PROMISE

Participative Research labOratory for Multimedia and Multilingual Information Systems Evaluation

FP7 ICT 2009.4.3, Intelligent Information Management

Deliverable 5.4

Revised Collaborative User Interface Prototype with Annotation Functionalities

Version 1.00, 30 September 2013

SEVENTH FRAMEWORK PROGRAMME

Network of Excellence co-funded by the 7th Framework Program of the European Commission, grant agreement no. 258191

Document Information

Deliverable number	5.4
Deliverable title	Revised Collaborative User Interface Prototype with Annotation Functionalities
Delivery date	30 September 2013
Lead contractor for this deliverable	ROMA1
Author(s)	Marco Angelini, Nicola Ferro, Giuseppe Santucci, Alba García Seco de Herrera
Participant(s)	ROMA1, UNIPD, HES-SO
Workpackage	WP5
Workpackage title	Collaboration and Knowledge Sharing
Workpackage leader	ROMA1
Dissemination Level	PU – Public
Version	1.00
Keywords	FAST Annotation Service, Revised Visual Analytics Environment, Collaboration

History of Versions

Version	Date	Status	Author	Description
0.1	2013-07-25	Draft	UNIPD,HES-SO	First complete draft circulated to partners as documentation for the running annotation service prototype
0.2	2013-08-05	Draft	ROMA1	Integrated documentation about the visual analytics environment
0.3	2013-09-02	Draft	ROMA1	First draft circulated to partners for review
1.0	2013-09-26	Final	ROMA1, UNIPD,HES-SO	Final version after partners feedback

Abstract

This documents describes the revised version of the Promise Visual Analytics Environment, detailing the annotation functionalities, the validation activities and the addressed issues.

Network of Excellence co-funded by the 7th Framework Programme of the European Commission, grant agreement n. 258191

Contents

Executive Summary

One of the major objectives of PROMISE is to design and develop an innovative evaluation infrastructure which: (i) manages and provides access to the data produced during the experimental evaluation of multilingual and multimedia information access systems; (ii) allows for the development of rich applications on top of it. Among the PROMISE components, the user interface plays a key role, allowing for setting up experiments (see, e.g., the successful usage of PROMISE in CHIC 2012, as reported in D4.3 [Berendsen et al., 2012]) and for accessing and analyzing the experimental results. Moreover, it has to provide different means for promoting collaboration and information sharing across users.

Work package 5 ("Collaboration and Knowledge Sharing") is responsible for designing, developing, and delivering the user interfaces and the annotation service needed to promote the collaboration among the stakeholders of the evaluation infrastructure and foster the knowledge sharing and reuse. Moreover, it is responsible for exploring how to apply information visualization and visual analytics techniques to information retrieval experimental data in order to improve their understanding and allow researchers to effectively cope with huge amount of data.

This deliverable focuses on the revised version of the implementation of the PROMISE user interface, highlighting the the annotation functionality (see D5.3 [Angelini et al., 2012] for all the details on the Promise annotation functionality and for a description of the first implementation of the Promise user interface). This deliverable recalls the main concepts of thr PROMISE experimental data structure (D3.2 [Agosti et al., 2011]) and explains its usage in the two analysis strategies currently implemented in the prototype, i.e., per topic analysis and per experiment analysis. Moreover, issues collected during the evaluation activities are described, together with the way in which the new implementation addresses them.

1 Introduction

This document describes the revised version of the PROMISE Visual Analytics component that allows for quick and automated support to the main analysis strategies that are currently adopted by PROMISE's stakeholders. The details presented on the deliverable D3.3 [Agosti et al., 2012] allows for a clear understanding of how the visualizations produced by the Visual Analytics component are managed by the infrastructure: they are treated as "first class objects" and the system saves and retrieves not simple images but all the details behind them: track, run, experimental data, analysis strategy, and image manipulation. Moreover, the annotation service adopts the same architecture of the overall PROMISE infrastructure, described in Section 5 of D3.3. This documents details the implementation of the annotation functionality within the Promise user interface and describes the validation activities that have been carried on the first implementation. Issues have been collected and addressed in the new implementation. It is worth noting that, while people involved in the testing activities belong to the Promise consortium, they have been not involved in the first year requirement analysis and that they used real data coming form the CLEF 2013 conference, namely ImageClef track.

The deliverable is organized as follows: Section 2 describes the Visual Analytics components pointing out the relationship that exists with the annotation component, while the Appendix A contains the user manual that has been used by people testing the environment.

2 The Visual Analytics component

This section reports the functionalities of the Visual Analytics component.

Figure 1 systematizes the visual analytics process that combines automatic and visual analysis methods with a tight coupling through human interaction in order to gain knowledge from data. The figure shows an abstract overview of the different stages (represented through ovals) and their transitions (arrows) in the visual analytics process.
The first step is often to pre-process and transform the data to derive different representations for further exploration (as indicated by the Transformation arrow). Other typical preprocessing tasks include data cleaning, normalization, grouping, or integration of heterogeneous data sources.
After the transformation, the analyst may choose between applying visual or automatic analysis methods. Alternating between visual and automatic methods is characteristic for the visual analytics process and leads to a continuous refinement and verification of preliminary results. User interaction with the visualization is needed to reveal insightful information, for instance by zooming in on different data areas or by considering different visual views on the data. In summary, in the visual analytics process, knowledge can be gained from visualization, automatic analysis, as well as the preceding interactions between visualizations, models, and the human analysts.

According to that, before introducing the analytical process, we quickly recall the structure of the PROMISE data.

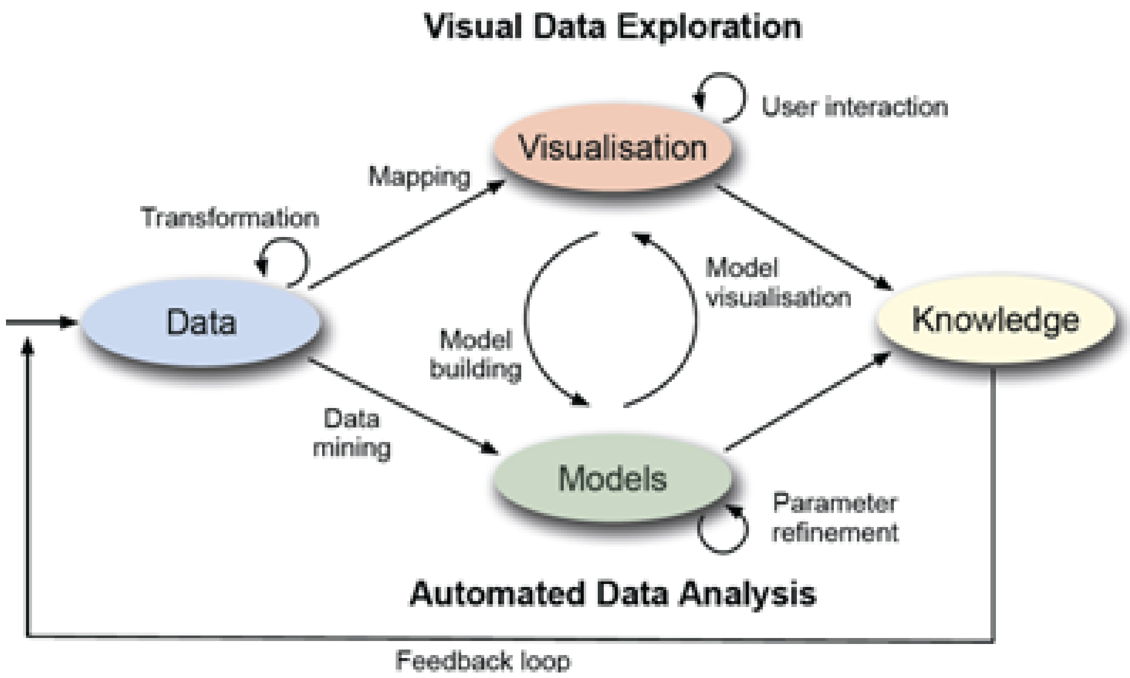


Figure 1: The Visual Analytics process

2.1 PROMISE data

In order to understand how data are organized and displayed it is important to define a typical scenario in which these data are used. In particular, we focus on information retrieval evaluation campaigns. An evaluation campaign is an activity intended to support researchers in information retrieval by providing a large test collection and uniform scoring procedures. Within an evaluation campaign there are many tracks like multimedia, multilingual, text, images, and so on. A track includes, in turn, several tasks. A task is used to define the experiment structure specifying a set of documents, a set of topics, and a relevance assessment. For each task the set of document can be structured defining for example a title, keywords, images, and so on. Some ad-hoc metadata allows for partitioning the set of documents. For example, in the same set we can have European or American documents and a mechanism that allows for choosing only one of these sets. Moreover, it is important to remark that very often in an evaluation campaign the so called closed world assumption holds, which means that the set of documents is finite and known a-priori.
A topic represents an information need. It is structured and its structure can change according to the task at hand. Documents can be assessed as being relevant or not (or more or less relevant) for a given information need (topic). The relevance of a document with respect to a specific topic is independent of the other documents in the collection, based solely on the qualities of that document. In some case we can have different sets of relevance assessment for a set of documents. The relevance assessment can be done manually, automatically, or using online approach like Amazon mechanical Turk.

Having introduced these basic notions we can analyze the PROMISE data. We will refer to data which are stored in the DIRECT system developed by Padua University (see PROMISE Deliverable 3.2 Specification of the evaluation infrastructure based on user requirements, Section 6, for details about accessing such data). These data can be represented by the TME (Topics-Metrics-Experiment) cube shown on Figure 2:

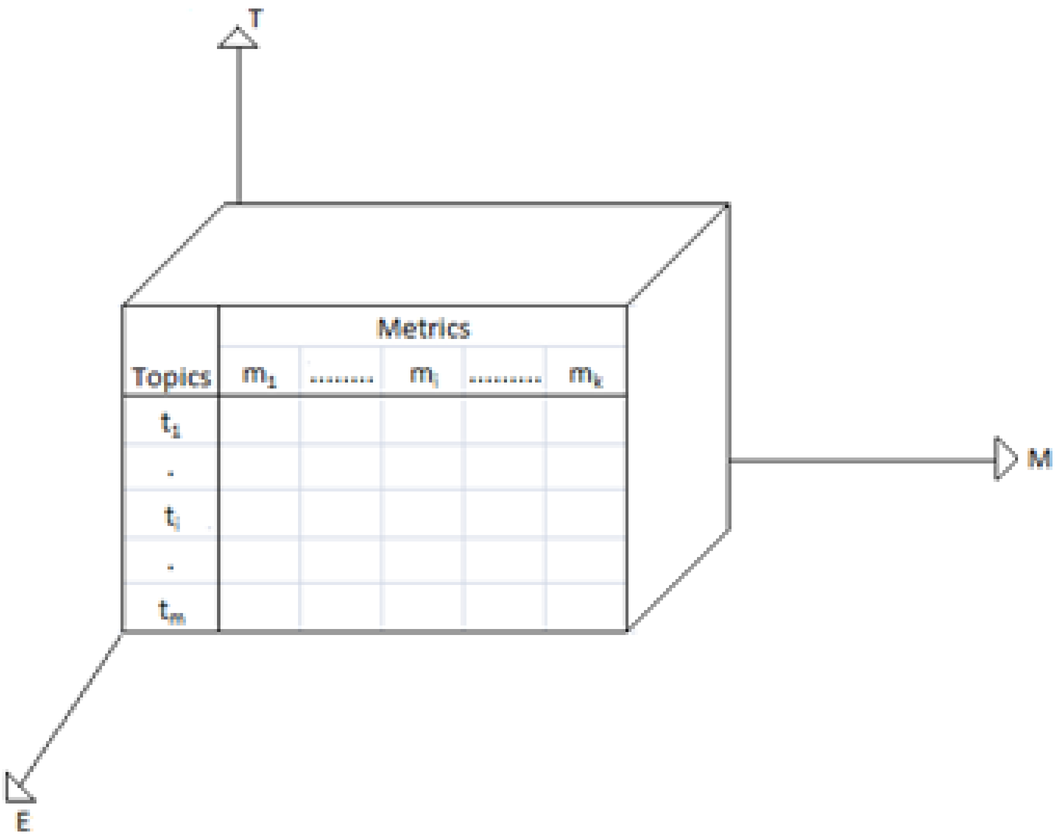


Figure 2: The PROMISE TME Data cube

Starting from this cube, we can aggregate or manipulate data in different ways, according to our needs. In particular we are recall the structure of a TE(m) table, useful in the next sections.

Considering the TME cube we can derive the table shown on Figure 3, useful to analyze a single metric m in terms of topics and experiments. In particular, this table is represented by a matrix T x E where T is the set of topics and E is the set of experiments. In the following we will refer to this kind of tables with the name TE(m) tables (topics x experiments table of metric m). Comparisons are made along rows, to evaluate the behavior of a single topic, or among columns to compare two or more experiments. For the number of topics the same considerations previously discussed hold. The number of experiments depends on how many algorithms are compared.

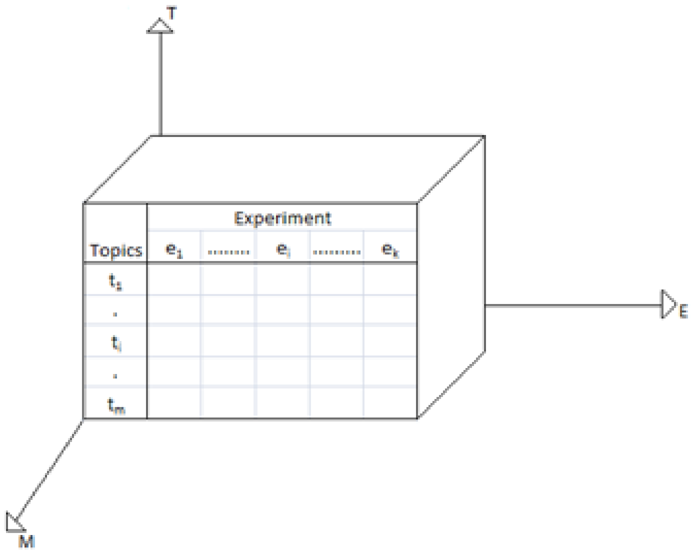


Figure 3: Projecting the TME data cube on the Topics-Experiments axes

To complete our analysis we recall the concept of meta-attribute. A meta-attribute is a categorical attribute that is associated with a cube component (for example the experiments) and it is used to define a further classification of data, with respect to a category. Examples of meta-attributes are: reference track, year, and type of search. Meta-attributes are mainly associated to experiments and documents (see PROMISE Deliverable 3.2 Specification of the evaluation infrastructure based on user requirements), but also topics can have their own meta-attributes (for example the provenance data). Actually there are no meta-attributes defined on metrics. A possible meta-attribute for metrics is the scope of metric, but we will consider this categorization for future developments.

