A rule-based decision support system for detecting, reporting and substantiating contract cheating within assignments in computing courses in UK Higher Education

Dr Suraj Ajit, Associate Professor (Computing)
Mrs Aparna Maikkara, MSc Student
Outline

- Contract Cheating
- Context/Problem/Motivation
- Hypothesis
- System Design
- Preliminary Evaluation
- Future Work
Contract Cheating

Contract cheating is a form of academic misconduct in which a third party completes work for a student assignment which is passed off by the student as their own work. The third party may be family/friends and need not involve money.

Balance of Probabilities: Decisions in cases of suspected academic misconduct are determined on the basis of whether the overall evidence supports the referral, or the student’s explanation i.e., which is more likely/more probable?
Contract Cheating Problems

• Disrepute to qualifications/degrees and their providers
• Potential threat to public health and safety
• Unethical and can negatively affect student experience
• Essay Mills blackmailing students
• Student tends to struggle in future assessments
Context/Problem/Motivation

- Drastic increase in cases referred for suspected contract cheating in UoN (during COVID 19)
- Tedious, resource intensive and time-consuming process to refer, detect and substantiate these cases
- Significant delays in receiving outcomes. Unfair particularly to students falsely accused.
- Inconsistent outcomes
- High workload involved can deter markers from making referrals
Hypothesis

• An intelligent decision support system corroborating evidence from different tools and sources could improve the efficiency of detecting, reporting and substantiating contract cheating

Efficiency Attributes: Systematic; Time taken; Consistency; Traceability
Can training improve marker accuracy at detecting contract cheating? A multi-disciplinary pre-post study

Phillip Dawson & Wendy Sutherland-Smith

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Abstract

Contract cheating occurs when students outsource assessed work. In this study, we asked experienced markers from four disciplines to detect contract cheating in a set of 20 discipline-specific assignments. We then conducted a training workshop to improve their detection accuracy, and afterwards asked them to detect contract cheating in 20 new assignments. We analysed the data in terms of sensitivity (the rate at which markers spotted contract cheating) and specificity (the rate at which markers spotted real student work). Pre-workshop marker sensitivity was 58% and specificity was 83%. Post-workshop marker sensitivity was 82% and specificity was 87%. The increase in sensitivity was statistically significant, but the increase in specificity was not. These results indicate that markers can often detect contract cheating when asked to do so, and that training may be helpful in improving their accuracy. We suggest that markers' suspicions may be crucial in addressing contract cheating.
Can software improve marker accuracy at detecting contract cheating? A pilot study of the Turnitin authorship investigate alpha

Phillip Dawson, Wendy Sutherland-Smith, and Mark Rickson

Centre for Research in Assessment and Digital Learning, Deakin University, Melbourne, VIC, Australia; School of Psychology, Faculty of Health, Deakin University, Burwood, Australia; Turnitin LLC, Oakland, CA, USA

ABSTRACT

Contract cheating happens when students outsource their assessed work to a third party. One approach that has been suggested for improving contract cheating detection is comparing students’ assignment submissions with their previous work, the rationale being that changes in style may indicate a piece of work has been written by somebody else. This approach is time consuming, but recent advances in machine learning and natural language processing suggest that it may be well suited to computerization. We trialed an early alpha version of Turnitin’s Authorship Investigate tool, which compares students’ submissions against their previous work. Twenty-four experienced markers from five units of study were asked to make decisions about the presence of contract cheating in bundles of 20 student assignments, which included 14 legitimate assignments and six purchased from contract cheating sites. We asked markers to determine if each assignment was contract cheating, then provided them with an Authorship Investigate report and let them change their decision. Marker accuracy at detecting contract cheating increased significantly, from 48% to 59% after using the report, with no significant difference in false positives. These findings suggest that software may be an effective component of institutional strategies to address contract cheating.

