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# EALOG: Emotion-Aware Local Guide

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**Abstract**

Utilizing location recommendation as a method of improving mood has the potential to help combat rising rates of anxiety, stress, and depression. In this study, we attempt to improve an individual's mood by finding the most positive seeming environments near a user or a specified geo-location, and suggesting the location to a mobile user. We analyze online photos from the specified region using an embedded evoked emotion rating engine that automatically evaluates the retrieved local photos in terms of valence and arousal aspects. From these values, nearby locations are categorized as evoking positive, neutral, or negative emotions. Results from user experiment demonstrates a 64.46% acceptance rate of recommended locations.

**Author Keywords**

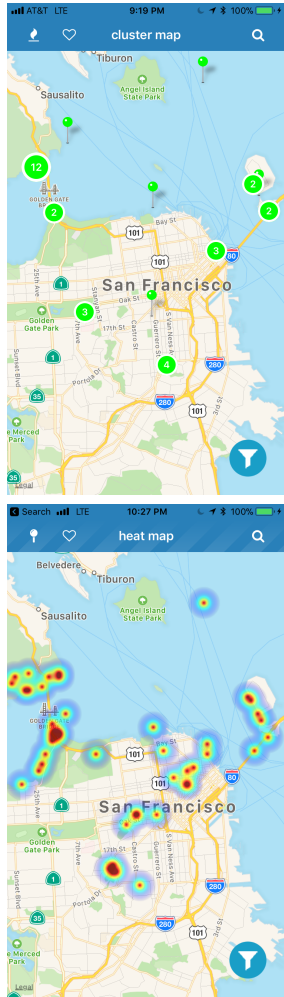
Affective Computing, Evoked Emotion, Local Guide, Mobile Application, Photography.

**ACM Classification Keywords**

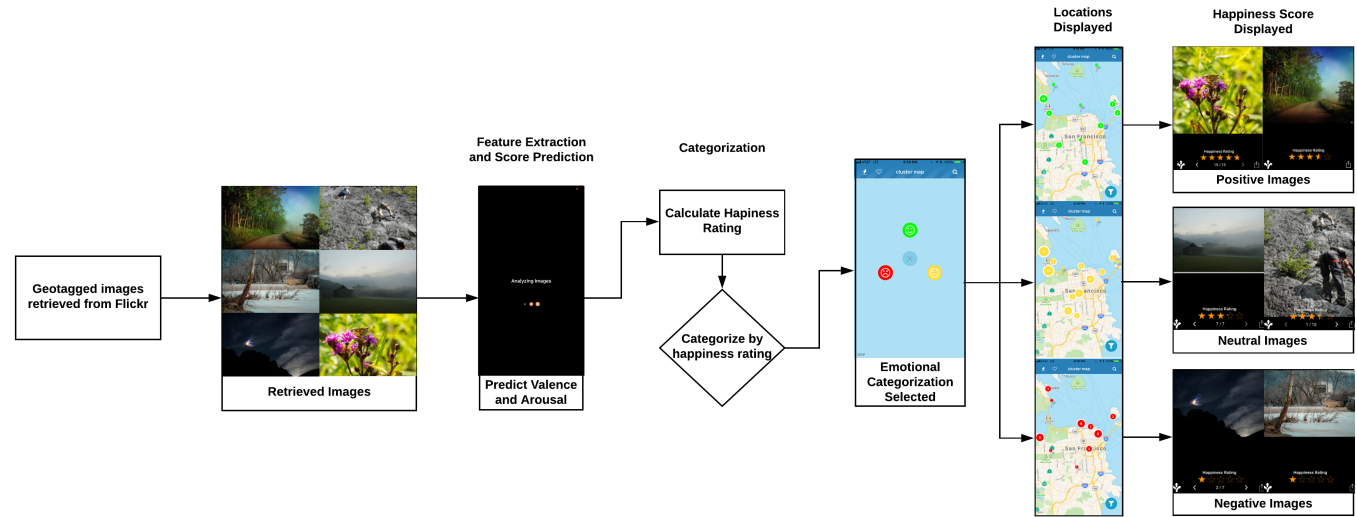
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous; I.4.9 [Image Processing and Computer Vision]: Applications

**Introduction**

With rates of stress, anxiety, and depression on the rise [1, 2, 3], the importance of finding ways to improve mood



**Figure 2:** Images showing two different viewing modes within application. Top: Clustered Map, Bottom: Heat Map.



**Figure 1:** The flowchart of the image retrieval and categorization process of EALOG. Images are retrieved from Flickr first. Evoked emotions are automatically predicted for each image and represented in dimensions as valence and arousal. Emotion values of the surrounding places are then determined for the user-specified geo-location based on the predictions.

and relaxation is arguably more important than ever. The ability to accurately determine whether a place is worthwhile to visit with respect to your mood and the evoked emotion from its environment is essential. One method that has been used is analyzing the emotional perception of the pre-taken photos from the location. The power of images to provoke certain emotional responses in humans [6] has been studied well. Aspects such as roundness, angularity, complexity, and color can play a part in changing the way it evokes emotion. With a data-driven approach, statistical modeling methods can connect these visual features to evoked emotions in dimensions as valence and arousal [5, 4].