2.2 PROMISE Visual Analytics module architecture

The overall architecture is depicted on Figure 4 and its structure is totally parametric, without any assumption about the data structure (in the most general case it is contained in non-normalized table). Moreover, there are no assumptions about visualizations (it is possible to obtain any kind of visualization), about the mapping between data and visualizations, and about analytical components.
The most general situation is the one in which the system presents the user with multiple visualizations, each of them working on the same set of data. Visualizations are synchronized using two main interaction mechanisms: selection (it is just a way to focus the attention on a subset of data) and the highlighting (it allows for highlighting a part of the displayed data).
In order to produce a visualization, three main steps are, in principle, needed:

1. data extraction from PROMISE database.
2. data manipulation, i.e., deriving new attributes, applying some aggregation operations , applying some analytical algorithms, etc. During such a process the system adds some hidden

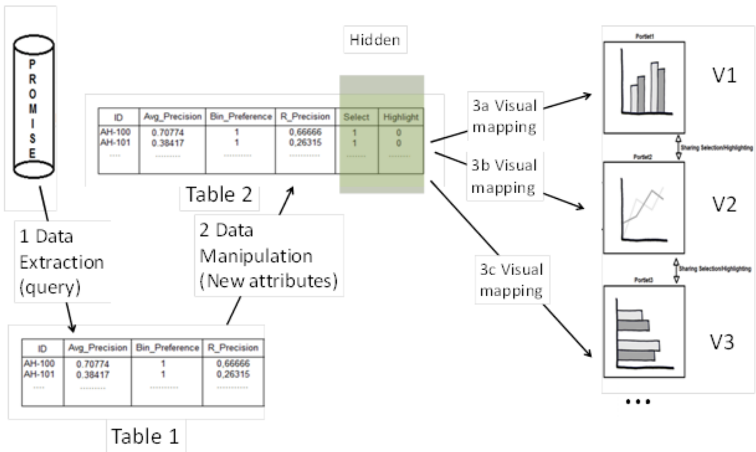


Figure 4: : The PROMISE Visual Analytics architecture

attributes to the data, in order to support the selection and the highlighting mechanisms.

3. Mapping the data obtained from step two on one or more visualizations.

The first two steps are optional: in some cases the system will automatically perform them, allowing the user to focus only on the mapping and analysis activities.

2.3 The Revised Visual Analytics Environment

This section presents the enhancements that has been applied to the Visual Analytics Environment in order to meet the new requirements and issues coming from the validation activity.

The section is structured as follows: a first subsection presents the aggregated results coming from a user evaluation test led by HES-SO to help in validating and refining the Visual Analytics Environment; for each of the highlighted issues the actual corrections applied to the system are described.

The second part, instead, presents a general description of the final version of the Visual Analytics Environment, with particular focus on all the new added functionalities.

2.3.1 User Evaluation Test Results

In this section the results of a user test of the Visual Analytics Environment are presented. The current system has been investigated to identify its strong and weak points, and to give feedback to the developers. The system analysis has been performed by a Ph.D. student, a medical image retrieval expert, from the University of Applied Sciences Western Switzerland (HES-SO). The test raised a series of issues, relatives to both usability and efficacy of the tool; in the following of this section the the outcomes of this work are detailed:

1. **Issue:**"Per-Experiment Analysis at the current state of the system was not available for the ImageCLEFmed data".

textbfSolution: At the time of test, Per-Experiment Analysis was still lacking the relative data processing of ImageCLEFmed task, so, despite the V.A. Environment was ready to analyze the data (the format is common to all the data set), it was impossible to load and analyze that particular data-set. In this final version all the task's data stored into the Database of Direct system can be loaded and explored into the system for both types of analysis.

2. **Issue:**Commands Menu: "This menu allows changing the metric the user wants to apply. The selection of the experiments was not working. Moreover the numerical version of the double-table did not change when a different metric was selected."
   Solution: as a result of a process of integration of a well-known visualization (Analytic table) with a novel added one (Table-Lens) in order to provide the user a new powerful visualization tool, some of the selection menu were accidentally disconnected from one of the version of the table. This bug has been addressed and now the menu selection are totally functional and the changes applied to one of the table version (Analytic Table or Table-Lens) fully translate in the other.

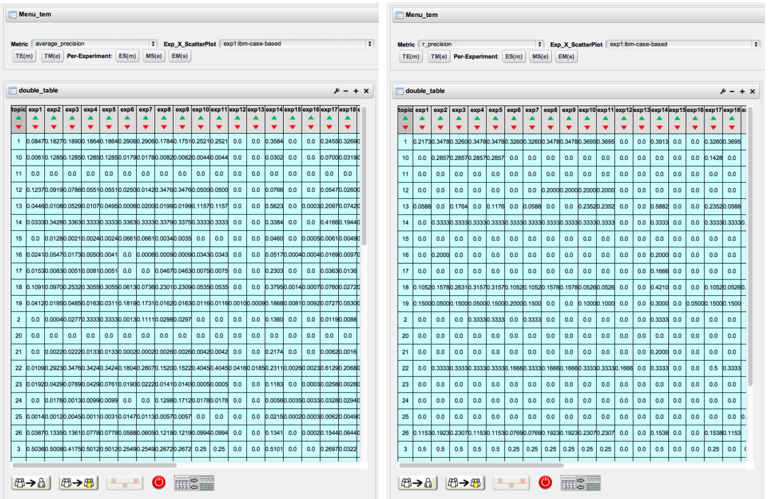


Figure 5: : Analytic table for average precision (left) and for r-precision (right)

3. **Issue:**double-table, "the visualization of this table was not clear".
   Solution: Still not implemented resizability of the visualization, in addition to the high cardinality of experiments of the selected task resulted in poor readable table; this issue has been fixed by transforming the visualizations from fixed size area to scrollable size area, in order to have a minimum area span for each of the cell of the double-table as seen in Figure 6

4. **Issue:** double-table, "the number of topic was not always visible".
   Solution: same bug as the one described above. The same fix resolved both problems.

5. **Issue:** double-table, "red and green arrows did not show intuitive results".
   Solution: The Red and Green arrows present in each of the headers of the table have the

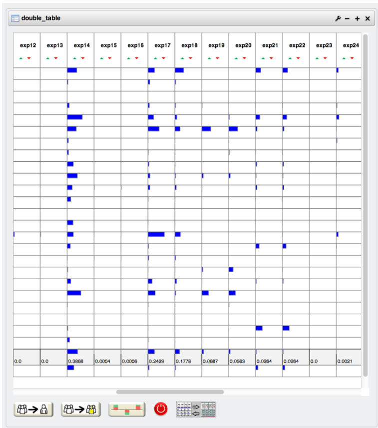


Figure 6: : Example of scrollable double-table

function of ordering the collection under analysis in increasing (green) or decreasing (red) order with respect to the values present in the selected column. To improve readability and comprehensibility of their functions an informative Tool-tip has been added as shown in Figure 7.

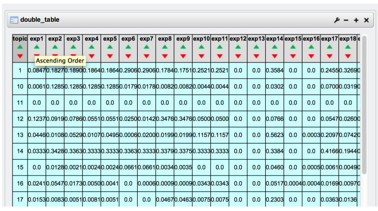


Figure 7: : Informative tool-tip about the functions of green upward arrow

6. **Issue:** double-table, "it was possible to select topics but not experiments".
   Solution: This is a design choice justified by the fact that for each of the two main analysis (Per Topic and Per Experiment) a whole set of rotation of the data involved (Topics-Metrics-Experiments for the former and Statistics-Metrics-Experiments for the latter) are selectable during the analysis. So, by choosing the right rotation the user can interact with the coordinates of analysis preferred. Figure 8 show an example of rotation with fixed experiment (TM(e)).

7. **Issue:** double-table, "when changing the order of the topics in this table, the remaining plots are not changing".
   Solution: Also this is a precise design choice. It was chosen to distinct the ordering functions among different visualizations, in order to maintain some particular insight that is visible in one particular configuration on one of them but not on the other. Moreover, by simply using the "select" button on the set of data chosen will propagate that changes to the other visualizations.

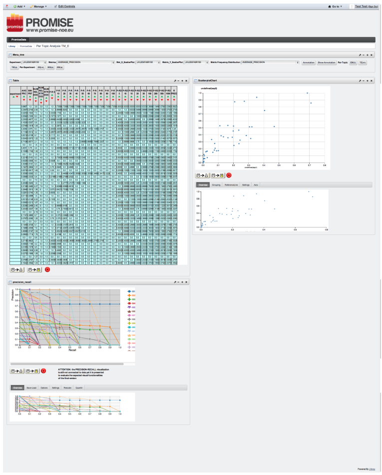


Figure 8: :Example of Per-Topic analysis with fixed experiment

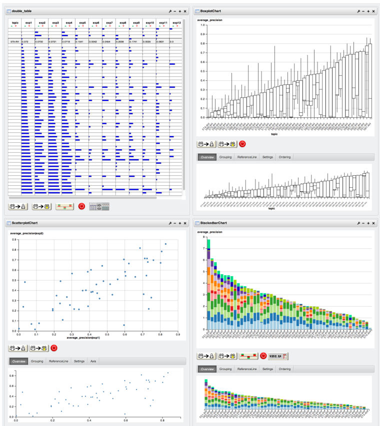


Figure 9: :Example of different ordering functions on different visualizations

8. **Issue:** double-table, "the order of the topics was not intuitive".
   Solution: thanks to the evaluation test was possible to discover this (and others) nasty bug, that appear only when the label of the topic was constituted by simple number (example: 1 instead of 1-AH). This bug was corrected by changing the behaviour of the text ordering function.

9. **Issue:** Box Plot chart, " it was not possible to highlight a topic on the overview table".
   Solution: on the overview tab of context area (in figure 10 the small graphical area that literally represent an overview of the relative main one) is not possible to invoke the operations of selection and highlighting simply because there isn't enough details showed to conduct an analysis, but just an overview of the whole data set after the refinement of the analysis in the focus area.

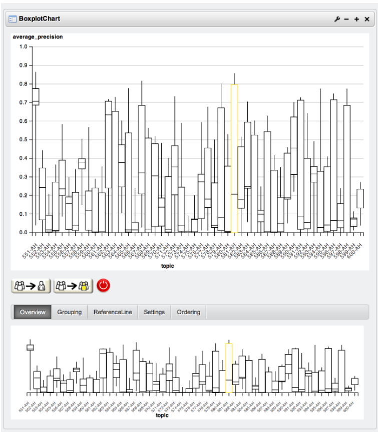


Figure 10: :highlight of a box plot from the focus area, and its replica in context area

10. **Issue:** Box Plot chart, " When a topic was selected, additional information about this topic is shown but this was not the information of the topic selected".
Solution: This bug was caused by a mismatch in the labelling of the topic (in fact the same that caused issue 7). It was identified and resolved in this version of the V.A. Environment.

11. **Issue:** Precision-Recall chart, " only the plot of the first four experiments was visible. It is not possible to do a real comparison across the experiments if not all of them are visible".
Solution: at the time of the test the Precision-Recall visualization was under heavy development revision and was disconnected from data, as explicitly stated in the corpus of the visualization (see Figure 11). In this version of the V.A. Environment it is fully functional and bound to data; its behaviour is fully described in Section 2.5.5.

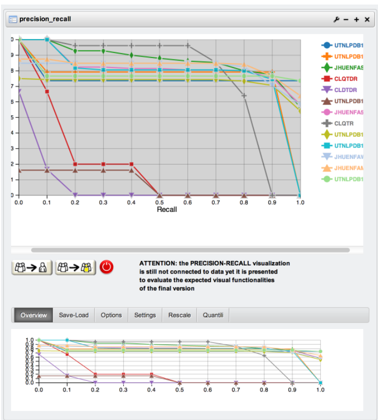


Figure 11: :data bound Precision Recall chart (with still the warning about data of the previous, static, version)

12. **Issue:** Frequency Distribution chart, "The numbering of topics started at topic number zero although topic zero does not exist".

Solution: A naive, yet unforgivable bug simply shifted the enumeration of the topics present in the data-set. This bug has been fixed in this version, as visible in Figure 12.

Figure 12: : right labelling of the topics in the Frequency Distribution chart

13. **Issue:** Frequency Distribution chart, " It was not possible to highlight any element in the graphic even when the button was there".
    Solution: Procedures for selecting and highlighting elements in the Frequency-Distribution-chart has been revised and a new behaviour has been implemented. Now the chart is totally coordinated with the rest of the V.A. Environment, as visible in Figure 13.

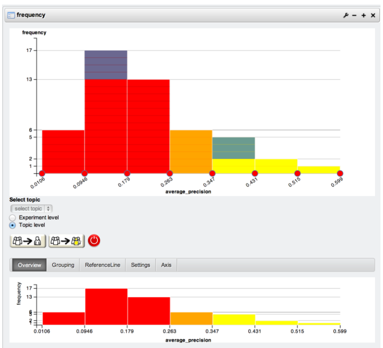


Figure 13: : highlight function called from frequency distribution

14. **Issue:** Frequency Distribution chart, " When a topic was highlighted in another table, as Ďouble tableĬ, this topic was not shown in the frequency graphic".
    Solution: This bug was fixed and now, as stated above, the Frequency-Distribution-chart is totally coordinated with the rest of visualizations.

From the analysis of that list is possible to note the minor and major fixes that has been applied on the revised V.A. Environment. In the next section instead will be presented a more broader description of the whole prototype.

Figure 14: : Topics highlighted in The Frequency Distribution chart as results of propagation from another chart

2.3.2 Revised Visualization Environment

This section describes the finalized layout of the Visual Analytics Environment, encompassing both the fixes described in the previous subsection and new added features.

After the user connects herself to the system, she will be presented with the data loading wizard, that hallows for selecting the data set on which she wants to concentrate her analysis. The old and new version of the wizard are shown in Figure 15: it is visible the restyling on user interface that has been applied: the tree visualization has been completely redesigned in order to better convey the choices made by the user; two useful buttons have been added respectively to completely expand the tree (representing the data hierarchy) or collapse it, in order to facilitate a quick data set selection and to reduce the interaction steps.

