

## WIK

The legality of contract cheating companies was reviewed by Newton and Lang in a 2016 book section of the Springer Handbook for Academic Integrity. The official status of these services varies internationally. In New Zealand it is not legal to "advertise or provide third party assistance to cheat", with similar, older regulations on the statutes of 17 states in the US. Australia has suggested laws similar to that of the New Zealand law, with a proposal Bill at the federal level. In the United Kingdom, the Quality Assurance Agency announced a report advocating the use of a law-based approach as one way to address contract cheating.

## IJEI

Plagiarism, ghost writing, contract cheating, as well as learner's motivation for breaching academic ethics have been the subject of numerous papers. Many, recently, have dealt concretely with the extent of contract cheating. Clarke and Lancaster (2006) researched a site RentACoder where computer solutions are being sold both for legitimate uses and for cheating. They conclude that 236 contributions requesting services (more than 12%) were posted to facilitate cheating. The same authors enumerated number of postings and their meta data at one of the contract cheating sites. They revealed that the number of postings requesting ghost writing services had been ascending (Lancaster and Clarke 2012).

## ICAI

Lesson #3 – We Must Do Something Against Contract Cheating.

Perhaps our biggest shared fight right now are the threats pertained by the industry of contract cheating, We were already aware that contract cheating threatens student learning and the integrity of our educational institutions, but findings by Cath Ellis, David House & Kane Murdoch (of University of New South Wales, Sydney Australia), Thomas Lancaster (of Imperial College London), and Douglas Harrison (of UMUC) reminded us that it also threatens our students. Students are being tricked and attracted into the contract cheating world, where they not only have their learning and identities stolen but where they also face danger of extortion.

## ARX

Another related method has been proposed by [11] which suggests API call sequences to programmers who are seeking to obtain a target object starting with a different entity. They depend on code search tools to retrieve relevant code fragments from the Web, and then statically examine such code snippets to identify the method invocation blocks. Yet another new approach that assists a developer by suggesting him/her the code fragments is presented in [12]. It proposes to a programmer how an API could be used in a given programming environment. Similarly, [13] comes with a "Context-Aware IDE-Based Meta Search Tool for Recommendation about Programming Mistakes and Exceptions".

## BELA

To reveal similar text, we focus on established text retrieval methods. For candidate retrieval, our method employs a text fingerprinting method, which we did by adapting the Sherlock tool. The method uses text chunking using word 3-grams and probabilistically chooses a subset of chunks for computing a digital signature of the input sequence. The mean probability for sequence retention is 1/16. For the detailed analysis, we offer users a choice between whole string matching and the Encoplot algorithm. We changed the Boyer-

Moore algorithm to match all sequences (including repetitions) with 12 or more same words. Encoplot, created by Grozea et al. [8], is an efficient character 16-gram comparison that has a time-complexity of  $O(n)$  by ignoring repeated matches.

#### WIK

QAA is proposing that existing fraud laws could be used, since the activities of such services, and their customers, could be reasonably interpreted to fit with definitions of cheating as they involve 'false presentation' and 'failure to disclose information'. A subsequent research project studied the UK Fraud laws and the terms and conditions used by contract cheating companies and concluded that they would be unlikely to fall foul of Fraud Act due to the disclaimers, definitions and conditions they use which generally state that any custom written products should be used only as 'study guides' or 'revision aids', thereby placing responsibility, and 'intent', onto the student customer.

#### IJEI

For this article, studies examining relative number of cheating learners are also relevant. In a large North American study, Donald McCabe (2005) found that 7% of undergraduate and 3% of graduate students admitted cheating on written assignments by turning in work prepared by another person. Australian research reported that in 2004, 1.1% of students questioned admitted to being involved with ghost writing, whereas in 2009 the percentage increased to 3.5% (Curtis and Popal 2011). Zafarghandi et al. (2012) examined students in Iran and found that 7.9% of them admitting having engaged in contract cheating.

#### ICAI

To respond to this danger, we need the appropriate tools, policies and processes to identify and respond to contract cheating, as well as a redesign of our approach to teaching and learning and a rethink for what measures should be used as the grounds for admissions and graduation decisions. Our international day of fight against contract cheating (the third Wednesday of October each year) is an excellent start for responding to the threat – as Evangeline Mourelatos of Deree, American College of Greece and I stated in our conference presentation – and we invite more institutions to join us on the 4th day of action on October 16th 2019.

#### ARX

They developed an IDE (Eclipse) plug-in that makes use of the APIs used by popular web search engines (viz. Google, Yahoo, Bing) to examine the entire Web using keywords from a development context in an IDE. They reveal relevant results by taking into consideration the programming environment as well as popularity of the preliminary search results. There have also been studies such as [14] which infers possible links/similarity among artifacts of a software programming project by analyzing the projects artifact storages. Main goal in case of majority the existing works such as the ones mentioned above is to suggest code samples or similar Q&A Discussions.

#### BELA

The HyPlag prototype consists of a backend server program and a web-based fronted application, which are loosely binded via a REST web service interface. The backend is done in Java using the Spring Boot framework. We employ an Elasticsearch index as the main data

repository for content features. To extract text, header metadata, links, and references from PDF, we integrated the GROBID2 and ParsCit3 tools. We combine the result sets of both tools to increase precision and recall of the mining. HyPlag relies on MathML4 to present and process mathematical data. We use InftyReader5 to convert PDF that contains mathematical content to TeX.

