Understanding Usage Pattern of Korean Smartphone Users

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Abstract. In this paper, using a comprehensive smartphone usage logging system (a client app and a server), various statistical analysis results from more than 800 man-days usage logs are presented. The analysis shows 1) significant difference in usage frequency and time statistics among the applications, 2) strong popularity in social network application category and 3) little usage variation between weekdays and weekends, but less frequent usage in night time.

Keywords: Smartphones, User Behavior, Data Mining

1 Introduction

During the last decade, smartphones have gained popularity all over the world. In July of 2013, over 50% of mobile subscribers in the US and over 65% of mobile subscribers in South Korea are using smartphones, and these percentages keep increasing [1], [2]. Understanding the application and service usage of users is the first important step for designing applications and systems on which the applications run. Because of the short existence of smartphones, only a few previous works has been done yet. Roehlich et al developed ‘MyExperience’ [3], a logging system for cellphones. Falaki et al [4] studied the usage pattern of cellular phones in the perspective of energy efficient scheduling algorithm design for mobile systems.

Motivated by previous study [5] on the causes and symptoms of smartphone addiction, this study is more oriented to users and application perspectives than system performance. Figure 1 illustrates the overall system architecture and workflow of the SAMS (Smartphone Addiction Management System) framework. On the client side, the SAMS application continuously monitors the applications in use and stores the usage records in its local storage. The stored records can be displayed locally to users for self-recognition and control. Periodically, the new records are transmitted to the SAMS server via the Internet. The SAMS server stores the usage records in its database for later processing. Data analysis and visualization are performed on the records to help the clinicians’ diagnosis and treatment. Clinicians can determine feedback actions, such as requesting current condition check survey or updating the usage limit time table for a specific application.
2 Usage Pattern Analysis

Various usage pattern analyses: application popularity analysis, categorization analysis, and usage pattern analysis were performed from 800 man-days usage logs in order to understand user behavior.

2.1 Popularity Analysis

The ranks in Google Play do not have correlation with the user’s usage, especially on which application is most often used or used in longer duration. We analyzed the log records, and the observations from the graph are as follows. First, less than 10 applications contribute to more than 50% of total usage in time duration. Second, there is a significant difference in the rank of applications between usage time and frequency. Table 1 lists the top 10 applications in usage time and frequency. Except for the top 2 applications, KakaoTalk and browser, the rankings of top applications differ in usage time and usage frequency.

Table 1. Top 10 applications ranked by average daily use times and counts

<table>
<thead>
<tr>
<th>Rank</th>
<th>App name by usage duration</th>
<th>Freq. (%)</th>
<th>Dur. (%)</th>
<th>App name by usage frequency</th>
<th>Freq. (%)</th>
<th>Dur. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KakaoTalk</td>
<td>18.86</td>
<td>17.48</td>
<td>KakaoTalk</td>
<td>18.86</td>
<td>17.48</td>
</tr>
<tr>
<td>2</td>
<td>Android Browser</td>
<td>10.02</td>
<td>8.69</td>
<td>Android Browser</td>
<td>10.02</td>
<td>8.69</td>
</tr>
<tr>
<td>3</td>
<td>African TV for LGU +</td>
<td>0.28</td>
<td>5.52</td>
<td>Facebook</td>
<td>7.06</td>
<td>4.97</td>
</tr>
<tr>
<td>4</td>
<td>Facebook</td>
<td>7.06</td>
<td>4.97</td>
<td>Address</td>
<td>5.22</td>
<td>1.19</td>
</tr>
<tr>
<td>5</td>
<td>You + HDTV</td>
<td>0.48</td>
<td>4.48</td>
<td>Phone</td>
<td>5.07</td>
<td>1.27</td>
</tr>
<tr>
<td>6</td>
<td>NAVER</td>
<td>3.28</td>
<td>4.34</td>
<td>Vintage Red Story</td>
<td>3.45</td>
<td>2.09</td>
</tr>
<tr>
<td>7</td>
<td>YouTube</td>
<td>1.03</td>
<td>3.92</td>
<td>NAVER</td>
<td>3.28</td>
<td>4.34</td>
</tr>
<tr>
<td>8</td>
<td>Aenipang</td>
<td>0.76</td>
<td>3.71</td>
<td>Line</td>
<td>3.12</td>
<td>1.48</td>
</tr>
<tr>
<td>9</td>
<td>Naver Real Madrid</td>
<td>1.27</td>
<td>3.00</td>
<td>GO Locker</td>
<td>3.04</td>
<td>0.37</td>
</tr>
<tr>
<td>10</td>
<td>Vintage Red Story</td>
<td>3.45</td>
<td>2.09</td>
<td>Messaging</td>
<td>2.89</td>
<td>0.87</td>
</tr>
</tbody>
</table>
2.2 Category Analysis

The contrast between usage time and usage frequency for each application is related with the category of that application. Based on Figure 2, it can be concluded that some application categories may have high usage frequencies but lower usage durations. In this case, the application in communication category, KakaoTalk, has a higher tendency to be used more frequently, but in shorter duration. Other categories are less frequently used, but once the user uses these applications, the usage duration gets longer.

![Fig. 2. Comparison of usage frequency and duration in each category](image)

2.3 Time Domain Usage Pattern

Fig. 3 shows the patterns of daily and hourly usages. In contrast to our prediction of significant difference in weekday and weekend, day by day usage differences are small. Note that the standard deviation from each day is quite high. It can be explained that every user has a different daily usage pattern. The decrease in usage by 11 p.m. until 5 a.m. is due to this period being the rest time for common users. For the hourly pattern, usages from non-addicted users get slightly higher than addicted users by 9 a.m. until 5 p.m.

![Fig. 3. Usage patterns in daily and hourly usage](image)
3 Conclusion

The conclusions from our experimental study are as follows: 1) social and communication applications have shorter usage time and higher daily usage frequency than game applications, 2) users’ daily usage time has slight differences and hourly usage time is mostly high at night and decreasing after midnight.

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References