Peereviz: Visualizing Peer Reviews

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ABSTRACT
Peer reviews are important and commonly used in many project-based classes. In massive online open classrooms (MOOCs), the data from peer review process is huge and it becomes very difficult to explore and understand. Our goal is to design a visualization tool for large-scale peer review exploration which helps course instructors to understand and gain insights from the peer review activities, the engagement of students, and the quality of the reviews. We utilize existing text visualization techniques as well as multi-view coordination and enable the navigation through score distributions and the text feedbacks.

Author Keywords
peer review; group collaboration; visualization; MOOC; exploration; text visualization

INTRODUCTION
Massive open online courses(MOOCs) including Khan Academy, Udacity, Coursera and Venture Lab are increasing in numbers. [2] One emerging challenge is how to scale assessment to these high student-teacher ratio environments.

Using peer review system [5] to evaluate students work is one possible solution. However, in the massive online courses, the number of reviews done in each class is large and it is overly difficult and time-consuming for instructors to get a comprehensive understanding of the review of each task.

To address this problem, we developed Peereviz, a peer review exploration tool on top of Venture Lab platform. It aims for helping instructors to understand the massive amount of peer review results. The design goal of the tool is to create a visualization tool that helps course instructors in three ways: 1) get the overall understanding of peer review activities; 2) be able to dive into specific part of the review results; 3) quick browse and select higher quality reviews to read.

As a data explorer, it follows "overview first, zoom and filter, then details- on-demand" mantra. [4]

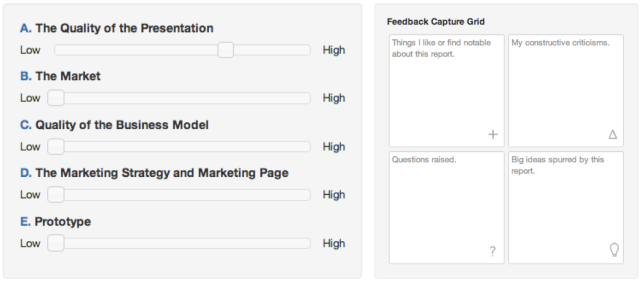

Figure 1. the actual evaluation form on the Venture lab platform. The top part shows the quantitative feedbacks which are score ranging from Low (1) to High (10) while the bottom part shows the feedback capture grid which a form where the reviewers give their opinions on four different aspect: notable, constructive, questions, and ideas.

The paper organization is as follows. We first summarize previous work in peer review system and visualization. We then describe the peer review data we used. Next, we present our design and visualization techniques, followed by the evaluation and feedbacks from users. Finally, we suggest the possible directions for future work and then summarize our work.

RELATED WORK
A number of studies has confirmed the usefulness of the peer review system to the students in various domains including programming and writing class [6, 7].

As for visualization, Multiple Coordinated Views is an exploratory visualization technique that shows data in different representations, enabling users to interact and explore intricate data to understand the data. [State of the art: coordinated & multiple views....] And text visualization techniques including word count list and tag cloud are often used to visualize and understand various large text data.[Tag clouds for summarizing web search results][http://www.wordcount.org/main.php]

However, to the best of our knowledge, work that combine visualization techniques to help instructors understand peer review data is still limited. The only work we discovered is an interactive tool for peer-review exploration proposed by Xiong et al. [8] They primarily work on the improvement of semantic information to help instructor discover interesting patterns and compare different groups of student in the writing class on SWoRD system [**?**]. In contrast to the prior work, we mainly focuses on the visualization and interaction design for exploring multi-dimensional peer review data in the recently emerging large-scale online classrooms.

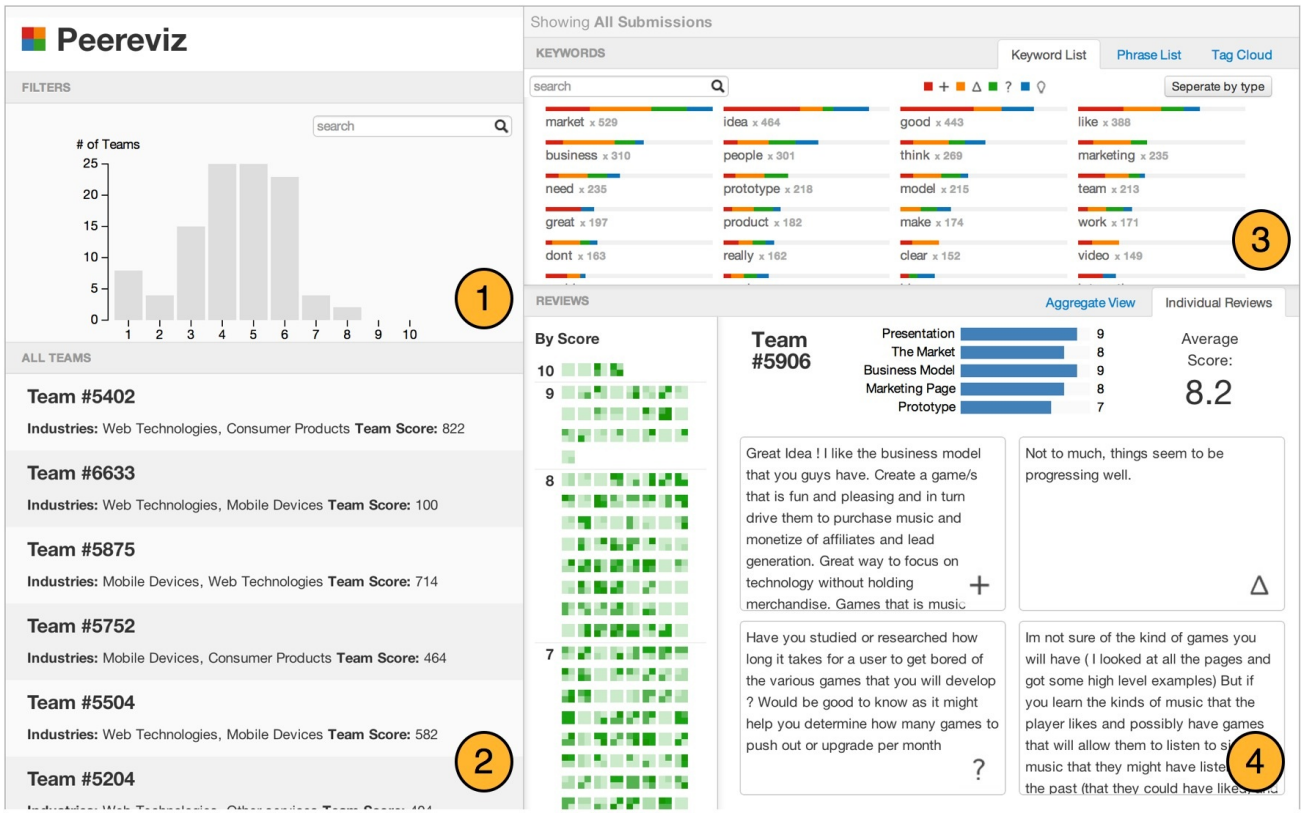

Figure 2. The layout for Peereviz is divided into two parts: the team browser (1,2) and the review browser (3,4). (1) shows the overall score distribution, (2) team description list, (3) keyword list, and (4) Aggregate and individual reviews.

describe: An Interactive Analytic Tool for Peer-Review Exploration How are we different?: focus on multiview, navigation, qualitative + quantitative feedback

DATA SET DESCRIPTION

We use a sample data set from a final project peer review result in the Spring 2012 Entrepreneurship class on the Venture Lab platform. A total of 1,206 peer reviews are collected, which consists of 116 teams being reviewed and 212 individual reviewers. For privacy reasons, the team names are anonymized and we presented team description as much as needed. The actual peer review form has two parts, including (1) multiple quantitative score ranging from low(1) to high(10) for different aspects of the final project and (2) qualitative text feedback, which utilizes a feedback capture grid [**?**] where reviewers could express their opinions in four dimensionswhat they like(*notable*), constructive criticisms (*constructive*), questions they have about the work (*questions*), and any additional ideas for the project (*ideas*).

