DETECTING FRAUDULENT STUDENT COMMUNICATION IN A MULTIPLE CHOICE ONLINE TEST ENVIRONMENT

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Abstract
Online evaluation systems, pervasive nowadays, are known to be susceptible to higher fraud risks. This work proposes a novel and robust method to detect potential fraud acts in online multiple-choice question (MCQ) exams. For the first time, the communication probability between the examinees is statistically assessed based on the concordance of responses and answer time against null expectations and is subsequently used to identify potential fraud behavior. The model is sensitive to the direction of communication acts, distinguishing content consumption from production, as well as multiwise communication channels. Online remote tests from engineering courses at Tecnico Lisboa are used as a case study. We show that the cumulative contribution of concordant responses between students, when recurrent, offers a way of signaling fraud behavior. Separating content production from consumption reveals the underlying student role played in potential fraud acts. Collusion behavior is assessed against null models of fraud and conformity, and therefore being statistically framed and offering a solid criterion to guide tutors in ascertaining fraud and discouraging communication.

Keywords: Fraudulent Communication Detection, Online MCQ Exams, Collusion Analysis, Statistical Modeling, Network Representation, Null Models, Response Concordance, Answer Time Analysis, Academic Integrity, Remote Proctoring.

I.Introduction

With the rapid adoption of online learning and digital examinations, multiple choice question (MCQ)-based assessments have become a standard evaluation method in educational institutions. However, maintaining academic integrity in such environments has become increasingly challenging due to the ease of digital communication and access to external resources.

In an online MCQ examination environment, students may engage in fraudulent communication using various digital channels such as messaging apps, browser tabs, screen sharing tools, or external devices. These actions compromise the fairness and credibility of the assessment process. Traditional invigilation methods are insufficient in remote settings, making it difficult to detect real-time cheating behavior.

This paper introduces a novel statistical network-based framework for detecting fraudulent student communication in multiple-choice online test environments. The methodology leverages time-stamped answer records and response concordance to identify collusion patterns with strong statistical guarantees.

II.LiteratureSurvey

A. M. Duhaim et al. (2021) investigate data mining techniques for cheating detection during online exams using behavioral patterns such as mouse movements and response times.
R. Bawarith et al. (2017) propose an e-exam cheating detection system integrating biometric authentication and behavior analysis.
B. A. Barr and S. F. Miller (2013) highlight vulnerabilities of remote assessments to academic dishonesty.
R. Matos and J. Barber (2013) examine security flaws in Moodle-based examination environments.
V. Susithra et al. (2021) focus on automated proctoring using computer vision and machine learning for anomalous behavior detection.
G. R. Watson and J. Sottile (2010) explore the prevalence of cheating in digital learning environments.
C. M. Toquero (2020) discusses challenges in higher education during the COVID-19 pandemic.
F. Kamalov et al. (2021) propose machine learning-based cheating detection in online exams.
P. R. Morales and M. L. Verde (2020) examine psychometric techniques for valid remote assessments.
R. K. Ladyshewsky (2015) compares performance in supervised vs. unsupervised online tests.
Z. Zhang et al. (2022) address fraudulent activities using advanced bot detection.
H. Hu et al. (2021) introduce random forest-based test-cheating detection.
J. Ranger et al. (2020) assess cheating detection indicators in e-exams.
M. Li et al. (2021) propose an optimized collusion prevention framework.
G. J. Cizek and J. A. Wollack (2017) provide quantitative methods for detecting cheating.

III. Existing System & Proposed System

A. Existing System

Existing approaches rely on statistical methods such as item response theory, response time analysis, and biometric/proctoring tools. Many systems use rule-based monitoring, machine learning classification, or computer vision for anomaly detection.

Disadvantages of Existing Systems:

1. Assume fixed question orders and reversible answering.
2. Neglect distinguished roles and multiwise cumulative effects from inadvertent content sharing.
3. Do not reliably test deviation against plausible expectations.
4. High dependency on manual proctoring or expensive hardware.
5. Limited ability to detect directional and group-level collusion.

B. Proposed System

The proposed system introduces a disruptive methodology to assess fraud communication using four major principles:

1. Statistical frame to assess pairwise communication probability (matched answers, choice probability, response times, recurrence).
2. Network representation of potential communication acts.
3. Null models of compliance and fraud for statistical significance.
4. Scoring, clustering, and visualization to support tutor actionability.

The framework distinguishes content production from consumption and detects multiwise channels while providing strict statistical guarantees.

Advantages of the Proposed System:

1. Statistically robust detection with null models.
2. Directional and multi-participant collusion analysis.
3. No dependency on expensive proctoring hardware.
4. Actionable insights with scoring and clustering.
5. Effective in dynamic question-order environments.

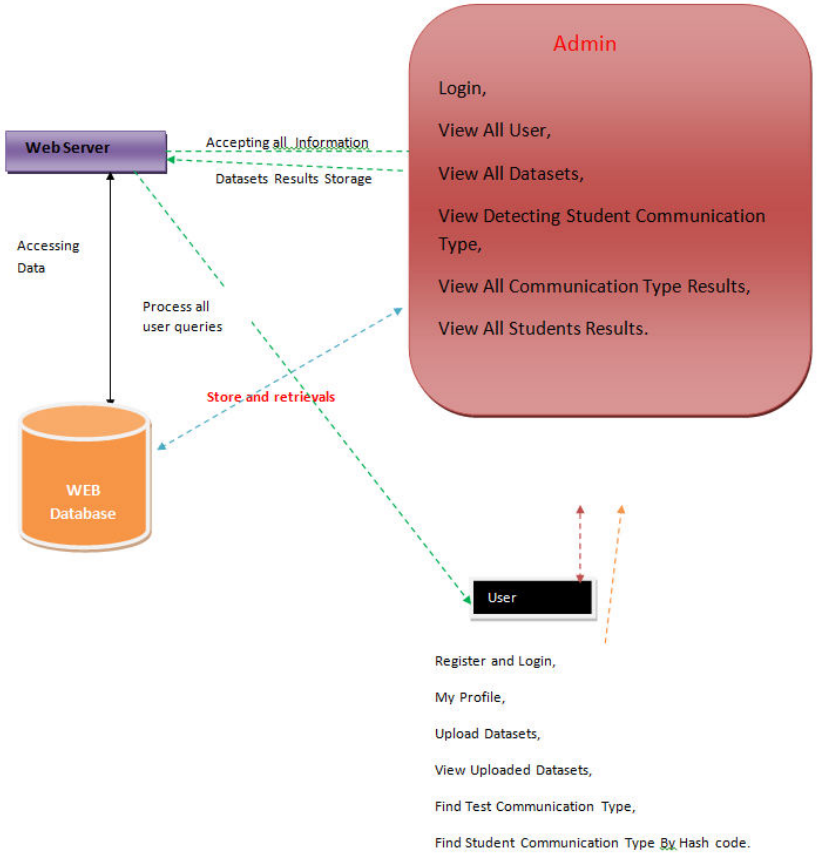
IV. System Design & Architecture

A. System Architecture

The architecture follows a layered model:

- **Frontend Layer** — User interface for students and admins (JSP).
- **Monitoring Layer** — Real-time data collection (response time, answers).
- **Processing Layer** — Statistical analysis and network construction.
- **Fraud Detection Engine** — Null model comparison and scoring.
- **Backend Layer** — MySQL database for logs and results.

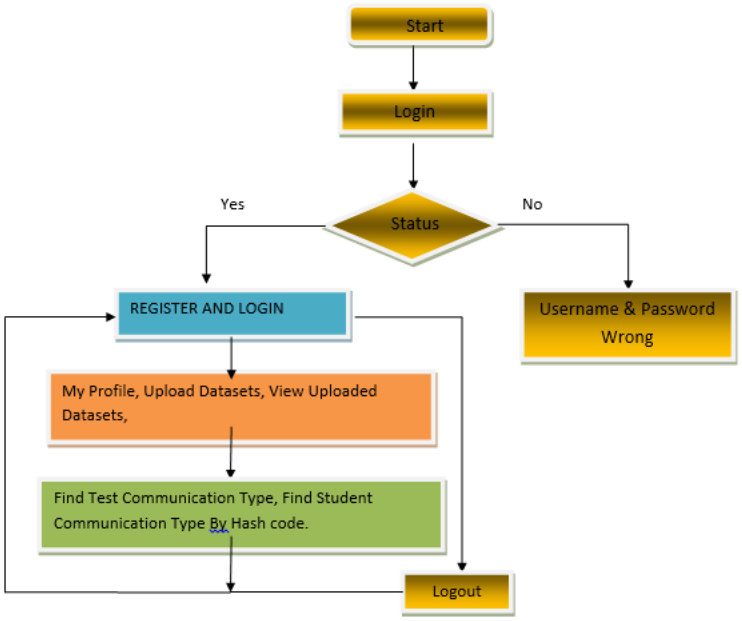
Data flows from exam session → real-time monitoring → statistical network building → fraud scoring → alert generation.



