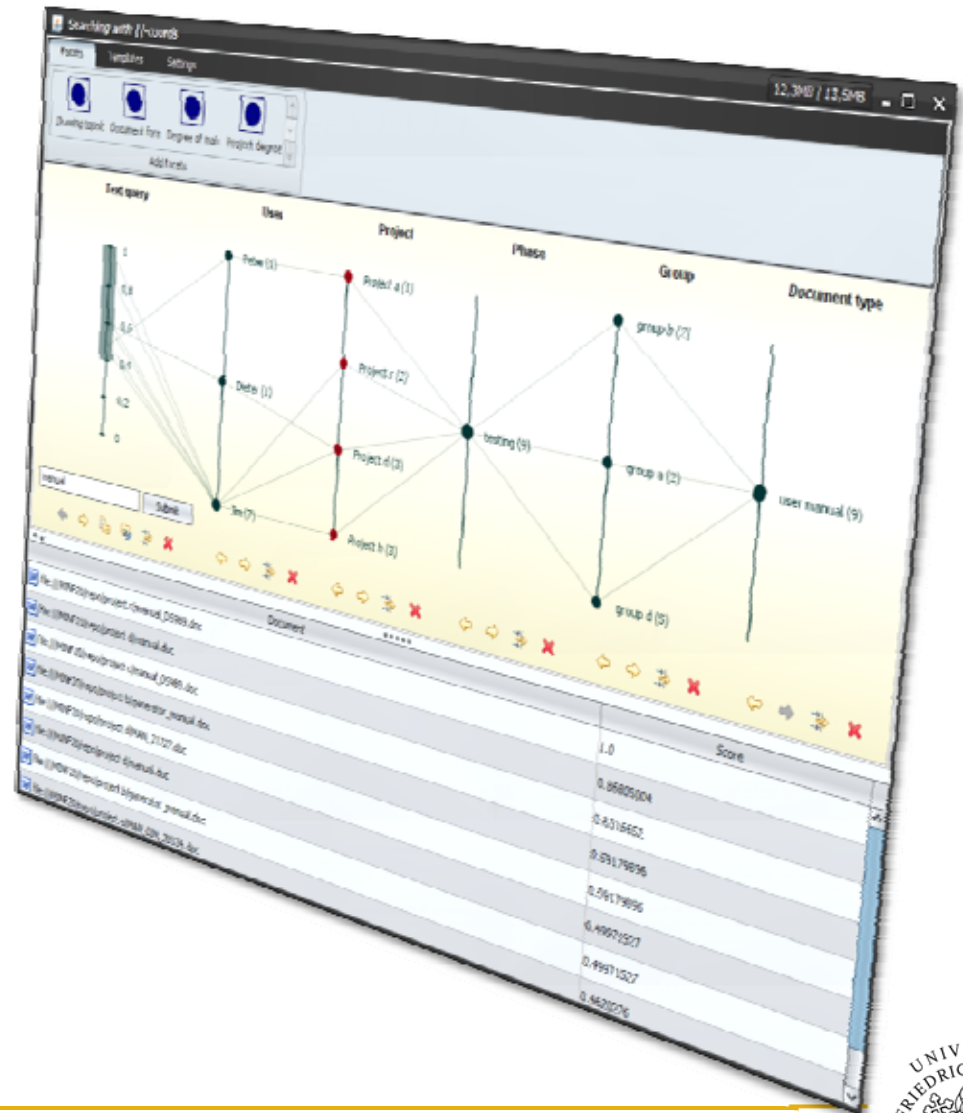
Possible approaches:

1. We use “artificial intelligence” (machine learning)
2. We ask “human experts”
3. We let the “user” decide



# The visual approach

- Intuitive
- High query expressiveness
- Browsing
- Keyword search
- Query-by-example



# Starting from the idea of faceted searching ....



Simply add and remove of facets

all items  in current results

These terms define your current search

GENDER: male

PRIZE: physics

Items 1 to 40 of 164 results

Group by: [gender](#), [prize](#)

Sort by: usual name, [year of birth](#), [year of death](#), [country](#)

Overview of available facets

1 21 31 121

Refine your search within these categories:

GENDER: [all](#) > male

### COUNTRY [\(group results\)](#)

- [Austria](#) (3)
- [Canada](#) (1)
- [China](#) (2)
- [Denmark](#) (3)
- [Federal Republic of Germany](#) (10)
- [France](#) (10)
- [Germany](#) (11)
- [India](#) (1)
- [Ireland](#) (1)
- [Italy](#) (3)
- [more...](#)

### AFFILIATION [\(group results\)](#)

- [Austria](#) (1)
- [Denmark](#) (3)
- [Federal Republic of Germany](#) (6)
- [France](#) (11)
- [Germany](#) (12)
- [India](#) (1)
- [Ireland](#) (1)
- [Italy](#) (2)
- [Japan](#) (3)
- [Russia](#) (1)
- [more...](#)

PRIZE: [all](#) > physics

### YEAR [\(group results\)](#)

- [1900s](#) (12)
- [1910s](#) (10)
- [1920s](#) (12)
- [1930s](#) (11)
- [1940s](#) (7)
- [1950s](#) (20)
- [1960s](#) (18)
- [1970s](#) (25)
- [1980s](#) (22)
- [1990s](#) (18)
- [more...](#)

