Accepted Manuscript

Breaking up friendships in exams: A case study for minimizing student cheating in higher education using social network analysis

Alexandru Topîrceanu

PII: S0360-1315(17)30194-X

DOI: 10.1016/j.compedu.2017.08.008

Reference: CAE 3229

To appear in: *Computers & Education*

Received Date: 8 November 2016

Revised Date: 22 August 2017

Accepted Date: 23 August 2017

Please cite this article as: Topîrceanu A., Breaking up friendships in exams: A case study for minimizing student cheating in higher education using social network analysis, *Computers & Education* (2017), doi: 10.1016/j.compedu.2017.08.008.

1. Introduction

Cheating during academic examinations is as old as exams themselves. Students, at many educational levels, adopt this technique as a way to increase their overall grades or to avoid failing examination. Many survey studies over the last decades show how this phenomenon has evolved to a current alarming proportion. Studies warn that cheating is chronic, with 60 to 75% of students admitting to cheat (Maramark and Maline, 1993). In a 1999 survey of 2,100 students on 21 campuses across the USA, about one third of the participating students admitted to serious test cheating (Yee and MacKown, 2009). A comprehensive review by Whitley (Whitley, 1998) found that across 46 studies, around 70% of the college students have cheated in college. For newer studies, the means are 70% (Klein et al., 2007), 86% (McCabe et al., 2006), and 60% (Rakovski and Levy, 2007). In conjuncture with the cheating phenomenon itself, several authors warn that technology has given students increased access to learning resources, at the expense of more ways that students can cheat (Etter et al., 2006).

While punishment of academic integrity is a common phenomenon worldwide, in some educational institutions, years of studies still suggest that as many as half of students cheat at least once per year (McCabe, 2005; Fontana, 2009; Hosny and Fatima, 2014; Gallant et al., 2015). We note that cheating in high schools has also become alarmingly high Stephens and Wangaard (2016), often caused by home-school dissonance (Brown-Wright et al., 2013), however this study focuses solely on the tertiary educational sector. The current mindset of students is adapting to increasingly diversified methods of damaging the integrity of education (Simkin and McLeod, 2010). This tendency evolves, as there are inconsistent preventive measures to combat classic cheating (e.g. homework copying, cheat sheets and whispering during an exam).

It becomes clear that there is a changing perspective in how students relate to academic integrity, and recent studies reach the idea that cheating is *perceived* as acceptable, and certainly not unethical. The main causes of cheating are often considered a mix of ignorance and stress (Maramark and Maline, 1993), and also the fact that the trade-off between benefits and punishment is favourable for students (Hutton, 2006). Other factors that were found to correlate with cheating include having cheated in the past, studying under poor conditions, having a positive attitude towards cheating, combined with the perception that social norms support it (Whitley, 1998).

In light of these perpetuous and damaging phenomena, it seems wise that educators learn as much as possible about cheating methods used by students, and new ways to prevent them (Yee and MacKown, 2009; Wang et al., 2015; Couch and Dodd, 2005; Jiang-bing, 2009). Cheating is considered the act of gaining a reward for ability by dishonest means, and is commonly used to break rules in order to gain an unfair advantage in competitive situations. Academic cheating was classified in 7 different ways by McCabe (McCabe, 2005). Summarizing these categories, in 41% of cases a student obtains help by copying from another student (33% with their knowledge), and in 29% of cases, the help is provided to other neighbouring students.

Combining state of the art perspectives from educational sciences (Yee and MacKown, 2009; Wang et al., 2015; Hutton, 2006; Faucher and Caves, 2009) with the interdisciplinary prowess of social network analysis (Wang and Chen, 2003; Lazer et al., 2009; Barabási, 2016) and the analytical insights in topological optimization (Wang et al., 2006; Topirceanu et al., 2014), we present a case study (2013-2016) on the Romanian higher education system in which we have applied an original methodology and assessment system that can naturally reduce the probability that students cheat during an examination. The solution combines both empirical and computer simulation observations regarding student seating methodologies, being inspired from genetic algorithm optimization (Mitchell, 1998) and social networks analysis; the methodology takes into consideration the mapping between social ties outside the classroom and tries to *interrupt* (break) them during exam.

Our proposed solution is inspired from correlating aspects of social network analysis with the empirical observations during the examination of students in college (Borgatti et al., 2009). The use of prohibited information sources, like printed papers, phones, and other hands-free devices, can usually be detected by a trained eye, and can be immediately punished. However, detecting students whispering information is often hard, and also requires a more subjective manner of punishing. Our assumptions revolve around two empirically observed facts: