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Plagiarism-Detection Services:

How Well Do They *Actually* Perform?

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Professors spend many hours grading student papers and reviewing scholarly work submitted for publication. In addition to providing constructive, informative, and engaging critiques, professors must be aware of a broader literature to enforce academic standards of attribution and integrity. Adopting the mindset to support plagiarism detection—skeptically looking for the source of an unusually well written paragraph, for example—is incompatible with a sympathetic, constructive effort to help authors improve their work.

Plagiarism-detection services promise a helpful division of labor. When someone submits a paper for evaluation, the evaluator can send the paper to a plagiarism-detection service as a first step, looking at the content and expression of the paper only after the service has cleared the paper as not plagiarized. This saves review time on papers that the service flags as plagiarized.

Many academics operate under the impression that plagiarism-detection services are demonstrably effective and do a thorough check of the professional literature. This impression is fostered by marketing claims made by the plagiarism-detection services. *TurnItIn's* website claims that "*TurnItIn*'s plagiarism prevention is often so successful that institutions using our system on a large scale see measurable *rates of plagiarism drop to almost zero*" (emphasis in the original, see Fig. 1) and "Results are based on exhaustive searches of billions of pages from both current and archived instances of the internet, millions of student papers previously submitted to *TurnItIn*, and commercial databases of journal articles and periodicals." See Fig. 2 (Figs. 1 and 2 retrieved March 7, 2008 from http://www.turnitin.com/static/plagiarism.html).

See Table I for additional examples of marketing claims by the two leading services.

In 2007, over 30 million papers were submitted to *TurnItIn* [1]. To enjoy widespread adoption, would one not expect the service to be reasonably effective? Instead, when reviewing scholarly work (theses, dissertations, essays, and journal submissions) the authors of this paper have too often had the impression that a paper was plagiarized even though it had been cleared by the plagiarism-detection services. In some cases, by luck or by diligent search of the professional literature, we were able to find the plagiarized sources, confirming our suspicion. Do the plagiarism-detection services have blind spots? What are they? How significant are they? Why does the academic community seem so unaware of these?

There has been extensive discussion of plagiarism in the professional literature [2]–[9], including reports of plagiarism by graduate students [10], [11] and faculty. See also [12]–[15], [16]–[23]. Famously, the ongoing coverage of widespread M.Sc. plagiarism in Ohio University's Mechanical Engineering program, [24], [25] has prompted universities to reexamine their own anti-plagiarism efforts.

The simplest type of scholarly plagiarism involves submission of an article that was already published by another author. Several reports of plagiarism in the scholarly literature discuss examples of exactly this extreme case [26]–[30]. With the availability of reasonably priced plagiarism-checking service, how do papers such as these get into print?

In this paper, the authors consider plagiarism-detection issues in terms of the marketing claims and performance of the two largest plagiarism-detection services, *TurnItIn* (www.turnitin.com) and *MyDropBox* (www.MyDropBox.com) (now a service of Blackboard (www.blackboard.com) known as *SafeAssignment*). Although the ethical and legal concerns involving these services' archiving of student papers [1] are worthy of discussion, the considerations are independent of those reported in this article.

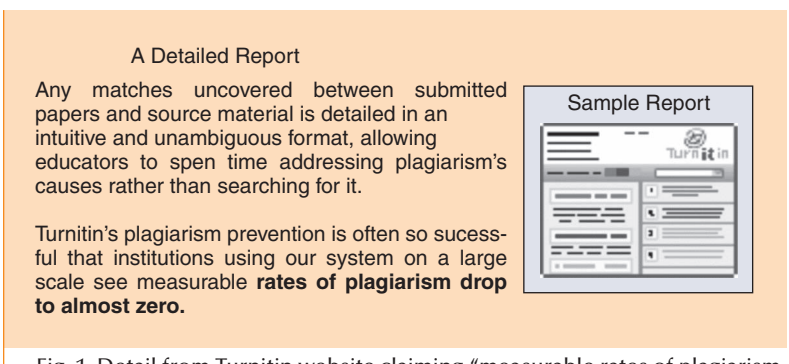

Fig. 1. Detail from Turnitin website claiming "measurable rates of plagiarism drop to almost zero."