VISUALIZATION DESIGN

We use multiple coordinated views techniques to show data in different representations which enable users to interact, explore and understand intricate data [**?**]. Furthermore, we also use text visualization techniques, including word count list and tag cloud, which are often used to visualize and understand various large text data [**?**] [http://www.wordcount.org/main.php].

Layout

The layout as shown in Figure 2 consists of two parts, the team browser and the review browser. The first is the team browser on the left side, which contains a team list and a bar chart that visualizes overall score distribution for all team projects. The second is the review browser on the right side which consists of two sub-parts: the keyword visualization for browsing keyword on the upper part and review display view on the bottom part.

Team Browser

The team browser serves as the main part of the overview where we can select one or multiple teams using different ways of filtering.

We can select one team by clicking one of the small block on the stacked bar chart or select multiple teams at the same time by brushing over the bar chart. After the selection, the team descriptions will be listed below as noted by (2) in Figure 2. The information provided in the review browser will be updated accordingly with the data of the selected team(s). In addition, it provides a search tool to select teams by their descriptions as well.

Review Browser

The review browser shows data for the selected team(s) in the team browser. If the user has not selected any team in the team browser, the review browser provides overview by showing aggregated data of all teams.

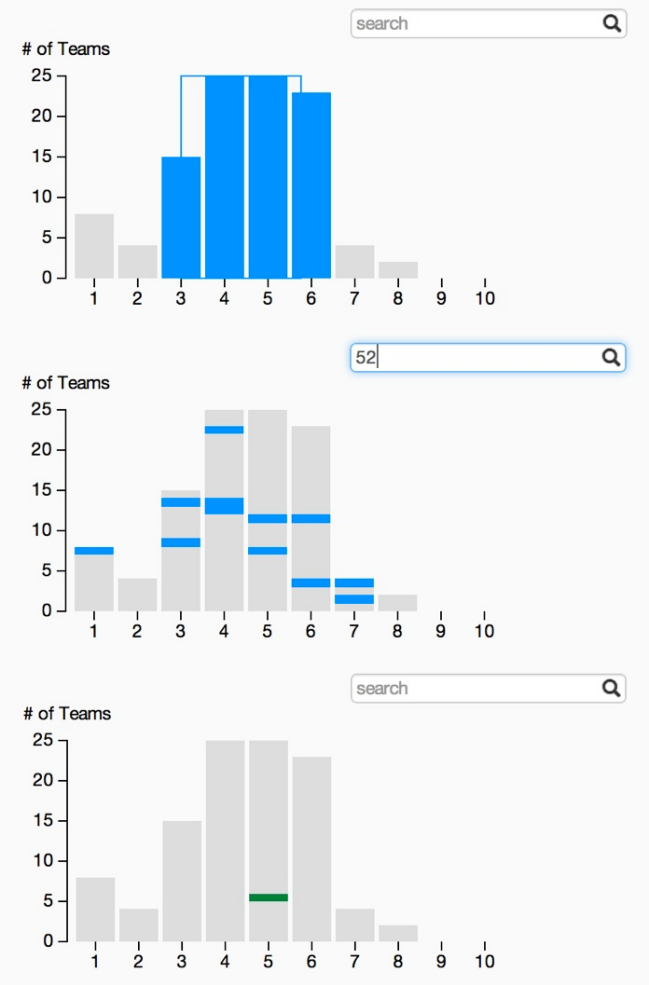

Figure 3. Different selection modes in the team browser.

Keyword List, Phrase List and Tag Clouds

Since one major component of the review is qualitative text feedbacks, we extracted keywords from text feedbacks based on their term frequency in bag-of- words model [1] to provide an overview of what students wrote the most in their reviews. There are three representations: keyword list, phrase list and tag cloud. In any of the three modes, users can click any word to see the actual occurrence of the word to further understand the context of the word.

