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Review on fraud detection in mobile apps by ranking, rating & review

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Abstract
Now a day's number of fraud activities are performing frequently by various imposters for population of their application. Imposter always try to keep their mobile on top ranking in leader board. This paper describes the step wise process of fraud detection for mobile Apps. The aim is to develop such system that find ranking, rating and review behaviors for investigating review based evidences, rating based evidences and ranking based evidences and then aggregation based on optimization to combine all the evidences for detection of fraud.

Keywords: mobile apps, ranking, rating, review, evidence aggregation

1. Introduction
For the permotion of mobile apps, many app store launched their apps in leader board which display ranking chart, higher rank in leader bord shows large number of downloads that's why app developer for getting higher rank in leaderboard, find out various ways for advertising their apps for million dollars in revenue.
A report from cyber security firm Trend Labs back in October showed that there are over 400 malicious apps on the Android app store. According to the report, the Android platform is especially susceptible to such apps, which once installed are capable of spying on a user as well as leaking their private data to hackers and spammers fake reviews is not just a Google problem. Large corporations like Amazon have stood up against the issue of fake reviews with the American e-commerce giant filing a lawsuit against over 1000 people back in October for providing fake reviews on their products sold on Amazon. Amazon had said that misleading and fake reviews are bad for the company's brand and only profit a handful of dishonest manufacturers and sellers.so it is necessary to identify imposter during app downloading [8].
For finding out the fraudulent Apps it is impossible to manually label ranking fraud for each apps therefore by historical record data set mine leading session i.e constructed by leading events. Fraud is happen at any time during the whole life cycle of app, so the identification of the exact time of fraud is needed. Therefore, main target is to detect ranking fraud of mobile Apps within leading sessions. By analysis of Apps' ranking behaviors, find out the fraudulent Apps often have different ranking patterns in each leading session compared with normal Apps. Thus, some fraud evidences are characterized from Apps' historical ranking records. Therefore, further fraud evidences are describe based on Apps' ranking, rating and review history, which reflect some anomaly patterns from Apps' historical raking, rating and review records.

2. Step wise process for fraud app detection
This ranking fraud framework consists of 7 steps for fraud detection in mobile apps.

2.1 Input: Historical record dataset of mobile apps
The input data sets of historical record can be collected from the leader boards of play store like Google's Play Store or apple play store. The data sets contain the daily chart rankings of Apps. Moreover, each data set also contains the user ratings and review information.

2.2 Mining leading session with the help of leading events
For mining the leading session we have to discover firstly leading events from historical ranking records collected in step first. Adjacent leading events create leading session. Ranking fraud usually occur in leading session. Those apps whose ranking pattern different after analyzing ranking behavior than normal app found to be suspicious.

a) Leading events: Given a ranking threshold $K^* \in [1, K]$, a leading event e of App a contains a time range $T_e = [T^e start, T^e end]$ and corresponding rankings of a, which satisfies $r^a start \leq K\_ < r^a_{start-1}$, and $r^a end \leq K\_ < r^a_{end+1}$,. Moreover, $\forall t_k \in (t^e_{start}, t^e_{end})$, we have $r^a_k \leq K^*$
b) Leading Session: A leading session s of App a contains a time range $T_s = [T^s start, T^s end]$ and *n* adjacent leading events *{e*1,..., *en}*, which satisfies $t^s_{start} = t^{e1}_{start}$, $t^s_{end} = t^{en}_{end}$ and there is no other leading session *s** that makes *Ts* ⊆ *Ts**. Meanwhile, $\forall i \in [1, n)$, we have $(t^{ei+1}_{start} - t^{ei}_{end}) < \phi$, where ϕ is a predefined time threshold for merging leading events. Examples of leading events and leading session has been shown in fig 2.

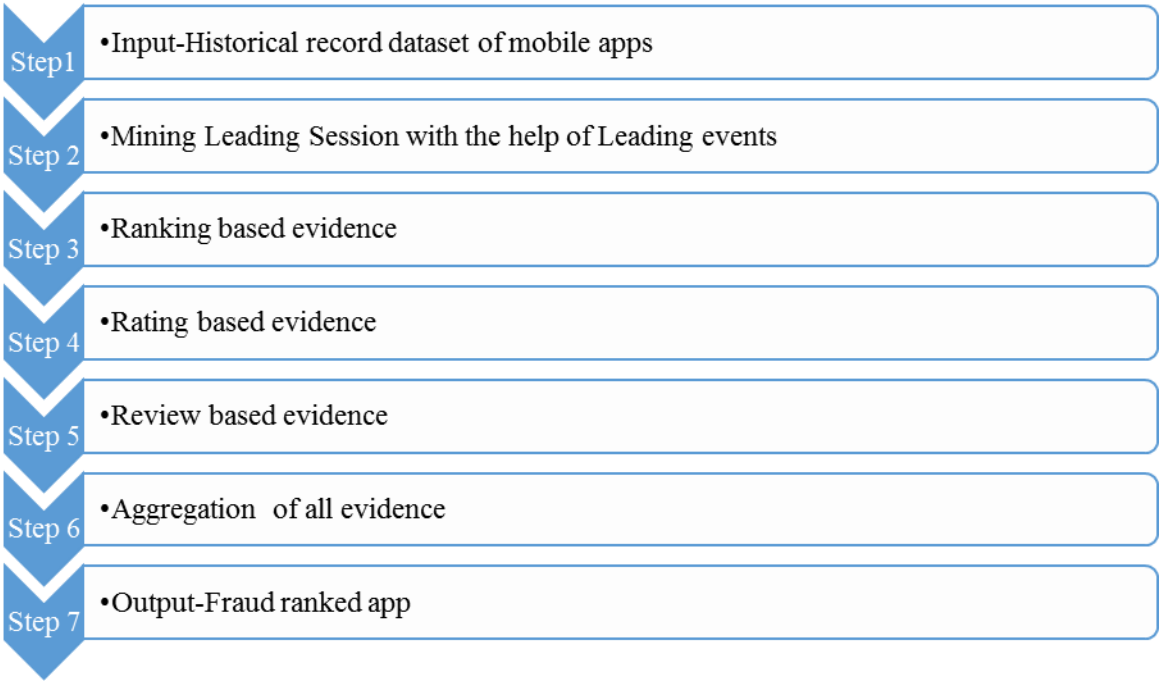

Fig 1

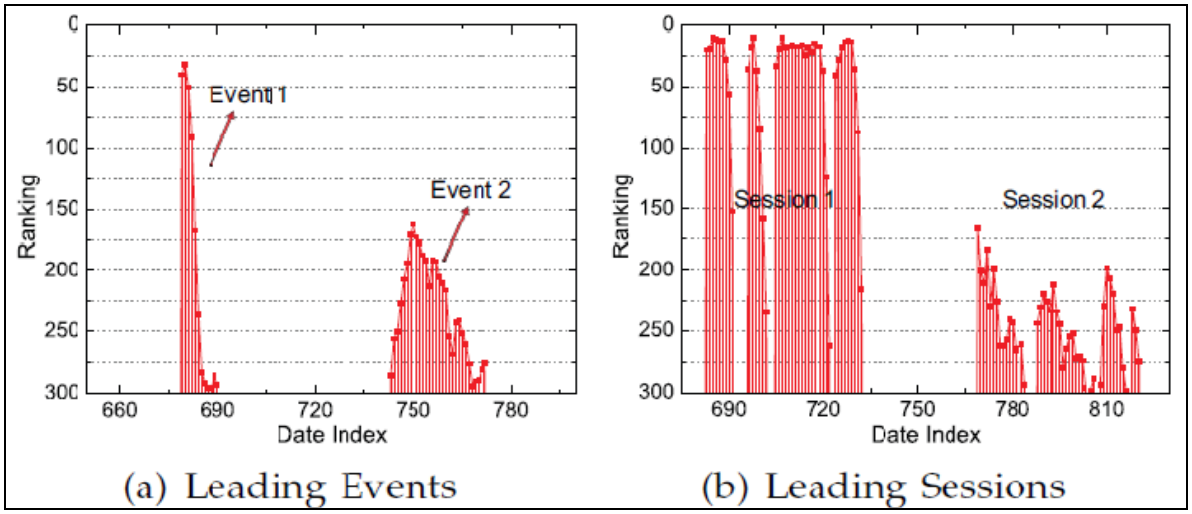

Fig 2

2.3 Ranking Based Evidences

By analyzing leading event discovered in step two we detect Apps' ranking behavior, by finding three phases of ranking, namely, rising phase, maintaining phase and recession phase. If the apps ranking reach to peak position in the leader board that phase is called as rising phase and maintaining same peak position for specific time period is called as maintaining phase. If the ranking of the app decreases rapidly in the leading event then it is called as recession phase.

2.4 Rating Based Evidences

After downloading an app users generally rate the app. The rating given by the user is one of the most important factors for the popularity of the app. An app having higher rating always attracts more number of users to download it and naturally it can also be ranked higher in the chart rankings. Thus, in ranking fraud of apps, rating based evidences is also an important feature so they are needs to be considered.

a) Rating Score Calculation

Ratings on App store are generally between one to five, in this module we compute the average rating of particular app and set a threshold and compare with it. The rating which are less than or equal to three are considered as negative ratings and rating above three are considered as positive ratings. Finally, the output is in the form of zeros and ones i.e. negative rating gives zero as an output while positive rating gives one as an output.

2.5 Review Based Evidences

Along with rating users are allowed to write their reviews about the app. Such reviews are showing the personalized experiences of usage for particular mobile Apps. The review given by the user is one of the most important

factors for the popularity of the app. As the reviews are given in natural language so preprocessing of reviews and then sentiment analysis on preprocessed reviews is performed. The system will find sentiment of the review which can be positive or negative. Positive review adds plus one to positive score, if negative it will add one to negative score. In this way it will find out score of each of the reviews and determine whether app is fraud or not on the basis of review based evidences. This module contains two subparts given below:

