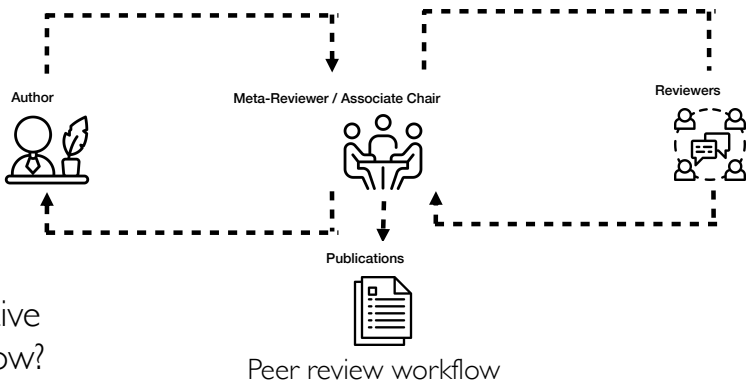# Designing Interactions with AI to Support the Scientific Peer Review Process

Lu Sun, Stone Tao, Junjie Hu, Steven P. Dow

l5sun@ucsd.edu, stao@ucsd.edu, junjie.hu@wisc.edu, spdow@ucsd.edu

Background

- Peer review processes include a series of activities from review writing, reviewers discussion and meta-review authoring.
- AI and LLM provides opportunities to scaffold inexperienced reviewers, reduce the workload of reviewers, and raise awareness of bias.

RQ: What are the possibilities and risks of designing interactive systems with AI to support the scientific peer review workflow?

Peer review workflow

## MetaWriter System

Study on meta-review writing:

- Meta-reviewers have challenges on controlling review quality, making sure the decision process is fair and assembling the most relevant information.
- Inexperienced reviewers have challenges understanding the standard.
- AI interactions may scaffold reviewers, raise awareness of high viability in reviews and improve efficiency while maintain reviewers' agency.
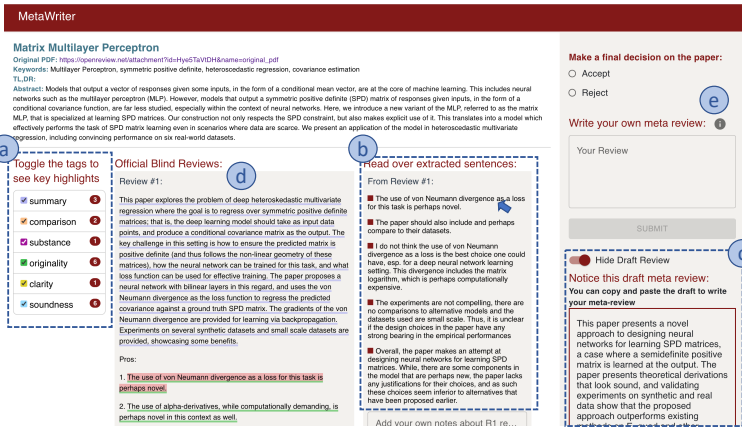
MetaWriter uses three forms of AI to support meta-review authoring:

- **Visualizing tagged aspects:** use aspect tagger to color-code aspects including originality, soundness, etc
- **Highlighting extracted stances:** extractive summarization to automatically identify key points across three reviews
- **Generating meta-review draft using a hybrid model:** extraction-then-generation pipeline to generate a draft to enhance transparency and fact-checking
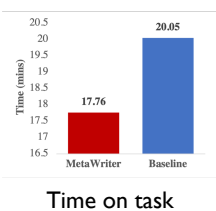

MetaWriter Interface

MetaWriter features
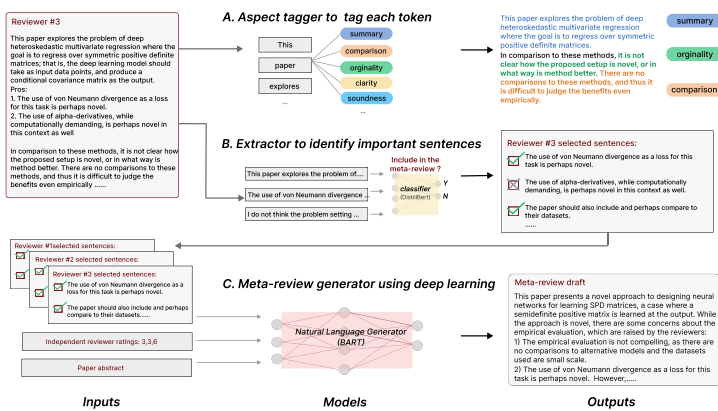
Case Study

Meta-review generation evaluation:

- LexRank
- TF-Extract: PreSumm
- TF-Abstract: BART
- **Hybrid model: extract-then-generate**

Model	R_1	R_2	R_L
LexRank	0.202	0.031	0.173
TF-Extract	0.271	0.068	**0.234**
TF-Abstract	0.334	0.091	0.203
Hybrid	**0.329**	**0.099**	0.215

Controlled experiment:

- Within-subject experiment with 32 reviewers to write meta-reviews on two papers
- **MetaWriter reduces meta-reviewing time and improves the meta-review quality**

Time on task

Meta-review quality
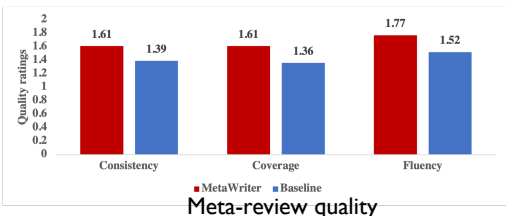
Design interactions with AI for peer review:

- AI can provide customized examples or interactive scaffolding to guide inexperienced reviewers
- Balance the trade-offs of agency and efficiency by providing more controllability
- Increasing transparency to raise awareness of bias.