

## Accepted Manuscript

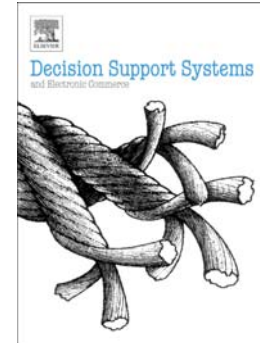
Android Application Classification and Anomaly Detection with Graph-based Permission Patterns

Karina Sokolova, Charles Perez, Marc Lemerrier

PII: S0167-9236(16)30155-5  
DOI: doi: [10.1016/j.dss.2016.09.006](https://doi.org/10.1016/j.dss.2016.09.006)  
Reference: DECSUP 12763

To appear in: *Decision Support Systems*

Received date: 2 July 2015  
Revised date: 12 August 2016  
Accepted date: 10 September 2016



Please cite this article as: Karina Sokolova, Charles Perez, Marc Lemerrier, Android Application Classification and Anomaly Detection with Graph-based Permission Patterns, *Decision Support Systems* (2016), doi: [10.1016/j.dss.2016.09.006](https://doi.org/10.1016/j.dss.2016.09.006)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# Android Application Classification and Anomaly Detection with Graph-based Permission Patterns

Karina Sokolova<sup>a,\*</sup>, Charles Perez<sup>b</sup>, Marc Lemerrier<sup>a</sup>

<sup>a</sup>University of Technology of Troyes, 12 rue Marie Curie, Troyes, France

<sup>b</sup>PSB : Paris School of Business, Digital Data Design, Chair D<sup>3</sup>, 59 rue nationale, Paris, France

---

## Abstract

Android is one of the mobile market leaders, offering more than a million applications on Google Play store. Google checks the application for known malware, but applications abusively collecting users' data and requiring access to sensitive services not related to functionalities are still present on the market. A permission system is a user-centric security solution against abusive applications and malware that has been unsuccessful: users are incapable of understanding and judging the permissions required by each application and often ignore on-installation warnings. State-of-the-art shows that the current permission system is inappropriate for end-users. However, Android permission lists do provide information about the application's behaviour and may be suitable for automatic application analysis. Identifying key permissions for functionalities and expected permission requests can help leverage abnormal application behaviour and provide a simpler risk warning for users. Applications with similar functionalities are grouped into categories on Google Play and this work therefore analyses permission requests by category.

In this study, we propose a methodology to characterize normal behaviour for each category of applications, highlighting expected permission requests. The co-required permissions are modeled as a graph and the category patterns and central permissions are obtained using graph analysis metrics. The obtained patterns are evaluated by the performance of the application classification into categories that allow choosing the best graph metrics representing categories. Finally, this study proposes a privacy score and a risk warning threshold based on the best metrics. The efficiency of the proposed methodology was tested on a set of 9,512 applications collected from Google Play and a set of malware.

*Keywords:* Android, permission, pattern, classification, anomaly detection, risk warning, graph analysis

---

## 1. Introduction

Mobile applications are extensively used worldwide and new applications are added every day to mobile markets - platforms for the distribution of mobile applications. Recently there has been a spate of interest in Android - one of

---

\*Corresponding author

Email addresses: karina.sokolova@utt.fr (Karina Sokolova), c.perez@psbedu.paris (Charles Perez), marc.lemerrier@utt.fr (Marc Lemerrier)

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات