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A3P System for Image Uploading

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Abstract: With the sharing of images on social media such as Facebook, twitter, etc. increases, maintain their privacy becomes the major problem. As user shares their private images on social sites, people expect more tools to allow them to regain control over their privacy. By considering this need, we propose an Adaptive Privacy Policy Prediction (A3P) system which provides user convenient privacy settings by automatically generating personalized policies. To define users' privacy preferences we consider the different factors such as social environment, personal characteristics, image content and metadata. We also consider the side information of the user such as contact list, visitors view and previous settings. For the images being uploaded, we define the best available privacy policy for the user based on the users' available history on the site. For that we propose a two level framework. A3P system relies on the image classification framework for image categories which may be associated with similar policies and on a policy prediction algorithm to automatically generate a policy for each newly uploaded image, also according to users' social features. We increase the efficiency by using the side information of the user.

Keywords: Social media, content sharing sites, metadata, policy mining, policy prediction.

I. INTRODUCTION

Social media is a two way communication. It means to communicate, share and interact with an individual or with a large audience. Social networking sites are the most famous sites on the internet and millions of people use them to connect with other people. On these social websites most shared content is images. User of this website uploads their images on the websites and also shares these images with other people. The sharing of images is based on the group of people he/she knows, social circle or public and private environment. Sometimes images may contain the sensitive information. For example, consider a photo of family function. It could be shared with a Google+ circle or Flicker group, but may unnecessarily expose to the college friends. Thus, the sharing of images online sites lead to a privacy violation. The persistent nature of online media, can results in a misuse of one's personal information and its social environment.

Most content sharing sites allow users to enter their privacy preferences like private or public. But recent study shows that user struggles to setup and maintain such privacy settings. Therefore, we need a policy recommendation system which can guide user to easily and properly configure privacy settings. As the amount of information carried within images and their relationship with the online environment causes the existing privacy setting inadequate to address the unique privacy needs of images.

In this paper, we propose an Adaptive Privacy Policy Prediction (A3P) system which provides user convenient privacy settings by automatically generating personalized policies. The A3P system handles user uploaded images and factors in the following criteria that influence ones privacy settings of images: The impact of social environment and personal characteristics:users' social environment such as their profile information and relationship with other users provide useful information regarding the users' privacy preferences. Also, for the same type of images users have a different opinion. So it is important to find the balancing point between these two to predict the policies that match each individual's needs.

The role of images content and metadata:In general, similar images often incur similar privacy preferences, especially when people appear in the images. Analyzing the visual content may not be sufficient to capture users' privacy preferences. Tags and other metadata are indicative of the social context of the image, including where it was taken and why and also provide a synthetic description of images, complementing the information obtained from visual content analysis.

II. LITERATURE SURVEY

Chen et al. [1] proposed a system named Sheep Dog to automatically insert photos into appropriate groups and recommend suitable tags for users on Flickr. They adopt concept detection to predict relevant concepts (tags) of a photo. Based on some existing information from Flickr, they used a ranking-based method which is applied to obtain reliable training data and to provide reasonable group/tag recommendations for input photos.

Choudhury et al. [2] proposed a recommendation framework to connect image content with communities in online social media. They characterize images through three types of features: visual features, user generated text tags, and social interaction, from which they recommend the most likely groups for a given image. Then they use the model learning, bag-of-features based representations of the groups are generated and a model is learnt to represent the groups in a latent space.

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There is also a large body of work on the customization and personalization of tag-based information retrieval (e.g., [3], [4], [5]), which utilizes techniques such as association rule mining. Forexample, [5] proposes an interesting experimental evaluation of several collaborative filtering algorithms to recommend groups for Flickr users. They present a probabilistic latent topic model in an integrated framework, expecting to jointly discover the latent interests for users and groups and simultaneously learn the recommendation function.

A. Existing Systems

a. PVIZ Comprehension Tool

An interface and system that corresponds more directly with how users model groups and privacy policies applied to their networks. PViz Comprehension Tool [8] allows the user to understand the visibility of her profile according to automatically constructed, natural sub-groupings of friends, and at different levels of granularity. Because the user must be able to identify and distinguish automatically constructed groups, we also address the important sub-problem of producing effective group labels.

b. Tag Based Access Control Of Data

Tag Based Access Control of Data [9] is a system that creates access-control policies from photo management tags. Every photo is incorporated with an access grid for mapping the photo with the participant's friends. The participants can select a suitable preference and access the information. Photo tags can be categorized as organizational or communicative based on the user needs. There are several important limitations to our study design. First, our results are limited by the participants we recruited and the photos they provided. A second set of limitations concerns our use of machine generated access control rules. The algorithm has no access to the context and meaning of tags and no insight into the policy the participant intended when tagging for access control. As a result, some rules appeared strange or arbitrary to the participants, potentially driving them toward explicit policy-based tags like "private" and "public".

c. Privacy aware Image Classification and Search

To automatically detect private images and to enable privacy oriented image search Privacy Aware Image Classification and Search [6] combines textual meta data images with variety of visual features to provide security policies. In this the selected image features (edges, faces, color histograms) which can help discriminate between natural and manmade objects/scenes (the EDCV feature) that can indicate the presence or absence of particular objects (SIFT). It uses various classification models trained on a large scale dataset with privacy assignments obtained through a social annotation game.

d. Social Circles

Social Circles [7] provides a web based solution to protect personal information. The technique named Social Circles Finder automatically generates the friend's list. It is a technique that analyses the social circle of a person and identifies the intensity of relationship and therefore social circles provide a meaningful categorization of friends for setting privacy policies. The application will identify the social circles of the subject but not show them to the subject. The subject will then be asked questions about their willingness to share a piece of their personal information. Based on the answers the application finds the visual graph of users.

