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Big data analytics for behavior monitoring of students

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Abstract

Security threat from senseless terrorist attacks on unarmed civilians is a major concern in today's society. The recent developments in data technology allow us to have scalable and flexible data capture, storage, processing and analytics. We can utilize these capabilities to help us in dealing with our security related problems. This paper gives a new meaning to behavioral analytics and introduces a new opportunity for analytics in a typical university setting using data that is already present and being utilized in a university environment. We propose the basics of a system based on Big Data technologies that can be used to monitor students and predict whether some of them are becoming prone to deviant ideologies that may lead to terrorism.

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1. Introduction

Behavioral analytics is an emerging area of research^{1,2}. It focuses on the “how” and “why” of behaviors taking a holistic and human view of data. Traditionally, the term has been reserved for data collected for E-commerce, but in this paper we broaden its scope and use it to include data from all available resources in order to predict if someone is becoming prone to deviant ideologies leading to terrorist tendencies. This is a sensitive but very important topic as new challenges involving terrorism and killing of innocent civilians are emerging and we have to do all that is possible to deal with the situation. This includes turning to rapidly evolving new technologies to help us.

In a university setting, a sizeable amount of personal and academic data is usually available for each student and it can be augmented with data from other sources that we will discuss in later sections. Various tools and techniques⁴

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are already available for automatic monitoring and analysis of data collected regarding the students' activities. The recent developments in data technology allow us to have scalable and flexible data capture, storage, processing and analytics. We can now utilize these powerful capabilities to integrate a large quantity of data from multiple sources and use them to extract worthwhile information.

Even though the ideas propounded in this paper can be easily applied to other situations and settings, but we limit the scope of our discourse to monitoring of student activities at the university level. Particularly, we note that the idea can be easily extended to include teachers and staff and that they can be more dangerous as they easily influence dozens or even hundreds. Furthermore, with some modifications the endeavor can be at the level of Ministry of Higher Education to include all universities or even at the level of Ministry of Education to include schools (K-12). In fact, this type of effort can be easily modified for any organization or enterprise large enough to justify the cost and benefits.

The rest of the paper is organized as follows. Analytics, particularly Big Data analytics pertaining to educational sector data is discussed in the next section. In Sections III, IV, and V, we discuss the sources of data, the possibilities of capturing, storing, and analyzing behavioral analytics of students, respectively. In Section VI we give our concluding remarks.

2. Educational sector behavioral analytics

In the educational sector setting, the most relevant analytics would be that which supports pedagogy. There are several examples of efforts made in this regard. In³ the authors report student performance prediction, intelligent course recommendation, data driven learning analytics, and personalized learning. An interesting example is given in⁴ regarding data analysis of students from 2000 high schools of Colorado, USA. The total number of students analyzed was 860,000 and the aim of the analysis was to discover a student's readiness for college or career. In⁵, the authors propose an architecture for using Big Data in education.

Our idea, though described in an educational setting, does not focus on pedagogy. Analytics pertaining to student behavior aims at monitoring a student to observe if he or she is deviating from normal behavior. The normal behavior is defined in context of a particular issue that is in focus. Judging from the news items and newspaper articles one of the concerns of recent times is the ideological deviation leading to terrorism, particularly among young people. We focus on the monitoring and anomaly detection of students with regards to this issue.

Ideological deviation, if left unchecked, can make the student wander into the realm of unlawful activities. The monitoring and prediction could provide us with early detection capability that can be backed up by information, guidance, advice, and early feedback to the person concerned and also can be used to notify the relevant authorities. That may help to improve the student's behavior and also make him/her realize where he/she is heading and its consequences. A good and reliable model of a "normal" student could also be beneficial for academic and other purposes. From the society's point of view, the biggest benefit of all is that this system, if in place, can save innocent lives and curb other negative fallouts of terrorist activities, in addition to saving the future of our precious youth.

In the following, we give a perspective on how the analytics has evolved in recent years to allow us the implementation and exploitation of our idea.

Informally, analytics can be defined as the process of getting insights from the available data. According to one prevalent view point analytics has three levels⁴. At the basic level we have descriptive or reporting analytics. It is about knowing what has happened and why it has happened. The next level is predictive analytics⁶ that attempts to foretell what is going to happen. The third level builds upon the first two levels and recommends actions to deal with a given situation. It is called prescriptive analytics.

Analytics allows organizations to take actions based on data driven insights rather than only on experience and intuition of their executives. It helps businesses to be more effective and efficient in their operations, management, and strategic planning.

Analytics is not a recent discipline. Ever since we had databases, we have been able to query them. However, with databases we have the problem that critical data we need for reports and analysis is scattered among numerous different applications and systems (PC, mobile phones, etc.) residing on many different platforms, in many different formats, in many different organizations (internal and external) and geographies.

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