

# Towards an AI-Assisted Peer Review System

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## THE AUTHOR

*“Dear Mr Harsh, Thank you for submitting your manuscript ‘Impact of...’ to the ‘Journal of....’ After careful consideration by our editors, we regret to inform you that we must decline this submission on editorial grounds and have subsequently decided to not send the paper out to external peer reviewers.” ... blinked his email. Another desk rejection!! Harsh let the email sink in slowly. It was his third rejection in a row and that too from the editor’s desk. He could not believe that after three months of submission this is what he got in response to his correspondence. The editor did not even consider sending his manuscript to the reviewers. It pained him to realise, not only did the editor dislike his toil; he disliked it sufficiently to circumvent its progress through the review process. What is going wrong with me? He mumbled At least he bothered to read it! My guide is not an expert in this field; he is finding very little time for me. What if...”*

## THE EDITOR

*“Dear Sir, You would be pleased to know that I have been elevated to the position of Associate Editor in the highly reputed Journal of ...” Dr Saha finished typing her email to Director IIT... and Professor-in-Charge Public Relations. Another one ticked off my bucket list.... she looked out of her cabin window, smiling. Little did she comprehend that this job could be so demanding. Regular classes, evaluations, meetings, PhD students, invited talks, Professor-in-Charge Guest House, and now an added responsibility. To go through these huge number of submissions to this*

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\* Mr. Tirthankar Ghosal, Ph.D. Scholar from Indian Institute of Technology, Patna, is pursuing his research on “Investigating AI Techniques in Various Aspects of Academic Peer Review.” His popular science story entitled “Towards an Artificial intelligence Assisted Peer Review System” has been selected for AWSAR Award

popular journal, check plagiarism, decide relevance, find suitable reviewers, coordinate and write responses... an array of non-escaping tasks. She found most of the submissions are uninformed ones, not falling within the aims and scope of the Journal of ... and even if they fall, most are average-merit, not warranting further review. *Sometimes I wonder how people could write so much trash and send these many irrelevant articles. Why don't they just consult the published papers and decide wisely about their work? What if....* she sighed in exasperation.

### THE REVIEWER

*Two deadlines already missed...* Dr Moorthy is having a hard time to manage everything. He recently came back to India after his second postdoc and joined this reputed private university. But work pressure has taken a toll on him. Too many engagements! And, on top of that, these pending paper reviews. He is struggling to find a spare time to go through this seemingly interesting paper. *What if there was an AI that could read the article and point out significant contributions?* Finally, after the third reminder, Dr Moorthy forced himself to review the paper.

All the three stories, although fictional, are true in the current context, converging to one deep question: *What if there was an Artificial Intelligence (AI) support to the peer review system? An AI to support research evaluation?*

Desk rejection is a common phenomenon in academia, a woe faced by most early career, sometimes even by seasoned researchers. It implies that the journal editor sends back a prospective research article to the author without consulting its merit to the expert reviewers. Several reasons account for this activity: plagiarised content, article not falling within the scope of the journal, below quality article with respect to the competitive benchmark of the journal, template mismatch, spellings, language and grammar, etc.

The current peer review system is mostly human-centric and is biased sometimes. With the exponential rise of article submissions (better known as the 'Publish or Perish' bubble in academia), it is becoming increasingly difficult for the journal editors to keep up the pace with the latest research, go through each submission and respond to the authors in reasonable time. *What if there was an AI which could help the editors to take appropriate decisions by pointing out seemingly out-of-scope, below quality submissions? What if the AI could relieve the editors from this "burden of science" to some extent?*

Our current research is about investigating the role that AI could play in several aspects of the scholarly peer review process. We partnered with a reputed global scientific publishing house to pursue this very timely problem with the goal to ease the information overload on journal editors using Machine Learning and Natural Language Processing techniques. A system of this kind could also help the authors to choose the journals wisely and retrospect on the quality of his/her paper according to the journal standards. An ambitious vision of this project is to help the reviewers identify the novel aspects of a proposed research. It is now somewhat impossible for a human to go through the massive volume of interdisciplinary research available. The need of the hour is to develop automated solutions for relevant literature discovery. We believe that the progress of this

investigation at any stage could lower down the average turnaround response time of a journal, thus speeding up the overall process of peer review.

We begin with investigating the general causes of desk rejection from the author-editor-reviewer interactions made available to us by our industry partner. Upon in-depth analysis of rejection comments and rejected papers, we found that more than 50% of desk rejection accounts for the paper being “outofscope”. In spite of having merit, sometimes an editor is left with no other choice than to reject because the paper won’t find a reader among the audience of the particular journal. So, we took up this problem and viewed it as classifying a paper as “In Scope” or “OutofScope” using Machine Learning techniques. Our seed idea was *“information contained in the accepted and published papers of a journal are the benchmark of reference which defines the domain of operation of the journal”*. We incorporate features extracted from almost all possible sections of a manuscript that may contribute to determining its belongingness to the journal concerned. We consider extracting keywords, topics from the full-text portions, clustering in-scope articles, author activity in the past five years, bibliographic information, etc. with respect to the published articles of the journal as our features. Our approach proved highly accurate and was able to outperform a popular state-of-the-art journal recommender by a relative margin of 37% for one journal. Thus, with our method, a system could be developed to assist the editors and authors to identify out-of-scope submissions effectively.

Our further analysis of desk-rejection comments revealed that editors are also concerned about the quality of research not matching to journal standards. We take a very simplistic approach here: ‘*Good papers cite good papers*’. We look into the bibliography section and see how many influential papers are cited and where are the cited references published (reputed venues generally publish significant contributions). We take the citation counts of the references, reputation of venues (Impact Factor, CORE Rankings), the temporal distance of the citations (too many old citations may indicate that the authors are not aware of current state-of-the-art), the presence of mathematical content, etc. as our quality features. We also identify which citations are influential to the current paper and which are just incidental and appropriately adjust the corresponding feature weights. We found that inclusion of quality features into our system greatly enhances its capability to identify desk rejections. Although there are other factors which are basic checklists at the editor’s desk like plagiarism, spellings, language and grammar, template mismatch, etc., we found proprietary state-of-the-art tools available to address them. However, these factors could make our proposed system more accurate.

Spending almost three years with the problem, we are now pretty convinced that this is an issue of epic proportions having many layers of investigation which requires significant collaborative efforts. It is more like *doing science over science*. Designing an AI-based peer review system is just the surface form of this investigation. Connecting the ever-expanding human scientific knowledge (which manifests in the form of research papers) and translating it to a machine-understandable form is the grand vision. However, there are several practical challenges: to get hold of knowledge (research papers) that are behind paywalls, enforcing a more knowledge discoverable format of research papers rather than just PDFs, annotating scholarly artefacts, etc. With the rise of open access movements, significant technical efforts by AI companies like Chan Zuckerberg Initiative-

Meta, Allen Institute of Artificial Intelligence, communities like FORCE11, we are hopeful that we are moving in the right direction.

Understanding novel scientific knowledge by an AI is a very far-stretched vision. However, with the ever-growing prowess of AI, in the near future, we could think of helping THE REVIEWER in identifying the NEW as well as to validate it. Maybe someday we can have an AI scientist as our peer, *as a gatekeeper of scientific knowledge and wisdom*.