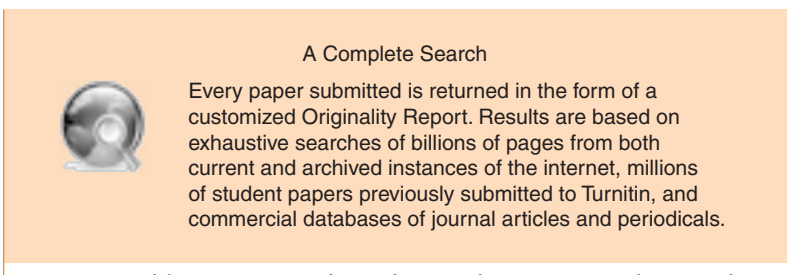

Fig. 2. Detail from Turnitin website claiming their service performs "exhaustive" search of sources.

Guiding Questions

We report findings regarding four related questions about

Table I
Examples of Marketing Claims From Turnitin and Mydropbox

Claim	Turnitin	MyDropBox
Coverage	Results are based on exhaustive searches of billions of pages from both current and archived instances of the Internet, millions of student papers previously submitted to Turnitin, and commercial databases of journal articles and periodicals. From www.turnitin.com/static/plagiarism.html	SafeAssignment searches an enormously wide range of databases, covering virtually all potential sources of electronic plagiarism From mdb2.mydropbox.com/man/sa_instructor_manual.htm
Effectiveness	Turnitin's plagiarism prevention is often so successful that institutions using our system on a large scale see measurable rates of plagiarism drop to almost zero. From www.turnitin.com/static/plagiarism.html	Masked Plagiarism. A unique originality detection engine built into SafeAssignment allows detecting plagiarism that was intentionally masked by changing words to synonyms or swapping words in a sentence. This phenomenal technology is unique to Safe Assignment and serves as an additional stimulus for students to submit authentic and properly referenced work. From www.mydropbox.com/services/facts.php

plagiarism-detection services: a) Will plagiarism-detection services such as *TurnItIn* and *MyDropBox* (*SafeAssignment*) correctly identify obviously plagiarized submissions when such work is submitted to their service? b) Do these services have systematic blind spots? c) How widely used are plagiarism-detection services such as *TurnItIn* and *MyDropBox*? d) How effective do the users of plagiarism-detection services perceive these services to be in detecting plagiarism?

Two demonstrations and a survey of Deans provide the data discussed in this paper. Deans responding to the survey answered questions to explore their perceptions of the use of these tools among their faculty and the effectiveness of the tools.

Demonstration One

In the first demonstration, the authors selected 13 papers from the Computer Science literature, downloaded them from the password-protected publisher's site, and submitted them without modification of any kind to both *TurnItIn* and *MyDropBox*. That demonstration is fully described in another publication [31]. In 10 of the 13 cases submitted, *TurnItIn* failed to expose plagiarism in the experimental submissions. *MyDropBox* failed in 9 of the 13 cases. On the few submissions in which the services detected the previous publications, they matched a reprint of the article posted on the open Web rather than the publisher's database thereby exposing a serious blind spot of their services—at least for Computer Science. How would the services perform with the literature from another discipline?

Demonstration Two

For the second demonstration, the authors chose 24 papers from Education publications. See Table II for a list of the papers used. The primary criterion for choosing papers was that they be relevant to the first author's current teaching and research interests. Several papers were from journals to which she intended to submit a manuscript.

The PDF file for each of the selected papers was downloaded from an academic database and submitted without modification to both *TurnItIn and MyDropBox* for a plagiarism check. In other words, the authors played the role of a plagiarizing student to see if the services would detect their misdeeds. To be clear, the authors of this paper are not suggesting the original works were plagiarized in any way.

Both *TurnItIn* and *MyDropBox* report the percentage of similarity between the submitted document and other work indexed by the service. In addition, the services report a color code suggesting an overall degree of similarity. For example, the color codes for *TurnItIn* run from low to high through blue, green, yellow, orange, and red. *TurnItIn* might report a similarity of 1% with a green rating suggesting very little similarity exists. A 1% similarity may easily be explained by an author's properly attributed use of quotations or odd snippets of text that are not plagiarized.

For this demonstration, *TurnItIn* reported a green rating for 21 of the 24 experimental submissions and failed to flag any as fully plagiarized. *MyDropBox* reported a green rating for 18 of the 24 experimental submissions and recognized only 2 of the 24 experimental submissions as 100% plagiarized. Results for each experimental submission are reported in Table II.

