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Collaborative Document Evaluation: An Alternative Approach to Classic Peer Review

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***Abstract*—**Research papers are usually evaluated via peer review. However, peer review has limitations in evaluating research papers. In this paper, *Scienstein* and the new idea of 'collaborative document evaluation' are presented. *Scienstein* is a project to evaluate scientific papers collaboratively based on ratings, links, annotations and classifications by the scientific community using the internet. In this paper, critical success factors of collaborative document evaluation are analyzed. That is the scientists' motivation to participate as reviewers, the reviewers' competence and the reviewers' trustworthiness. It is shown that if these factors are ensured, collaborative document evaluation may prove to be a more objective, faster and less resource intensive approach to scientific document evaluation in comparison to the classical peer review process. It is shown that additional advantages exist as collaborative document evaluation supports interdisciplinary work, allows continuous post-publishing quality assessments and enables the implementation of academic recommendation engines. In the long term, it seems possible that collaborative document evaluation will successively substitute peer review and decrease the need for journals.

***Keywords*—**Peer Review, Alternative, Collaboration, Document Evaluation, Rating, Annotations.

I. Introduction

PEER review is the most common approach for evaluating scientific documents. However, as studies have shown, peer review often does not deliver the desired results [1]. Therefore, *Scienstein*[1] project was initiated [2]. The project's aim is among others to improve the evaluation process of scientific documents.

In this paper, the new idea of 'collaborative document evaluation' is presented. This approach evaluates scientific papers using the internet based on ratings, annotations, links and classifications performed by the scientific community.

In the first part of this paper the *Scienstein* project is introduced and the basic idea of collaborative document evaluation presented. In the second part the limitations of classical peer review are discussed. In the third part, current attempts of the scientific community to implement methods similar to collaborative document evaluation are analyzed including reasons for their failure. In the fourth part, requirements for a successful collaborative document evaluation system are analyzed. In the final part, additional benefits of collaborative document evaluation are presented.

[1] http://scienstein.org

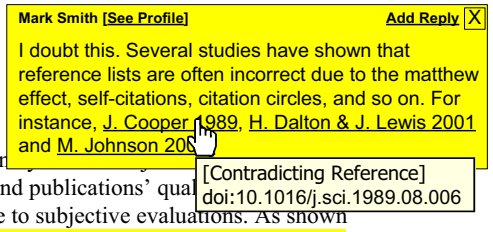
II. Scienstein & Collaborative Document Evaluation

Scienstein aims to research and implement collaborative document evaluation as a complement and in the long term as an alternative to classical peer review. As part of the implementation an open standard is developed for freely accessing and exchanging collaboratively collected metadata of scientific documents.

We define 'collaborative document evaluation' as the combined application of collaborative ratings, collaborative annotations, collaborative classifications and collaborative links by the documents' readers using the internet. *Scienstein* focuses on scientific documents but could theoretically be applied to all kind of documents.

'Collaborative rating' describes the quantitative rating of scientific documents. In *Scienstein*, readers may rate different criteria, for instance documents' quality.

'Collaborative annotations' are in-text annotations containing the readers' comments related to a certain passage of a document (see Fig. 1) or the document itself. These annotations may be classified for instance as *contradiction, correction*, *supporting,* or *addition/improvement*. The annotations can include a rating to enable a more detailed evaluation of document passages and annotations themselves can be annotated and rated by other users to estimate an annotation's relevance and quality.



Citation ar
authors' and publications' qual
alternative to subjective evaluations. As shown by J. Smith, a majority of authors honestly and carefully reference their influences [8]. As a

Fig. 1 Collaborative Annotation

'Collaborative classifications' are classifications of a research paper according to its research field(s) (e.g. *business*, or *medicine*), research topics (e.g. *impact factor*, or *h-index*) and research types (e.g. *empirical study, original paper* or *literature survey*).