Recently Viewed Items

[Go to Item History](#)



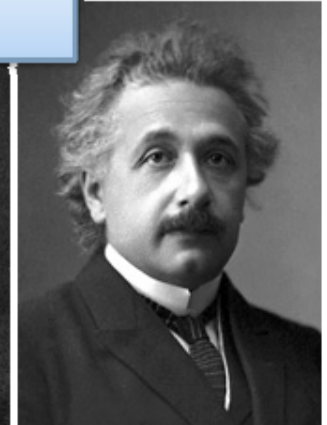
[Aage N. Bohr](#)  
1922-



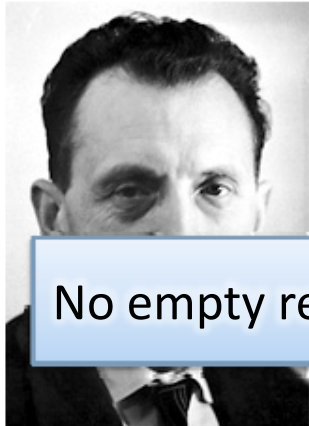
[Abdus Salam](#)  
1926-1996



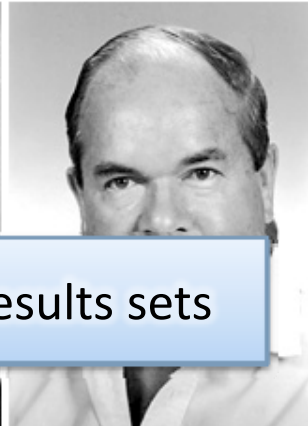
[Albert A. Michelson](#)  
1852-1931



[Albert Einstein](#)  
1879-1955



[Aleksandr M. Prokhorov](#)  
1916-2002



[Alexei A. Abrikosov](#)  
1928



[Alfred Kastler](#)  
1902-1984



[Anthony J. Leggett](#)  
1928

No empty results sets

# ... we enhance that paradigm

- Higher query expressiveness
  - Single & multi-value selections
  - Intervals
  - Ranking documents by facet selection
- Visualization of dependencies between documents / facets
- Consideration of dependencies between facets



# Parallel Coordinates Plots

- Developed by Alfred Inselberg due to missing visualizations for multi-dimensional geometries
- Later adopted for visualizations of multi-dimensional data



# The prototype – A walkthrough





Facets Templates Settings

Text CAD geometry Drawing geome Drawing toolc

Add facets



Searching with ||-coords

Query by Example

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text	CAD geometry	Drawing geometry	Drawing topology

Additional Facets

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text query	User	Project	Phase
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Group	Document type	Document format	Degree of maturity
<input type="checkbox"/>			
Project degree of maturity			

Searching with ||-coords

Document	Score
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Facets Templates Settings



Text



CAD geometry



Drawing geome



Drawing topolc

Add facets

### Text query



Document

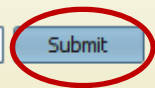
Score

Facets Templates Settings

- Text
- CAD geometry
- Drawing geome
- Drawing topolc

Add facets

### Text query



Document

Score

Facets Templates Settings

Text CAD geometry Drawing geome Drawing topolc

Add facets

### Text query



manual Submit

← → ↺ ↻ ↷ ✖

Document	Score
file:///MINF20/repo/project d/manual.doc	1.0
file:///MINF20/repo/project c/manual_DS989.doc	1.0
file:///MINF20/repo/project b/generator_manual.doc	0.625
file:///MINF20/repo/project d/MAN_21727.doc	0.625
file:///MINF20/repo/project d/manual.doc	0.5
file:///MINF20/repo/project c/manual_DS989.doc	0.5
file:///MINF20/repo/project b/generator_manual.doc	0.5
file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375

Facets

Templates

Settings



Text



CAD geometry



Drawing geome



Drawing topolc

Add facets

## Text query



Document	Score
file:///MINF20/repo/project d/manual.doc	1.0
file:///MINF20/repo/project c/manual_DS989.doc	1.0
file:///MINF20/repo/project b/generator_manual.doc	0.625
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file:///MINF20/repo/project d/manual.doc	0.5
file:///MINF20/repo/project c/manual_DS989.doc	0.5
file:///MINF20/repo/project b/generator_manual.doc	0.5
file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375

Facets   Templates   Settings

Query by Example

Text    CAD geometry    Drawing geometry    Drawing topology

Additional Facets

User    Project    Phase    Group

Document type    Document format    Degree of maturity    Project degree of maturity