KEYWORDS

Cheating; contract cheating; marking; educational technology; academic integrity
Current process at UoN

- Marker finds cues in submitted assignment work
- Marker calls student for a viva-voce (recorded)
- On suspicion, marker completes referral form with supporting evidence and sends it to administrator [template]
- Administrator sends it to AIO
- AIO investigates, gathers evidence and refers to Panel (if needed)
- Panel analyses evidence and calls student for a hearing
- Panel decides on the outcomes
**Current process at UoN**

**Appendix 4: Academic Integrity and Misconduct (Referral for suspected contract cheating or commissioning)**

- **Referring Tutor**
  - CC/C Suspected. Apply standard text to student submission and assess the grade in NILE/Tii.

- **Student Records**

- **Contract-Cheating AIO**
  - Use Turnitin Authorship tool (or equivalent) to investigate the suspected submission and any other pieces of student work or comparator documents.

- **SCCA**

- **AMP**
  - Convene an AMP hearing.
  - Panel to consider case. CC/C AIO can be present.
  - Is there a finding of CC/C?
    - Yes
      - Apply penalty in the light of prior findings (with a final warning where appropriate).
    - No
      - Inform student of outcome and right to appeal.
  - Is there sufficient evidence to support referral?
    - No
      - Mark submission for academic worth as normal.
    - Yes
      - Complete referral form with initial evidence from AIO and via.

* If the Panel determine that misconduct has occurred, but that it is not contract-cheating or commissioning specifically, they can apply any of the available penalties from the tariff in the Academic Integrity Policy.
System Design

Virtual Learning Environment
- Awareness
- Learning analytics
- Academic engagement
- Academic history
- Plagiarism reports
- Authorship analysis

Lecturer
- Academic integrity dashboard
- Assessment observations
  - Observations on meta-data
  - Observations on submitted artefacts
  - Viva-voce rating

Academic Integrity Experts
- Knowledge base
  - Rules to be applied
  - Weightage for facts
  - Meta rules to be applied on rules

Inference Engine
- Processes facts based on rules
- Gathers more facts based on rules
- Applies weightage on all data points gathered and calculates ratings
- Consolidates observations and generates a report with recommendations

Whistleblowing

EXPERT SYSTEM
Factors influencing decision to conduct viva-voce

Figure 4. Relative weightage of evidence that substantiate contract cheating
Factors influencing decision to conduct viva-voce

• Student Engagement Level, Multiple/Concurrent Logins from different geographical locations [Learning analytics and Class attendance]
• Report Content - Turnitin Similarity [Extremely Low]
• Use of methods/libraries not taught in class
• Suspicious content or textual cues within document [format, author names acknowledgement(insert name), generalized writing style]
• Confidence and code explanation in recorded video
• Quality of references [availability, date accessed]
• Document metadata [total editing time, saved by]
• Academic misconduct history
• Grade profile (?) based on class exercises and other modules
• Academic Integrity Awareness; whistleblowing; online search

Marker to use checklist and examine above factors
Academic Integrity Score

Detected suspicious activity!!

The academic integrity score indicates that contract cheating may have occurred based on the results of this assessment. Add all evidence available and report the incident to the academic integrity officer for a detailed review of the situation.

Activity Timeline
- Add additional comments
- Record via results
- Schedule via assessment
- Initial observations
- Assessment submission

Evidences

<table>
<thead>
<tr>
<th>No.</th>
<th>File name</th>
<th>Category</th>
<th>Priority</th>
<th>Added by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;&lt;filename&gt;&gt;</td>
<td>Submission</td>
<td>HIGH</td>
<td>Systems</td>
</tr>
<tr>
<td>2</td>
<td>&lt;&lt;video&gt;&gt;</td>
<td>Video</td>
<td>HIGH</td>
<td>&lt;&lt;Lecturer Name&gt;&gt;</td>
</tr>
<tr>
<td>3</td>
<td>&lt;&lt;email file&gt;&gt;</td>
<td>Miscellaneous</td>
<td>MEDIUM</td>
<td>&lt;&lt;Lecturer Name&gt;&gt;</td>
</tr>
<tr>
<td>4</td>
<td>&lt;&lt;additional file&gt;&gt;</td>
<td>Miscellaneous</td>
<td>LOW</td>
<td>&lt;&lt;Lecturer Name&gt;&gt;</td>
</tr>
</tbody>
</table>
Preliminary Evaluation

