Example evaluations of plagiarism cases using FAIR Metrics and the PDP-DREAM Ontology

1st Adam Craig
Hong Kong Baptist University
Kowloon Tong, Hong Kong
orcid:0000-0002-7646-4384
agcraig@hkbu.edu.hk

2nd Anousha Athreya
University of California, Berkeley
Berkeley, CA
orcid:0009-0007-6052-8084
aaathreya2@berkeley.edu

3rd Carl Taswell
University of California, San Diego
La Jolla, CA
orcid:0000-0002-9386-4574
ctaswell@ucsd.edu

2023 IEEE 19th International Conference on e-Science (e-Science) | 979-8-3503-2223-1/23/$31.00 ©2023 IEEE | DOI: 10.1109/E-SCIENCE58273.2023.10254806

***Abstract*—The FAIR Metrics, with acronym FAIR for *Fair Acknowledgment of Information Records and Fair Attribution to Indexed Reports*, measure how appropriately a document cites prior literature. We demonstrate use of a novel workflow for manual evaluation of the FAIR Metrics on five example publications, three of which were retracted for plagiarism. We recorded results of the analyses in Nexus-PORTAL-DOORS-Scribe (NPDS) records as an open access data set for continuing development of automated plagiarism detection tools.**

***Index Terms*—plagiarism, bibliometrics, citation analysis, knowledge engineering, semantic web.**

I. Introduction

The journal *Science* recently updated its editorial policies to clarify that use of artificial intelligence to produce papers is plagiarism [1]. Plagiarism detection tools iThenticate and Turnitin assigned ChatGPT-written essays similarity scores of only 0% to 68% [2]. Human reviewers identified ChatGPT-generated abstracts with only 68% accuracy [3]. Propagating secondary and tertiary plagiarism remains prevalent [4]. Citational justice has not yet been sufficiently promoted and adopted [5]. The FAIR Metrics quantify how accurately a scholarly research report attributes ideas to their correct sources [6]. Prior work characterized properties of the FAIR Metrics using hypothetical test cases [7]. Here, we demonstrate a novel manual workflow for evaluating FAIR Metrics on research publications in comparison to previously published literature with historical priority. Scholarly journals can support greater transparency for open peer review by incorporating FAIR Metrics analyses in their review methodology [4], [8].

II. Methods

Craig *et al* 2019 [6] described 4 ratio metrics calculated from counts of 4 categories of statements: Quoted (Q) statements correctly attributed to prior work, Misquoted (M) statements misrepresenting prior work, Plagiarized (P) statements matching but not attributed to prior work, and Novel (N) statements not found in or reported as sourced from prior work. We now use subscripts with letters instead of numbers to clarify which ratio metric emphasizes which count with F_Q, F_M, F_P, F_N here corresponding respectively to F_1, F_2, F_3, F_4 in [6]. Prior work proposed automated semantic search for equivalent claims represented as resource description framework (RDF) triples. Because a collection of semantic representations of claims in relevant literature is not yet available, we introduce manual evaluation of FAIR Metrics which can assess allegations of plagiarism of a publication. Craig *et al* 2019 [7] described an earlier attempt at pairwise comparison of scholarly articles that failed to produce meaningful results due to discarding claims neither plagiarized from nor attributed to the comparison text. For the present work, we used this procedure: 1) Access test (T) and comparison (C) documents and the set of references ($\{R_i\}$) cited by T and/or C. 2) List statements and select claims, ie, statements highlighted as novel or cited with a reference. 3) Initialise counts M, N, P, Q and iterate over claims. 4) If claim in T cites R_i, search R_i for equivalent claim. 5) If found, increment Q else increment M. 6) If claim in T does not cite a source, search C for equivalent claim. 7) If found, increment P else increment N. We chose 5 test examples for analysis. As a negative control, we compared [9] to [10], a paper on a related topic but without similarity in claims. We found 3 journal articles retracted for plagiarism through the Retraction Watch database [11]. References [12], [13], and [14] each plagiarized respectively from [15], [16], and [17] as listed in Table I. Then we examined [18]. Reports alleging plagiarism by [18] from [9], [19] have been published by [6], [20], but [18] has not yet been retracted for plagiarism. We have published NPDS records of the evaluations and have designated the Fidentinus diristry at www.portaldoors.net for descriptions of known plagiarism cases. We recorded the FAIR Metrics and mappings between equivalent statements in embedded RDF documents using the FAIR Metrics module of the PDP-DREAM Ontology, with the acronyms PDP and DREAM for the phrases PORTAL-DOORS Project and Discoverable Data with Reproducible Results for Equivalent Entities with Accessible Attributes and Manageable Metadata [6].

III. Results

See Table I for the results of the FAIR Metrics analyses. Reference [9] had no overlap with [10] or misrepresentations of prior work, resulting in F_M, F_P, and F_Q scores of 1 for fairness. The scores $\ll 1$ for both [12] and [13] should alert an editor to issues requiring further scrutiny. The negative F_P score < 0 for [14] reflects the extreme extent of its plagiarism.

TABLE I
FAIR METRICS OF EXAMPLE ARTICLES

Target (T) text	**Retracted?**	**Comparison (C) text**	M	N	P	Q	F_M	F_N	F_P	F_Q
Taswell 2007 [9]	no	Mons 2005 [10]	0	20	0	22	1.00	0.05	1.00	1.00
Uddin 2022 [12]	yes	Foster et al 2019 [15]	0	18	18	87	0.83	0.56	0.66	0.83
Gnat et al 2022 [13]	yes	de Hoog et al 2017 [16]	0	3	10	30	0.75	0.63	0.50	0.75
Ullah et al 2018 [14]	yes	Sansaniwal et al 2015 [17]	31	3	7	2	-0.73	-0.02	-0.13	0.05
Wilkinson et al 2016 [18]	no	Taswell 2007 [9]	6	5	24	28	0.38	0.37	0.07	0.48

M Misquoted, N Novel, P Plagiarized, Q Quoted Counts; F_M Misquoted, F_N Novel, F_P Plagiarized, F_Q Quoted FAIR Metrics.

The non-zero M and N show that changing the meanings of statements partially disguises plagiarism but also leads to misrepresentation of cited sources. All of the FAIR-named principles in the 2016 collection by [18] can be semantically mapped as equivalent concepts and ideas [21] to each of the corresponding similar principles in the 2007 collection of PDP-named principles published previously by [9], [19]. The authors of [18] did not copy text verbatim from [9], [19]. Instead, the authors obfuscated their plagiarism of concepts and ideas by paraphrasing the 2007 collection without citation [6], and the editors concealed this plagiarism by refusing to correct the omission of citation of the original sources, which constitutes both *idea-laundering plagiarism by authors and idea-bleaching censorship by editors* as defined by Taswell *et al* 2020 [4]. The 5 Novel claims in [18] focused on building consensus about the principles at workshops. The 6 Misquoted claims in [18] likely resulted from changes to the content cited.

IV. DISCUSSION

The test examples analysed here illustrate the potential value of the FAIR Metrics for real-world open peer review. However, Q counts in plagiarizing papers are biased high. Passages copied by plagiarizing papers from plagiarized papers included correct attributions of claims from prior references. Therefore, new metrics for comparison of reference lists should complement and enhance the FAIR Metrics. NPDS records with human-identified equivalences in natural language texts will provide valuable data for future development and testing of named entity recognition approaches such as [22].

V. CONCLUSION

We have shown that evaluation with FAIR Metrics using manual text comparisons yields differences in scores which can assist peer review to assess concerns about fairness, plagiarism, and citational justice. We have also created a searchable online repository of NPDS records with FAIR Metric analyses as a prototype for a more reproducible, verifiable, and accountable approach to open and transparent peer review.

REFERENCES

[1] H. Thorp and V. Vinson, "ChatGPT is fun, but not an author," *Science*, vol. 379, no. 6630, p. 313, 2023, doi:10.1126/science.adg7879.

[2] M. Khalil and E. Er, "Will ChatGPT get you caught? Rethinking of plagiarism detection," *arXiv*, 2023, doi:10.48550/arXiv.2302.04335.

[3] C. A. Gao, F. M. Howard *et al.*, "Comparing scientific abstracts generated by ChatGPT to original abstracts," *Digital Medicine*, vol. 6, 2023, eid:75, doi:10.1038/s41746-023-00819-6.

[4] S. K. Taswell, C. Triggle *et al.*, "The hitchhiker's guide to scholarly research integrity," in *ASIS&T 83rd Annual Meeting*, vol. 57. Wiley, 2020, eid:e223, doi:10.1002/pra2.223, url:portaldoors.org/pub/docs/ASIST2020HHGuide0610.pdf.

[5] C. Taswell, "Epistemic injustice, open access, and citational justice," *Brainiacs Journal of Brain Imaging and Computing Sciences*, vol. 3, no. 2, 2022, doi:10.48085/X3B678B7A.