#### WIK

Despite this, news 'stings' have shown that companies can be complicit in the inappropriate handling of these products. A similar study in Lithuania concluded that contract fraud services were unlikely to fall foul of current laws, although an analysis of Australian Act concluded that fraud, as well as falsification and conspiracy, might be legal ways via which contract cheating could be handled. All three studies called for the introduction of novel legal approaches to tackle contract fraud. Contract cheating is legal in Canada. A follow-up research study suggested such a new law, based on the principle of strict liability, which lessens the demand for prosecutors.

#### IJEI

A study stating to be the first economic investigation of assignment market was conducted at 3 UK schools in 2013. Researchers examined behaviour of 90 learners using a hypothetical discrete choice experiment and revealed that half of the students reported a willingness to buy an essay. Some of them answered that they would not hesitate to pay up to \$445 for a 1st mark essay (Rigby et al. 2015). An earlier article dealt with the crowd working markets (crowd-sourcing). Authors found that "79.0% of crowd workers agreed to give their work for assistance on exams or homework tasks without additional incentive; this rose to 81.4% when additional incentives were given" (Harris and Srinivasan 2012).

#### ICAI

Lesson #4 – We Are Doing Great Work.

The jewel of the congress is seeing the absolutely fantastic and diverse activities being done by professionals and students around the globe to make cheating the exception and integrity the standard.

We heard from those who are working to actively educate our students about academic ethics, whether through integrity tutorials similar to those at Ryerson University and Sheridan College (both in Canada), honesty awareness days like that at Adelphi University (in the USA), or new academic ethics courses like those being introduced in Ukrainian Secondary Schools.

#### ARX

Emphasis is on helping a programmer in writing the code by leveraging code fragments (or discussions about code) from various sources. Secondly, most of the current works leverage normal information retrieval (IR) techniques to fetch relevant code/content from different sources such as the Web. For example, [9], [10] make use of term frequency-inverse file frequency based text mining methods, whereas [11], [13] make use of current search engines/APIs for retrieving relevant passages. Specifically, in the area of program review there have been feelings analysis of reviews [9], study on arguments that affect code review [10], and semi-automation in the review procedure [15].

## BELA

HyPlag's user interface contains two main views to present the results of the combined detection approach: the Results Overview depicted in Figure 2 and the Detailed Comparison View depicted in Figure 3. HyPlag also features a dashboard area which allows users to upload and manage data as well as to configure, start and trace analyses. We explain the functions of the analysis views using a withdrawn journal article from bioengineering [20]. The retraction message explains that the journal withdrew the article, because it reused a three-page math analysis without attribution from a study by Freeman et al. [4]. We used HyPlag to compare the withdrawn article with the source indicated in the retraction message and with other papers by Freeman, the source paper's first author.

## WIK

Prosecutors do not have to show that they 'intended to help student fraud, but instead would make them liable for prosecution just for offering services that could be reasonably viewed as being used for contract fraud. More broadly, despite the apparent potential of a law challenge to contract cheating companies, prosecutions are nowadays rare, largely due to the limits of existing laws. In addition, the very act of outlawing a service would not surely reduce demand for it; the aforementioned research studies all cry for a holistic, multi-pronged strategy to tackling contract cheating.

## IJEI

Many researchers have also examined the reasons students give for engaging in contract fraud. Devlin and Gray (2007) did focus groups with students at Melbourne University and identified 8 main motivators: Inadequate admission criteria, low understanding of plagiarism, low academic skills, teaching/learning problems, laziness/convenience, pride in plagiarizing, pressures, university costs (Devlin and Gray 2007). Another list of students' reasons for plagiarism more generally is given by Gullifer and Tyson (2010): lacking the time to complete assignment (poor time management), perceived disjuncture between mark (grade) and effort required, too much effort to complete over too many courses, pressure to do well.

## ICAI

Numerous people spoke to us about their work on ethics culture creation like that being done by Azalea Hulbert (West Virginia University, USA), the Emory Ethics Project (Emory University, USA), and the University of Monterrey (Mexico). We heard about how we can improve our responses to integrity breaches from the folks at MacEwan University (Canada) which talked about implementing restorative strategies in academic integrity processes, the group at the College of William & Mary (USA) who shared their novel mentoring program to enhance student progress and retention after suspension, and the development being conducted by Adriana Barberena (University of Monterrey, Mexico) on what learners learn through the process.

## ARX

Here, although [9] differs from this work as it just examines the comments of three OSS and characterizes them on the grounds of their sentiment and [15] suggests a tool based on static examination of code to automate the code examination process. [16] gives a detailed overview of various (semi-) automated tools of program reviews available for use but

concerning concretely to security aspect of the software. These programs are based on static analysis and their performance depends on program quality. Main aim of the work presented in this article, however, is to assist in reviewing a given fragment of source code.

#### BELA

For the example, the binding views in Figure 2 show the relatedness of text (left), citations (middle) and math content (right) in the retracted article by Xu et al. and two articles by Freeman et al. The upper result summary shows the source paper named in the retraction message. The match views for text indicate fair similarity of the retracted paper, particularly in the introduction, to both comparison files. This similarity is largely due to plagiarism in keywords and general scientific phrases and probably would not have caused suspicion for either of the 2 comparison documents. However, the binding view for mathematical content (right) in the top result summary shows a clearly suspicious relatedness that should prompt a user to examine the documents in detail.