USE OF SOCIAL MEDIA FOR VALIDATION OF METEOROLOGICAL SATELLITE PRODUCTS?

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Abstract

A vast source of information is available from personal notes (e.g., text, photos, videos) published on Web-based services such as Twitter, Facebook and Flickr. We explore if this data could be used for meteorological purposes, for example, as a complement to traditional weather observations. Indeed, photos from the photo-sharing service Flickr can offer the evidence of some phenomena for case studies. How to utilize this data for more quantitative studies remains an interesting open problem.

INTRODUCTION

An increasing number of people publish personal notes (e.g., text, photos, videos) on Web-based services such as Twitter, Facebook and Flickr. This creates a vast source of information that could be utilized in meteorology, for example, as a complement to traditional weather observations. Especially, photo-sharing services offer an increasing amount of useful data, as modern mobile devices can automatically include coordinates and time stamps on photos, and users can easily tag them for content.

DATA

Weather-related photos from 2007 to 2009, their free-form descriptive texts and metadata were accessed from the photo-sharing service Flickr. At the time of writing, more than one billion photos were available for viewing, 6% of these having geographical information included. Even though most of the photos were taken in North America and western Europe, the distribution of the photos is truly global. Photos have extensive metadata attached, e.g., a short description of the photo, when it was uploaded (“posted”) and Exchangeable image file (EXIF) information about the camera settings. EXIF can include the date when the photo was taken and geographical information from GPS. In addition to these parameters, the user can manually add freely chosen tags that describe the photo. Data can be accessed manually using the web interface or programmatically using the Application Programming Interface (API).
RELIABILITY AND QUALITY OF METADATA

We assessed the reliability and quality of metadata for Flickr photos in a series of tests. The results are presented in Hyvärinen and Saltikoff (2010), and only summarized here.

To compare the concept of different weather phenomena by Flickr users with that of people with a background in meteorology, photos with different common weather-related tags were collected and given tags were compared with our understanding of the phenomena shown in the photo. The best hit rate here was for the word snow, as it appears to be a generally well-known concept. Therefore it seems that Flickr should be used to search for the phenomena easily recognizable by laymen.

The location of the photo available from EXIF must be compared with known landmarks. Famous sights are an attractive option as the exact coordinates for them are readily available from various sources and a large amount of photos are available from Flickr. For tourists sights, the location error for most photos was less than one kilometers and the most of the large errors arose not from the erroneous location information but because the tag did not describe place where photo was taken but rather the subject of the photo. So, the location information is reasonably reliable.

The time in Flickr tags is always the local time when the photo was taken, not the UTC time. The clock faces of the Big Ben clock tower in London, United Kingdom, are a popular sight, of which a large number of photos can be retrieved from Flickr. From these photos the position of the clock hands can be extracted and this compared to EXIF data, but only the minute hand can be used, because tourists rarely set the time of their cameras. Interestingly, the mean temporal error is almost zero, but the spread of error varies depending of the devices used to take the photos. The best results come from the time of photos that are geotagged using GPS as then the correct time is either handled by the build-in GPS device or the camera is kept in time by the user for the later synching photos with coordinates from a GPS logger.

CASE STUDIES

a. A validation of hail detection using Flickr in Finland
For the hail algorithm testing [Hyvärinen and Saltikoff (2010), see also Moisseev et al. (2010) for a similar study of tornadoes in US], Flickr photos gave much needed ground level evidence of the existence of hail, even by manual search using simple keywords. Flickr can clearly produce useful information of existence for case studies. However, the quality of the radar method could not be determined from photos alone, as it is rarely possible to use the photos to depict nonevents (i.e., to show that there was no hail).

b. A quantitative test for snow detection in Europe
The choice of suitable tags for snow detection was explored. First, snow cover products from IMS and LSA SAF for 2008-2009 were retrieved. Pixels where both products agreed were used as “truth”. Next, tags of photos from these pixels were retrieved and then rated by their usefulness for snow detection using mutual information (e.g., Manning et al. 2008) as a measure.
Results are shown in Figure 1. The best-rated words are about snow and snow activities (snow, ski, schnee, ice, skiing), but there are also a lot of geographical (switzerland, finland, alps) and calendar (winter, christmas) names and words that are really not useful. And more importantly, all no-snow tags on the list were either geographical or calendar words. These results strengthen our hypothesis that the quantitative use of Flickr photos can be hampered by the lack of useful information for evidence of non-existence.

Figure 1: The mutual information of 60 best tags for snow detection and the average number of photos per day with these tags (grey for pixels with snow according to satellite snow cover products and green for pixels with no snow).

CONCLUSIONS

The metadata of Flickr photos is reasonable reliable and its use for case studies can be heartily recommended. These photos, especially with GPS-based location and temporal information, can be readily used to find evidence of the existence of some phenomena, which is often enough for case studies. For more quantitative studies, the problem of finding also evidence of non-existence of phenomena can be a problem. But we are interested to hear of studies proving us wrong!

REFERENCES