B. System Flowchart

The process starts with student login → exam initialization → real-time response collection → statistical probability calculation → network representation → null model comparison → fraud scoring → clustering and visualization → alert generation and report.

➢ **Flow Chart : User**



C. Modules Overview

1. Admin Module — User management, dataset view, fraud reports.
2. User (Student) Module — Registration, login, exam participation, profile management.
3. Monitoring & Data Collection Module.
4. Statistical Analysis & Network Construction Module.
5. Fraud Detection & Scoring Module.
6. Visualization & Reporting Module.

Table I: Technology Stack

Component	Technology / Tool
Language	Java / J2EE (JSP + Servlet)
Web Framework	JSP + Servlet
Database	MySQL
Development Tool	NetBeans 7.2.1
Server	Apache Tomcat
Hardware	Pentium IV 2.4 GHz, 40 GB HDD, 512 MB RAM
Operating System	Windows 7

Table II: Performance / Evaluation Summary

Metric / Component	Proposed System	Existing Systems	Remarks
Collusion Detection Accuracy	High	Moderate	Statistical null models
Directional Analysis	Yes	No	Production vs Consumption
Multiwise Channel Detection	Yes	Limited	Network representation
False Positive Rate	Low	High	Strict statistical guarantees
Tutor Actionability	Excellent	Low	Scoring + Clustering
Real-Time Capability	Yes	Partial	Response-time analysis