0,6  
0,4  
0,2  
0

manual   Submit

← → 📄 📄 → ✖

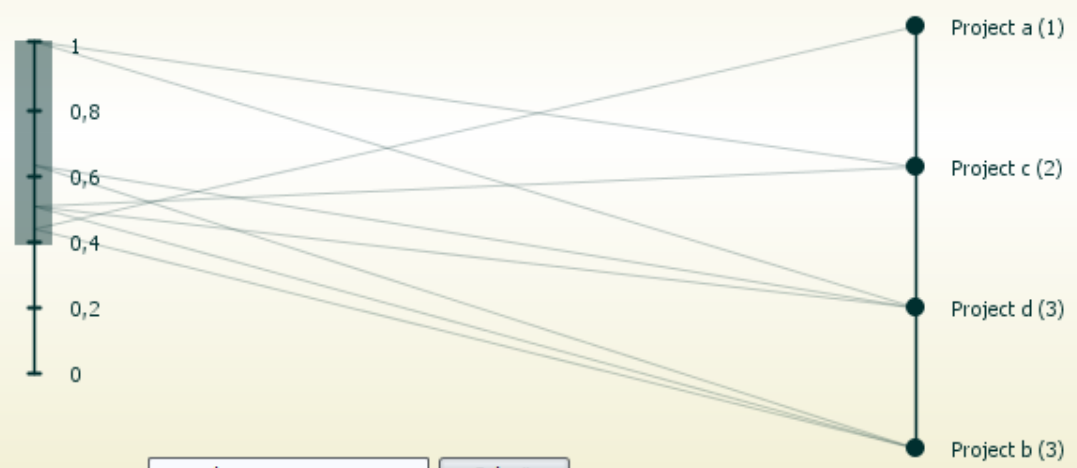
Document	Score
 file:///MINF20/repo/project d/manual.doc	1.0
 file:///MINF20/repo/project c/manual_DS989.doc	1.0
 file:///MINF20/repo/project b/generator_manual.doc	0.625
 file:///MINF20/repo/project d/MAN_21727.doc	0.625
 file:///MINF20/repo/project d/manual.doc	0.5
 file:///MINF20/repo/project c/manual_DS989.doc	0.5
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 file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375

Facets Templates Settings

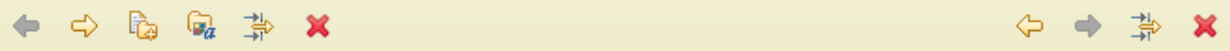
Text CAD geometry Drawing geome Drawing topol  
Add facets

Text query

Project



manual Submit



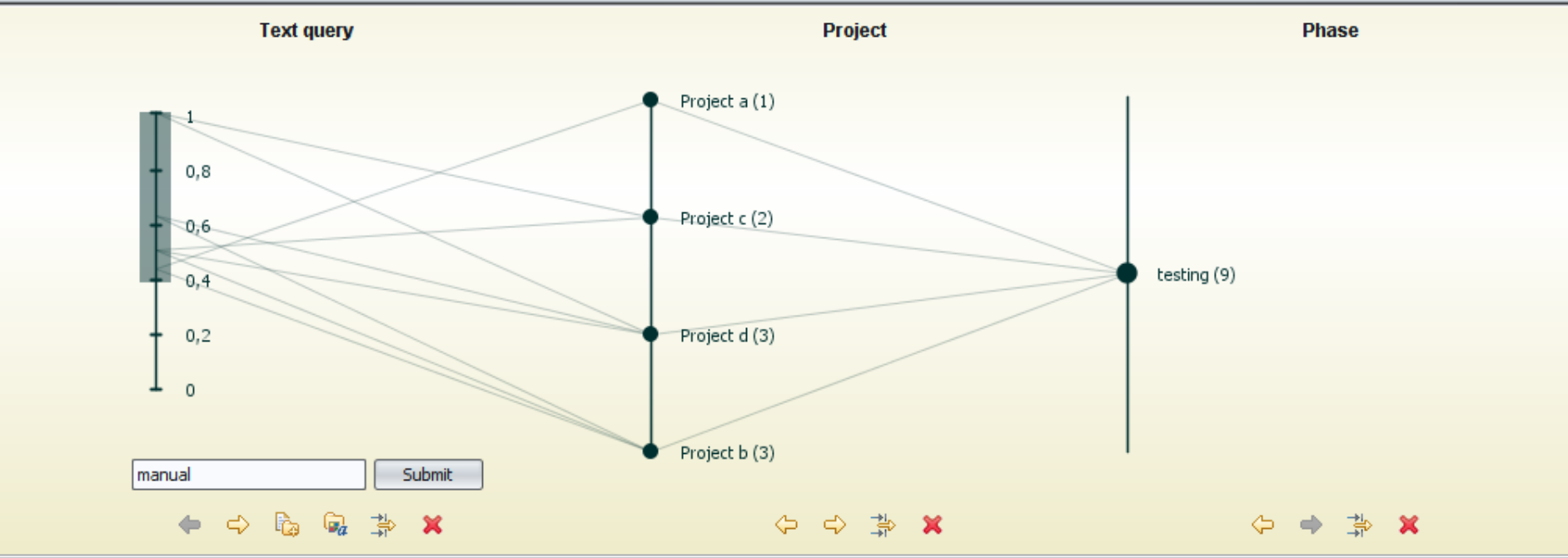
Document	Score
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file:///MINF20/repo/project c/manual_DS989.doc	1.0
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file:///MINF20/repo/project d/manual.doc	0.5
file:///MINF20/repo/project c/manual_DS989.doc	0.5
file:///MINF20/repo/project b/generator_manual.doc	0.5
file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375