The keyword list and phrase list are basically frequency lists of unigram and bigram respectively. Each word in the frequently list show a histogram of their frequencies on the top of the word. These frequency lists have two views. The first view (Upper in Figure 4) show the total frequency of the word aggregated from all the feedback types. In this first view, we use color to encoding the proportion of keyword found from each type on the histogram. The second view shows keywords in four columns, in which each column represent keywords from different types of feedback in the original feedback capture grid. Both frequency list views show the most frequent words on the top. User can also use the search box to search for unigram or bigram they are interested in. Meanwhile, the tag clouds view show four tag clouds of keywords group by each dimension in the feedback capture grid. Our tag clouds display all words horizontally for easy reading.

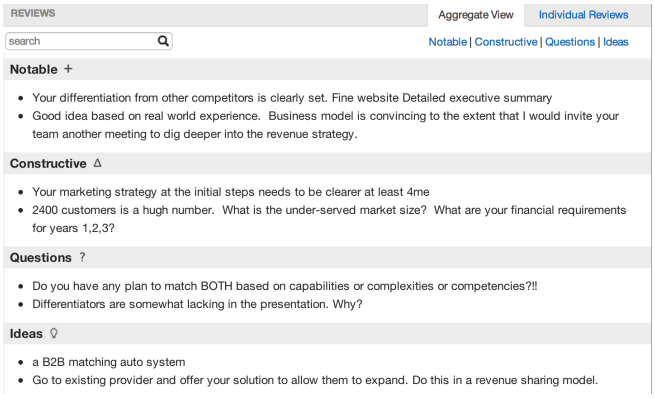

Figure 5. Aggregate View.

Aggregate View and Individual Review View

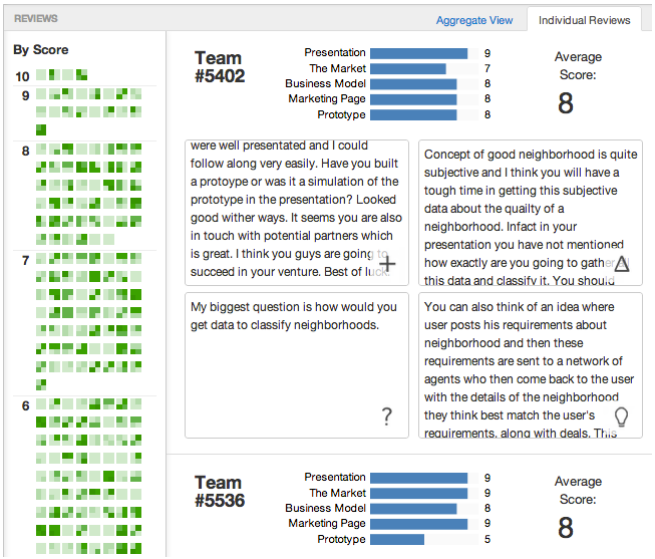

Figure 6. Aggregate View.

In aggregate view, all of the original reviews for the teams selected from team browser are are shown categorized by their types from feedback capture grid. This view provides instructors a quick way to read through a number of reviews for each feedback type at the same time. As usual, we provide a search tool so users can search original reviews.

To provide more details for each review, we can use individual review view consisting of two main parts as shown in Figure 6. First part on the left is a list of small multiples each of which represents a review. We use color encoding in the small grid to represent the length of the review text: the more intensity, the longer the review text, so that the instructors can quickly see and select longer reviews which are potentially more valuable to read. We can select small multiple to navigate to the view on the right which is a list of detailed

review. Each item in the list contains all the the score distribution according to the score rubrics, the average score, and the feedback capture grid as in the original form.

From these extracted keywords, a keyword browser is provided to let users quickly browse through the reviews.

IMPLEMENTATION NOTES

Peereviz was written in HTML, CSS and Javascript using the d3.js visualization toolkit [3] and a combination of javascript libraries including jQuery, Underscore.js, Backbone.js [ref for each one]. The d3s design that utilizes existing web standards including SVG and HTML has greatly facilitated our implementation. Additionally, we performed data preprocessing and imported it directly into an one-page web application.