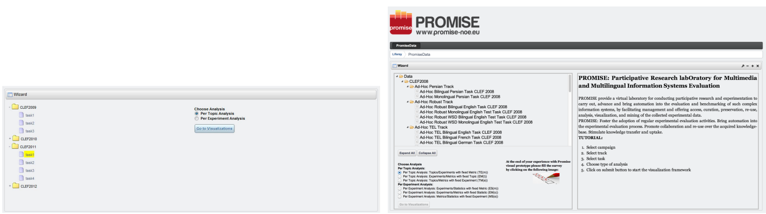


Figure 15: : Old (left) and new (right) version of the wizard

Moreover, a descriptive tab of both the project as a whole and a brief tutorial for interacting with the system has been added in the right panel. Finally, also the choices on the different types of analysis has been expanded and made clearly visible from the start, in order to save an additional user's selection.

As shown in figure 16 the user can choose a task within a track of a campaign and the kind of analysis that he wants to perform. In particular she can choose between six types of analyses; each of them will be fully described in the following.

The wizard home page allows for accessing a set of predefined ways to perform a data analysis similar to those currently used by users of PROMISE community. In particular we focus on two basic

Figure 16: : Selection of the task

approaches: per topic analysis, and per experiment analysis.

- per topic analysis
- per experiment analysis

According to the typical PROMISE analysis tasks, we foresee a set of ad-hoc visualizations. These visualizations must support synchronization and interaction that are specific for each visualization. Moreover, for each visualization it is needed a mapping mechanism in order to support the user in the creation process. From a technical point of view, designing ad-hoc visualizations implies the design of a module for each visualization. If a user wants to use a visualization he has to select the suitable module and to map on it the desired data. As reported in deliverable 5.3, the initial requirement analysis allows for selecting six visualizations: bi-dimensional scatter-plots, bar charts, stacked bar-charts, box plots, table lens, and frequency distributions; With respect to the list just mentioned, in the final version of the environments has been heavily revised the table-lens visualization (now integrated into the new Double-Table Visualization), the frequency distribution (completely overhauled and made more interactive and explorable) and the addition of a novel Visualization, the Precision-Recall-chart, particularly suited for evaluation tasks in Information Retrieval Field. Depending on the chosen type of analysis, the system will present the user with different subset of these visualizations. In the following we will analyze the six basic approaches to data analysis and present a general description of the foreseen visualizations.

2.4 Types of analysis

In this section will be presented the types of analysis that the Visual Analytics environment implements. We have two main categories of analysis, specifically Per-Topic analysis, more focused on the evaluation of the data topic-based, and Per-Experiment analysis, more focused on the results of the single experiments.

For each of them have been provided three categories of sub-analysis, based on the rotation of the relative data cubes (TME and SME) described in section 2.1. Overall this will give a total number of six possible types of analysis:

1. Per topic analysis with fixed experiment
2. Per topic analysis with fixed topic
3. Per topic analysis with fixed metric
4. Per experiment analysis with fixed metric
5. Per experiment analysis with fixed experiment
6. Per experiment analysis with fixed statistic

In the following, for each of them will be provided an accurate description of the functionalities exposed to the user.

2.4.1 Per topic analysis with fixed experiment

In our model, Per topic analysis with fixed experiment means comparing a chosen experiment on each topic and on each metric , in order to obtain a precise and comprehensive analysis of the experiment under examination. Therefore the first step for a user is to choose an experiment *e*. Looking at the data cube TME we can note that choosing an experiment is equivalent to fix an axis and reduce the set of data to the TM(e) table shown on Figure xh.

Per topic analysis with fixed experiment implies a comparison on each topic for the selected experiment, so we foresee to represent topics on x-axis in each available visualization.
Having chosen an experiment *e*, the user has to choose the data to display. This choice corresponds to select a subset of the columns of the TM(e) table and that can be performed either by selection or using meta-attribute. For example, the user can select some participants or some topics. Moreover the user can decide to highlight some elements within the visualizations.
The analysis environment will be composed of Double-table chart, Scatter Plot chart, Precision-Recall chart and Frequency Distribution chart (Figure df).

2.4.2 Per topic analysis with fixed topic

In our model, Per topic analysis with fixed topic means comparing the whole set of experiments on each metric for the selected Topic. Therefore the first step for a user is to choose a topic *t*. Looking at the data cube TME we can note that choosing a topic is equivalent to fix an axis and reduce the set of data to the EM(t) table shown on Figure xh.

Per topic analysis with fixed topic implies a comparison on each experiment for the selected topic, so we foresee to represent experiments on x-axis in each available visualization.

Topics	Experiment				
	e_1	....	e_i	....	e_k
t_1					
.					
t_i					
.					
t_m					

Figure 17: : The TE(m) table

Having chosen a topic *t*, the user has to choose the data to display. This choice corresponds to select a subset of the columns of the EM(t) table and that can be performed either by selection or using meta-attribute. For example, the user can select some participants or some experiments. Moreover the user can decide to highlight some elements within the visualizations.
The analysis environment will be composed of Double-table chart, Scatter Plot chart, Precision-Recall chart and Frequency Distribution chart (Figure df).

2.4.3 Per topic analysis with fixed metric

In our model, Per topic analysis with fixed metric means comparing a set of experiments on each topic with respect to a chosen metric. Therefore the first step for a user is to choose a metric *m*. Looking at the data cube TME we can note that choosing a metric is equivalent to fix an axis and reduce the set of data to the TE(m) table shown on Figure 17.

Per topic analysis implies a comparison on each topic, so we foresee to represent topics on x-axis in each available visualization.
Having chosen a metric *m*, the user has to choose the data to display. This choice corresponds to select a subset of the columns of the TE(m) table and that can be performed either by selection or using meta-attribute. For example, the user can select some participants or some experiments. Moreover the user can decide to highlight some elements within the visualizations.
The analysis environment will be composed of Double-table chart, Box Plot chart, Scatter Plot chart, Stacked bar chart and Frequency Distribution chart (Figure df).

2.4.4 Per experiment analysis with fixed metric

In our model, Per experiment analysis with fixed metric means comparing experiments among them, computing all statistical indicators on a fixed metric , in order to obtain a precise and comprehensive analysis of the experiments under examination. Therefore the first step for a user is to choose a metric *m*. Looking at the data cube SME we can note that choosing an experiment is equivalent to fix an axis and reduce the set of data to the ES(m) table shown on Figure xh.

Per experiment analysis with fixed metric implies a comparison of each experiment for the selected metric, so we foresee to represent experiments on x-axis in each available visualization.
Having chosen a metric *m*, the user has to choose the data to display. This choice corresponds to select a subset of the columns of the ES(m) table and that can be performed either by selection or using meta-attribute. For example, the user can select some participants or some experiments. Moreover the user can decide to highlight some elements within the visualizations.
The analysis environment will be composed of Double-table chart, Box-Plot chart, Scatter Plot chart and Frequency Distribution chart (Figure df).

2.4.5 Per experiment analysis with fixed experiment

In our model, Per experiment analysis with fixed experiment means exploring the results that a fixed experiment awards in term of evaluation metrics and statistical indicators computed on them,in order to obtain a precise and comprehensive analysis of the experiment under examination. Therefore the first step for a user is to choose an experiment *e*. Looking at the data cube SME we can note that choosing an experiment is equivalent to fix an axis and reduce the set of data to the MS(e) table shown on Figure xh.

Per experiment analysis with fixed experiment implies a comparison of results on different metrics and statistical indicators for the chosen experiment, so we foresee to represent metrics on x-axis in each available visualization.
Having chosen an experiment *e*, the user has to choose the data to display. This choice corresponds to select a subset of the columns of the MS(e) table and that can be performed either by selection or using meta-attribute. For example, the user can select some participants or some metrics. Moreover the user can decide to highlight some elements within the visualizations.
The analysis environment will be composed of Double-table chart, Box-Plot chart, Scatter Plot chart and Frequency Distribution chart (Figure df).

2.4.6 Per experiment analysis with fixed statistic

In our model, Per experiment analysis with fixed statistic means exploring the results that the set of experiments awards in term of a fixed statistic value computed for all the evaluation metrics, in order to allow a precise and comprehensive analysis of the experiments under examination. Therefore the first step for a user is to choose a statistic *s*. Looking at the data cube SME we can note that choosing a statistic is equivalent to fix an axis and reduce the set of data to the EM(s) table shown on Figure xh.

Per experiment analysis with fixed statistic implies a comparison of results of experiments on different metrics with respect to a fixed statistical indicator, so we foresee to represent experiments on x-axis in each available visualization.
Having chosen a statistic *s*, the user has to choose the data to display. This choice corresponds to select a subset of the columns of the EM(s) table and that can be performed either by selection

or using meta-attribute. For example, the user can select some participants or some experiments. Moreover the user can decide to highlight some elements within the visualizations.
The analysis environment will be composed of Double-table chart,Box-Plot chart, Scatter Plot chart and Frequency Distribution chart (Figure df).

2.5 Modular visualizations

In this section will be presented the modules that compose the Visual Analytics Environment. An important change applied as a result of the revision process is that all the modular visualization are now auto-adaptive to resolution screen and, in the case in which the area of the screen is not wide and/or long enough to contain the data represented, an automatic procedure will make the visualization scrollable: Example of this behaviour is visible in figure fd and gh.

More in details, six modular visualization has been developed for the Visual Analytics Environment:

1. Double Table chart
2. Box Plot chart
3. Scatter Plot chart
4. Stacked Bar chart
5. Precision-Recall chart
6. Frequency Distribution chart

In the following, for each of them will be provided an accurate description.

2.5.1 Double Table chart

Double-Table chart displays the particular rotation applied to the dataset chosen (e.g: TE(m)) as a table, available in two possible fashion: as a table lens (Figure 18) or as an analytic table (Figure 19):

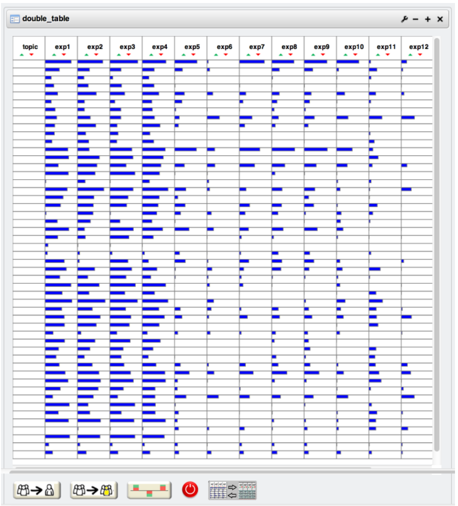
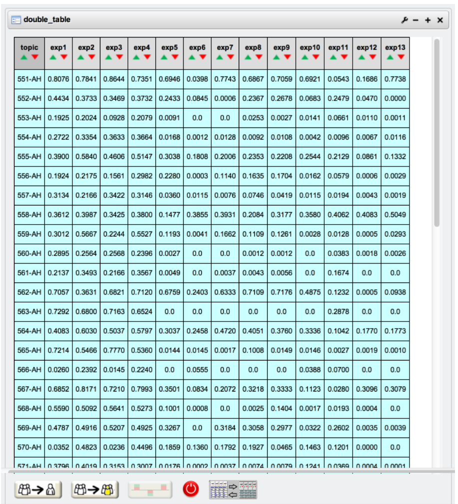


Figure 18: : Double Table mode 1: Table Lens Visualization



topic	exp1	exp2	exp3	exp4	exp5	exp6	exp7	exp8	exp9	exp10	exp11	exp12	exp13
551-AH	0.8076	0.7841	0.8644	0.7351	0.6946	0.0398	0.7743	0.6867	0.7059	0.6921	0.0543	0.1686	0.7738
552-AH	0.4434	0.3733	0.3469	0.3732	0.2433	0.0845	0.0006	0.2367	0.2678	0.0683	0.2479	0.0470	0.0000
553-AH	0.1925	0.2024	0.0928	0.2079	0.0091	0.0	0.0	0.0253	0.0027	0.0141	0.0661	0.0110	0.0011
554-AH	0.2722	0.3354	0.3633	0.3664	0.0168	0.0012	0.0128	0.0092	0.0108	0.0042	0.0096	0.0067	0.0116
555-AH	0.3900	0.5840	0.4606	0.5147	0.3038	0.1808	0.2006	0.2353	0.2208	0.2544	0.2129	0.0861	0.1332
556-AH	0.1924	0.2175	0.1561	0.2982	0.2280	0.0003	0.1140	0.1635	0.1704	0.0162	0.0579	0.0006	0.0029
557-AH	0.3134	0.2166	0.3422	0.3146	0.0360	0.0115	0.0076	0.0746	0.0419	0.0115	0.0194	0.0043	0.0019
558-AH	0.3612	0.3987	0.3425	0.3800	0.1477	0.3855	0.3931	0.2084	0.3177	0.3580	0.4062	0.4083	0.5049
559-AH	0.3012	0.5667	0.2244	0.5527	0.1193	0.0041	0.1662	0.1109	0.1261	0.0028	0.0128	0.0005	0.0293
560-AH	0.2895	0.2564	0.2568	0.2396	0.0027	0.0	0.0	0.0012	0.0012	0.0	0.0383	0.0018	0.0026
561-AH	0.2137	0.3493	0.2166	0.3567	0.0049	0.0	0.0037	0.0043	0.0056	0.0	0.1674	0.0	0.0
562-AH	0.7057	0.3631	0.6821	0.7120	0.6759	0.2403	0.6333	0.7109	0.7176	0.4875	0.1232	0.0005	0.0938
563-AH	0.7292	0.6800	0.7163	0.6524	0.0	0.0	0.0	0.0	0.0	0.0	0.2878	0.0	0.0
564-AH	0.4083	0.6030	0.5037	0.5797	0.3037	0.2458	0.4720	0.4051	0.3760	0.3336	0.1042	0.1770	0.1773
565-AH	0.7214	0.5466	0.7770	0.5360	0.0144	0.0145	0.0017	0.1008	0.0149	0.0146	0.0027	0.0019	0.0010
566-AH	0.0260	0.2392	0.0145	0.2240	0.0	0.0555	0.0	0.0	0.0	0.0388	0.0700	0.0	0.0
567-AH	0.6852	0.8171	0.7210	0.7993	0.3501	0.0834	0.2072	0.3218	0.3333	0.1123	0.0280	0.3096	0.3079
568-AH	0.5590	0.5092	0.5641	0.5273	0.1001	0.0008	0.0	0.0025	0.1404	0.0017	0.0193	0.0004	0.0
569-AH	0.4787	0.4916	0.5207	0.4925	0.3267	0.0	0.3184	0.3058	0.2977	0.0322	0.2602	0.0035	0.0039
570-AH	0.0352	0.4823	0.0236	0.4496	0.1859	0.1360	0.1792	0.1927	0.0465	0.1463	0.1201	0.0000	0.0
571-AH	0.3796	0.4019	0.3153	0.3007	0.0176	0.0002	0.0037	0.0074	0.0079	0.1241	0.0369	0.0004	0.0001

Figure 19: : Double Table mode 1: analytic Table Visualization

The former follow a formalism well known in Information Visualization, and it is particularly useful when coping with data with high cardinality. It presents the user with a table composed by various graphical cells, each of them comprehending an horizontal bar, which length is proportional to the numerical value assigned to that cell. When the user perform a mouseover on one of the rows the numerical values will be shown on a now magnified area, as visible in Figure 20.

