[DEMO PAPER] TWITTER VISUAL EVENT MINING SYSTEM

Takamu Kaneko, Hiroyoshi Harada and Keiji Yanai

Department of Informatics, The University of Electro-Communications, Tokyo
1-5-1 Chofugaoka, Chofu-shi, Tokyo, 182-8585 Japan
{kaneko-t,harada-h,yanai}@mm.inf.uec.ac.jp

ABSTRACT

In this demo, we demonstrate a system to mine events visually from the Twitter stream by making use of "geo-tweet photos". Some works on event mining which utilize geotagged tweets have been proposed so far. However, they used no images but only textual analysis of tweet texts. In this work, we detect events using visual information as well as textual information, which is the first work to mine event photos automatically from a huge number of Twitter photos, as long as we know. In the experiments, we show some examples of detected events and their photos such as "blooming cherry blossom" and "Tokyo firefly festival".

Fig. 1. Some detected events are shown on the Google map with their representative photos.

1. INTRODUCTION

Twitter can be regarded as "socially distributed cameras", since many of the Twitter's users send send photos with geotags as well as messages to Twitter with mobile phones or smart phones from various kinds of places. In fact, we collected about 200 thousand geotagged photos a day on average in December 2012 via Twitter Streaming API. Such geotagged photo tweets are sometimes posted from the places where some events happen such as festival, sport game and earthquake. Then, we can regard Twitter's users as distributed image sensors on events.

We think that Twitter is a promising data source of geotagged of photos, while Flickr has been the most popular data source of geotagged photos in the research community of multimedia so far. Since the characteristic of Twitter is quickness and on-the-spot-ness, the photos on Twitter are different from the photos on Flickr. Flickr has many travel photos, while Twitter has many photos related to everyday life such as food, weather, street scene and some events. Therefore, we think that geo-tweet photos are more useful for event photo mining than Flickr geo-photos, which are used in the MediaEval Social Event Mining task [1] as data source.

In this demo, we show a system to mine events visually from the Twitter stream. To do that, we pay attention to the tweets having both geotags and photos. We call such tweets as "geo-tweet photos". So far some works on event mining which utilize geotagged tweets have been proposed. However, they used no images but only textual analysis of tweet texts. On the other hand, in this work, we detect events using visual information as well as textual information. As long as we know, this is the first system that leverages the use of images along with the geotagged tweets, while the previous systems used Flickr geotagged photos for the same objective, or mined events with only textual information from Tweets.

2. OVERVIEW

To detect events visually from Twitter stream, we monitor Twitter stream to pick up tweets having both geotags and photos, and store them into a geo-photo tweet database. We apply to this database the proposed visual event mining system which consists of event keyword detection, event photo clustering and representative photo selection. The processing steps of the proposed system are as follows:

(1) Detect event keyword candidates which frequently appear in the tweets posted from specific areas in specific days.
To detect events, we search for bursting keywords by examining change of the daily frequency of each keywords within each unit area. The area which is a location unit to detect events are defined in the grids by one degree latitude and one degree longitude.

(2) Unify and complement detected event keywords.
In the previous step, we extract a single noun as an event keyword. However, since some events are represented by compound keywords, the same event are sometimes detected by several keywords independently. In such case, we unify them into a compound keyword related to the same event.

[1] http://www.multimediaeval.org/mediaeval2012/sed2012/

(3) Select geo-tweet photos corresponding to the event keywords by image clustering.
As image features, we use bag-of-features (BoF) with densely-sampled SURF local features and 64-dim RGB color histograms. For visual clustering of photos, we use the Ward method which is one of agglomerative hierarchical clustering methods.

(4) Select a representative photo to each event
We evaluate each of the obtained clusters in terms of visual coherence based on average similarity among the photos in each cluster.
In addition, the cluster having the maximum inner similarity is regarded as a representative cluster, and the photo the visual feature vector of which is the closest to the cluster center is selected as a representative photo for the corresponding event. Moreover, representative photos can be selected by VisualRank as well.

(5) Show the detected events with their representative photos on the map as shown in Figure 1.

This work will be presented at ICME Workshop on Social Multimedia Research (SMMR2013) as a workshop paper [1]. Please refer to it for the detail.

3. EXPERIMENTS

In the experiment, we used about 3,000,000 geo-tweet photos posted from Japan which were collected from the Twitter stream from February 10th, 2011 to September 30th, 2012.

As results of event keyword extraction for the given dataset, we obtained 306 keywords related to natural phenomena such as "rainbow" and "typhoon" and local events related to "fireworks" and "festival".

We show some example results of event photo clustering corresponding to the two keywords, "cherry blossoms" and "firefly" (See Table 1 for the detail) in Figure 2 and 3. The numbers shown on the right of each photo cluster represent cluster scores. The clusters (with red boxes) having the score which is with more than 5.0 are regarded as event photo clusters, while the rest clusters (with blue boxes) are regarded as non-event clusters unrelated to the corresponding event keyword. Within each cluster, photos are sorted in the ascending order of the distance to the cluster center. From the results, scoring of clusters worked successfully to place more visual clusters in the higher rank.

In Figure 2 ("cherry blossom"), the first cluster shows fully-blooming cherry blossoms, which the second cluster shows cherry blossom photos mostly taken in night. In Figure 3 ("firefly"), the first cluster represents illumination event of Tokyo Skytree which was called "Tokyo firefly", while the other clusters with blue boxes are judged as being irrelevant to "Tokyo firefly".

Some detected events are shown on the map with their representative photos in Figure 1. This map is an interactive system based on Google Maps API, and a user can see any event photos by clicking markers.

Finally, 258 events were detected in this experiment, and the precision of the representative photos were 65.5%. All the 258 detected events can be regarded as being related to some of various kind of actual "events".

Table 1. Summary for the example results.

event keyword	date	grid (lat,lng)	area	# photos
cherry blossoms	2012/04/21	34,35,135,136	Osaka	57
firefly	2012/05/06	35,36,139,140	Tokyo	93
fireworks	2011/12/23	35,36,139,140	Tokyo	91
tree	2011/12/23	35,36,139,140	Tokyo	91
rainbow	2012/05/04	35,36,139,140	Tokyo	93

Fig. 2. "Cherry blossoms" photo clusters. The clusters with red boxes are relevant, while one with a blue box in which the evaluation score is less than 5.0 are irrelevant.

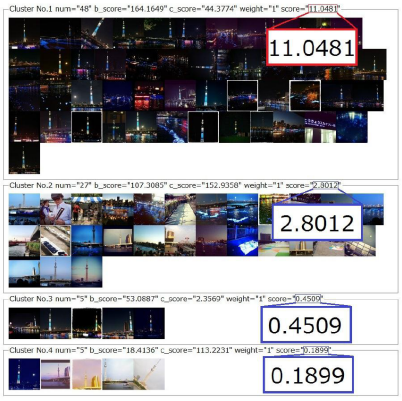

Fig. 3. "Firefly" photo clusters.

4. CONCLUSIONS

In this demo paper, we demonstrated a novel visual event mining system from the Twitter stream using visual information as well as textual and location information. The system enables us to discover and understand events visually, which is the novel contribution of this work.

For future work, we will extend the system for real-time visual event detection. We also plan to analyze the differences between Tweet geo-photos and Flickr geo-photos in terms of their characteristic.

In the ICME demo, we will show the extended results which are mined from more than 10,000,000 geo-tweet photos posted from all over the world which were collected from the Twitter stream since 2011 till now.

5. REFERENCES

[1] T. Kaneko and K. Yanai, "Visual event mining from geo-tweet photos," in *Proc. of IEEE ICME Workshop on Social Multimedia Research (SMMR)*, 2013.