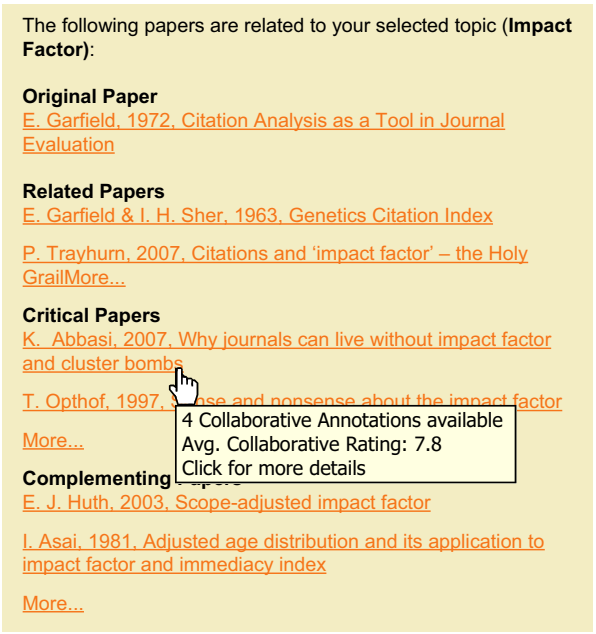


Fig. 2 Presentation of related papers on Scienstein.org

'Collaborative linking' describes the possibility to link related documents and classify the links as *related, critique,* or *complement*. In this way, statements can be created that 'Paper X contradicts Paper Y but supports Paper Z'. Collaborative links may appear within annotations (see Fig. 1) or on its own. As a result, *Scienstein* can display how papers are related to each other (see Fig. 2).

III. Classic Peer Review

In theory, classic peer review aims to serve three main objectives [3], [4]. First, it supports authors to improve their scientific papers by giving eligible feedback. Secondly, it assesses whether a paper is relevant in terms of content e.g. for a certain journal. And third, it assesses whether a paper fulfils the quality requirements e.g. of a certain journal.

In practice, peer review is criticized for delaying publications, being resource intensive and, more importantly, struggling to achieve the above named objectives [5]. One reason being the bias or incompetence of reviewers [6]. Further reasons are the reviewers' or journal publishers' personal interests [7]. For instance, papers are more likely to be published in certain journals if they contain references to publications by the same publisher. This way publishers benefit as their journals obtain a higher Impact Factor [7].

The classical peer-reviewing process with two to five reviewers has also limitations in evaluating interdisciplinary research. For instance, an empirical study about the effects of music on online shop visitors would relate to five research fields: music, business, computer science, psychology, and neurology. In addition, a competent statistician might be required to examine the validity of the empirical data analysis. In classic peer review, only few journals could provide the required experts to evaluate submissions like the example above thoroughly.

The weaknesses of peer review hinder fraud and error detection and lead to nonobjective decisions regarding the acceptance of scientific papers. Godlee et al. showed that only 10% of reviewers were able to identify half or more of the errors that existed in scientific publications [8]. The probability that reviewers agree about acceptance or rejection of research papers often does not differ significantly from chance [9], [10].

Accordingly, a need exists for significant improvements or alternatives to peer review.

IV. Current Attempts of Evaluating Documents Collaboratively

On the internet a different approach than peer review is used to evaluate documents, namely web pages. Services like del.ico.us enable the tagging, rating and annotation of websites by visitors. Services like Wikipedia even manage to let the "wisdom of crowd" create comparatively high quality content.

In the academic community first attempts were undertaken to use collaboration to evaluate scientific documents. Some preprint repositories[2], online reference managers[3], and minor open access journals[4] allow their users to comment, tag and rate publications. At first glance, the concept of these projects seems promising especially regarding the need to let papers be evaluated by many experts. Through the collaboration of scientists, more reviewers can contribute their specialized knowledge for the evaluation.