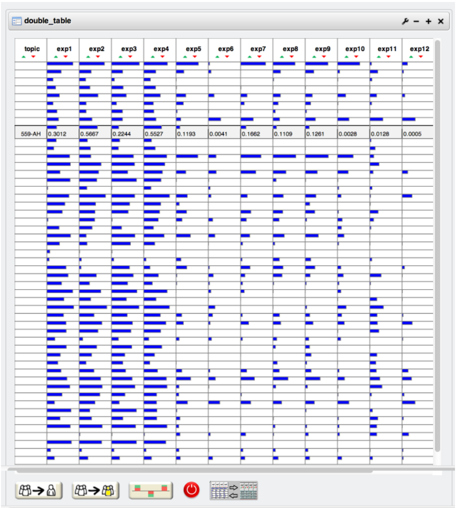


Figure 20: : magnification of the area of the table on a mouseover

In that way, it is possible to quickly have an insights on the trend of data, without losing precision in the analysis,also for tables with a lot of tuples (in the hundreds or thousands of tuples) for which the use of a classic numerical table will be impracticable. Moreover, it can be useful for executing a first reduction (by selection) of the data, and when the user is happy with the remaining tuples she can switch the visualization to the traditionally analytic table; this operation is possible by clicking on the button highlighted in figure 21 in order to analyze more in detail the subset of data the user is interested in.

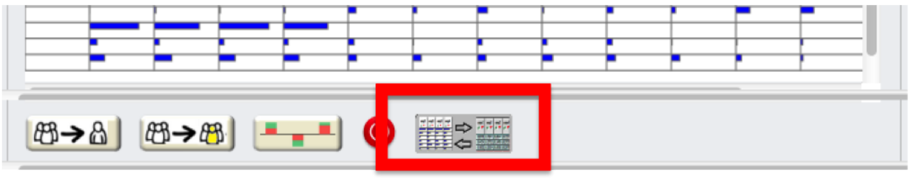


Figure 21: : change table mode button

By clicking on the red or green arrows positioned under each column header it is possible to order the tuples constituting the table respectively in ascending (green) and descending (red) order: this can facilitate the analysis of the results with respect to a single coordinate (that can be, depending on the rotation of data, a metric, an experiment or a topic). This behaviour is visible in Figure 22.

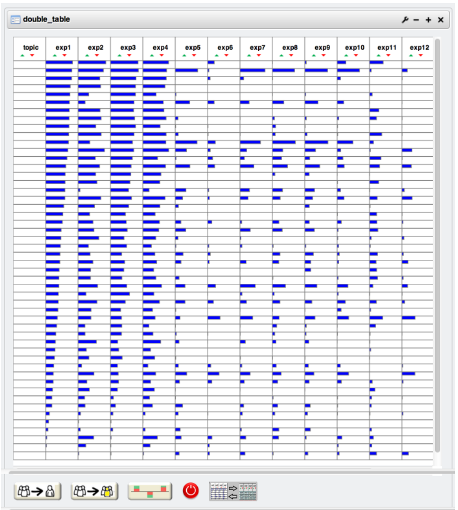


Figure 22: : descending order displayed for exp1 by clicking on the corresponding red descending arrow

It is important to note that the two modalities of visualization of the table shares the same status, letting the user to switch between them without losing all the work of refinement of the analysis, as Figure ad demonstrate. About analytic table representation, it maintains all the characteristics described in the deliverable 5.3.

2.5.2 Box Plot chart

Box Plot chart displays an aggregated visualization of values that each topic/experiment (depending on type of analysis) reached with respect to the chosen metric (rows of TE(m). Taking by example the Per topic analysis with fixed metric, a box plot chart is used to evaluate the trend of a topic among experiments with respect to a chosen metric; it will presents a box plot for each topic on x-axis and the chosen metric on y-axis (Figure 23).

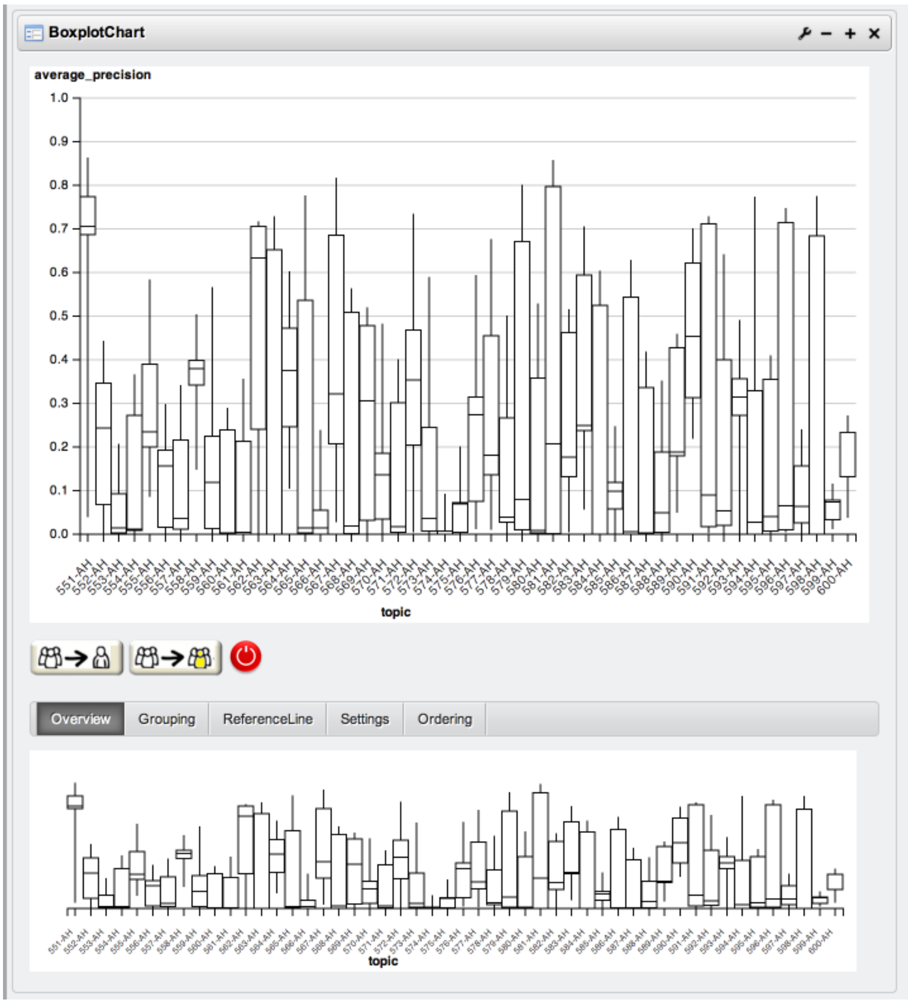


Figure 23: : Box Plot chart visualization

By applying a mouseover on one of the box plot a tool-tip will be shown with the values of the principal points constituting the box plot (upper limit, upper quartile, median, lower quartile,lower limit) in order to better contextualize the results. In this visualization is present also a tabular menu with the following functions:

- **Overview:** display the context visualization, a smaller representation of the chart that displays the whole data set (in contrast with the Focus area, that can display also a smaller portion of the data under investigation)(Figure 24.

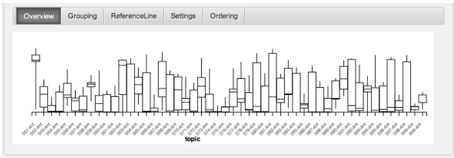


Figure 24: : Box Plot chart: overview

- **Grouping:** presents the grouping functions (a way to create different groups of data based on a common characteristic), specifically grouping by Adjacency and/or by color (Figure 25.

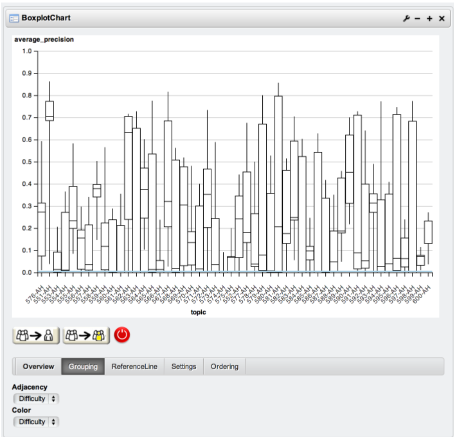


Figure 25: : Box Plot chart: grouping

- **Reference Lines:** presents a series of reference values displayed as lines into the graph; specifically, they represent minimum, mean and maximum values of the data represented, as visible in Figure 26.

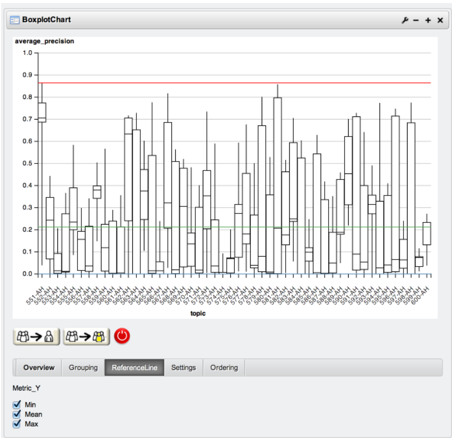


Figure 26: : Box Plot chart: reference lines

- **Settings:** the settings menu allows to select or deselect the reference grid lines in the visualization, in order to help the user to visually identify the range in which a box plot is contained (Figure 27).

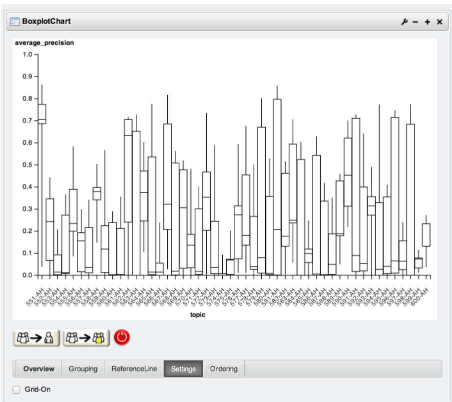


Figure 27: : Box Plot chart: settings

- **Ordering:** presents the possible ordering functions on the data. specifically, it is possible to order the Box Plot by alphabetical, upper quartile and lower quartile orders, and in each case by both ascending and descending order. Results are visible in Figure 28.

Network of Excellence co-funded by the 7th Framework Programme of the European Commission, grant agreement n. 258191

Figure 28: : Box Plot chart: ascending order on upper quartile (left) and descending order on lower quartile (right)

2.5.3 Scatter Plot chart

Scatter-plot chart is used to compare two elements of the same family (experiments/topics/metrics based on the type of analysis chosen) in order to find correlation. Each value is represented by a point.if we consider Per topic analysis with fixed metric, for each topic there are as many points on y-axis as the selected TE(m) columns. To see the trend of a single experiment (a column) you can unify its points with a poly-line. To highlight some point it is possible to use color or markers. Also in this case, by hovering the mouse on one of the points displayed, a tool-tip will presents details about the data represented (usually the values, with respect to the selected metric, of the experiments correlated on the selected topic).

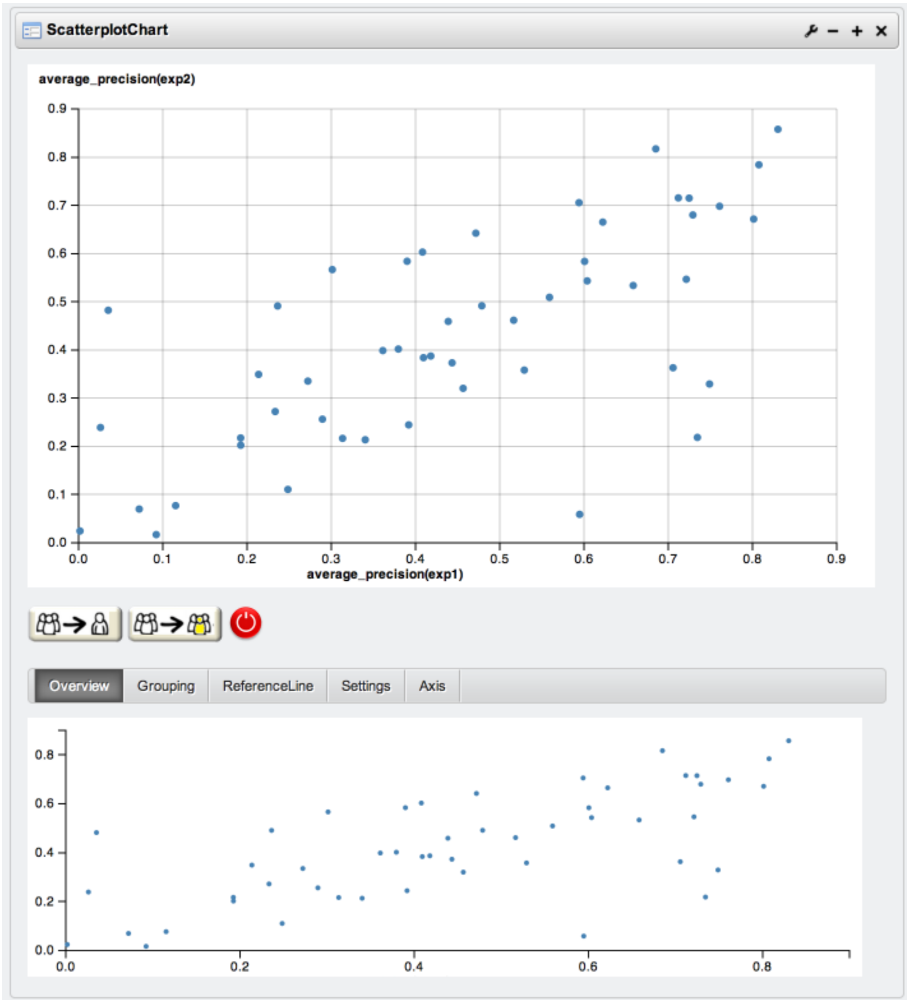


Figure 29: : Scatter plot chart visualization

In this visualization is present also a tabular menu with the following functions:

- **Overview:** display the context visualization, a smaller representation of the chart that displays the whole data set (in contrast with the Focus area, that can display also a smaller portion of the data under investigation (Figure 30).