a) Preprocessing Reviews

This phase consists of following steps:

1. Tokenization: Meaningful collection of elements is called token. Tokenization is the process of breaking a stream of text into words, phrases, symbols or meaningful elements. The list of tokens becomes input for further processing.
2. Stop word removal: Stop words are commonly used words such as: a, the, and, for, from, is, in and many more.....
3. Stemming: Stemming algorithm is used to find base word. Porter Stemmer Algorithm is used to find base words. Porter Stemmer algorithm: Porter Stemmer algorithm is a process for removing suffixes from words in English.

Example: A stemming algorithm reduces the words: stems, stemmer, stemming, stemmed as based on "stem".

b) Sentiment Analysis

After preprocessing of reviews system find out the sentiments of the reviews. **S**entiment Analysis is the process of determining whether a piece of writing is positive, negative or neutral. It's also known as opinion mining, deriving the opinion or attitude of a speaker**.** A common use case for this technology is to discover how people feel about a particular topic. It will classify the review as positive or negative. Positive review adds plus one to positive score, if negative it will add one to negative score. In this way it will find out score of each of the reviews and determine whether app is fraud or not on the basis of review based evidences.

2.6 Aggregation of all evidence

After three types of fraud evidences are extracted in previous step, the next work is to combine them for ranking fraud detection. Every evidence is given a Boolean weight as 0 or 1 where 0 indicate no fraud nature and 1indicate fraud nature.

3. Conclusion

This paper gives review on how mobile app fraud can be detected by using three evidences ranking, rating and review based on historical record data set, after that all these evidences are combined together for detecting the fraud because large number of apps are available in market and for promoting their apps imposter wants to keep their fraudulent apps on high rank in leader board therefore users are always in fuzzy situation while downloading the apps for their use.

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