

App mining: Finding the Real Value of Mobile Apps

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Contribution

The main contribution of this paper is a novel algorithm for ranking mobile apps by their actual value to users based on user installation and uninstallation records.

- 1, Our algorithm is based on a novel idea that users make judgements of mobile apps' value when they choose to uninstall them.
- 2, We test our algorithm on a real data set collected from a popular mobile app store, and prove that the algorithm is effective.
- 3, We analyse our algorithm's ability to resist abuse, such as app developer's deliberate actions to promote their apps.

The Actual Value(AV) model

Data: Install and Uninstall Log
Result: User score vector \mathbf{u} , App score vector \mathbf{a}

```
// Initialization
for  $a_i \in \mathbf{a}$  do
   $a_i = 1$ 
while iteration  $I$  do
  // Update user scores
  for  $u_i \in \mathbf{u}$  do
    for  $a_k \in F(u_i)$  do
       $u_i += a_k$ 
  // Create middle temp storage for every app
   $\hat{\mathbf{a}} = \mathbf{a}$  // Update app scores
  for  $u_i \in \mathbf{u}$  do
    for  $a_j \in G(u_i)$  do
      for  $a_k \in F(u_i)$  do
         $\hat{a}_k += \frac{u_i}{|G(u_i)|} * a_j$ 
  // Normalize apps scores
  for  $a'_i \in \hat{\mathbf{a}}$  do
     $a_i = \frac{a'_i - \min(\hat{\mathbf{a}})}{\max(\hat{\mathbf{a}}) - \min(\hat{\mathbf{a}})}$ 
Return  $\mathbf{u}$  and  $\mathbf{a}$ 
```

Background

The popularity of smart phones and mobile apps have been rising rapidly in recent years. As a result, App markets have become an important channel for App developers to advertise and promote their Apps. Existing App recommendations are often not able to take credibility and user satisfaction into consideration. In addition, recommendations based on popularity or user feedback may not be robust enough against abuse actions, as many developers and companies are keen to promote their apps by all means in order to make more profit. To address these problems, we propose a method to rank mobile apps by their actual value to users.

Intuition

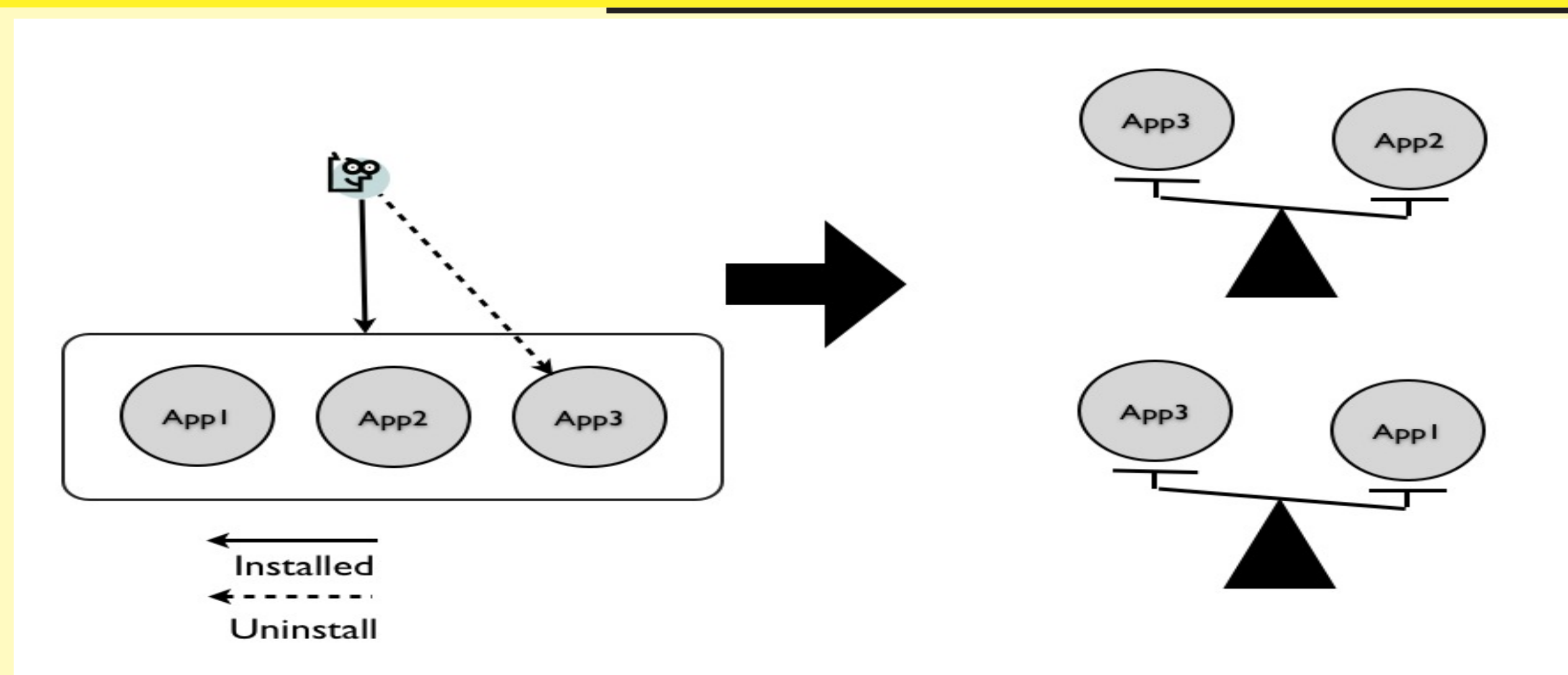
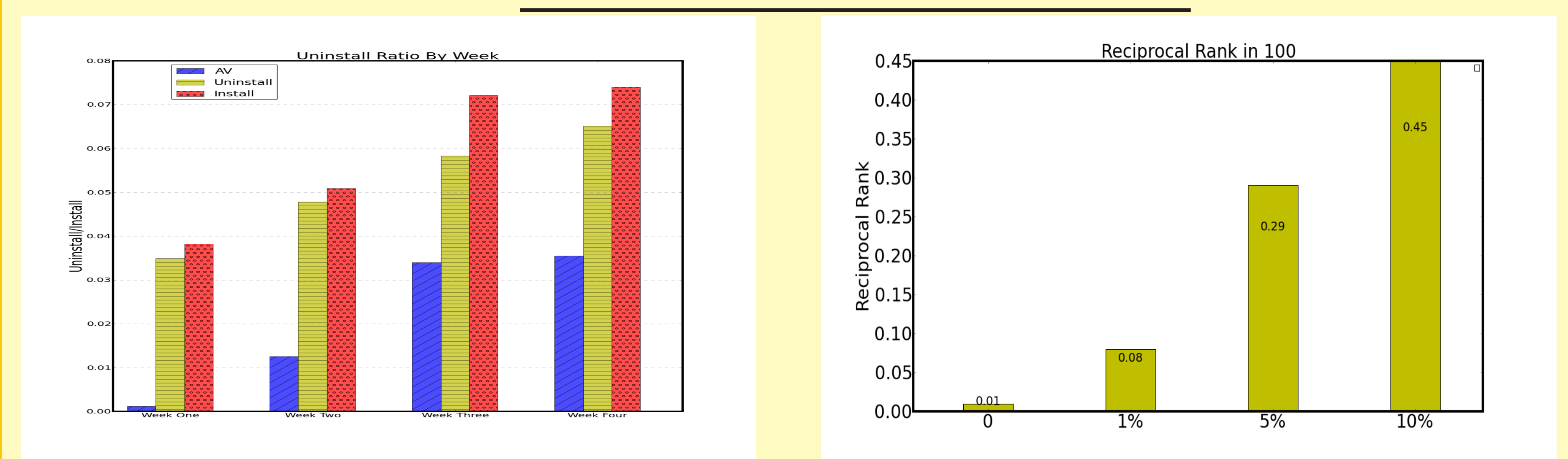


Illustration of our assumption that when a user uninstalls an app, its value is being considered to be lower than other apps which are already installed in the smartphone.

Predicting Uninstallation and Robustness against Abuse

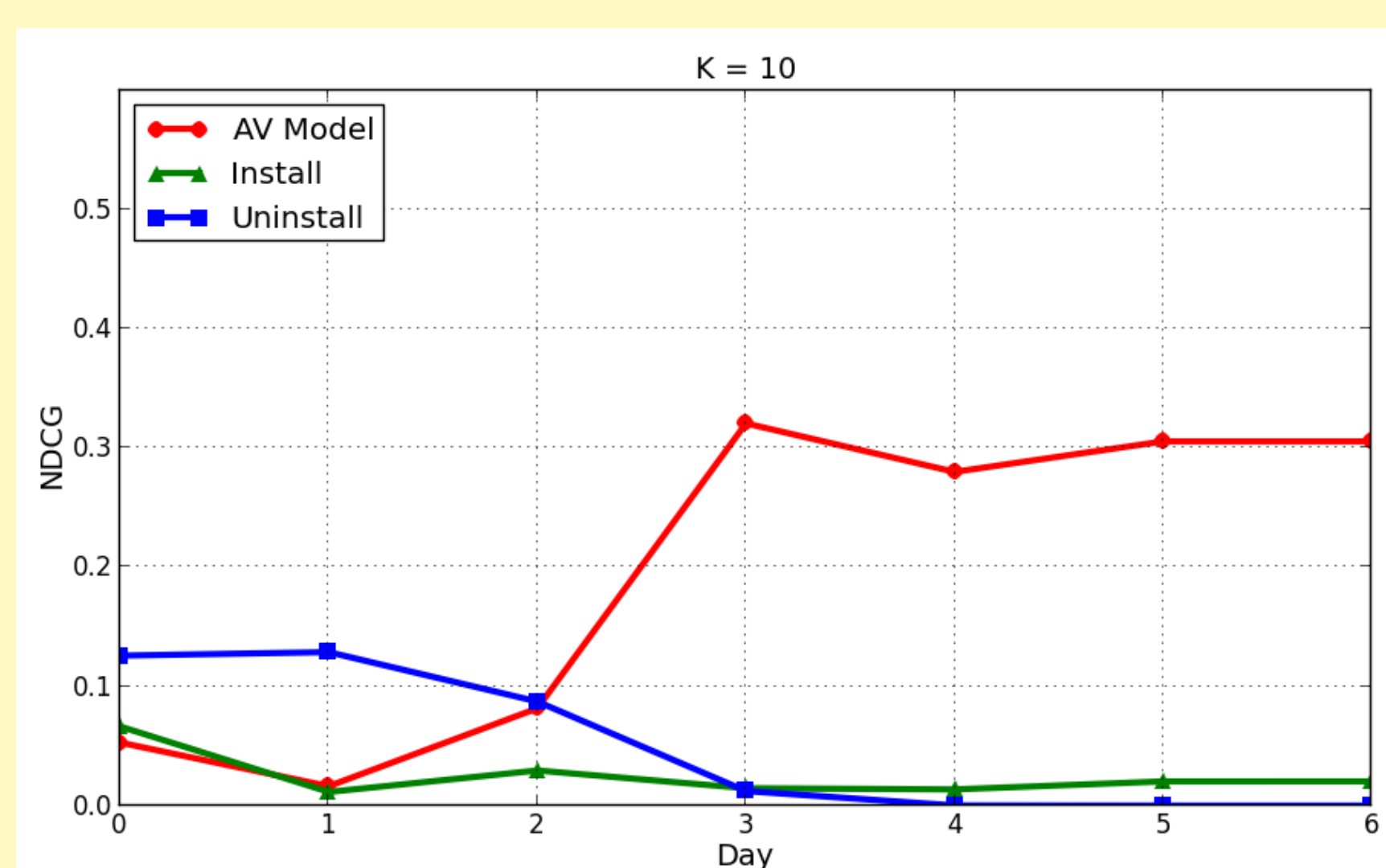
To evaluate the proposed algorithm, we carried out two experiments. Firstly, we investigate the uninstallation ratio of apps with high ranks in our model (Figure 1). It shows that our algorithm performs better in predicting the uninstallation ratio of apps. Secondly, we study the robustness of our algorithm against abuse (Figure 2). We find that our algorithm is very resistant to common abuse methods such as Sybil attacks. Apps that have low value to users cannot be easily promoted even with a significant amount of fake installation and uninstallation actions.