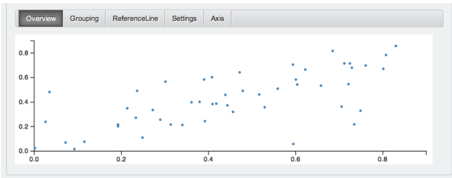


Figure 30: : Scatter plot chart: overview

- **Grouping:** presents the grouping functions (a way to create different groups of data based on a common characteristic), specifically grouping by shape (different shapes assigned to points belonging to different groups) and grouping by color. These functions can be combined (Figure 31).

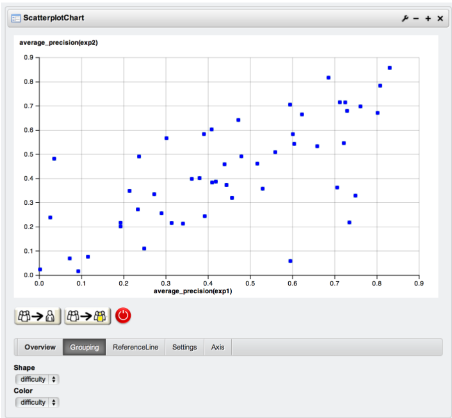


Figure 31: : Scatter plot chart: grouping

- **Reference Lines:** presents a series of reference values displayed as lines into the graph; specifically, they represent minimum, mean and maximum values of the data represented, as visible in Figure 32.

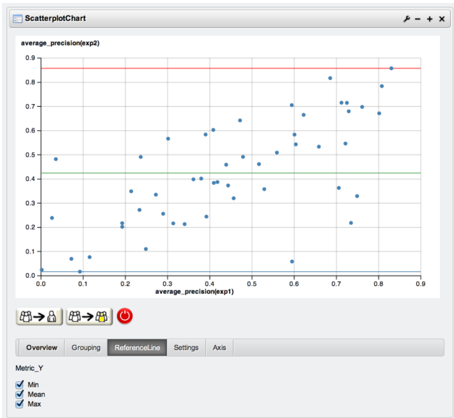


Figure 32: : Scatter plot chart: reference lines

- **Settings:** the settings menu allows to select or deselect the reference grid lines in the visualization, in order to help the user to visually identify the range in which a box plot is contained (Figure 33).

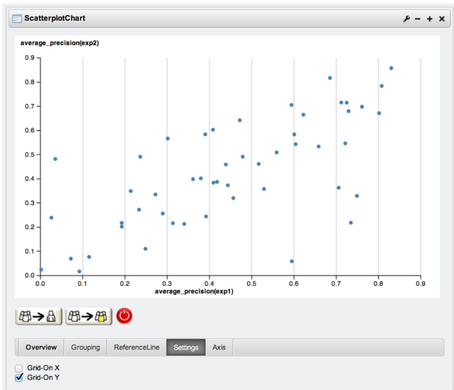


Figure 33: : Scatter plot chart: settings

- **Axis:** presents the possible assignment of the data to the different axes of the chart. While these assignments work locally (they change only the Scatter Plot without propagation of the choice to other visualizations), in the main command menu exists a similar function that propagates the assignment globally (Figure 34).

2.5.4 Stacked Bar chart

A stacked bar chart can be used to compare two or more experiments/topics (based on the type of analysis chosen) with respect to a chosen metric. Although it is possible to compare more than two experiments/topics, as the number of experiments (topics) increases the chart representation loses

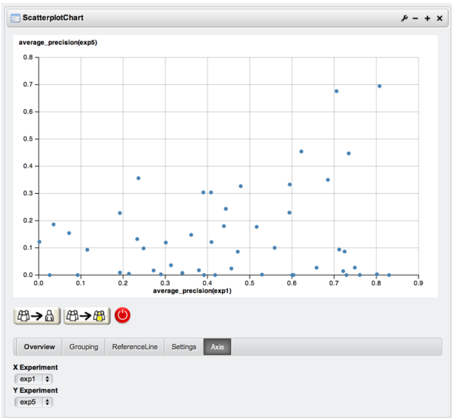


Figure 34: : Scatter plot chart: axis

clarity. Possible comparisons are two algorithm of the same participant or the best algorithm of two different participants (Figure 35).

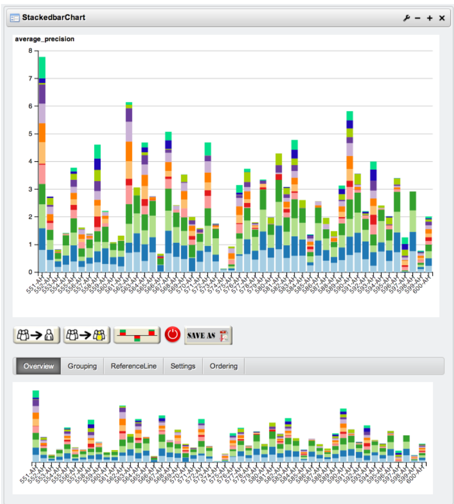


Figure 35: : Stacked bar chart visualization

A different color, chosen by a metric of maximum perceived distance, is assigned to each of the data representation (a bar), in order to convey to the user the different contribution of the experiments with respect to the evaluated topic. By selecting the button in Figure 36 is possible to change the visualization from the plain stacked bar visualization to a differential stacked bar visualization, where the bars are represented by their difference with the mean value (mean-deviation (Figure 37).

Figure 36: : button for activating/deactivating mean-deviation mode

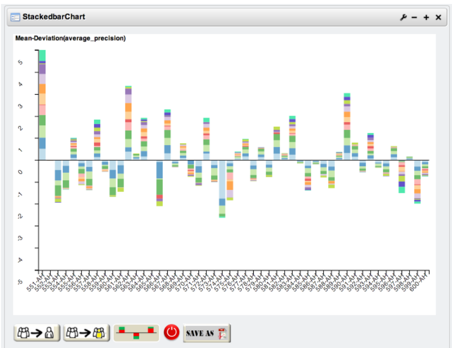


Figure 37: : Stacked bar chart in mean-deviation mode

Also in this case an informative tool-tip is activated after a mouse-over on one of the bars: like all previous case, the tool-tip will be scrollable with respect to the cardinality of data represented. In this visualization is present also a tabular menu with the following functions:

- **Overview:** display the context visualization, a smaller representation of the chart that displays the whole data set (in contrast with the Focus area, that can display also a smaller portion of the data under investigation)(Figure 38).

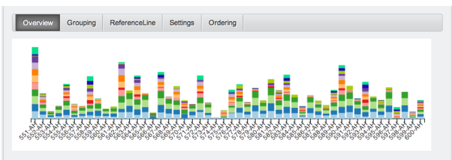


Figure 38: : Stacked bar chart: overview

- **Grouping:** presents the grouping functions (a way to create different groups of data based on a common characteristic), specifically grouping by adjacency and grouping by color. These functions can be combined (Figure 39).

Figure 39: : Stacked bar chart: grouping

- **Reference Lines:** presents a series of reference values displayed as lines into the graph; specifically, they represent minimum, mean and maximum values of the data represented, as visible in Figure 40.

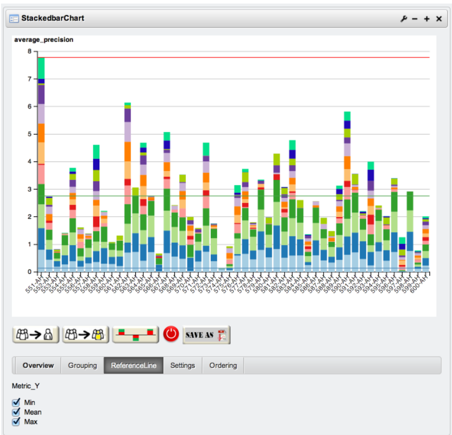


Figure 40: : Stacked bar chart: reference lines

- **Settings:** the settings menu allows to select or deselect the grid lines in the visualization, in order to help the user to visually identify the range in which a box plot is contained. Moreover, an additional function allow the user to change the visualization paradigm from Stacked bars to aligned bars: this additional visualization will help to understand better the ratio among different data contributions related to the same stacked bar (Figure 41).

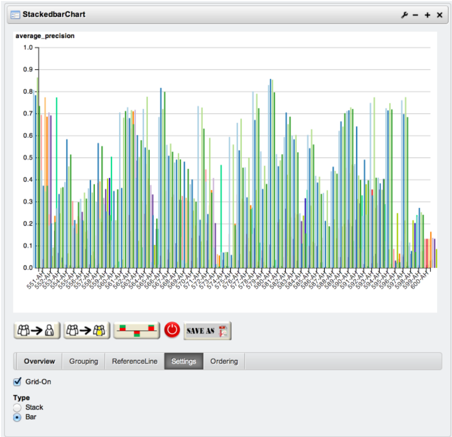


Figure 41: : Stacked bar chart: settings

- **Ordering:** the ordering menu allow for apply an order to the data set investigated based on alphabetical ordering or selected evaluation metric. results from the latter can be seen in Figure 42.

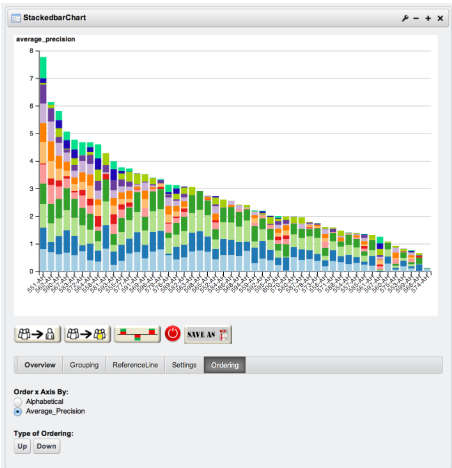


Figure 42: : Stacked bar chart: ordering

2.5.5 Precision-Recall chart

Precision-Recall chart is a totally new visualization designed during the project development and finalized in the revision process of the Visual Analytics Environment. The information it conveys is central in an IR systems evaluation activity; the general layout of this chart is visible in Figure 43.

Following the general conceptual schema of the other charts, the focus area represents the main visualization, where data set reduction can occurs, while the context area provides a summary view of the whole process. Precision-Recall chart can be applied in both Per topic analysis with fixed topic

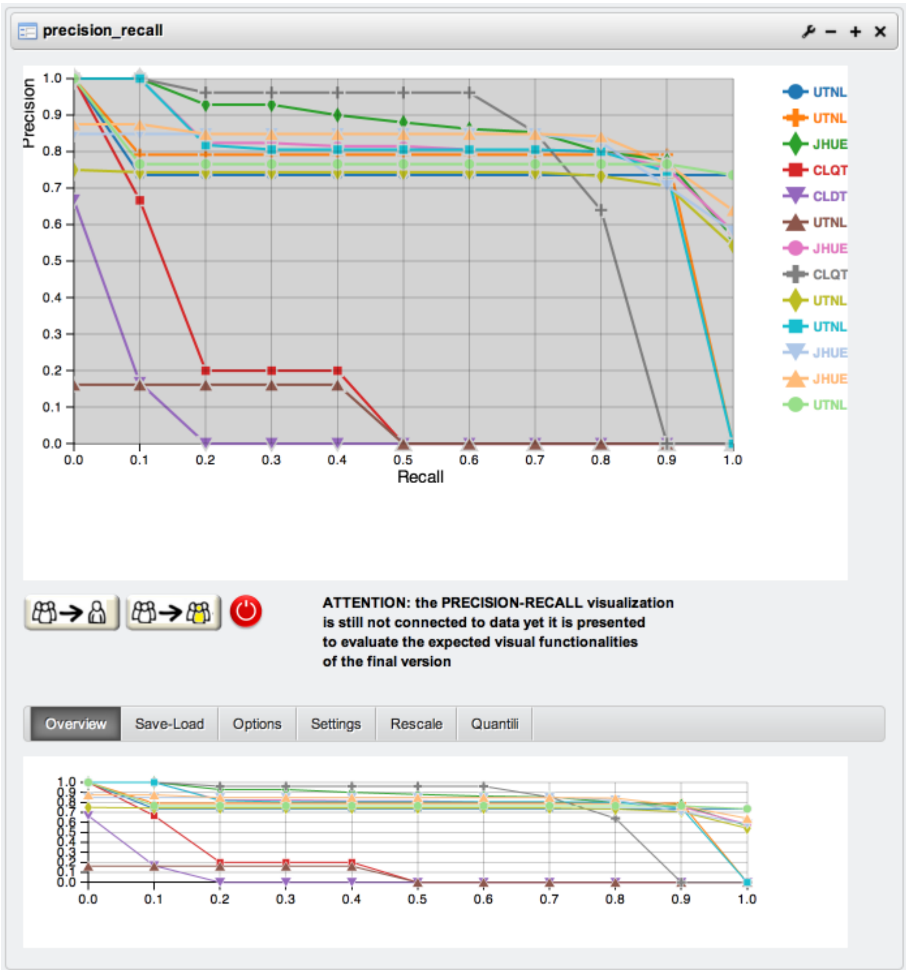


Figure 43: : Precision-Recall chart visualization

and Per topic analysis with fixed experiment: the curves plotted represents, for the former case, the trends of the interpolated precision-recall curve for all the different experiments with respect to a fixed topic; for the latter, instead, it represents the trends of the interpolated precision-recall curve for a single experiment with respect to all the topics. By hovering the mouse on the level of recall it is possible to show the related values of precision (Figure 44).

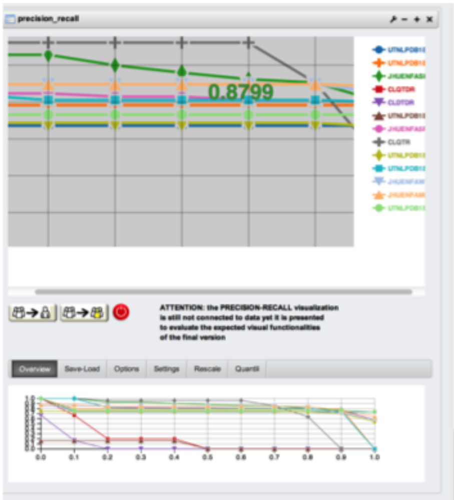


Figure 44: : Precision-Recall chart: example of zoom function with value based tool-tip

Moreover, the focus area is completely zoom-able in order to concentrate attention on just a portion of the chart and/or for improve readability of the visualization in crowded situation (many curves on the screen at the same time) (Figure 44).