III.SYSTEM WORKFLOW

Fig. 1 shows the architecture of the A3P framework. The A3P system consists of two main components: A3P-core and A3P-social. The overall data flow is as following.

When a user uploads an image, the image will be first sent to the A3P-core. The A3P-core focuses on analyzing each individual user's own images and metadata. There are two major components in A3P-core: (i) Image classification (ii) Adaptive policy prediction.

In image classification images are classified based on their contents and then refine each category into subcategories based on their metadata. In content based image classification we consider spatial information of images such as image color, size, shape, texture, symmetry, etc. In metadata based classification we first extract keywords from the metadata associated with an image. That is we identify all the nouns, verbs and adjectives in the metadata and store them in the metadata vector (τ). Then we derive a representative hypernym from each metadata vector. In this step we retrieve a representative hypernym of τ_{noun},τ_{verb}, $\tau_{adj}$for each attribute in the metadata vector. Also we count its frequency. And at the end we find a subcategory that image belongs to. For this we calculate the distance between image and subcategory is computed as a weighted sum of edit distance between corresponding pair of representative hypernym.

The policy prediction provides a predicted policy of a newly uploaded image to the user for his/her reference. The prediction process consists of two main phases: (i) policy mining; and (ii) policy prediction. Policy mining uses hierarchical approach which is carried out in three steps. In first step we look for popular subjects defined by user that is in the same category of the new image we conduct association rule mining on the subject component of policies and denote such policy set as Γ_i^{sub}. In second step we look for the popular actions in the policy containing popular subjects that is in each policy set Γ_i^{sub}, we conduct association rule mining on the action component. And in third step we look for popular conditions in the policy containing both popular subjects and conditions.

Policy prediction defines the recommended policy to the user. User can select one of the policies he is agreed upon and that policy is applied to that image.

A3P social generates the representative policies by using information related to user's social context. A3P core invokes the A3P social in two cases: (i) The user does

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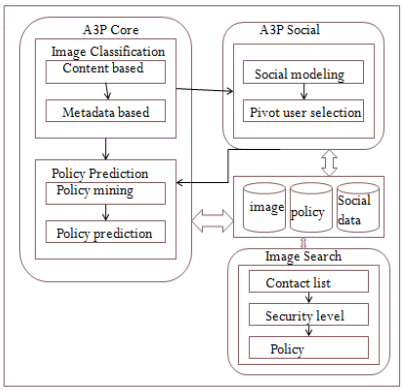

Fig.1. A3P Framework

not have enough information for the type of the uploaded image (ii) There are recent major changes in the user's community. Social context capture the common social elements of user and identify communities formed by users with similar privacy concerns. In the first step it models each user's social context as a list of attributes and in the second step we group the user's based on the identified factors. Then we find the social group which is most similar to user and then choose the representative user. For that purpose we use inverted file index. Next, given new user, we search his attribute values in the inverted file and obtain a set of candidate social groups. We also count the number of occurrences of the candidate group during the search. We select the candidate group with the highest occurrence as the social group for the new user.

We can search the image either category wise or based on the content of that image. When user upload an image or enter a category to search an image then for the same image or category, we first consider the contact list of that image. In contact list we can consider the friends, family members of the user. After that we check the blocking status of each friend in the contact list. After that we check the security level of each and every user for the same image. At the end we consider the policy which we provided to see the image is displayed to the requested user or not. Then we get the final result of the search image.

IV. MATHEMATICAL MODEL

System S = {U, F, I, P}
Initial State (U) : Upload Image
Final State (F) : Accept / Reject Policy
Input (I) :
I = {I_1, I_2, I_3..I_n}Images
For each image,
Input (I_1) = {content, metadata, access conditions}
Output (P) :
P = Predicted Policy

A. Algorithm

1. when user uploads an image I, it send to A3P core
2. if A3P core classifies image
3. then it predict policies P to the user
4. end of if
5. else if A3P social is called
6. then it identifies social group to the user
7. end of if
8. predicted policy P is displayed to the user
9. if user satisfied by the policy
10. then it will be accepted A
11. end of if.

V. CONCLUSION

We have proposed an Adaptive Privacy Policy Prediction (A3P) system that helps users automate the privacy policy settings for their uploaded images. It provides a framework todeduce the privacy preferences based on the information available for given user. It automatically generates the policy for each newly uploaded image, according to users' social environment.

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BIOGRAPHIES

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