Since participation barriers are comparatively low, competent persons that otherwise would not act as a reviewer can share their knowledge. For instance, a busy manager might be willing to share his practical experiences with the scientific community, but does not want to invest the time to submit a paper. As a collaborative reviewer the manager could provide feedback to the authors by writing a short comment or providing a rating within minutes.

However, the existing services suffer from three drawbacks. First, the incentives for scientists to participate are low. Secondly, it is not possible to determine the competence of the participants. And thirdly, the systems are open to manipulation. For instance, authors could create multiple accounts and submit positive ratings and comments for their own publications. As a result, the overall benefit of the services is comparatively low.

V. Scienstein's Collaborative Document Evaluation

We are convinced that by applying the right strategies, the three above outlined problems can be minimized to a level that collaborative document evaluation using the internet presents a promising alternative to classical peer review. The strategies to achieve this are described in detail in the

[2] e.g. http://arxiv.org
[3] e.g. http://bibsonomy.org and http://citeulike.org
[4] e.g. http://philica.com and http://naboj.com

following.

A. Incentives to Participate

To motivate scientists' to participate as reviewers in collaborative document evaluation, *Scienstein* provides incentives in the form of increasing a scientist's visibility and reputation in the scientific community and offering a research paper recommender system and literature management software.

Scientists may improve their reputation in the scientific community by annotating publications. If the annotations are rated positively by other participants and the ratings are public, the scientists benefit by being perceived competent.

Scientists may improve their visibility and the visibility of their publications by annotating, rating, and classifying papers. In particular, the possibility to reference own publications, for instance with annotations, should motivate scientists to annotate publications.

Scientists may improve the recommendations of academic recommendation engines by participating in the system (compare also section 'Academic Recommendation Engines'). The more a scientist rates, annotates and classifies the more personalized recommendations for scientific publications can be made.

Collaborative ratings, annotations and classifications are used by *Scienstein* to support scientists managing their literature. The *Scienstein*-software allows, for instance, a scientist working on a paper about peer review to rate and classify the electronic documents found in academic databases. When writing an article on limitations of peer review, the software can display all publications that were previously rated as 'good' and classified as 'peer review; limitations'. Accordingly, the more scientists participate, the more their literature management benefits.

B. Competence

A reader of a scientific document should be able to estimate the competence of the collaborative reviewers, respectively the reliability of ratings, annotations, classifications and links. In *Scienstein*, competence is displayed for each author as the ratio and amount of positive ratings that their publications and annotations received. In addition, scientists are considered to be more competent if competent authors have referenced the scientist's publication in their own publications or annotations. For instance, author x is likely to be competent when author x's publication was referenced by author y who is already considered competent by the system. Scientists are also considered more competent when they are co-authors of a publication with another author that is already considered competent by the system.

In addition to competence, it is important to determine the research field(s) a scientist is competent in. This is accomplished via the scientist's publications. If, for instance, a publication was classified by scientists as being in the field of *astrophysics*, then it is assumed that the scientist's competence field is astrophysics. For the case that the publications of a scientist are not classified, further reference, citation, and link analysis can be performed. For instance, a scientist's competence field would also be determined as astrophysics when many publications in the field of astrophysics reference the scientist's publication.

C. Trustworthiness

To succeed, a collaborative document evaluation system must be able to differentiate trustworthy from not trustworthy reviewers. Otherwise, the system could be manipulated and abused. Scientists could try to promote their publications by making irrelevant annotations with links to their own papers. Additionally, scientists could manipulate the ratings of their publications in order to increase their prestige.

Different approaches are currently tested to prevent manipulations on *Scienstein* as far as possible. In the long term, *Scienstein* advocates the use of digital signatures for authentication. Although digital signatures are not widely used at the moment, this might change with the introduction of electronic passports enabling the passport holders to identify themselves online[5].

VI. Additional Benefits of Collaborative Document Evaluation

In comparison to peer review, collaborative document evaluation provides additional benefits to the academic community.