Some of the experimental submissions yielded surprising and interesting results. Experimental submission 1 was 100% plagiarized yet both services detected only 3% similarity and gave an overall similarity rating of green. Experimental submission 11 was also rated green by both plagiarism-detection services but the services highlighted

Table II
Summary Table

		% Similarity		Services' Assessments	
Submission	Authors	TurnItIn	MyDropBox	TurnItIn	MyDropBox
ES 1	Breault (2004)	3%	3%	Green	Green
ES 2	Davis, et al. (2007)	12%	100%	Green	Pink
ES 3	De Rijdt, et al. (2006)	2%	11%	Green	Green
ES 4	Deveci, Ersoy, & Ersoy (2006)	49%	28%	Yellow	Yellow
ES 5	Ginns & Ellis (2007)	18%	19%	Green	Green
ES 6	Grant (2004)	10%	14%	Green	Green
ES 7	Hauge (2006)	14%	NA	Green	Green
ES 8	Hunt, et al. (2006)	9%	14%	Green	Green
ES 9	Joram (2007)	7%	6%	Green	Green
ES 10	Kennedy (2007)	3%	100%	Green	Pink
ES 11	Kerr, Rynearson, & Kerr (2006)	19%	7%	Green	Green
ES 12	Kirkwood (2006)	6%	26%	Green	Yellow
ES 13	Koehler, Mishra, & Yahya (2007)	21%	51%	Green	Pink
ES 14	Ledoux & McHenry (2006)	35%	4%	Yellow	Green
ES 15	Lim & Chan (2007)	6%	17%	Green	Green
ES 16	Loveless, Burton, & Turvey (2006)	25%	8%	Green	Green
ES 17	Niess (2005)	17%	10%	Green	Green
ES 18	Perry (2006)	17%	20%	Green	Green
ES 19	Reis-George (2007)	6%	9%	Green	Green
ES 20	Romano, et al. (2005)	23%	0%	Green	Green
ES 21	Rovai (2007)	37%	33%	Yellow	Yellow
ES 22	Schlusser, et al. (2007)	5%	10%	Green	Green
ES 23	Tillema & Smith (2007)	1%	6%	Green	Green
ES 24	Ury, Mardis, & Wainscott (2006)	13%	3%	Green	Green

seemingly obvious plagiarism. Finally, Experimental Submission 10 illustrated how differently the plagiarism-detection services may perform on one specific submission. In this instance, *TurnItIn* identified only 3% similarity between the submission and published work, missing a copy of the paper that had been posted on the Internet. *MyDropBox* found that copy and thus identified the submission as 100% similar to the posted work.

Survey of Deans

How widely used are plagiarism-detection services and how effective do other academics perceive them to be in detecting plagiarism? Because administrators set policy regarding plagiarism detection and services, the authors of this paper chose to survey administrators about their perceptions. Deans seemed the obvious choice because they are closer to facts in the classroom than higher-level administrators. They typically act as the interface between the resources of the university and the needs of the departments. In addition, their perceptions about the effectiveness of these services influence funding allocation for plagiarism-detection initiatives.

A mailing list of 3285 names and e-mail addresses for Deans (Arts and Sciences, Education, Engineering, Computer Science, Math and Science, and Graduate Programs) was purchased from a commercial mailing list provider. In mid-February 2008, the Deans on the list were invited to participate in a brief survey and promised a summary of the results. After removing undeliverable addresses and those belonging to individuals who had retired or moved from their positions, the survey was delivered to approximately 3000 people with a reminder to non-responders one week later.

The two-contact approach netted 954 respondents over a three-week period from Deans of: Arts and Sciences (37%); Education (22%); Graduate Studies (22%); Engineering (11%); Business (2%); Students (1%); Law (0.2%); and Other (15%). Among the respondents, 96.3% said their institutions typically require students to submit essays. If respondents reported instructors at their institution did not require student essays (the case in some Engineering programs, for example), the survey ended without asking further questions. In institutions where instructors typically assign student essays, 74% used plagiarism-detection services: *TurnItIn* (79%), *MyDropBox* (26%), and other tools

(21%). (Some institutions use more than one tool). Many respondents reported using *Google* searches along with or instead of the specialized detection services. Several respondents indicated their belief that *Google* was more effective. For example, one respondent wrote "Actually, we just *Google* unfamiliar phrases or word patterns and it works!"