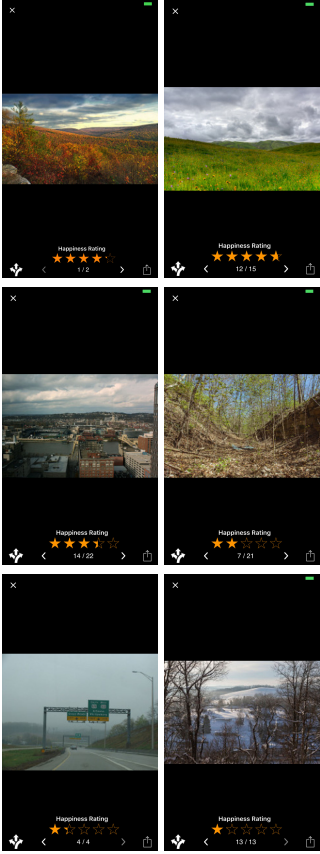
Emotion-aware Local Guide (EALOG) attempts to analyze images from Flickr, or any online photo-sharing sites, that were taken from locations near the user-specified location. Prior to utilization of the application, geotagged images.

These images are then analyzed to determine evoked emotions in terms of valence and arousal to categorize the images into one of three categories: positive, neutral, or negative as depicted. The image and its associated data are then stored in a database. A user is then able to discover locations from these previously rated and categorized images. Figure 1 shows the flow. Figure 2 shows two viewing modes. Users are able to browse the rated photos based on the category that is was assigned which allows the user to find only the locations that evoke a certain emotion.

## Emotion-aware Local Guidance

### *Application Description*

In order to aid individuals to improve their mood, we designed and developed a mobile application called EALOG (implemented currently under iOS). This application allows users to easily view categorized images located around them placed upon a map. Users are able to see images



**Figure 3:** Examples of images from each emotional category. Row 1 depicts images that evoke positive emotions, row 2 depicts images that evoke neutral emotions, and row 3 depicts images that evoke negative emotions.

that evoke positive, neutral, and negative emotions and easily find navigation instructions to their locations. These locations will provide more favorable environments for the user in order to change their mood. In order to find suitable locations for mood management, Emotion Guide collects 50 Flickr images with location data for each search. The images are chosen from a 10 km radius of the user's current location in order to ensure proximity to the locations from the user. If more than 50 Flickr images are present within the 10km radius, images are randomly sampled in order to provide variety for the user, if they use the application multiple times. In addition, the user is able to scroll through the map interface and press a button which searches a 10 km distance around the new center of the map rather than the user's current location. We utilize tags, which are assigned by the photo submitter, of images to ensure that we are only gathering appropriate images. Emotion Guide also allows individuals to tailor the tags searched for based on their own criteria as detailed below.

#### *Emotion Rating Modeling*

To rate the images from the local environments emotionally, we exploit two dimensions of valence and arousal [7], where valence represents the positiveness (like happiness and joy) or negativeness (like sadness and anger) of the emotion, and arousal represents the amount of physiological reaction to stimuli e.g. sadness arousal is lower than anger arousal. Our method exploits dimensional perspective modeling to predict valence and arousal ratings rather than traditional discrete emotional categories modeling [4]. Given the continuity of the emotion label, we formulate the problem as a regression model. Therefore, we train a Support Vector Regression (SVR) using radial basis function (RBF or Gaussian) kernel to predict valence and arousal values as continuously normal values around zero. Our model used in EALOG is trained on EmoSet [4] dataset, an

emotion-aware dataset containing 50K images crawled from Flickr and labeled for valence and arousal evoked emotion values from 1 to 9 through the Amazon Mechanical Turk.

#### *Categorization Methodology*

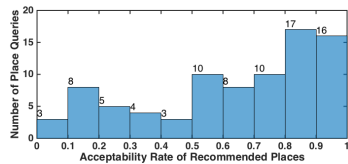
The categorizations are based on the valence and arousal scores that arise from the emotional perception calculations. A combination of high valence and high arousal indicates a positive-evoking image, while a combination of low valence and high arousal indicates a negative-evoking image. A mid-range valence or a low arousal indicates a neutral image that evokes neither positive nor negative emotions strongly. After all images have been categorized, the user is able to view the images of each category by pressing a toggle button that is located in the bottom right of the interface which allows for them to select between a happy face, neutral face, and a sad face representing positive, neutral, and negative images, respectively. As shown in Figure 3, a rating of 1 to 5 stars is used to represent the determined value with 0-1.5 stars being categorized as negative, 1.5-3.5 stars as neutral, and 3.5-5 stars as positive.

#### *User Interface Design*

When many images are found in close proximity to each others, they are displayed on the map to the user as a cluster. The cluster's size is dependent upon the number of images it represents, which is the text shown in the center of the cluster as depicted in Figure 2.

## **Results**

In order to determine the validity of the places we classify as positive, neutral, and negative, 20 participants were recruited from undergraduate and graduate students at Penn State. To conduct this study, an online user response survey was developed. During the survey the user went through 84 rounds of images. During each round two local



**Figure 4:** The histogram of the acceptability rate for some recommended places versus random places.

images (one recommended place and one random place) and an associated emotional category, either positive or negative, were given. One of the image was determined to meet the criteria for the given category, while the other was random. The expected value of the accepted recommended places with respect to the total number of place queries is 64.46%. More accurately, the histogram of acceptability rate for place queries is shown in Figure 4. The x-axis shows the acceptability rate from 0 to 1 with 0.1-width bins, and the y-axis shows the numbers of queries fall into each bin. The histogram has indicated that 17 recommended places were accepted by 80-90% of the participants, 16 other locations with over 90%, 10 other locations with 70-80%, 10 others with 50-60%. Consequently, the majority of the recommended places are accepted with a mean of 64.46%.

## Conclusions

We described our approach developing an application, called Emotion-aware Local Guide (EALOG) to help individuals managing their mood. We demonstrated how images are categorized as evoking positive, neutral, or negative emotions. The categorized images are then presented to the user in order to provide the most probable locations that they would be able to improve their mood. Results of our field trial of the application showed feasibility of the application due to positive responses in regards to the categorization of images and the possible effects they could have on the participants' emotions.

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