A. Post-Publishing Quality Assessment

Classic peer review evaluates a paper at a certain point in time. If, at a later point in time new insights would lead to a different assessment – for good or bad – scientists might not be aware of this. This might be problematic especially in the case of a paper that was proven to be erroneous or fraudulent after its publication in a prestigious journal. Most scientists probably would not know about the flaws and still trust the paper due the publication in a prestigious journal. In the case of collaborative rating, one reader is sufficient to create transparency by submitting a rating and comment. Hence, a post-publishing quality assessment of scientific papers can take place.

B. Vanishing Need for the Impact Factor

Although it is widely known that citation counts do not allow any conclusions about quality, the Impact Factor and citation analysis in general are of major importance in the academic community for journal, research paper and author evaluation [11], [12], [13]. If collaborative document evaluation proves to be effective, the need for the Impact Factor and citation analysis would decrease. Instead of falling back to 'impact' as an inadequate substitute for quality, 'real' quality could be measured by collaborative document evaluation.

[5] For instance in Germany from 2009

C. Academic Recommendation Engines

Collaborative document evaluation enables the implementation of a recommendation engine for scientific research papers [14]. Those research papers are recommended to users which were liked by similar users. User's similarity is determined via implicit and explicit ratings of research papers. For instance, if many scientists rated paper A and paper B positively, then paper B could be recommended to those scientists that have positively rated paper A, but do not know paper B. Alternatively, collaborative links are used by *Scienstein* to make recommendations. Author's may provide an input paper which they considered relevant and based on collaborative links *Scienstein* recommends related papers.

Academic recommendation engines combined with collaborative document evaluation might even have the potential to successively substitute the need for journals. Scientific papers could be published, for instance, on the authors' websites. Scientists then could simply use recommendation engines to retrieve relevant publications. The publication's quality could be determined via collaborative document evaluation.

D. Assisting Interdisciplinary Work

Through the collaboration of scientists, more reviewers can contribute their specialized knowledge to the reviewing process than in classic peer review and so support interdisciplinary work.

Based on reviewer's profiles and their activities *Scienstein* is able to identify papers that are controversially discussed, for instance by scientists of different research fields or backgrounds (e. g. scholars vs. professionals). This may help scientists to consider different points of view when performing their research.

E. Trend Analysis

Based on the amount of ratings and annotations, popular authors, research fields and papers can be identified. Additionally, the evolvement and development of (new) research fields can be observed. This kind of trend analysis could similarly be performed with data based on citation analysis. However, if trend analysis is based on collaborative data, trends could be identified at an earlier stage and more precisely.

VII. Conclusion

Classic peer reviewers often evaluate in a biased way, inconsistently and driven by own interests. Therefore, the *Scienstein* project was initiated. The project's aim is among others to improve the evaluation process of scientific papers.

In this paper, the new idea of 'collaborative document evaluation' was presented. This approach evaluates scientific papers using the internet, based on ratings, annotations, links and classifications by the scientific community. Collaborative document evaluation has the potential to achieve more objective results than peer review and to provide further benefits to the scientific community.

The success of collaborative document evaluation mainly depends on three critical factors: The scientists' motivation to participate as reviewer, the reviewers' competence and the reviewers' trustworthiness.

In the paper several approaches were presented to ensure the three critical success factors. For instance, scientists' motivation to participate as reviewer may evolve by offering opportunities to reviewers to promote own publications or increase prestige as part of the reviewing process. The reviewers' competence can be estimated by the ratings of the reviewers' publications and competence of co-authors. Trustworthiness of reviewers is promoted by requiring reviewers to reveal their identity and digital signatures may prevent identity fraud.

If the critical success factors are ensured, collaborative document evaluation may prove to be a more objective, faster and less resource intensive approach to research paper evaluation than classic peer review. Additionally, it supports interdisciplinary work, allows continuous post-publishing quality assessments and enables the implementation of academic recommendation engines.

Considering the advantages it seems possible that in the long term collaborative document evaluation will successively substitute peer review and decrease the need for journals and the Impact Factor.

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