

Algorithms and Patterns for Illustrating User Engagement

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Abstract

Organizations and business ventures develop online services to build a strong user base for their products. In this paper, a key concept associated with these online services is described. This concept is user engagement. This paper explores user engagement from the perspective of two algorithms, *k-means* and Kernel *k-means*. It also explores patterns of user engagement and explains them according to their categories respectively.

Keywords: User Engagement; Kernel *k-means*; *k-means*; Patterns.

1. INTRODUCTION

In [3], a novel framework is described that takes a kernelized approach for segmenting users by their engagement. Kernel *k-means* algorithm is used instead of *k-means* algorithm for reporting user engagement [3]. In this paper, an algorithmic perspective of user engagement is reported that takes into account two algorithms kernel *k-means* and *k-means*. For a given set of users with a particular feature (a social element related to user engagement [3]), *k-means* algorithm finds clusters of users [1]. For the same set of users, Kernel *k-means* finds users that actually belong together as a cluster, that is, it finds patterns in the given set of users [3] unlike *k-means* that is focused for obtaining clusters. This could be verified from the figure below that illustrates kernel *k-means*. Therefore, in *k-means*, it could be said that focus is on user segmentation [1] while in kernel *k-means* the focus is on user engagement where patterns found denote user engagement [3].

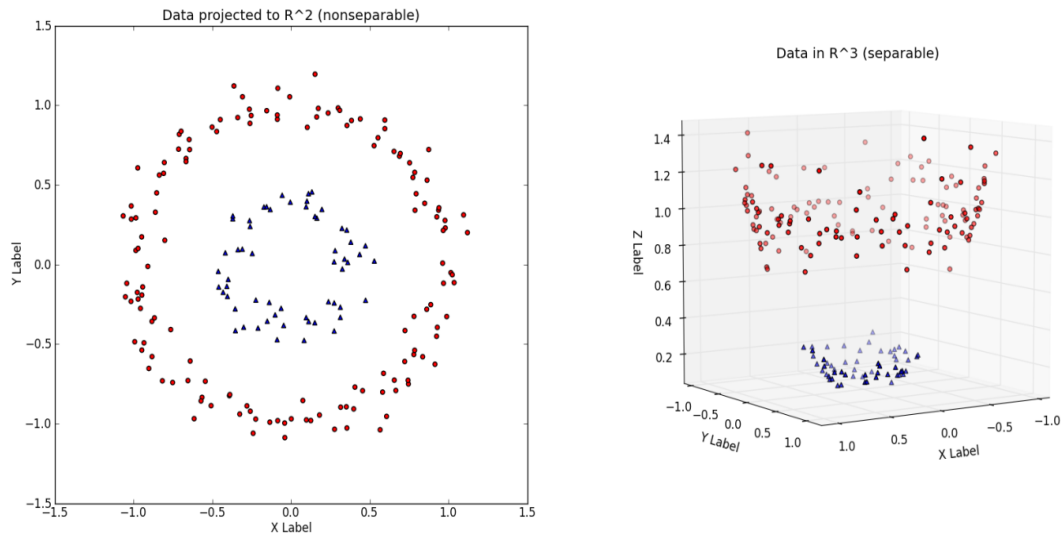


Figure 1: Illustration of working of Kernel *k-means*, reprinted with permission from (Kim 2013)

In *k-means*, points are grouped together in the same plane such that clusters are found in the given data. For the same data for Kernel *k-means*, points are projected into higher dimensions such that patterns are found in the given data as shown in figure 1.