Facets Templates Settings

Text CAD geometry Drawing geome Drawing topolc

Add facets

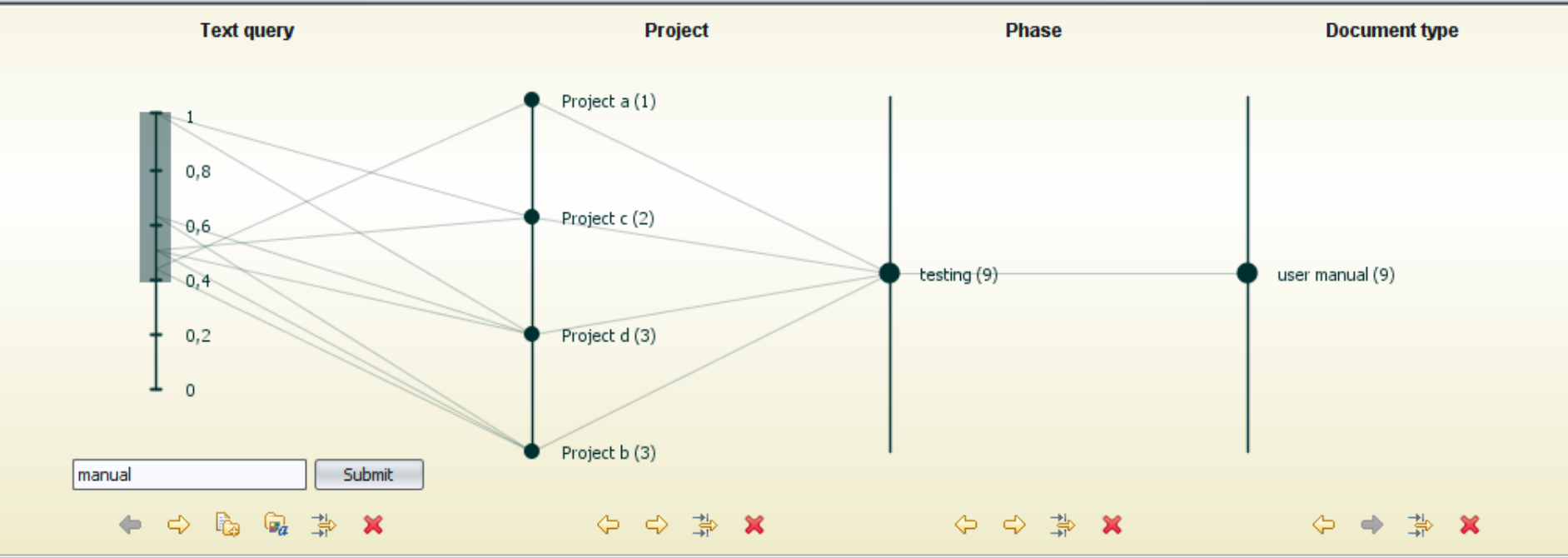


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file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375

Facets Templates Settings

Text CAD geometry Drawing geome Drawing topol

Add facets

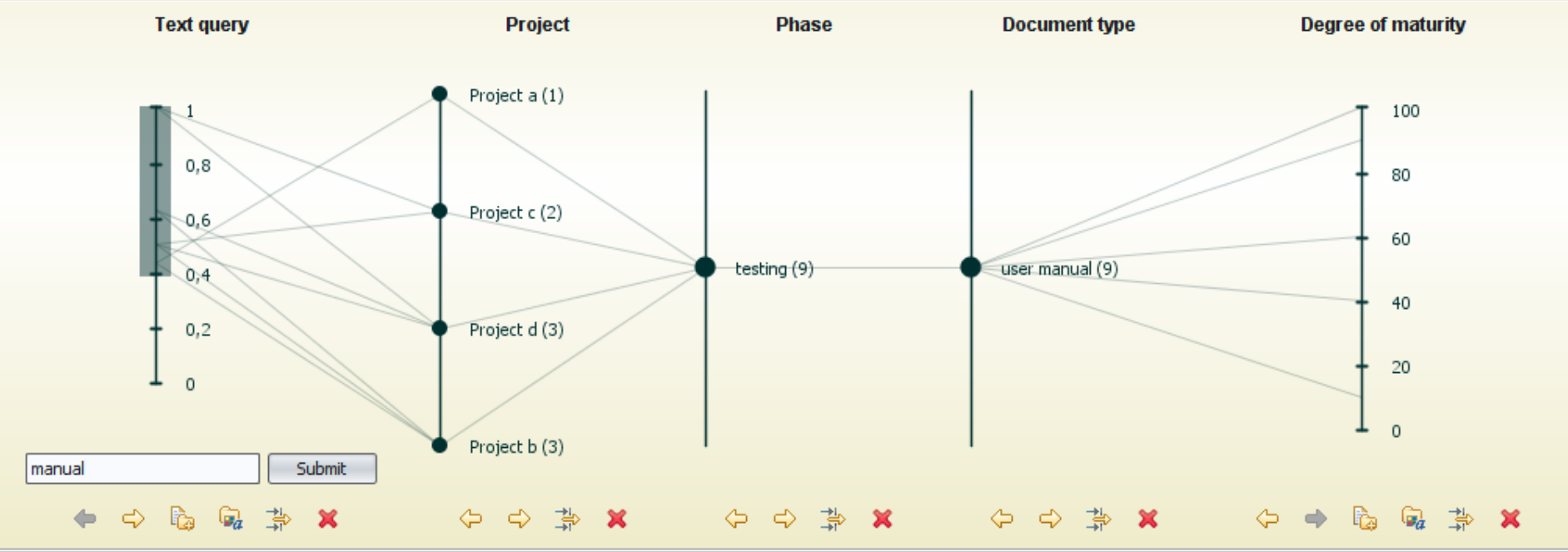


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Facets Templates Settings

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Add facets



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file:///MINF20/repo/project b/generator_manual.doc	0.5
file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375

