Towards Privacy-Preserving Mobile Apps: A Balancing Act

Dengfeng Li\(^1\), Wing Lam\(^1\), Wei Yang\(^1\), Zhengkai Wu\(^1\), Xusheng Xiao\(^2\), Tao Xie\(^1\)

\(^1\)(University of Illinois at Urbana-Champaign, email: taoxie@illinois.edu)
\(^2\)(Case Western Reserve University, email: xusheng.xiao@case.edu)

Objective

- Maximize utilities while minimizing the amount of sensitive information exposed to protect users’ app usage data

Motivation

- Collecting some highly sensitive information provides little or no benefit towards delivering an app’s utilities
- Existing techniques lack customized solutions to preserve user privacy at different levels while delivering user-desirable level of utility efficacy (e.g., the number of enabled features)

Example – App displays videos only if some sensitive information is previously sent to a remote server [1]

1. Sensitive-Input Detection

- Leverage UI rendering, geometrical layout analysis, and NLP to identify sensitive input fields
- Leverages static data flow analysis to detect sensitive information (such as a GPS location) obtained from the system

2. Utility-Impact Analysis

- Anonymize each input, and measure its impact on the utilities of an app and produce an utility report
- Provide measurement to show how each input contributes to an app’s utilities

3. Privacy-Preserving Balancing

- Anonymize various sensitive information while assuring that the level of utility efficacy is above a user-predefined threshold

4. Privacy-Policy Compliance Checking

- Check whether the sensitive information collected by an app is privacy preserving against the declared privacy policy
- Conduct static data flow analysis on the app and its backend server to generate a usage summary of the obtained sensitive information
- Leverage NLP to annotate declared privacy policy to extract key features related to sensitive-information usage
- Check generated usage summary with extracted key features for inconsistencies

---


This material is based upon work supported by the Maryland Procurement Office under Contract No. H98230-14-C-0141

---

**HOTsOS Symposium and Bootcamp**

**HOT TOPICS in the SCIENCE OF SECURITY**

**APRIL 4-5, 2017 | HANOVER, MARYLAND**