Image Results Exploration using Ephemeral Clustering

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Abstract

The recent shift in human-computer interaction from desktop to mobile computing fosters the needs of new interfaces for web image search results exploration. We present two different strategies to cluster results gathered from a text-based image search engine and propose an adapted interface for handled devices. For that purpose, we suggest to expand the original text query based on labels of ephemeral text clusters and compare it to a query log-based approach. In particular, we present a new ephemeral clustering algorithm, the $HISGK$-means, which proposes a more compact representation of web search results compared to the commonly used STC algorithm and best fits to the mobile devices constraints by limiting browsing and zooming.

1 Proposed Frameworks

Our approach consists in two different methodologies to address the organization of web image search results. First, an ephemeral clustering approach is presented and a second one is based on query logs. Independently of the approach, the proposed algorithms must achieve the following goal: building a web image search results taxonomy for mobile devices in response to a text query in order to facilitate user exploration. Moreover, the methodologies are based on existing search engines services in order to propose a framework comparable to the work proposed in [2] and provide a meta image search engine for mobile devices capable to deal with real-world queries.

The main goal of ephemeral text clustering is to organize web snippets into a compact taxonomy, guaranteeing that at each level of the hierarchy, the most suitable number of clusters is found. Then, meaningful labels must be found for each cluster (i.e. a small set of representative words). The first framework is based on the ephemeral clustering algorithm called Hierarchical InfoSimba-based Global K-means ($HISGK$-means) [1], which uses web snippet results to generate a hierarchical representation of web search results. The clusters are groups of web page results and are labelled within the clustering process. Additionally, the $HISGK$-means offers four important characteristics for our work: (1) optimum clustering is guaranteed, (2) the labelling step is included in the clustering process to avoid unlabelled clusters, (3) it is language-independent and (4) a compact taxonomy is built. The procedure to get web image search clusters is defined in algorithm 1. The procedure to get web image search clusters is defined in algorithm 1. The second framework is based on query logs obtained through the Google Suggestions API, which allows to get frequently-used queries related to a given query. This service is usually used for query completion. As the previous approach, an image web search engine is queried after query expansion based on query suggestions is made. The results are then displayed in clusters, where each proposed query suggestion is a cluster containing the results of the image web search engine. The algorithm 1 describes the query log-based framework. In fact, each group is a set of images obtained by the image search API from Google and labelled by the cluster names obtained from the $HISGK$-means algorithm concatenated to the original query for the first approach and from the query expansion suggestions via query logs for the second approach. In particular, both approaches retrieve semantically separated results. The ephemeral clustering based approach finds the cluster names "sells services", "cars new", "land rover" and "onca america" (the animal) for the first four image clusters and the query log-based approach suggests "jaguar", "jaguar usa", "jaguar car" and "jaguar animal". In particular, we developed a prototype for the Android operating system for smart-phones, which implements facilitating interaction facilities to explore results. So, in order to facilitate the exploration phase, each cluster of image results can be explored with left and right movements as a typical gallery exploration. Moreover, the different groups can be explored using up and down movements allowing a quick exploration of different meanings involved in the original query.

References

[1] Dias, G., Cleuziou, G., and Machado, D. Informative polythetic hierarchical ephemeral clustering. In *IEEE/WIC/ACM International Conference on Web Intelligence (WIC 2011)* (2011).

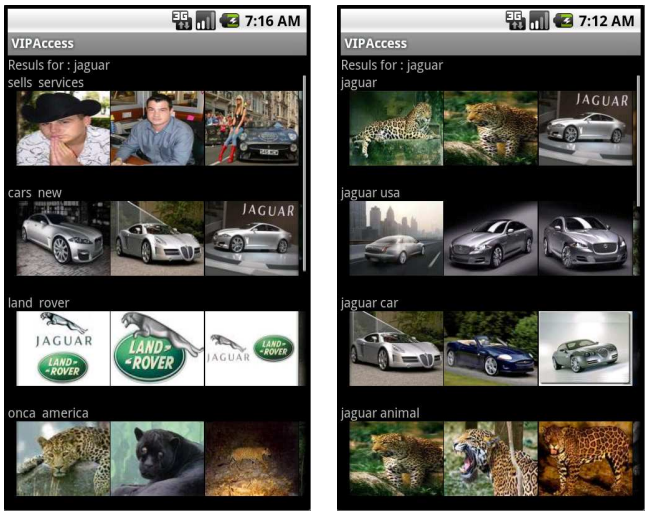
[2] Ding, H., Liu, J., and Lu, H. Hierarchical clustering-based navigation of image search results. In *16th Annual ACM International Conference on Multimedia (MM 2008)* (2008), 741–744.

A Framework Algorithm

Algorithm 1 Image clusters using different frameworks.

Input: $TextQuery, Framework_j$
Output: $ImgCluster$
$ExpandedSet = Framework_j(TextQuery)$
for Each element $cluster_i$ in $ClusterSet$ **do**
  $ClusterName = getClusterName(cluster_i)$
  $ExpandQuery = concat(TextQuery, ClusterName)$
  $ImgCluster_i = getImgResults(ExpandQuery)$
  $ImgClusterName_i = ClusterName$
end for
return $ImgCluster$

B Example Results



(a) HISGK (b) Query Log

Figure 1: Results for "jaguar" using ephemeral clustering (HISGK-means) and query logs.

C Link youtube video

http://www.youtube.com/watch?v=HmDIgDnUYgQ