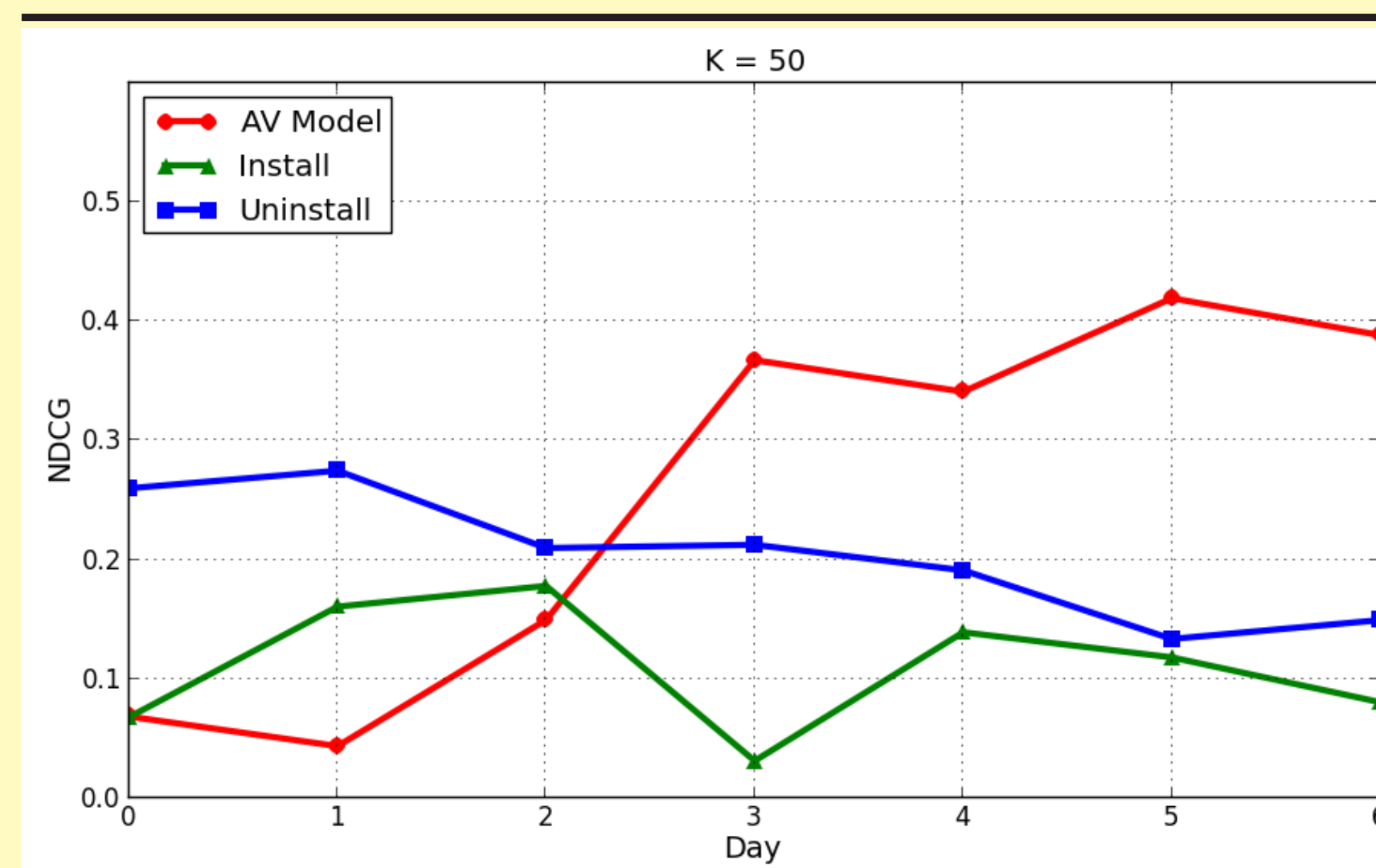
(1) Uninstallation ratio of top apps in our model (2) Robustness against abuse percentage

Download Trend Prediction

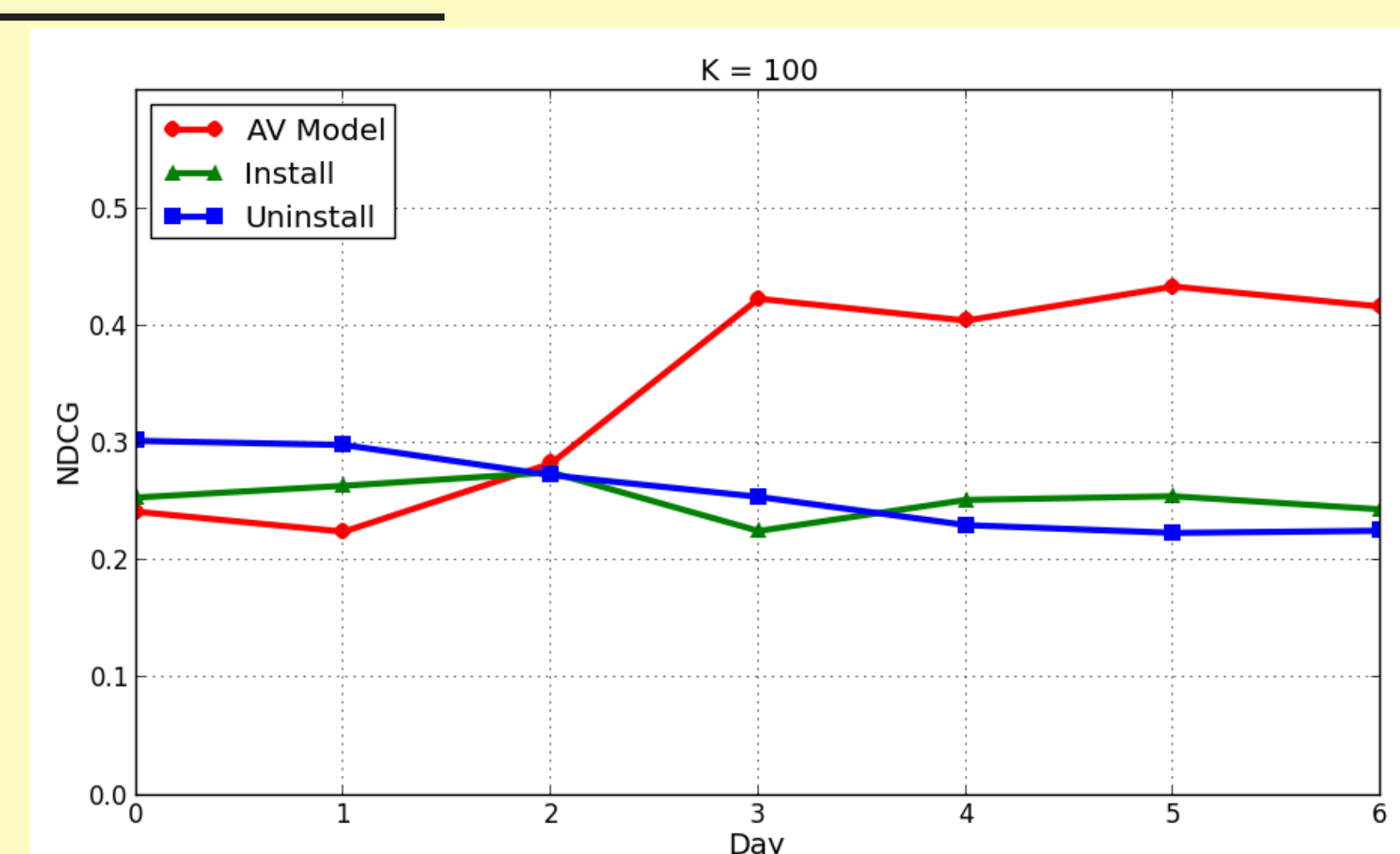
To study the effectiveness of our algorithm, we investigate how well it can be used to predict the download trend of mobile apps. We compare one week download trend of top apps generated by different methods, namely our proposed model, ranking by number of installations, and ranking by number of uninstallations. The results show that our proposed method is the best in predicting the future download trend, showing that it can be used to estimate the mobile apps' actual value to users.



(i) Top 10 apps ranking comparison



(ii) Top 50 apps ranking comparison



(iii) Top 100 apps ranking comparison

Conclusion & Future Work

Unlike other approaches that mainly focus on download history, comments or ratings, we focus on uncovering the actual value of apps and on whether they bring true satisfaction to users. We plan to further study the performance of our proposed method, and make it applicable to ranking newly released apps by considering how the expertise scores of users can be used. In addition, we also want to investigate how to take app updates and temporal changes of user perceptions into consideration, so as to develop a more comprehensive version of the actual value model.