- Samples of marked assignments
- Semi-structured interview [Developer, Marker and AIO]

Future Work

- Machine Learning
- Larger sample for wide range of assignments
Thank You

Email: suraj.ajit@northampton.ac.uk
Twitter:@surajajit
## Facts, Rules and Weightages

<table>
<thead>
<tr>
<th>Fact source</th>
<th>Fact Category</th>
<th>Fact subcategory</th>
<th>Question to collect fact</th>
<th>Fact Id</th>
<th>Possible values</th>
<th>Fact weightage</th>
<th>Evidence weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLE platform to rate these values</td>
<td>Awareness scores (AS)</td>
<td></td>
<td>Did the student attend a seminar, session, or training organised by the university to educate them about contract cheating?</td>
<td>AS1</td>
<td>YES NO NA</td>
<td>LOW</td>
<td>NA</td>
</tr>
<tr>
<td>VLE platform to rate these values</td>
<td></td>
<td></td>
<td>Was the student successful in passing an online or offline test on contract cheating awareness?</td>
<td>AS2</td>
<td>YES NO NA</td>
<td>LOW</td>
<td>NA</td>
</tr>
<tr>
<td>VLE platform to rate these values</td>
<td>Student's academic behaviour</td>
<td></td>
<td>Did the student participate in an academic integrity activity campaign or other similar events offered by the higher education institution?</td>
<td>AS3</td>
<td>YES NO NA</td>
<td>LOW</td>
<td>NA</td>
</tr>
<tr>
<td>VLE platform to rate these values</td>
<td></td>
<td></td>
<td>Has the student signed a self-declaration confirming that the student is committed to maintain academic integrity?</td>
<td>AS4</td>
<td>YES NO NA</td>
<td>LOW</td>
<td>NA</td>
</tr>
<tr>
<td>VLE platform to rate these values</td>
<td></td>
<td></td>
<td>What is the student's level of engagement in the virtual learning environment in terms of the overall interaction?</td>
<td>LA1</td>
<td>HIGH MEDIUM LOW NA</td>
<td>MEDIUM</td>
<td>LOW</td>
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</tbody>
</table>
## Facts, Rules and Weightages

<table>
<thead>
<tr>
<th>Assessment Presentation</th>
<th>AP1</th>
<th>YES</th>
<th>NO</th>
<th>HIGH</th>
<th>HIGH</th>
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</thead>
<tbody>
<tr>
<td>In the live/recorded presentation, does the student appear to be comfortable and confident?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Viva</th>
<th>V</th>
<th>YES</th>
<th>NO</th>
<th>NA</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is a viva needed? (This is a system generated value based on some facts specified above)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the student’s performance in the viva satisfactory?</td>
<td>V1</td>
<td>YES</td>
<td>NO</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
</tbody>
</table>
## Facts, Rules and Weightages

<table>
<thead>
<tr>
<th>Academic Integrity Officer</th>
<th>Initial investigation</th>
<th>Investigation factors</th>
<th>Any whistleblowing reported in the name of the student?</th>
<th>IF1</th>
<th>YES</th>
<th>NO</th>
<th>HIGH</th>
<th>HIGH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Authorship analysis score displayed on software like Turnitin indicates possibility of contract cheating?</td>
<td>IF2</td>
<td>YES</td>
<td>NO</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Is there any information about the student on social media platforms or on the internet that raises a warning flag?</td>
<td>IF3</td>
<td>YES</td>
<td>NO</td>
<td>MEDIUM</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>Student records department</td>
<td>Student Records from VLE</td>
<td>Academic history (AH)</td>
<td>What is extent of difference between the student's current grade of the assessment and the average of student's grades so far?</td>
<td>AH1</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Is there a history of academic misconduct suspicions or proceedings filed in the name of the student?</td>
<td>AH2</td>
<td>YES</td>
<td>NO</td>
<td>NA</td>
<td>HIGH</td>
</tr>
</tbody>
</table>