

WIK

The first published material detailing the extent of contract cheating is a study by Robert Clarke and Thomas Lancaster. The study presented three main findings:

- Over 12 percent of postings on a popular website for outsourcing computer contract work are actually bid requests from students looking to attempt contract cheating.
- Contract cheaters posted an average of 4–7 requests, suggesting that habitual use is made of such services by these students.
- A smaller number of users have posted over 50 bid requests, including examples from multiple institutions. This suggests that these are agencies subcontracting work, not students who are directly making use of the services.

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Contract cheating has become one of the most severe problems in academia across the globe. In virtually all fields of study, students asked to complete an assignment, essay, thesis, project or any other kind of student work frequently encounter offers from companies or individuals who offer to do the work for them. For various reasons, which will be discussed below, some percentage of students trying to take shortcuts regarding their studies, are open to the practice of using work done by someone else. For students in that situation, there are countless options.

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I'm starting to get worried. While we wait for educational and governmental leaders to do something about contract cheating, the industry is expanding and the providers are becoming less ashamed and more brazen. Our silence is equaling permission and the contract cheating providers are seizing the opportunity to become legitimate. To be sure, some educational and governmental leaders are doing something about contract cheating. In the UK, the Education Secretary asked PayPal and Google to refuse to service contract cheating providers, the Westminster Forum just recently held an event focused on contract cheating, and the Quality Assurance Agency has been busy working on the problem as well.

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We present a novel tool that assists in carrying out effective code reviews. Identifying and fixing buggy code consumes significant time and resources in a software development project. Code reviews by peers and experienced programmers is an effective method for identifying potentially buggy code. However, the process of code review is slow and quality of results depends on skills and experience of the reviewers involved. Moreover, a code review carried out by an individual expert is always subjective and hence open for questioning. An automated tool which can improve the quality of code reviews is thus highly desirable.

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Academic plagiarism (AP) has been defined as 'the use of ideas, concepts, words, or structures without appropriately acknowledging the source to benefit in a setting where originality is expected'. Forms of AP range from copying content (copy&paste) to reusing slightly modified content, e.g., interweaving text from multiple sources, to heavily concealing content reuse, e.g., by paraphrasing or translating text, and lastly, reusing data or

simply ideas without proper attribution. The easily recognizable copy&paste-type AP is more prevalent among students, while concealed AP is more characteristic of researchers, who have strong incentives to avoid detection. Plagiarized student assignments typically have no consequences for the public.

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Whereas the quality of solutions to assignments sold by essay mill has been questioned, a study by Jenkins and Helmore showed that work obtained through the use of an auction site was of sufficient quality to gain good marks and remain undetected by the module tutor. A 2007 study examined over 900 examples of contract cheating by students studying computing subjects. The published results categorise the assignment types (e.g. Programming, Database, Web Design) and are analysed by country. One new concern identified by this study was the number of major projects (both final year undergraduate and postgraduate) being posted onto auction sites.

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First are file sharing sites, where a wide variety of previously written student works are available, free of charge, or for a fee. Many of the authors of these files have agreed to have their work used by other students. Besides these essay file-sharing sites, there are websites where documents of many other types – scientific papers, theses, etc., are also publicly available and ready for instant download. Regardless of the type of document or method of procurement, using any source without proper acknowledgement of authorship is known as plagiarism.

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In Australia, the government is passing legislation to make contract cheating services illegal, and the universities have really stepped it up with their efforts to prevent and respond to contract cheating in direct and pointed ways. At the same time, the Canadian Ministry of Training, Colleges and Universities is refusing to step in saying that contract cheating is merely an issue to be addressed by individual institutions and students. And, of course, there seems to be no political or educational leadership on this issue in the United States. And we're seeing the impact of our collective silence.

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Especially if such a tool can reduce or eliminate the subjectivity associated with individual experts' code reviews, it will be a considerable gain. This is exactly what our tool helps with by leveraging "crowd expertise". How do programmers acquire "expertise" to become "expert reviewers"? Mostly one learns from other's experience which may be available in variety of forms such as in a text book, a best practices guide or available in the on-line question and answer forums. It is observed that often times a programmer, when faced with a problem or a bug in some source code, turns to searching an on-line professional programmer forum such as StackOverflow for assistance.

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Text retrieval research has yielded mature systems that reliably detect copied or moderately altered text in an input document and retrieve its source if the source is included in the system's reference collection. Such systems are well-suited to detect AP of the copy&paste

type. Yet, they often fail to find concealed forms of AP, such as paraphrases, translations, or idea plagiarism. Researchers have proposed numerous approaches to improve the text similarity assessment methods, e.g., semantic and syntactic analyses to better identify paraphrases, or cross-language retrieval to better detect translations. Research also showed that hybrid approaches, i.e., the combined analysis of text and other content features, improve the retrieval effectiveness

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From a study of 4,000 suspected cases of "contract cheating" some interesting patterns of behaviour have been observed. A summary was presented at the HEA Workshop on Contract Cheating (March 2008).

At the Aske conference held in June 2009 a paper detailing a "multi-faceted" approach to dealing with the problem of "contract cheating" was presented. A paper presented at the STEM conference (April 2012) was a study of over 600 assignments in subject areas ranging from "Anthropology to Theology". There is debate about which subjects are most susceptible to contract cheating, but an overall consensus points from several scholars including Curtis & Clare (2017), Bretag (2017), Lancaster & Clarke (2015) and Eaton (2019).

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While most university students have been taught what plagiarism is and how to avoid it, there is a nontrivial group of students who tend to submit the work of others rather than produce their own texts. Universities address plagiarism in a variety of ways, including the use of more or less sophisticated text-matching software tools, which are able to detect certain portion of plagiarized documents by comparing them to other texts and previously submitted papers. There is, however, an increasingly popular method of plagiarising that is specifically designed to get around these methods of detection and it has become a quite serious problem.

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When Dave Tomar first talked about his contract cheating provider days back in 2010, he hid his identity as the "shadow scholar" because he knew his actions were immoral – there was shame. Now, contract cheating providers are making their identities known – even when they are a graduate student themselves.

When the industry was getting started, the websites used to hide what they were doing. They would claim that they were only providing students with sample paper. Now, they are much more brazen. They admit that they are doing work for the students to submit and they are using seduction methods to lure students into using their services.

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In fact, most software vendors now use StackOverflow as a programmer support channel for their software. As such the information available on professional programmer forums has become a valuable source of experiential knowledge – or "crowd expertise" – about several aspects of software design and development. Challenges in using "crowd expertise" for assisting in software development tasks Search engines and information retrieval (IR) technologies have made it easy to locate relevant information on professional programmer support forums, however, in order to zero-in on a suitable solution for the problem at hand a programmer has to manually sift through the content presented by IR tools.

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Alzahrani et al. combined an analysis of text similarity and structural similarity. We showed that the combined analysis of citation patterns and text similarity improves the identification of concealed AP. Pertile et al. confirmed the positive effect of combining citation and text analysis and devised a hybrid approach using machine learning. Recently, we demonstrated the potential of analyzing the similarity of mathematical expressions, semantic concept patterns, and images for improving the detection of AP. Concluding from prior research, we see a hybrid approach that analyses heterogeneous content features as most promising to prevent and detect the wide range of AP forms.

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The Commercial Aspects of Contract Cheating are examined in a paper given at ITiCSE '13. This paper analyses the monetary value of contract cheating to the different parties who play a role in the contract cheating process. The main analysis is based on a corpus consisting of 14,438 identified attempts to cheat. The corpus was collected between March 2005 and July 2012.

In a 2017 meta-analysis of 5 studies, 3.5% of a total of 1378 students reported buying assignments to submit as their own. Of the students who reported engaging in contract cheating, more than 60% admitted doing so more than once.

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The terms “academic ghost writing” and “contract cheating” apply to situations in which students hire someone else to produce an original work for them and then, pretending that the work is their own, submitting it under their own name. These cases are, of course, plagiarism, – using someone else’s work as one’s own. However, as this work has been created as an original, text-matching software is usually unable to detect it. In such cases, even if cheating is discovered, it is very difficult to prove.

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The industry is growing as a result. And the impact of our silence is that contract cheating will become a normal and accepted way to receive a university degree.

I urge all universities and colleges to join us in the fight against contract cheating by doing one simple thing – participating in the 4th International Day of Action Against Contract Cheating (IDoA). It will be happening on October 16th, 2019. Start planning now by seeing what has been done in the past and rallying the troops on your campus to help you with your day of action plans.

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One of the reasons why a programmer needs manual sifting through the search results is that normal IR tools may not always take into account the semantic context in which a programmer is operating. As such the ability to derive benefit from the content available on professional programmer support forums is limited by the domain expertise of a programmer and his/her fluency in relevant technical vocabulary.

To address the issues concerning consumption of raw “crowd expertise” researchers have leveraged, technologies such as Natural Language Processing (NLP) and Knowledge Discovery (KD). Particularly, the application of NLP techniques for deriving sentiment (on a selected scale) has been a popular direction.

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HyPlag is a research prototype that realizes a hybrid approach to plagiarism detection for academic documents. The system analyzes mathematical expressions, images, citations, and text to improve the identification of potentially suspicious content similarity, particularly in research publications, such as journal articles, PhD theses, and grant proposals. The target audience of our system are reviewers of such works, e.g., journal editors or PhD advisors. Figure 1 gives an overview of the hybrid PD approach currently implemented in HyPlag. The approach follows the established design principle of a multi-stage detection process consisting of candidate retrieval, detailed comparison, and human inspection. The following subsections present the analysis steps for each class of content features (math, images, citations, and text).