EVALUATION

FUTURE WORK

... -¿ generalize for other platform

CONCLUSION

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ACKNOWLEDGMENTS

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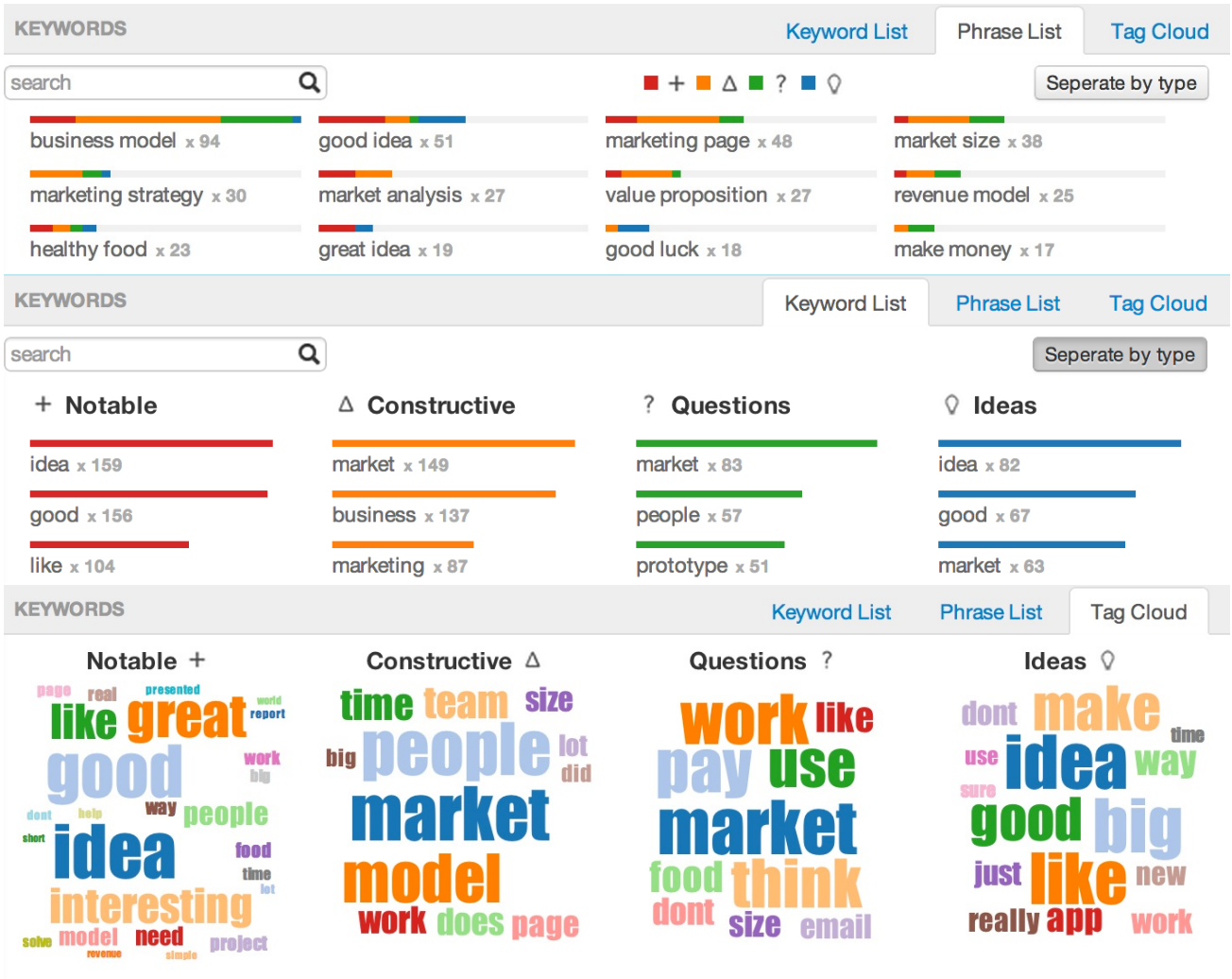

Figure 4. Three views of the keyword browser: (top) the phrase list in integrated mode, (middle) the keyword list in group-by-type mode, (bottom) the tag clouds grouped by type.