A different zoom, that resize the whole graph or a portion of it with respect to the new area selected, is activated by shaping an area in the context overview (Figure 49).

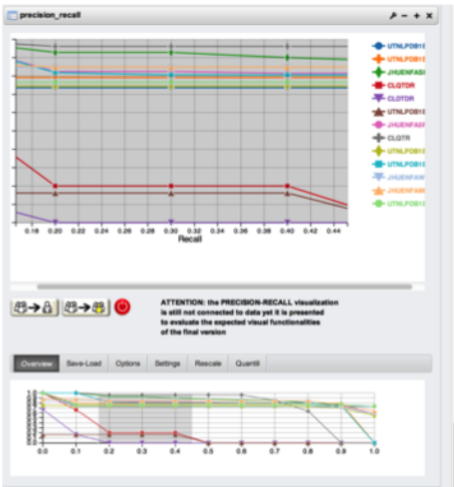


Figure 45: : Precision-Recall chart: zoom in focus area triggered by area selection in context area

By clicking on the list of experiments/topics represented on the right part of the visualization is possible to select/deselect them from the focus area. In this visualization is also present a tabular menu with the following functions:

- **Overview:** display the context visualization, a smaller representation of the chart that displays the whole data set (in contrast with the Focus area, that can display also a smaller portion of the data under investigation).

Figure 46: : Precision-Recall chart: overview

- **Options:** presents the ability to plot two additional curves family in the graph: the *F-measure*, another well known IR evaluation metric, for the data set loaded, and the *E-measure*, with the possibility to explore different solutions in order to set manually the appropriate coefficient for the function. (Figure 47 shows an example of *F-measure* visualization).

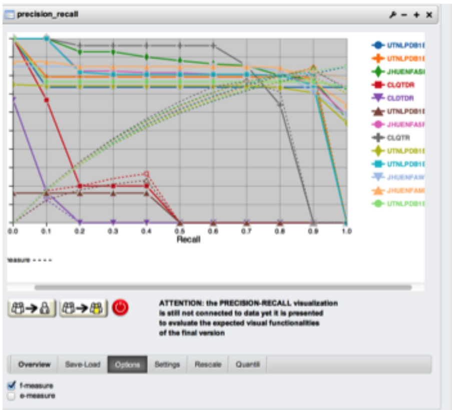


Figure 47: : Precision-Recall chart: options

- **Settings:** this tab exposes the functionality for changing the theme color of the visualization (from right themes to more dark ones) in order to better suit the look& feel of the visualization. An example is visible in Figure 48.

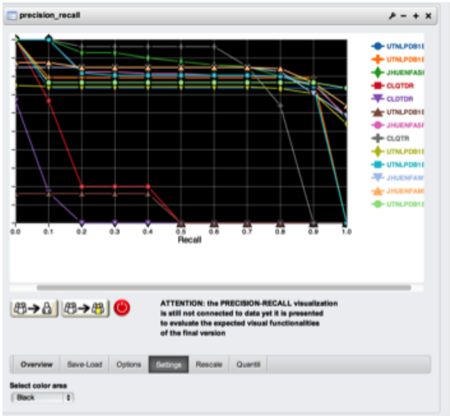


Figure 48: : Precision-Recall chart: settings

- **Rescale:** this menu allow to manually select the rescale factor of the visualization, in order to adjust the graph to the selected dimensions.

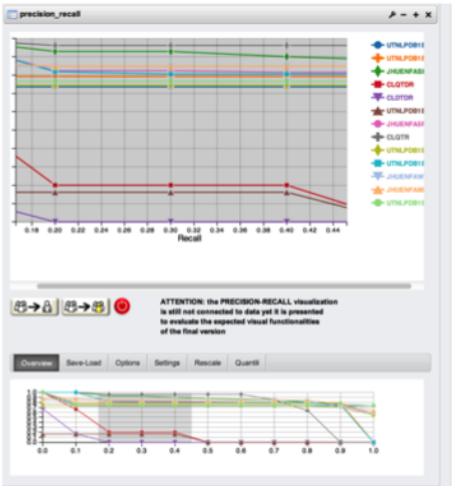


Figure 49: : Precision-Recall chart: zoom in focus area triggered by area selection in context area

- **Quantiles:** this menu allow to switch the visualization from the punctual view of the different curves represented, to an aggregated visualization of the data set, with the trends aggregated in 3 areas of quality (*bad*, in red color, *medium*, in blue color, and *good*, in green color) with respect to a quality metric based on the distribution of points in the area. This particular visualization will help the user in situation in which a large number of curves is drawn (like in Figure tf, with more than 40 curves...), with the ability, by simply clicking on one of the areas, to display its belongings curves. Figure tr shows an examples for the selection of green area (best curves).

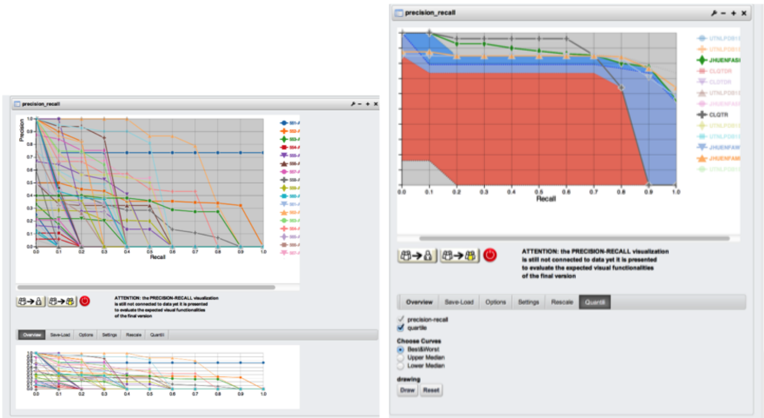


Figure 50: : Precision-Recall chart: high number of curves represented (left) and quantiles representation and selection (right)

A list of fixed choice is present, in order to provides short-cuts to most commonly used functions (best curves, worst curves, single quantiles). Moreover, an additional menu allow the expert user to change the parameters of the evaluation function, in order to better suits the aggregated results to the investigated data.

2.5.6 Frequency Distribution chart

This chart is the result of a complete revision of a previous implemented frequency distribution chart, with the goal of making the visual analysis broader and more interactive (Figure 51).

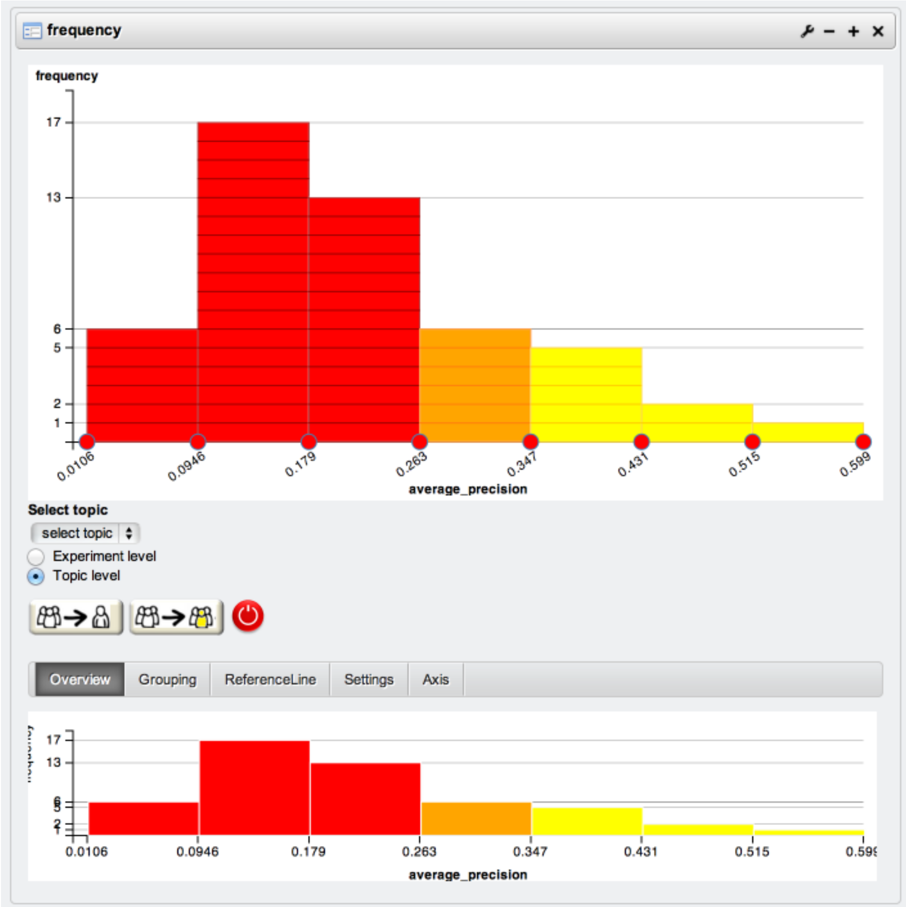


Figure 51: : Frequency distribution chart

The user is presented with a frequency distribution of experiments with respect to a fixed topic and metric in the EM(t) analysis and aggregated by topics with respect to a fixed metric in the TE(m) analysis. In this respect, each of the bins represented is partitioned in the number of experiments/-topics that constitute the bin, and by simply hover the mouse on one of the bins the user will get precise analytical information on the relative data (Figure 52).

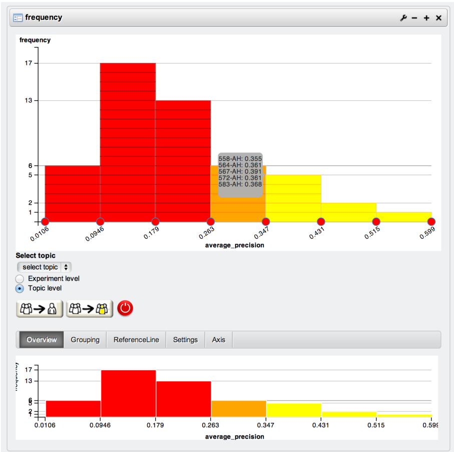


Figure 52: : Frequency distribution chart: detail of the topic constituting the selected bin

The initial choice on the number and extension of the bins is set by default as the result of Sturges Law; (however, by simply dragging the red circles that delimits each bin the user will be able to change the extension of the bin itself, even making it disappear and so reducing the number of bin of the distribution (as visible in Figure 53);

Figure 53: : Frequency distribution chart: with respect with the previous figure, the orange bin is now the result of the merge with the previous orange one with the adjacent yellow bin; on the bottom is visible the new "blue" circle for reverting the operation

Clearly this process is always reversible, by simply clicking on the now present blue circle that will regain the user the control of the extension of the disappeared bin (Figure 53). The color coding assigned to the distribution (ranging from deep red to light green) allows for immediate judge on the results obtained by the investigated experiment/topic with respect to the chosen metric. A series of additional functionality is presented in the contextual menu:

- **Overview:** display the context visualization, a smaller representation of the chart that displays the whole data set (in contrast with the Focus area, that can display also a smaller portion of the data under investigation).

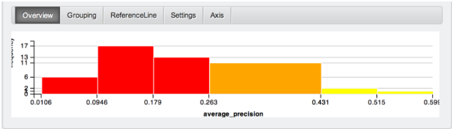


Figure 54: : Frequency distribution chart: overview

- **Settings:** In this tab are present the main manipulation functionalities of the frequency distribution chart:

  1. **Domain characteristics:** this command allow for selecting the whole domain of data (due to metrics being normalized, it usually ranges in the interval $[0, 1]$); Otherwise, a box will be presented for manually select the range of domain chosen by the user.
  2. **Bin characteristics:** this command allow for selecting the initial distribution of the bin: if "uniform" is chosen, as is by default, the Sturges law will be used. Otherwise, the user is asked to specify the number of bin preferred and optionally the preferred extension of each of them (Figure 55).

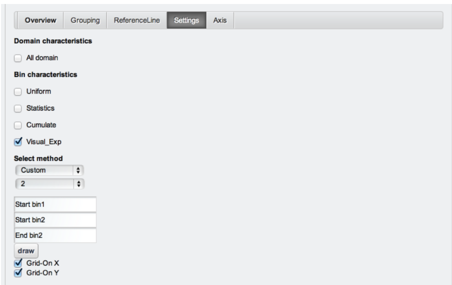


Figure 55: : Frequency distribution chart: case of 2 custom bins

  3. **Alternative views:** this command allow for displaying different distribution inferred from the initial one; in details, *"Statistics"* overlap the distribution with some statistical indicator (e.g.mean value, median,..) as shown if Figure 56 (left). *Cumulate* computes and displays the cumulated frequency distribution for each interval, resulting in a trend line that can be easily compared to other data set previously loaded (Figure 56 (center)). Finally, *"Visual Exp"* , available only for TE(m) analysis, presents an aggregated view in which each of the Topics is decomposed and over impressed with all the experiment's results tested against it, in order to show what experiments contribute the most to the final evaluation of the topic and what instead diverge from that. an example is shown in Figure 56 (right). Hovering the mouse on the distribution of experiments allow to display in the top-right corner the label of the topic, the label of the experiment selected and the numerical scoring value, each of them in the related color coding.

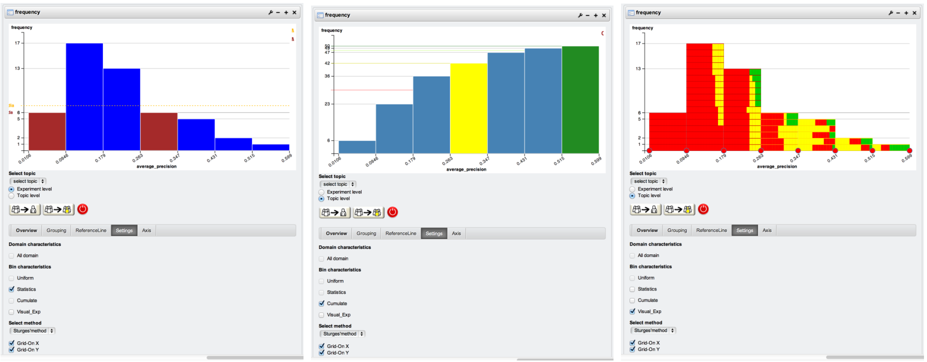


Figure 56: : Frequency distribution chart: statistical (left), cumulated (center) and with additional ranked Experiments evaluation (right)

4. **Grid lines:** as in other charts, this command allow to display the reference levels on y-axis, in order to quickly understand the numerical values reached by each bin of the distribution.