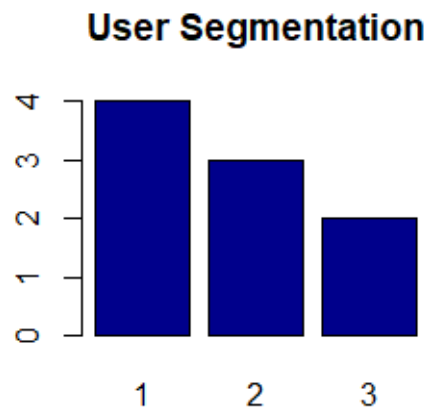


Figure 2: Pattern of User Segmentation

K-means is focused on user segmentation as described above. The pattern of user segmentation is shown in figure 2 above. This is a general pattern indicating user segmentation[1] since size of clusters could always be arranged from largest to smallest in size where bars indicate the sizes respectively.

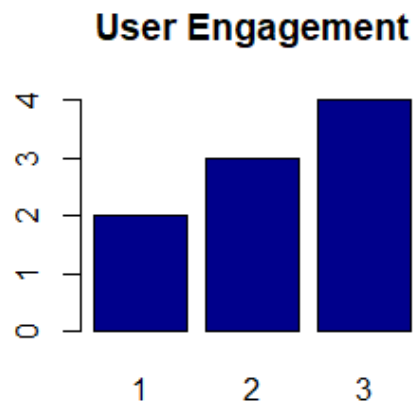


Figure 3: Pattern of User Engagement

Kernel *k-means* is focused on finding patterns indicating user engagement as described in [3]. The pattern of user engagement is shown in figure 3 above. This is a general pattern of user engagement since size of patterns indicating user engagement found using kernel *k-means*[3] is from smallest to largest in size where bars indicate the sizes respectively. In Kernel *k-means*, the smallest pattern is found first and then other patterns are looked at as shown in Fig 1, thus giving figure 3.

2. DISCUSSION

After describing the general pattern for user engagement as shown in figure 3, the specifics patterns of user engagement can be looked at. In [4], specific patterns of user engagement are illustrated. These patterns belong to specific categories as shown in Table 1 below. As described in [4], these categories are obtained after conducting topic modelling over the content of a hacker forum (an online social service[3]). The engagement patterns corresponding to the three categories are shown in figure 4 following their description in table 1.

Table 1: List of categories with description of each category

Category 1	Seeking help as infected by malware, virus
Category 2	Discussing and promoting malware, spyware
Category 3	Seeking help for software, installation

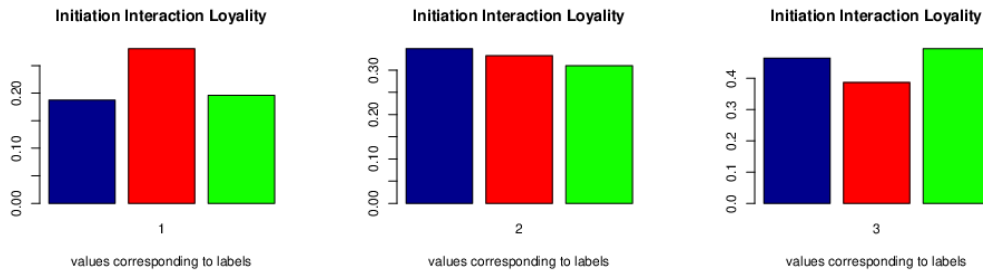


Figure 4: Patterns of User engagement

These user engagement patterns indicate the way users are engaged with the online social service[3] and with other users on that service. In category 1 and category 3, users ask for help from other users. Therefore, the engagement patterns corresponding to these two categories illustrate the way users are engaged with each other. In category 2, users discuss and promote various products on the online social service (here a hacker forum). Therefore, the engagement pattern corresponding to this category indicates the way a user is engaged with the online social service.

3. CONCLUSION

This paper draws inferences from [3] and [4] and reports its findings in the section above. This paper compares the two algorithms, Kernel k -means and k -means and concludes that Kernel k -means could be used for finding patterns of user engagement as in [3] while k -means is ill-suited for this purpose. In discussion section, the paper illustrates three user engagement patterns described in [4] and finally explains them by corresponding them with their respective categories.

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