To the question, "Across your faculty, which of the following commonly trigger use of plagiarism detection services?" the Deans responded:

- "Routine submission of student assignments" 60%
- "Routine checks of theses or dissertations" 22%
- "Routine self-evaluation by students" 14%
- "Suspicion of plagiarism" 90%

To the question, "Which of the following behaviors constitute plagiarism in an essay or thesis?" the Deans responded:

- "Uses ideas from another source but without attribution" 90%
- "Uses text from another source but without attribution and without marking it as a quote" 97%
- "Uses text from another source with some form of attribution but without marking it as a quote" 69%

Seventy-three Deans added comments to the question on behaviors. The common themes were *how much text is copied is important* ("All of these have difficult-to-specify 'thresholds' that must be crossed before being called plagiarism"); *intent of the student is important* ("I define plagiarism as deliberately doing one of these things, knowing that it is wrong. Otherwise, I would call it '"misuse of sources"'"); and *other behaviors are plagiarism, too*, such as copying from the Internet, submitting someone else's work as one's own, copying a lab report, or "paraphrasing by thesaurus."

The survey asked, "Overall, how satisfied or dissatisfied are you with the plagiarism-detection service you use?" and 51% of respondents were either satisfied or very satisfied. Another 40% were somewhat satisfied. Only 8% were somewhat dissatisfied, dissatisfied, or very dissatisfied.

Taken together, the questions so far provided the context for the critical issue explored in this survey. *Do the users of these services realize how ineffective the plagiarism-detection services are for the professional literature?* Over 20% of respondents routinely check theses and dissertations with these tools. *What risk do they think they are mitigating by doing this?*

The survey asked, "How well or poorly do you believe the plagiarism detection service you use covers the literature in the following areas?" Many (n=433) respondents skipped this question and the 131 comments on this and another 131 comments at the end of the survey provided a hint about the low response rate on this question: Many Deans said they were not sufficiently close to the data, the tools, or to what was actually happening in the classroom, to know how to respond. Many Deans did not understand how well or how poorly the tools they used at their institution covered the literature and were reluctant to provide an uninformed guess. Approximately 500 respondents *did* answer this question on the effectiveness of the plagiarism-detection services across several types of literature. Table III provides their answers:

The striking picture from Table III is that 56% of respondents rate the plagiarism-detection services coverage of their field's professional literature as "Very Well" or "Moderately Well" (87% rate coverage "Somewhat Well" or better) even though the actual coverage probably deserves a rating closer to "Moderately Terrible." The ratings look the same across all of the types of the materials, even though the services are much more effective with materials available on the open Web. Given the aggressive marketing claims of the leading plagiarism-detection services [1], it is no surprise respondents believe the service they use performs equally well across the various sources of literature.

Only a few of the respondents' comments showed a sophisticated understanding of the plagiarism-detection services' capabilities. For example, one respondent wrote, "Plagiarism services are primarily used in composition classes and in some first and second-year general education classes. They work well for many of the source types used by students in these settings. More advanced undergraduate courses less frequently require essay writing or require writing that does not lend itself to *TurnItIn* -type checking. We do have graduate programs that require theses and dissertations but I do not have knowledge of how these programs check for plagiarism." However, comments that distinguished between types of materials were rare. Only six participants addressed the issue of differential effectiveness and they noted difficulties in exposing plagiarism from print publications (books), magazines, and recent Web postings—not one said it was difficult to find journal articles (or theses/dissertations) available only at password-protected sites or in hard copy. Many respondents said they were satisfied with Google, and none of them noted that Google did not reach text hidden behind a password.

Consider the customer satisfaction data (only 8% reported being dissatisfied to any degree with these services) and the results of Table III. Deans either perceive the services as equally effective for the professional scholarly literature as for the general sources, or they do not know enough to have an opinion. It is easy to understand why some graduate schools submit every thesis or dissertation to

Table III
Responses to "How Well or Poorly do You Believe the Plagiarism-Detection Service You Use Covers the Literature in the Following Areas?"