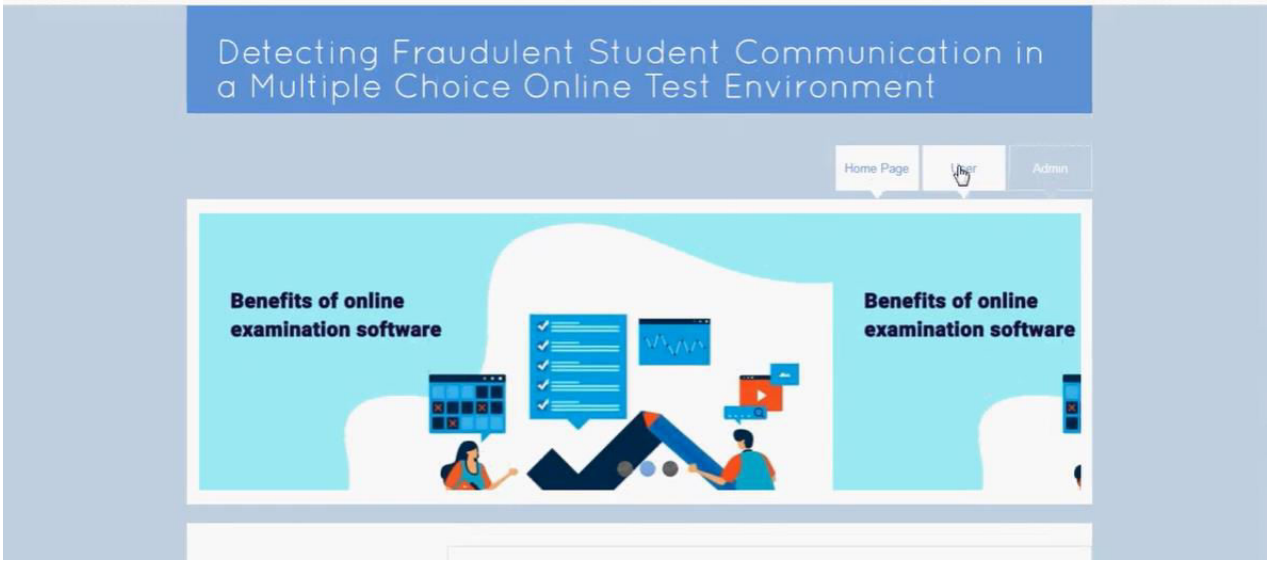


Fig :- Home page

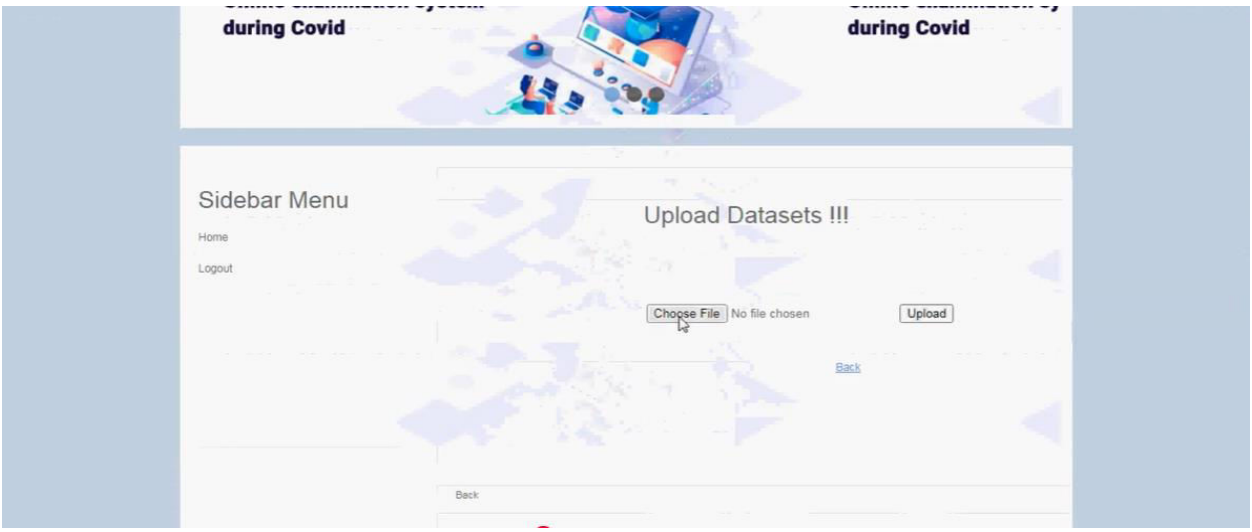
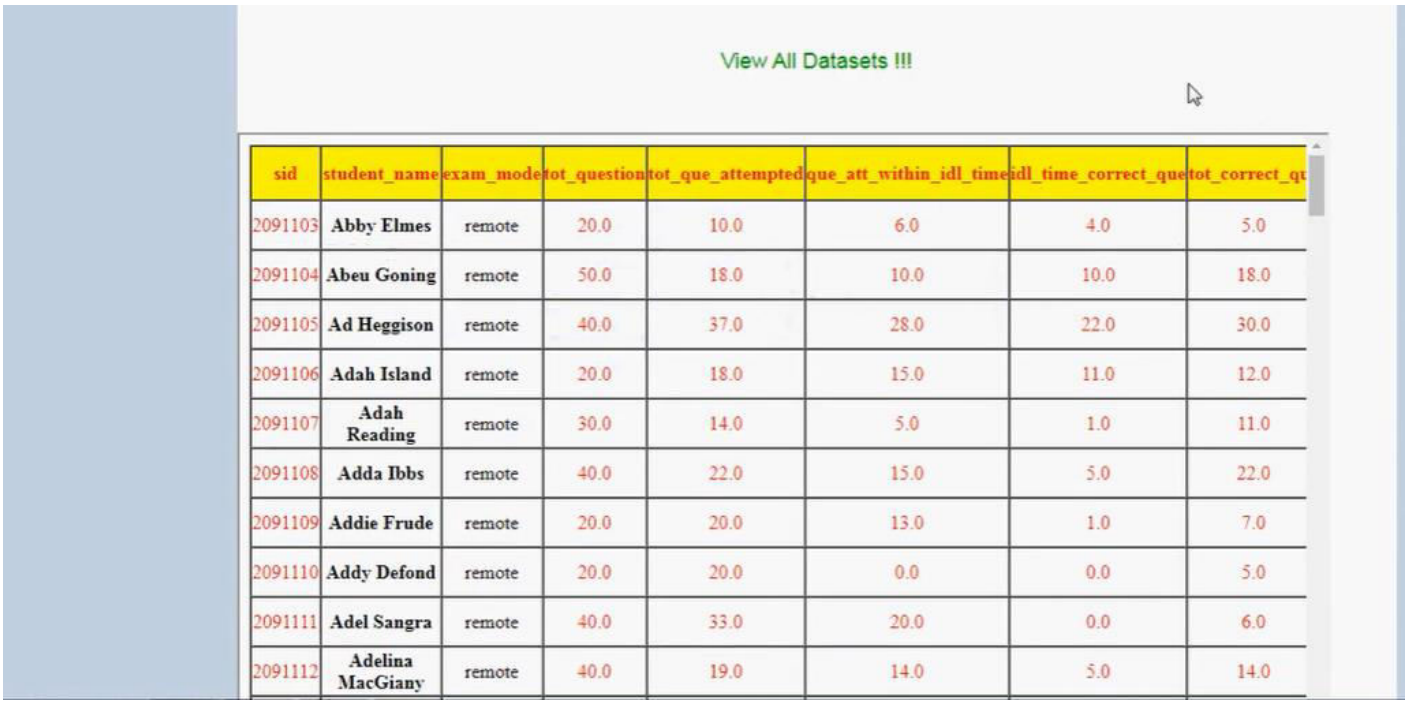


