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Evaluating the descriptive power of Instagram hashtags

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HIGHLIGHTS

- Instagram hashtags as annotation metadata is examined.
- Instagram photo-hastags as training sets for Automatic Image Annotation is proposed.
- Half of the chosen Instagram hashtags describe the visual content of an image.
- Instagram hashtags can be used as training examples for machine learning algorithms.

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ABSTRACT

Image tagging is an essential step for developing Automatic Image Annotation (AIA) methods that are based on the learning by example paradigm. However, manual image annotation, even for creating training sets for machine learning algorithms, requires hard effort and contains human judgment errors and subjectivity. Thus, alternative ways for automatically creating training examples, i.e., pairs of images and tags, are pursued. In this work, we investigate whether tags accompanying photos in the Instagram can be considered as image annotation metadata. If such a claim is proved then Instagram could be used as a very rich, easy to collect automatically, source of training data for the development of AIA techniques. Our hypothesis is that Instagram hashtags, and especially those provided by the photo owner/creator, express more accurately the content of a photo compared to the tags assigned to a photo during explicit image annotation processes like crowdsourcing. In this context, we explore the descriptive power of hashtags by examining whether other users would use the same, with the owner, hashtags to annotate an image. For this purpose 1000 Instagram images were collected and one to four hashtags, considered as the most descriptive ones for the image in question, were chosen among the hashtags used by the photo owner. An online database was constructed to generate online questionnaires containing 20 images each, which were distributed to experiment participants so they can choose the best suitable hashtag for every image according to their interpretation. Results show that an average of 66% of the participants hashtag choices coincide with those suggested by the photo owners; thus, an initial evidence towards our hypothesis confirmation can be claimed.

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1. Introduction

On average 300 million photos are uploaded to Facebook per day [1] while an average of 80 million photos are shared every day in Instagram [2]. Locating and retrieving these and other images uploaded on the Web is very challenging not only in terms of effectiveness (retrieve the right image according to the user needs/queries) and efficiency (execution time) but also in terms of visibility (being locatable). Contemporary search engines retrieve images in a text-based manner since the majority of end users are familiar with text-based queries for retrieving web pages and digital documents. In text-based image retrieval images must be somehow related with specific keywords or textual description. This kind of textual description is, usually, obtained from the web page, or the document, containing the corresponding images and includes HTML alternative text, the file names of the images, captions, metadata tags and surrounding text [3,4]. However, images in social media, which constitute the great majority of Web images, cannot effectively indexed (extract relevant text description) with pure web-based techniques, mainly because the user pages in social media do not follow the classic web-page structure. As a result, the well-known content-based image retrieval field revitalized and a more specific research area, Automatic Image Annotation (AIA) [5] emerged. AIA refers to the process of extracting low-level features from an image and assigning one or more semantic concepts to it [6].

A large category of AIA involves machine learning techniques has its roots in the learning by example paradigm [7]. Training examples used for AIA are pairs of images and related tags. Many different models and machine learning techniques were developed to build the so-called 'visual models', that is, models that capture the correlation between image features and textual words from the training examples. Visual models are then fed with image features extracted from unseen images to predict their tagging [8]. Assuming that good visual models can be achieved, image retrieval using the training by example paradigm provides a promising alternative to text-based methods (since it does not require explicit annotation of all images in the collection, but only a small set of properly annotated images) [9]. Nevertheless, the first important step to create effective visual models is to use good training examples (pairs of images and annotations). In this context, automatic creation of training examples via crawling is highly desirable because it addresses the scalability (models for new concepts) and adaptability (modification of training models) issues.

According to a survey of Pew Research Internet Project,[1] the proportion of online American adults who use Instagram has doubled since 2012 showing the highest increase among all social media platforms [10]. Instagram is a free application for mobile devices, which offers a user the possibility to upload, edit and share with other Instagram users pictures and very short videos. The term Instagram is a combination of two words, from the word instant used to old market cameras and the gram comes from telegram from the snapshots people were taking.[2] Instagram launched on 6 October 2010 and rapidly gained popularity, managed to have 400 million active users on January 2016.[3] It is estimated that 80 million pictures are being shared per day [2] through Instagram.

In January 2011 Instagram added hashtags [11] and from 27 April 2015 users are able to use emoji as hashtags.[4] Hashtags are tags or words prepended with '#' used to indicate the content of the picture, allowing users to search for pictures and increase visibility. Photo owners sometimes want to connect pictures with emotions; in that case they use emoji which are pictograms that are connected with emotions.

Hashtags are not totally new in the web; users started to use them with IRC (Internet Relay Chat) in order to categorize items into groups. The first who used hashtags, in contemporary Social Media and especially inTwitter, was Chris Messina, a designer, who asked his followers how they felt about using the pound sign to group conversations [12]. Thus, a basic role of hashtags was traditionally to organize knowledge and facilitate access and enable retrieval of information (see also the work of Small [13] on this). Tapastreet, a search engine platform that offers users the opportunity to browse geo-located video and photos from social media such as Twitter, Facebook and Instagram, harvests location, time and hashtags [14] assuming that hashtags can be used in order to retrieve visual content. On the other hand, we know that users extend the function of hashtagging beyond findability and give hashtags a metacommunicative use. According to Daer et al. [15] the metacommunicative function can be split into four codes: 'emphasizing', 'iterating', 'critiquing', 'identifying', and 'rallying'. 'Emphasizing' is used to give emphasis or call attention; 'critiquing' expresses judgment or verdict; 'identifying' is used to refer to the author of the post; 'iterating' to expresses humor and 'rallying' brings awareness or support to a cause.

Several researchers suggest also that hashtags carry emotional information [16] which is not directly related with the context they appear [17]. In a research on the tags of a set of 2700 pictures, it was measured that approximately 10% of these photos were related with emotion words not directly related with their visual content [18]. A recent study, on gender difference in hashtag usage in Instagram for the hashtag 'Malaysianfood', revealed that women tend to use emotional hashtags while men hashtags are more informative [19]. Ferrara et al. [20] studied user behavior while they annotate their photos with hashtags. They found that users use quite a few hashtags in order to annotate an image.

It should be evident from the above that Instagram provides a rich forum for automatically creating training sets for AIA. It contains a huge amount of images which are commented through hashtags by their creators/owners and, despite that not all hashtags are actually related with the visual content of images, many of hashtags carry significant descriptive information of the visual content. Thus, if we assume that it is the owner who can better express the real visual content or meaning of an image then choosing among the hashtags for assigning tags to images is much safer than traditional text-based indexing approaches [21–23]. This is extremely important in training sets where pairs of images

[1] http://www.pewresearch.org/.

[2] Instagram: FAQ, https://instagram.com/about/faq/#.

[3] http://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/.

[4] Instagram: Our Story, https://instagram.com/press/.