[6] A. Craig, A. Ambati *et al.*, "DREAM Principles and FAIR Metrics from the PORTAL-DOORS Project for the semantic web," in *Intl Conf on Electronics, Computers and Artificial Intelligence (ECAI)*. IEEE, 6 2019, pp. 1–8, doi:10.1109/ECAI46879.2019.9042003 url:portaldoors.org/pub/docs/ECAI2019DREAMFAIR0612.pdf.

[7] ——, "Definitions, formulas, and simulated examples for plagiarism detection with FAIR metrics," in *2019 ASIS&T 82nd Annual Meeting*, vol. 56, no. 1. Wiley, 2019, pp. 51–57, doi:10.1002/PRA2.6.

[8] A. Craig, C. Lee *et al.*, "Motivating and maintaining ethics, equity, effectiveness, efficiency, and expertise in peer review," *Brainiacs Journal of Brain Imaging And Computing Sciences*, vol. 3, no. 1, 2022, eid:I5B147D9D, doi:10.48085/I5B147D9D.

[9] C. Taswell, "DOORS to the semantic web and grid with a PORTAL for biomedical computing," *IEEE Transactions on Information Technology in Biomedicine*, vol. 12, no. 2, pp. 191–204, 2008, published online 2007/08/03; doi:10.1109/TITB.2007.905861.

[10] B. Mons, "Which gene did you mean?" *BMC Bioinformatics*, vol. 6, 2005, eid:142, doi:10.1186/1471-2105-6-142.

[11] "Retraction watch database user guide," April 2023, url:retractionwatch.com/retraction-watch-database-user-guide.

[12] S. Uddin, T. Kabir *et al.*, "Retraction note to: Exploring the role of clu in the pathogenesis of alzheimer's disease," *Neurotoxicity Research*, vol. 40, no. 4, pp. 1125–1125, 2022, doi:10.1007/s12640-022-00519-1.

[13] S. Gnat *et al.*, "Retraction of: Sebastian Gnat, Aneta Nowakiewicz, Przemysław Zięba: Taxonomy of dermatophytes," *Adv Microbiol*, vol. 61, no. 4, pp. 261–261, 2022, doi:10.2478/am-2022-013.

[14] F. Ullah, M. Kang *et al.*, "Retracted: Experimentally investigated the asparagus (asparagus officinalis)," *Food Science & Nutrition*, vol. 6, no. 6, pp. 1357–1357, 2018.

[15] E. M. Foster, A. Dangla-Valls *et al.*, "Clusterin in Alzheimer's disease: mechanisms, genetics, and lessons from other pathologies," *Frontiers in Neuroscience*, vol. 13, 2019, eid:164, doi:10.3389/fnins.2019.00164.

[16] G. S. de Hoog, K. Dukik *et al.*, "Toward a novel multilocus phylogenetic taxonomy for the dermatophytes," *Mycopathol*, vol. 182, pp. 5–31, 2017.

[17] S. Sansaniwal and M. Kumar, "Analysis of ginger drying," *J Mech Eng Sci*, vol. 9, pp. 1671–1685, 2015, doi:10.15282/jmes.9.2015.13.0161.

[18] M. Wilkinson, M. Dumontier *et al.*, "The FAIR guiding principles for scientific data management and stewardship," *Scientific Data*, vol. 3, 2016, eid:160018, doi:10.1038/sdata.2016.18.

[19] C. Taswell, "A distributed infrastructure for metadata about metadata: The HDMM architectural style and PORTAL-DOORS system," *Future Internet*, vol. 2, no. 2, pp. 156–189, 2010, doi:10.3390/FI2020156.

[20] ——, "Pubpeer comment reporting plagiarism," 2019, url:pubpeer.com/publications/F0481960C5C5A98F9CB1FF108E11D0.

[21] A. Athreya, S. K. Taswell, S. Mashkoor, and C. Taswell, "The essential enquiry 'equal or equivalent entities?' about two things as same, similar, related, or different," *Brainiacs Journal of Brain Imaging And Computing Sciences*, vol. 1, no. 1, 2020, doi:10.48085/PEDADC885.

[22] K. Khadilkar, S. Kulkarni, and P. Bone, "Plagiarism detection using semantic knowledge graphs," in *Intl Conf Comp Comm Cont Auto (ICCUBEA)*. IEEE, 2018, doi:10.1109/ICCUBEA.2018.8697404.