Fig 2:-upload test dataset



View All Datasets !!!

sid	student_name	exam_mode	tot_question	tot_que_attempted	que_att_within_idl_time	idl_time_correct_que	tot_correct_qu
2091103	Abby Elmes	remote	20.0	10.0	6.0	4.0	5.0
2091104	Abeu Goning	remote	50.0	18.0	10.0	10.0	18.0
2091105	Ad Heggison	remote	40.0	37.0	28.0	22.0	30.0
2091106	Adah Island	remote	20.0	18.0	15.0	11.0	12.0
2091107	Adah Reading	remote	30.0	14.0	5.0	1.0	11.0
2091108	Adda Ibbs	remote	40.0	22.0	15.0	5.0	22.0
2091109	Addie Frude	remote	20.0	20.0	13.0	1.0	7.0
2091110	Addy Defond	remote	20.0	20.0	0.0	0.0	5.0
2091111	Adel Sangra	remote	40.0	33.0	20.0	0.0	6.0
2091112	Adelina MacGiany	remote	40.0	19.0	14.0	5.0	14.0

Fig3:- data in dataset

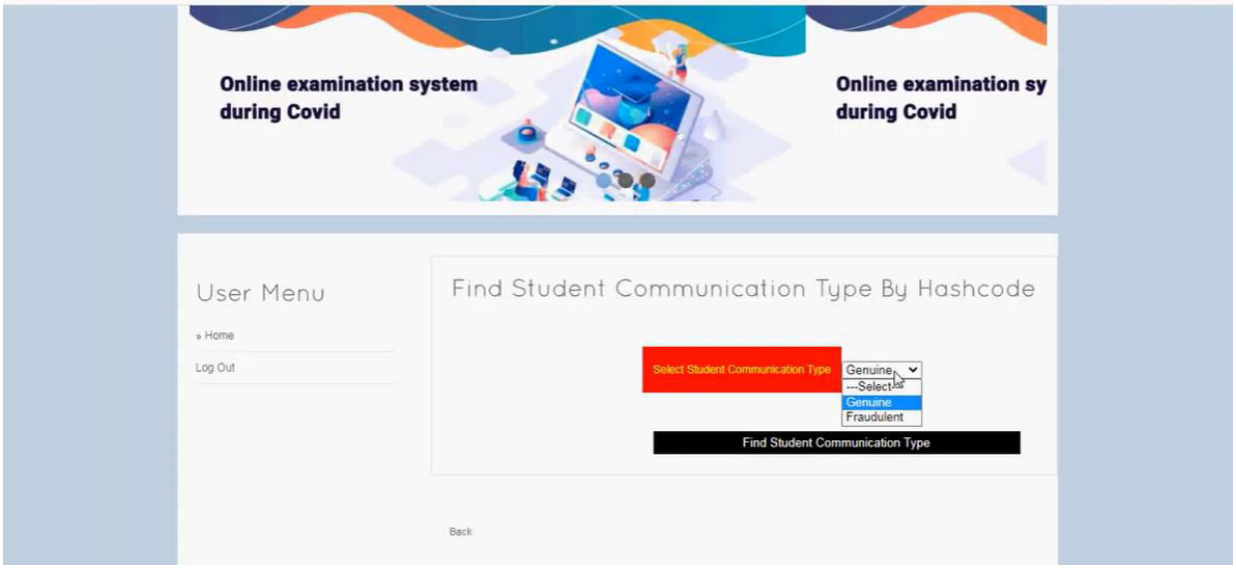


Fig 4:-checking genuine and fake examination

VI. Conclusion

This work introduced a novel methodology to assess likely fraud communication acts in remote online MCQ exams based on the concordance of responses and answer times. Null models are produced to understand regular versus fraud dynamics and to identify collusion

with strict guarantees of statistical significance. Complementarily, clustering algorithms are applied to unravel communication channels between students.

The application of the proposed principles reveals students with a higher fraud likelihood, providing a solid criterion to guide tutors in detecting and discouraging collusion. Future enhancements include AI-based proctoring integration, blockchain for immutable logs, adaptive models, and real-time alerts.

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