Interactive Multi-View Visualization for Fraud Detection in Mobile Money Transfer Services

Evgenia Novikova, Saint Petersburg Institute for Informatics and Automation (SPIIRAS), Saint Petersburg, Russia

Igor Kotenko, Saint Petersburg Institute for Informatics and Automation (SPIIRAS), Saint Petersburg, Russia

Evgenii Fedotov, Saint Petersburg Electrotechnical University (LETI), Saint Petersburg, Russia

ABSTRACT

Mobile money transfer services (MMTS) have gained a solid market segment and are widely used for domestic and international money transfers. Like traditional financial systems they can be used to conduct illegal financial activity including money laundering or usage of malicious software to gain access to mobile money. The paper considers an interactive multi-view approach for detection of the fraudulent activity in the MMTS. It considers a set of visualization techniques enabling comprehensive analysis of the behavior of the MMTS subscriber according to his/her transaction activity. The authors suggest a metaphoric visualization of the MMTS users’ behavior based on RadViz visualization that is able to identify groups with similar behavior and outliers. They demonstrate how the proposed approach can be used to reveal money laundering scenarios, behavior frauds, present and discuss the results of the efficiency evaluation of the visualization techniques used to detect fraudulent activity.

Keywords: Emerging Security Threats, Fraud Detection, Mobile Money Transfer Services, RadViz Visualization, Visual Analytics, Visual Defense Technologies

INTRODUCTION

Starting in 2000, with the introduction of Smart Money in the Philippines, the world’s first electronic cash card linked to a mobile phone account— mobile money transfer services (MMTS) — have gained a solid market segment especially in the developing countries. For example, M-Pesa, which was launched firstly in Kenya in 2007, displayed in December 2011 about 19 million subscribers, namely 70% of all mobile subscribers in Kenya (StatReport, 2012) and is

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used now in Tanzania, Afghanistan, South Africa, India and Romania (M-Pesa, 2015). Orange Money, another mobile money transfer service, is deployed in 10 countries and gathers around 14% of the mobile subscribers of these countries (Orange Money, 2012). The MMTS allows users to deposit money into an account stored on their cell phones and called mWallet, to transfer mobile money to other users, including sellers of goods and services, and to withdraw deposits for regular money. Users are charged a small fee for sending and withdrawing money using the service. In such services, transactions are made with electronic money, called mMoney (Merrit, 2010).

The risks inherent to all payment systems present in the mobile environment (FATF, 2010). However, as mobile money transfer services are operated by mobile network operators which are not classed as deposit-taking institutions, and, therefore, rely on usage of mobile technologies, additional risks caused by the large number of non-bank participants, rapidity of transactions are introduced (Merrit, 2010). Besides, the MMTS provide higher level of anonymity compared to traditional banking systems. Therefore, it is required to determine new approaches to detect frauds in mobile money transfer services.

In this paper the authors present a novel interactive multi-view visualization approach that provides a better insight in the large data sets describing MMTS activity and can assist in anomaly detection. It allows an analyst to get a global overview of the MMTS subscribers’ activity and then focus on users of the particular interest by drilling down into their transactions. It is based on a RadViz visualization (Ankerst et al., 1998) of the MMTS users that helps to determine groups of similarities and outliers among them and is supported by graph-based and table views assisting in analyzing structural links of users. An analyst has a possibility to monitor changes in transaction activity using a heat map visualization of the transaction attributes. The heat map presentation of the user transaction activity is used to form his temporal profile which could be helpful when analyzing suspicious bursts of activity or changes in transactions amounts.

The main contribution of the authors is the interactive visual representation of the MMTS subscribers allowing detection of groups of users with similar behavior. To the best of researchers’ knowledge, this work is the first to exploit the RadViz visualization technique to visualize MMTS subscribers. This paper is extended version of the paper presented on CD-ARES 2014 (Novikova & Kotenko, 2014). It contains detailed description of the developed visualization technique, extended by the heat map visualization of the MMTS user activity, proposed usage scenarios and comprehensive usability evaluation which includes expert assessment of the effectiveness of the proposed visualization technique for money laundering schemes and behavior fraud detection.

The rest of the paper is structured as follows. Section 2 presents overview on mobile money transfer service and its structure, discusses related work in the field of fraud detection techniques in mobile payments as well as visualization techniques used to detect financial frauds. Section 3 describes the approach suggested, including visual models and interactions with them. Section 4 outlines the case studies used to demonstrate the proposed approach for financial fraud detection in mobile payments. Section 5 presents and discusses results of the efficiency evaluation of the proposed visualization technique. Section 6 sums up the authors’ contributions.

**SUBJECT AREA AND RELATED WORK**

Mobile Money Transfer Services, also referred as mobile payment, mobile money, and mobile wallet, generally denote to money transfer and microfinancing services operated under financial regulation and performed from or via a mobile device (Merrit, 2010). In the developing countries,
A Method for Angular Super-Resolution via Big Data Radar System
www.igi-global.com/article/a-method-for-angular-super-resolution-via-big-data-radar-system/188620?camid=4v1a

On Balancing Energy Consumption, Rendering Speed, and Image Quality on Mobile Devices
www.igi-global.com/article/balancing-energy-consumption-rendering-speed/46087?camid=4v1a