2.6 Coordination functionalities of the Visual Analytics Environment

The analysis environment, regardless the different analysis strategies described in the previous section, provide users with the following set of functionalities:

1. interaction functionalities
    - manipulation
    - layout editing
    - reference lines
2. annotations and saving

Manipulation features are those interactions that changes the set of displayed data(i.e. semantic of visualization). In particular belong to manipulations selection, highlighting, and reset.

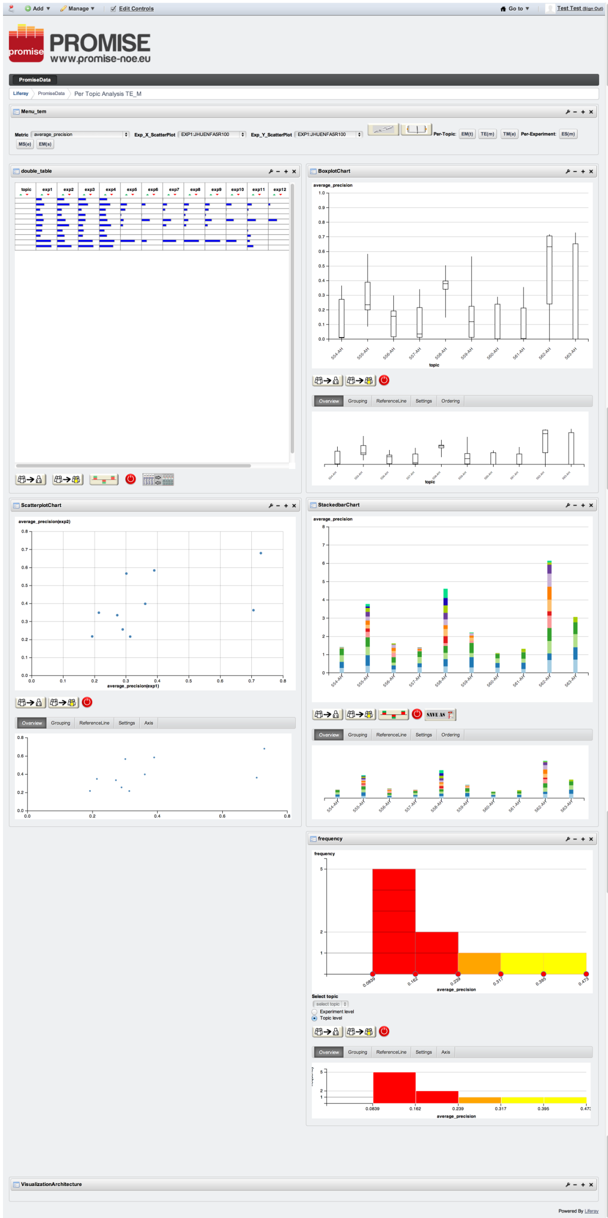


Figure 57: manipulation operation: Select

In Figure 57 is shown the implementation of the aforementioned manipulations. The user is capable of picking, from any of the different visualizations displayed, a set of relevant element for his goals: after the picking phase, the simple pressure of one of the contextual buttons will start one of the operations:

- Selection, that will display in the main focus area only the element picked (Figure57 shows an example on per topic analysis with fixed metric).
- Highlight, that will give emphasis on the elements picked and will put in background the remaining, for pointing at particular facts of interest (Figure 58 shows an example on per topic analysis with fixed topic).

Figure 58: manipulation operation: Highlight

- Reset, that will return the visualizations to their original state, not taking into account any of the effects of previous manipulations

In any case, a practical overview of the whole set of data visualized will always be available just below the main one, in order for the user to don't become lost in his analysis.

On a final note, we want to highlight two important features of this prototype: the first one is that all the visualizations supported are coordinated among them: that means that all the operations of manipulation,layout editing and reference lines will have effects on both the actual visualizations and all the other linked. The second one is that, having implemented each single visualizations like a portlet, we have obtained a very flexible and expandable environment where new visualizations can be easily added and synchronized with the existing one, and the layout can be easily adjusted to the needs of the user, as was the case with Precision-Recall and Frequency Distribution charts.

2.6.1 Annotations and saving

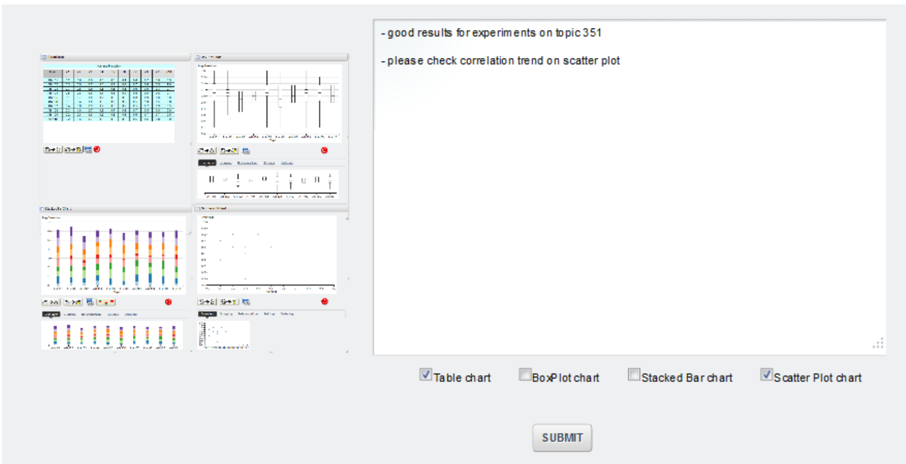


Figure 59: adding annotation to a visualization

Following the feedback received and the first version of the annotations system (described in deliverable 5.3), here is discussed the final version of the annotations management system. After the user has made reason about the data that are visualized in the different charts available, he may want to add permanent annotations for future referencing and/or to collaborate with other users in the developing of the particular insights that he has discovered.
Differently from what was happening in the previous version, where the user was asked to essentially add a *Global Level annotation*, in which he was specifying the single chart on which particular notes has to be added (an example is visible in Figure 59), in this new version the annotations are managed on a single related chart basis.

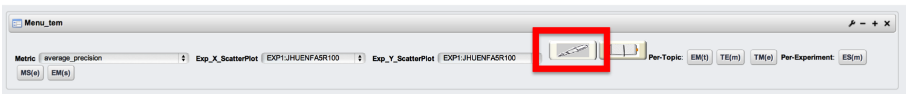


Figure 60: button for beginning an annotation action

The user, after pressing the button for making annotation in Figure 60, can simply click up to the point of the charts (i.e. rows of a table, or a single box plot, a trend in the Precision -Recall chart and so on) on which she wants to annotate something. After the click, an area for adding the annotation will be created at the bottom of the Focus area of the selected chart, as visible in Figure 61

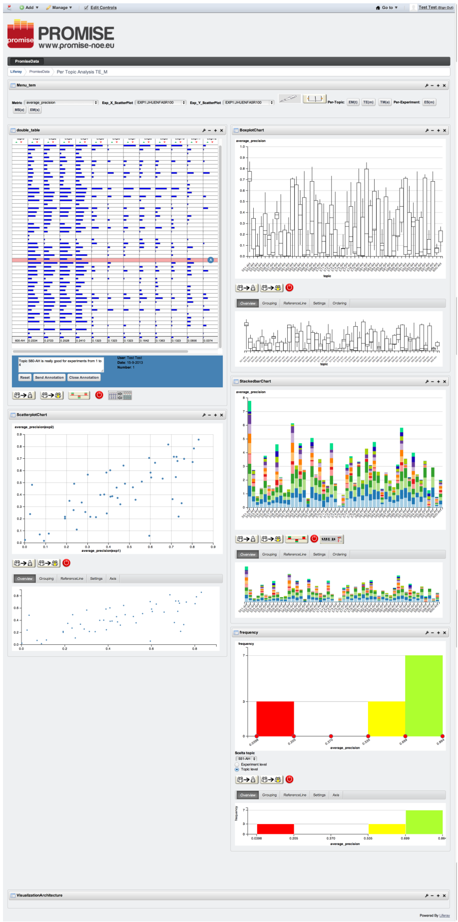


Figure 61: annotation box: the user will write his comment in the text box, marked with the same color as the circle marker on the point of interest

This box will maintain the user information and the time stamp of the annotation, and will let the user to add textual annotation, to cancel the process if for example activated by mistake, or to send the annotation to the central database. Moreover, at any moment the user can show the total number of annotations presents on a visualization by clicking on the button "show annotations": after the click, all the charts will report, by graphical indicators shown in Figure 62, the annotations made by all the allowed users.

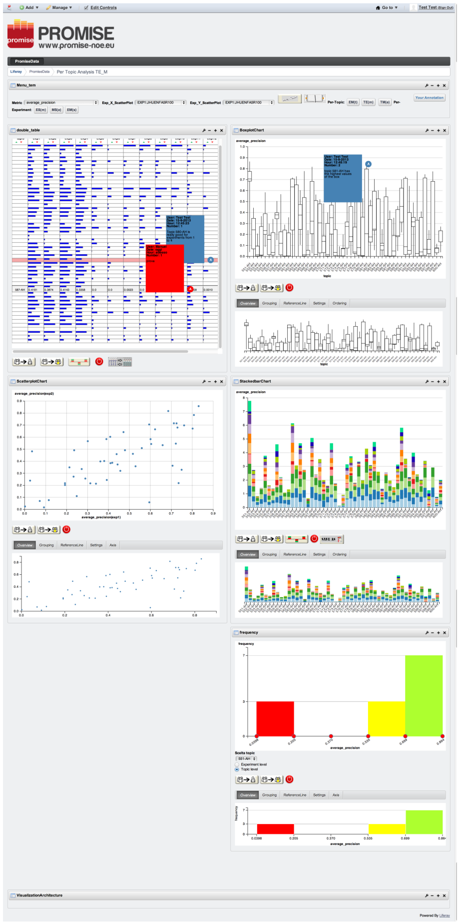


Figure 62: all the annotations from all the allowed participants are visible

To avoid to clutter the screen with too many annotations, their visibility is disabled by default; however, by simply clicking on one of the marker (see Figure 63), the annotation text and author will be visualized; another click will hide it again.

Coupled with a color-coding association of each of the participants, the user will be capable of filtering the annotations by participants (see (Figure 64).

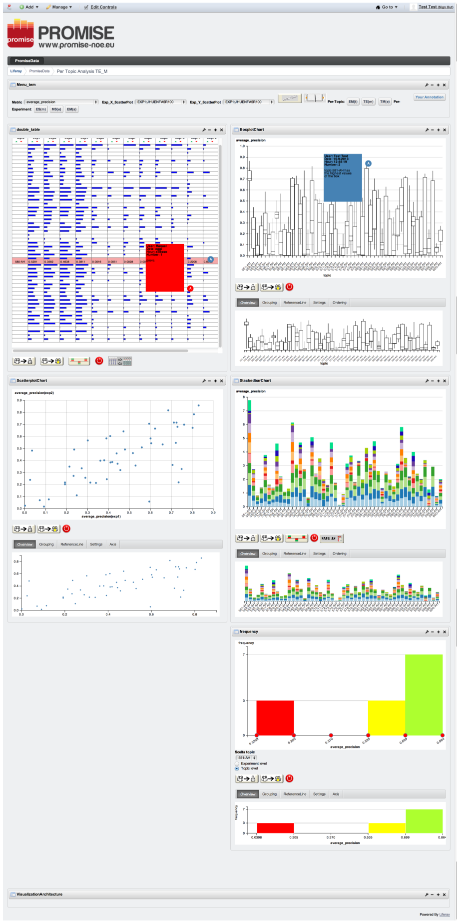


Figure 63: show/hide annotation text by simply clicking on the respective marker

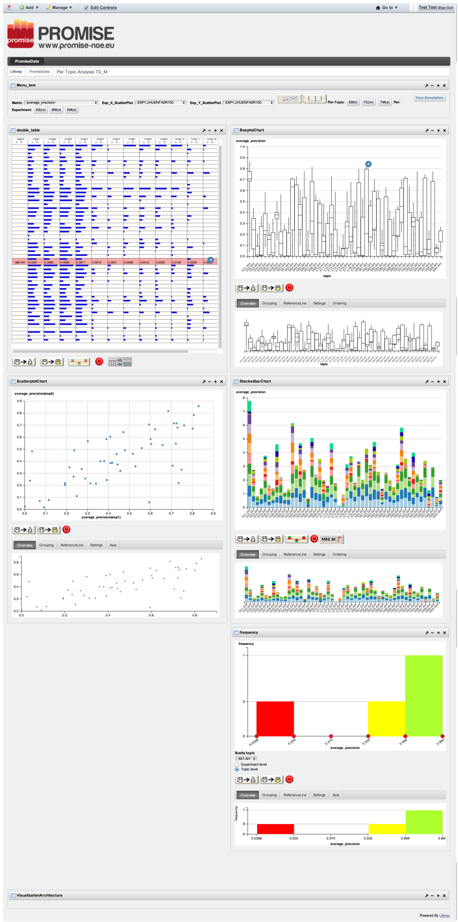


Figure 64: all the annotations from a single allowed participant are visible

Clearly a derived application of this functionality is to allow the user is to show just hers annotation, in order to review the previously committed ones.

These pieces of information will be attached to the image(s) under analysis an will be saved together with them: the system treats images as "first class objects" and store and retrieve not simple images but all the details behind them (e.g.,track, run, experimental data, analysis strategy, and image manipulation), including annotations.

A Promise Visual Analytics Quick reference guide

PROMISE Visual Analytics Environment:

Quick reference guide

1. Introduction

This document has its main focus on explaining the main patterns and functionalities of the PROMISE VISUALIZATION PROTOTYPE exposed at the uri:

http://151.100.59.83:11768/

The login credentials for accessing the PROMISE VISUALIZATION PROTOTYPE are:

Username: user

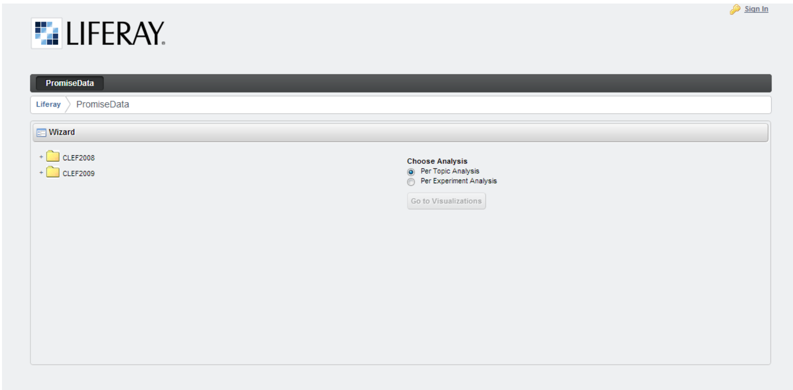
Password: demo2k12

The PROMISE VISUALIZATION PROTOTYPE allows the user to conduct a wide range of data analysis using a series of coordinated and interactive views, with the ability of incremental refinement of the data set of interest with the focus of finding new insights on the data set selected.

