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Research Paper

Continuous Authentication of Smartphone Users Based on Activity Pattern Recognition Using Passive Mobile Sensing

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Abstract: Smartphones are inescapable devices, which are becoming more and more intelligent and context-aware with emerging sensing, networking and computing capabilities. They offer a captivating platform to the users for performing a wide variety of tasks including socializing, communication, sending or receiving emails, storing and accessing personal data etc. at anytime and anywhere. Nowadays, loads of people tend to store different types of private and sensitive data in their smartphones including bank account details, personal identifiers, accounts credentials, and credit card details. A lot of people keep their personal e-accounts logged in all the time in their mobile devices. Hence these mobile devices are prone to different security and privacy threats and attacks from the attackers. Commonly used approaches for securing mobile devices such as passcode, PINs, pattern lock, face recognition, and fingerprint scan are vulnerable and exposed to several attacks including smudge attacks, side-channel attacks, and shoulder-surfing attacks. To address these challenges, a novel continuous authentication scheme is presented in this study, which recognizes smartphone users on the basis of their physical activity patterns using accelerometer, gyroscope, and magnetometer sensors of smartphone. A series of experiments are performed for user recognition using different machine learning classifiers, where six different activities are analyzed for the multiple locations of smartphone on the user's body. SVM classifier achieved the best results for user recognition with an overall average accuracy of 97.95%. A comprehensive analysis of the user recognition results validates the efficiency of the proposed scheme.

Keywords: Activity Pattern Recognition, Behavioral Biometrics, Continuous Authentication, Mobile Sensing, Smartphone User Recognition, Ubiquitous Computing

1. Introduction

Smartphone and mobile technologies have become much popular in a very short span of time. We have moved from larger phones to very slim yet powerful smartphones. These devices have aided people with internet connectivity and enabled them to do their routine tasks at anytime and anywhere. At the moment, 68% of the entire world's inhabitants possesses a mobile phone and this number is anticipated to reach up to 72% by 2019 ("The Statistic Portal", 2017). Smartphones have started to replace personal computers and laptops. A market research has shown that mobile phone shipments worldwide are projected to add up to 1.93 billion in 2019 (Gartner, 2017). Due to the increased use of smartphones, more and more data is being produced, stored, accessed, and analyzed on these devices at homes, offices, and workplaces on daily basis. This data also includes sensitive and confidential information including personal identifiers, bank account details, and credit card information etc. As much as these mobile devices have become popular and improved worker's output, the security and privacy of sensitive data stored on these devices is still a key problem to be resolved (Krupp et al., 2017). The ever growing popularity of smartphones and mobile devices has resulted in several incentives for the attackers. The attackers are shifting their focus on mobile and hand-held devices as these devices can be stolen easily and victims' confidential data can be compromised. By stealing mobile devices, the attackers can easily reach and contaminate more machines and earn more money by misusing individuals' private details or by

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