# The prototype - Query-by-example

- Support for domain specific documents
  - CAD models
  - Technical Drawings
  - ...
- Unification of the statement of the query
  - Queries considered as facets
  - Keyword query and query-by-example are similar



# Dynamic selection of facet values

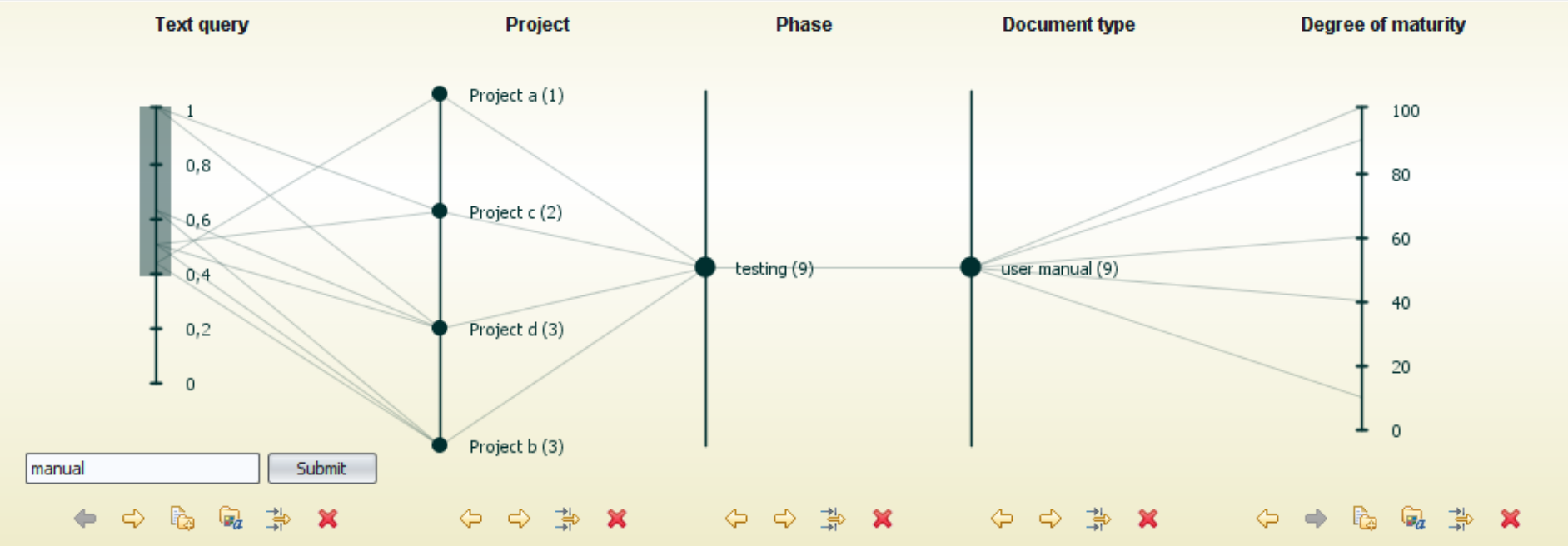
- Single-value
- Multi-value
- Interval



Facets Templates Settings

Text CAD geometry Drawing geome Drawing topol

Add facets

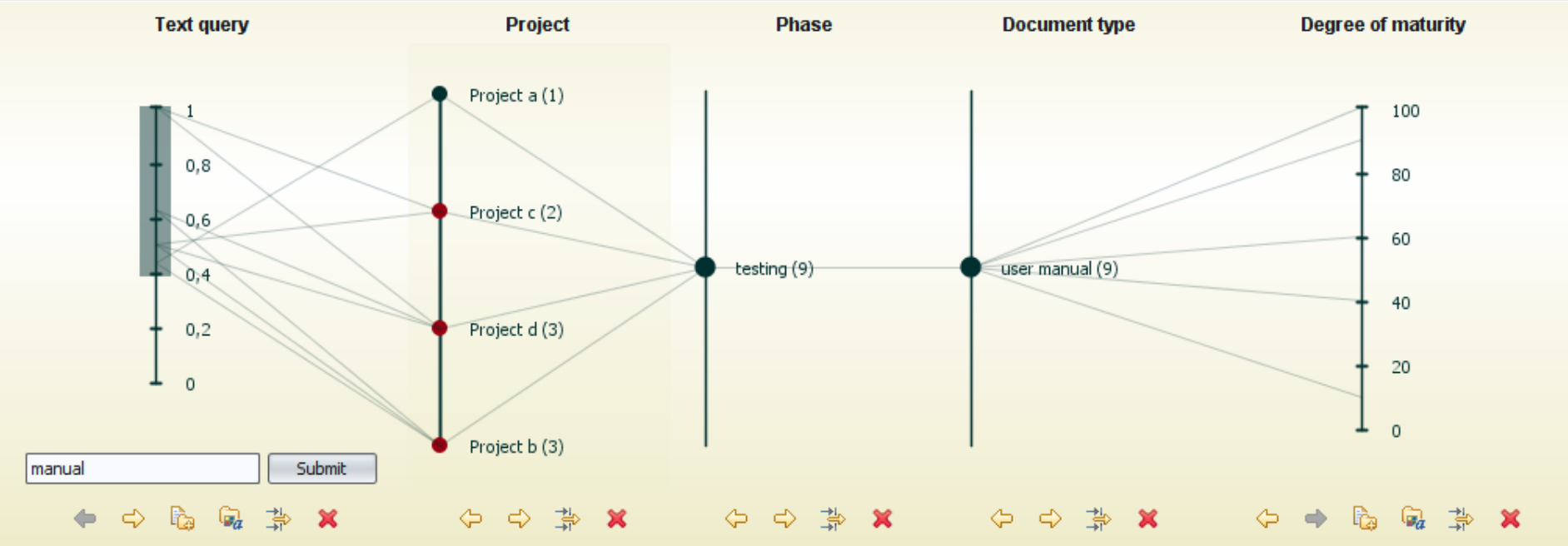


Document	Score
file:///MINF20/repo/project d/manual.doc	1.0
file:///MINF20/repo/project c/manual_DS989.doc	1.0
file:///MINF20/repo/project b/generator_manual.doc	0.625
file:///MINF20/repo/project d/MAN_21727.doc	0.625
file:///MINF20/repo/project d/manual.doc	0.5
file:///MINF20/repo/project c/manual_DS989.doc	0.5
file:///MINF20/repo/project b/generator_manual.doc	0.5
file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375

Facets Templates Settings


Text CAD geometry Drawing geome Drawing topol

Add facets




Document	Score
file:///MINF20/repo/project d/manual.doc	1.0
file:///MINF20/repo/project c/manual_DS989.doc	1.0
file:///MINF20/repo/project b/generator_manual.doc	0.625
file:///MINF20/repo/project d/MAN_21727.doc	0.625
file:///MINF20/repo/project d/manual.doc	0.5
file:///MINF20/repo/project c/manual_DS989.doc	0.5
file:///MINF20/repo/project b/generator_manual.doc	0.5
file:///MINF20/repo/project a/MAN_DIN_28334.doc	0.4375


Facets **Templates** Settings




Text



CAD geometry

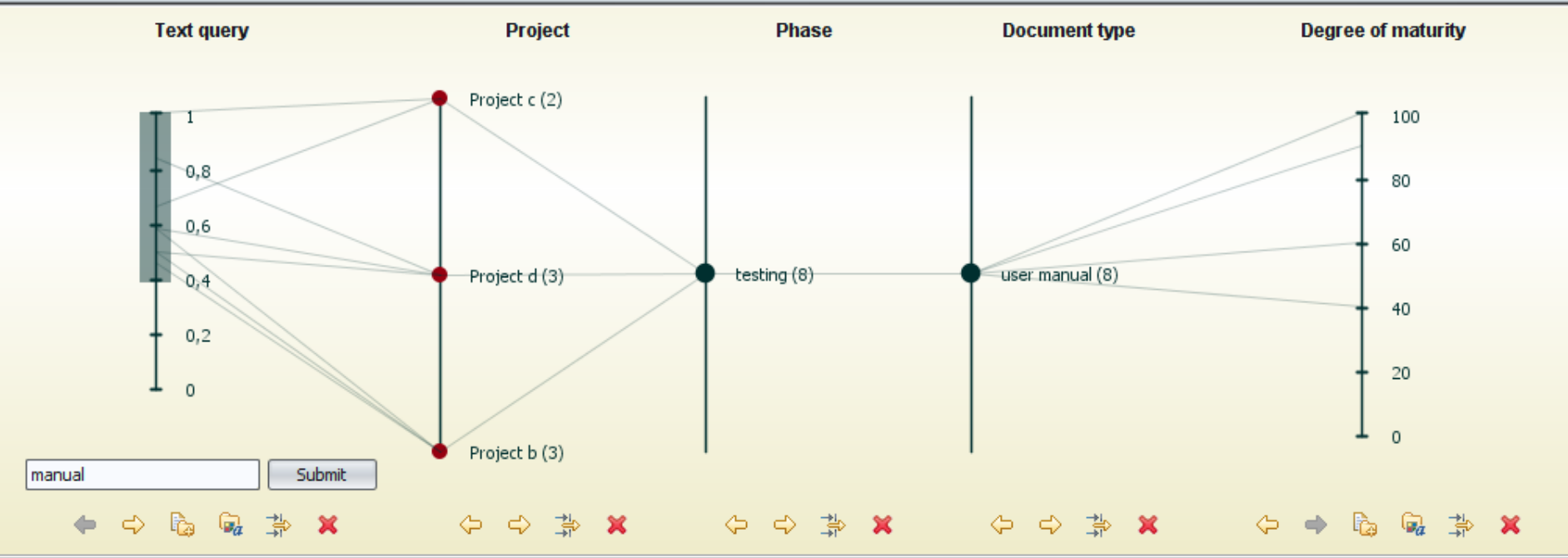


Drawing geome



Drawing topolc

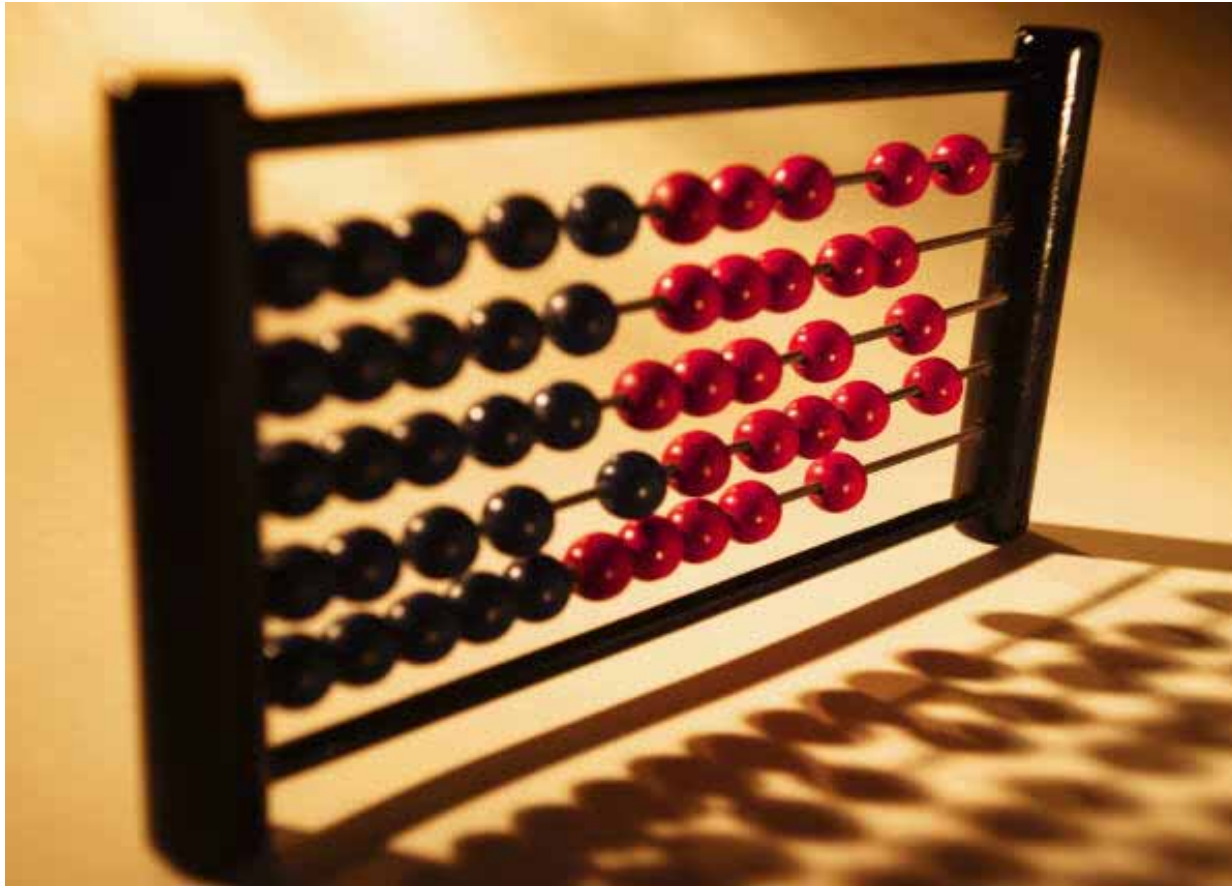
Add facets



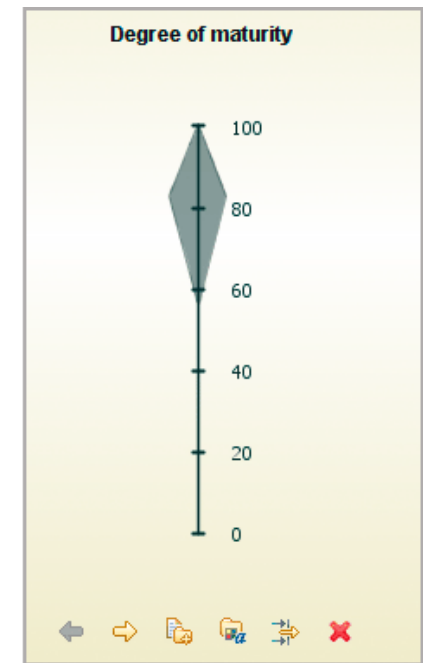
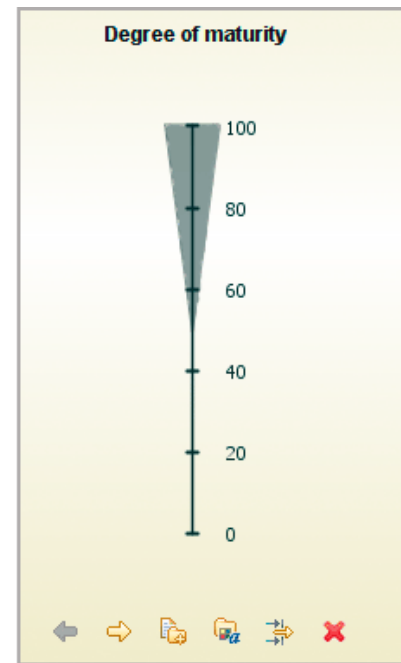
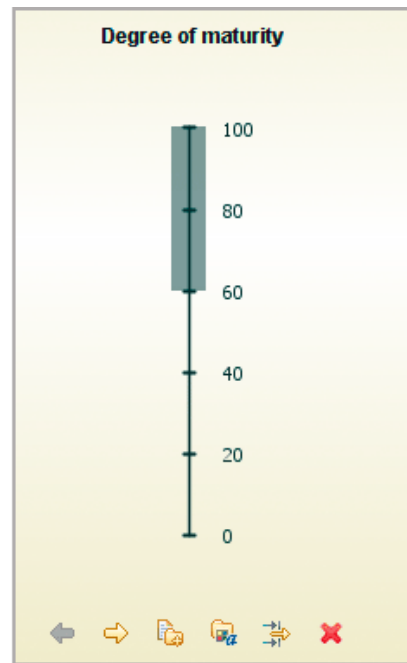
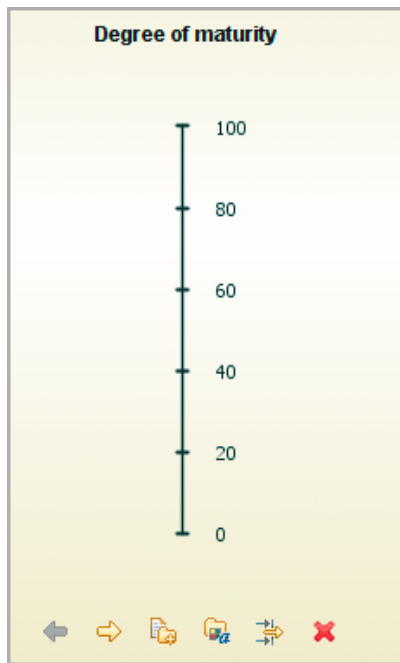
Document	Score
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file:///MINF20/repo/project c/manual_DS989.doc	0.6613876
file:///MINF20/repo/project b/generator_manual.doc	0.58430415
file:///MINF20/repo/project d/MAN_21727.doc	0.58430415
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# Influencing the ranking



# Ranking documents with function facets



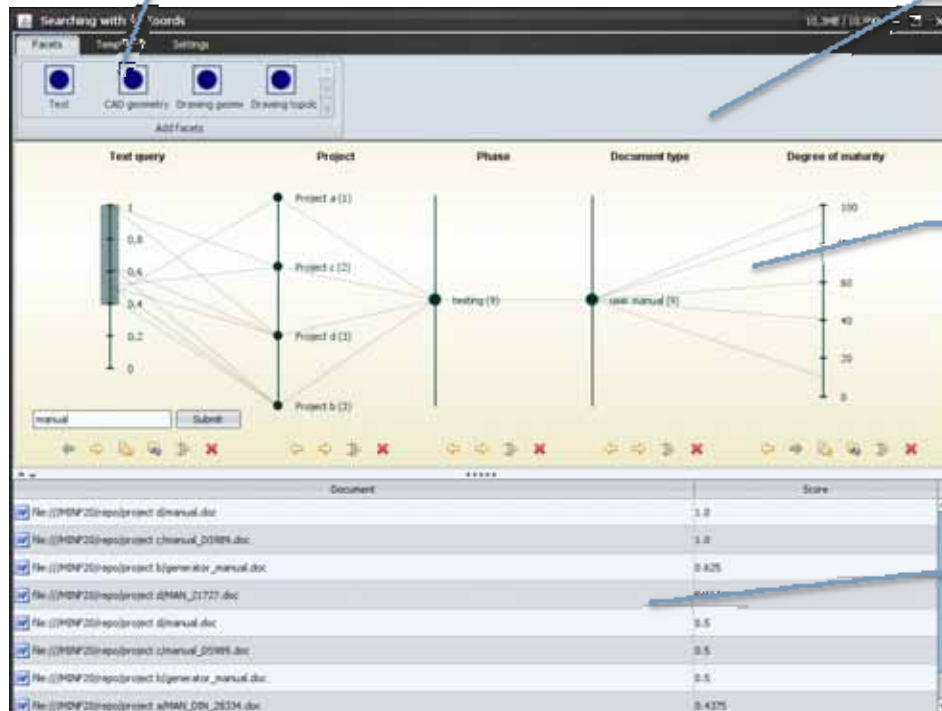
# ... those are the next tasks!

Add template mechanism

Collaborative search  
(Buzzword Web/Enterprise 2.0)

Optimization of facet design

Improving the result view



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**Thanks.**

[raiko.eckstein@uni-bamberg.de](mailto:raiko.eckstein@uni-bamberg.de)