Also if not strictly needed, it is highly recommended to first read this guide before interacting with the system.

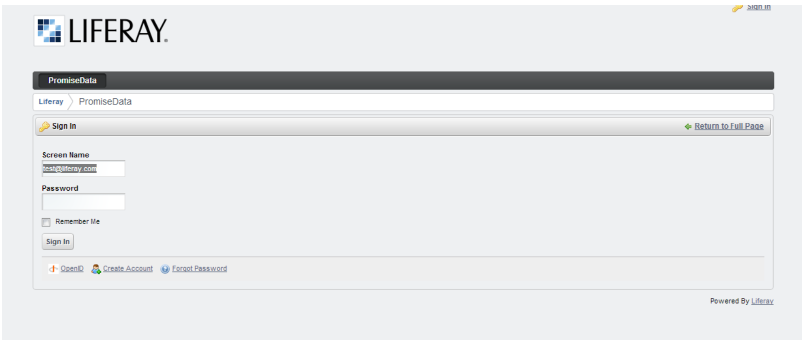
2. Login phase

The first screen that will be presented to the user is the login one, showed in figure:



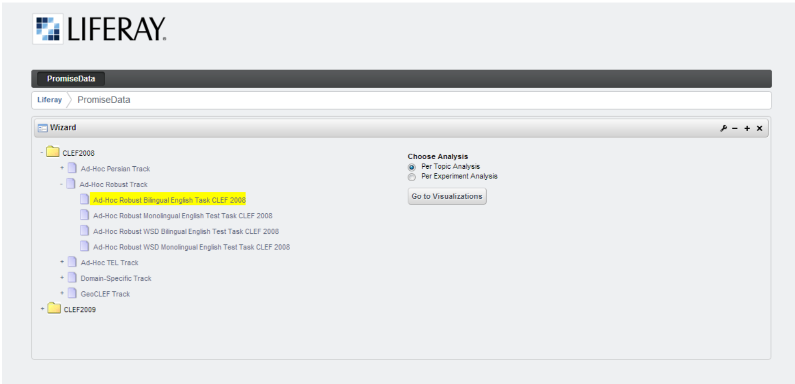
Starting page

As we can see the “sign in” link is on top-right part of the page; after clicking on it the user will be presented with the form for the authentication:



Login Form

Soon after the credentials inserted are accepted, the user will be redirected to the first page, where he can choose which campaign, track and task he wants to inspect from the tree structure on the left, and which type of analysis he wants to apply to it (Per Topic or Per experiment) from the menu on the right part of the page.

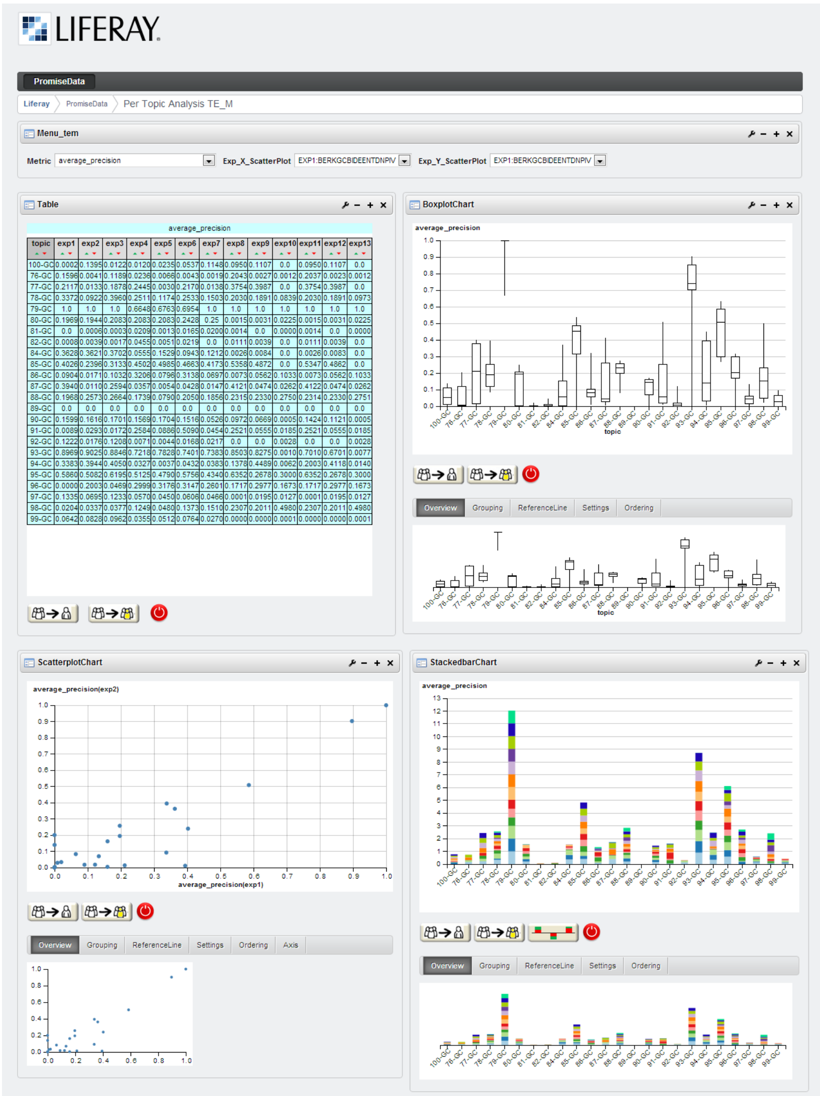


Campaign, Track, Task and type of analysis selection

After that , the pressure of the button “go to visualizations” redirect the user to the appropriate page.

3. Per Topic Analysis

If the user choose the Per Topic Analysis, the following page will be presented to him for the interaction with the data set chosen from the tree structure:



Per Topic Analysis page

In it we can highlight 5 main areas:

i. **Selection Menù:** from here the user can choose to change various parameters of the visualizations, like the metric used to evaluate results and the experiments analyzed on the scatter plot visualization.

ii. **Table view:** from here the user can inspect the results of the experiments against the set of topics chosen, on the metric selected.

iii. **Box Plot view:** from here the user can inspect an aggregated view of the results of the experiments, in term of a series of statistical indicators like minimum, maximum, lower and upper quartile and median values.

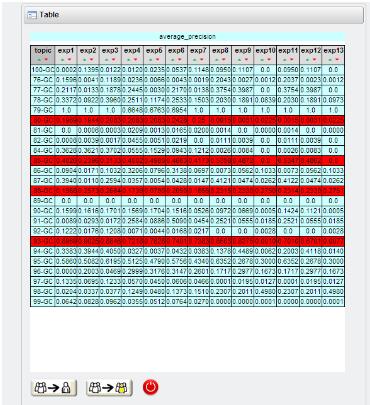
iv. **Scatter Plot view:** from here the user can inspect a series of statistical indicators calculated on different couple of experiments, in order to further specialize the inspection of the data on a subset carefully chosen of experiments, refined from the previous visualizations.

v. **Stacked Bar view:** from here the user can inspect another aggregated view, but with distinctive segment for each experiments, in order to have a general overview of the whole set of experiments.

The main interaction with the data are stylized in the form of 3 buttons on the bottom part of each visualizations, and represents respectively:

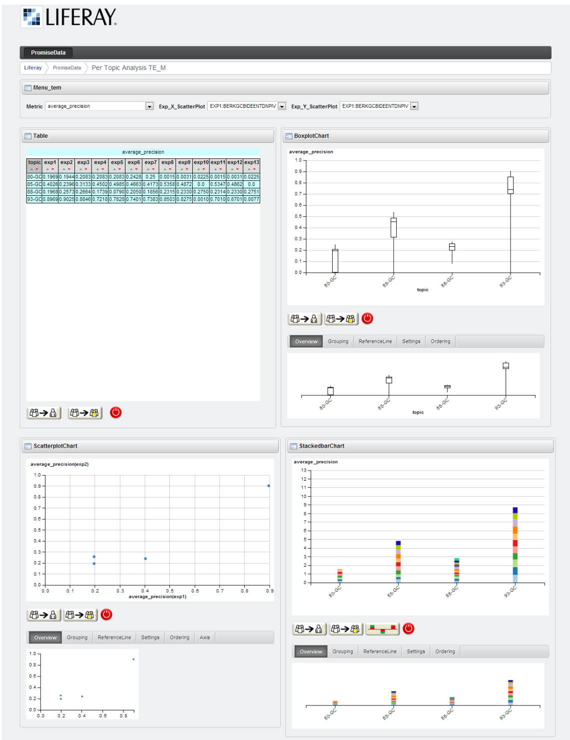
-  **SELECT:** This operation allow the inspection on a selected subset of the original data, in order to focus the analysis only on the important parts. The other data are suppressed from the visualization.
-  **HIGHLIGHT:** This operation allow the user to highlight a subset of the original data to make it more visible in respect to the others, that still remain in the visualization.
-  **RESET:** The reset button simply restore the visualizations to their initial state, with all the data present.

Each of them works only after the user has made is selection of data on the visualizations themselves: so each operation is finalized in two phases, where the first is the selection, with a click of the mouse, of the elements from the visualizations, as depicted below for the table view:



Picking of four elements from the table view

And then, with the click on the appropriate button, with the execution of the corresponding operation. In the figure below the results are showed for a "SELECT"



There are plenty of interactive ways to refine the analysis on the data other than the main ones, all positioned in the "Context" of each visualizations, represented by the small overview positioned below each one.

There , in the different tabs that composes the menu (Overview, Grouping, Reference Lines, etc…), the user will find useful functions for ordering the results, grouping them, adds reference lines for easy comparisons and so on.

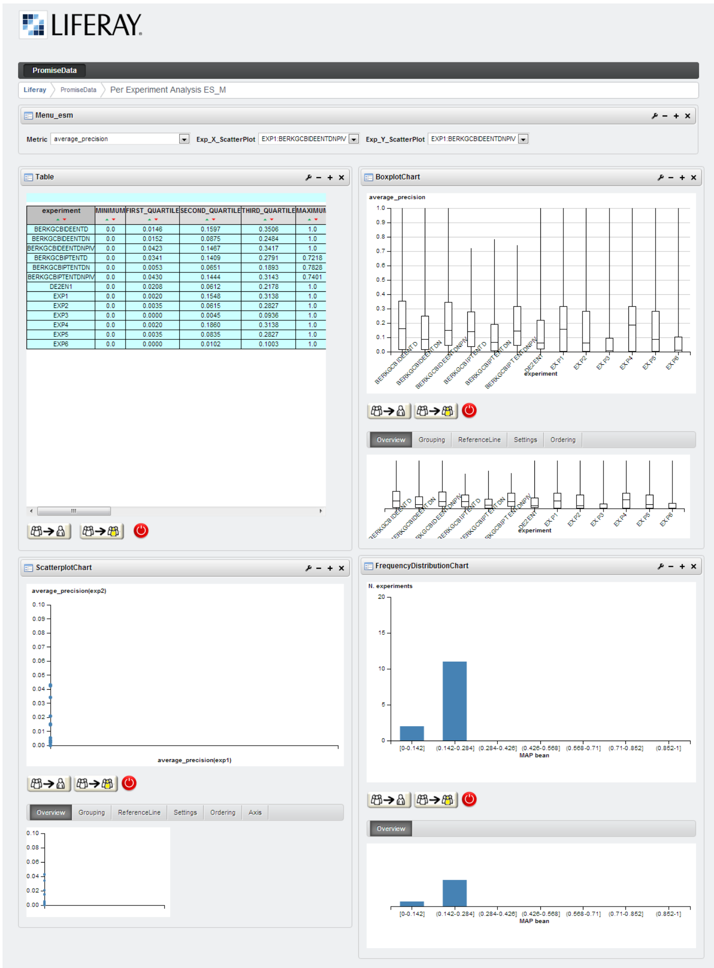
With a mechanism of brushing on the overview Tab, the user will also have a zoom on the selected area, useful for inspecting clusters of results.

All the functions are really intuitive, and also if we cannot list all of them in this quick reference, the user is invited to "play" with the system in order to find and experience all its functionalities.

4. Per Experiment Analysis

What explained for the Per Topic Analysis is true also for the Per Experiment, with the main focus on the fact that in this case the Experiment is what drives the analysis, and not the Topic.

Also, a new Tab is present, specifically a FREQUENCY DISTRIBUTION view, useful for having an insights on the distribution of the experiments results, as showed in figure:



It is important to note that in this version of the system, in order to switch the type of analysis, the user have to return to the starting page, reselect from the tree the data set and finally select the other type of analysis.

References

Agosti, M., Braschler, M., Di Buccio, E., Dussin, M., Ferro, N., Granato, G. L., Masiero, I., Pianta, E., Santucci, G., Silvello, G., and Tino, G. (2011). Deliverable D3.2 – Specification of the evaluation infrastructure based on user requirements. PROMISE Network of Excellence, EU 7FP, Contract N. 258191. http://www.promise-noe.eu/documents/10156/fdf43394-0997-4638-9f99-38b2e9c63802.

Agosti, M., Di Buccio, E., Ferro, N., Masiero, I., Nicchio, M., Peruzzo, S., and Silvello, G. (2012). Deliverable D3.3 – Prototype of the Evaluation Infrastructure. PROMISE Network of Excellence, EU 7FP, Contract N. 258191. http://www.promise-noe.eu/documents/10156/3783730a-bce3-481b-83df-48e209c6286a.

Angelini, M., Ferro, N., Granato, G. L., and Santucci, G. (2012). Deliverable D5.3 – Collaborative User Interface Prototype with Annotation Functionalities. PROMISE Network of Excellence, EU 7FP, Contract N. 258191. http://www.promise-noe.eu/documents/10156/8c475e6c-36b5-4822-9fbc-d7d116b3a897.

Berendsen, R., Braschler, M., Gäde, M., Kleineberg, M., Lupu, M., Petras, V., and Reitberger, S. (2012). Deliverable D4.3 – Final Report on Alternative Evaluation Methodology. PROMISE Network of Excellence, EU 7FP, Contract N. 258191. http://www.promise-noe.eu/documents/10156/0092298d-892b-45c0-a534-b9a3d0c717b1.