	Very Well	Moderately Well	Somewhat Well	Somewhat Poorly	Moderately Poorly	Very Poorly	Response Count
Popular sources such as magazines	14.1%	35.7%	34.3%	11.0%	3.0%	2.0%	502
Everything published on the open Web	23.4%	38.2%	26.9%	7.4%	2.9%	1.2%	513
The academic literature in your field published by the professional societies	11.4%	44.0%	28.8%	11.2%	3.4%	1.2%	507
The academic literature in your field published by the leading commercial publishers (e.g., Elsevier, Wiley, etc.)	12.7%	43.8%	30.4%	9.3%	3.0%	0.8%	504
All dissertations and theses available online (ProQuest)	16.8%	38.0%	29.7%	9.6%	3.4%	2.5%	471

a plagiarism-detection service and treat the work as fully vetted if it comes back with a clean report.

One respondents' comments expressed Author 1 and Author 2's sense of plagiarism-detection tools well: "They are imperfect tools that sometimes lead to unrealistic expectations of 'perfect plagiarism checking.' The public has a very low level of understanding of what software can do, does do, and what it cannot do."

Discussion and Recommendations for Practice

Most professors are aware of and use a variety of anti-plagiarism strategies to design assignments for students [32]. These strategies are helpful in both deterring and detecting plagiarism from students and instructors are encouraged to design assignments to make plagiarism less likely. However, this investigation focuses on plagiarism in Graduate Education and among scholars. Such strategies are not available to reviewers for theses, dissertations, or submissions to conferences and journals. For evaluation of graduate essays, theses, dissertations, or of papers submitted to conferences or journals, the current plagiarism-detection tools are very weak—occasionally finding plagiarism of a paper that has been posted on the public Web.

To catch copying from the professional literature, one has to search that literature but the plagiarism-detection services frequently do not have the access that would allow effective searches. Until plagiarism-detection services provide more thorough access to the scholarly literature, a few recommendations might be helpful for faculty and institutions coping with plagiarism:

Recommendation One

Use multiple approaches and services to check for plagiarism. In the demonstrations reported in this paper, and in our day-to-day work, neither service outperformed the other. Each has exposed plagiarism in some works that the other missed. Each has missed matches to papers on the open Web (reachable by Google) and each has exposed close paraphrases that would be much harder to find with Google searches of exact quotes.

Recommendation Two

Use plagiarism-detection services to expose obvious plagiarism quickly but do not place any trust in low plagiarism scores. In our survey, 14% of respondents give students access to the plagiarism-detection service for routine self-evaluation. In some cases, the professor requires students to submit their essays through the service, and in this way, students can learn what the service has found before a final draft is forwarded to the faculty member for grading [33], [34]. In other cases, students have discretionary access. Thus, for example, one survey respondent noted, "Students are taking the initiative to check their own papers. Our library offers the *TurnItIn* service to both faculty and students alike, so the students tend to check their papers in advance of turning them in. I think that, for some, it is for the security of knowing that their paper is acceptable. For others, *it may be a way to learn how to avoid detection*" (emphasis added). Given the huge body of scholarly literature that the plagiarism-detection services do not reach, when students or more experienced scholars check what the service finds before submitting their work, faculty should be skeptical of low plagiarism scores in the works they receive. One possibility is that those who choose to plagiarize learn from the service's feedback to copy from sources the service does not check.

Recommendation Three
Plagiarism detection is still a skilled, human investigative task. Therefore, set aside time for plagiarism checking as a distinct part of the grading process. Check for plagiarism by adopting a skeptical mindset toward the papers before taking a second pass through remaining papers in which you treat them as honest submissions deserving of feedback.

Recommendation Four
Contact professional society executives and journal editors demanding that they enable efficient plagiarism checking of the articles in their databases.

Plagiarists steal from members of the research community who are the authors of the scholarly works being plagiarized. It is scholars' work product that is stolen by plagiarists and scholars' time that is squandered in tedious checking for plagiarism from the databases of scholarly journals. Perhaps enabling efficient plagiarism checking involves a publisher-supplied search engine that checks a document for similarity with the papers in that publisher's database. Perhaps it involves proprietary databases opening access for plagiarism-checking services. Perhaps other solutions exist. The authors of this paper are not advocating for any *particular* solution.

The fact that academics do not have access to efficient plagiarism-detection is a tremendous problem. So far, the marketing hype from the plagiarism-detection services for the academic community has effectively convinced academics and key administrators these problems do not exist. It is time for faculty and professional associations to work with publishers to move toward a new model of publication access that protects our time and our work.

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