CSC 249 Project Proposal

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1 Problem Statement

For our final project in CSC 249, we intend to analyze the correlation between the weather of the top 50 largest cities in the United States and the general degree of happiness as seen from geotagged photos taken within those cities.

This two-part experiment will first involve retrieving a specified amount of publicly available cityscape photos taken within each of the cities, categorizing their features based upon the state of the weather, and combining the data to assign percentage values for the prevalence of each feature to each city.

The second part of the experiment will involve retrieving a specified amount of publicly available photos geotagged within each of the cities that contain faces. We will use the Instagram API to retrieve these photos. We will then analyze the faces to determine the mood of the subject and accumulate the results to calculate an average happiness score for each of the cities.

Lastly, we will chart the average happiness score against the weather score of each city, to obtain a comparison between the two variables and see if they are correlated.

2 Related Work

2.1 Classification of Weather Situations on Single Color Images

A 2008 approach to improve the performance of driver assistance systems in motor vehicles by increasing the reliability of the automated systems in bad weather (limited visibility). The approach sought to distinguish weather situations based of the classification of single monocular color images without any other input data. This was done by taking several histogram features such as brightness, contrast, sharpness, saturation, and hue at several different points in the image and gathering the data into one large vector. The vector was then classified as "clear weather", "light rain", or "heavy rain" using a Support Vector Machine to obtain an estimation for the weather situation.

2.2 Real-time emotion recognition from facial images using Raspberry Pi II

A 2016 real-time emotion recognition system that recognizes basic emotions (anger, disgust, happiness, surprise, and neutral) using the CMU MultiPIE

database and deployed on Raspberry Pi II with robotics usage in mind. The system utilized the Viola-Jones face detection method for finding faces and the Active Shape Model (ASM) for extracting facial points. In the preprocessing step, the image is converted to grayscale and a sobel filter is applied to the image to reduce noise. In the feature extraction step, an ASM automatic fiducial point location algorithm is applied first to a facial expression image, and then Euclidean distances between center gravity coordinate and the annotated fiducial points coordinates of the face image are calculated. Adaptive Boosting Classifier (AdaBoost) was used to perform the classification in the final step of the recogniton system.

3 Data Source / Acquisition

We will need to collect several data sets for our project. We will need a collection of city metadata and landscape photos from which to build a weather rating for each city, and will need access to geotagged photos that are retrieved from each city.

3.1 City Metadata

The first dataset will be a list of the 50 biggest US cities, which will be the locations we sample from. Data for each city will include the city name and latitude / longitude. The location data will be used to retrieve geotagged Instgram photos from the area as well as obtain skyline photos and weather data to compute the weather factor of each area. To obtain this city data, we will use a compination of hand-created lists of city names and a Java program to obtain coordinates for each city.

3.2 Weather Data Set

To compute the 'weather' factor of each of the cities, we will combine two factors: Analyzing the average sky color in skyline photos of the city, as well as using online weather APIs to obtain the average historical weather of the areas. These will combine into a set of weather variables eg. cloudy, sunny, snowy, rainy, each of which will be set to a percentage factor. To obtain landscape photos for each city, we can use public data sets that have been tagged with location labels.

3.3 Happiness Data Set

We will use the Instagram API to collect images from an area in a radius of the latitude / longitude of each city. We will filter out any pictures without faces, and then feed this data set into the emotion evaluator, which will produce a resulting score for each image and an average score for the overall set.

4 Software / Programming Languages

We will use a variety of software to build our solution. We will use Java for basic data collection via the internet. We will be developing Java programs to parse the 50 most common cities and get metadata for those cities. We will

also use Java to call from the Instagram API, retrieve an image, and send the image to the image processing program for analysis. Since our data set will be relatively large and can change over time, we will build a "manager" program that allows retrieving of a fresh data set and will automatically run the process again.

We will use MATLAB and/or C++ to build the image processing algorithms to compute weather based on the skyline image.

4.1 Facial Recognition Algorithms

There are several potential solutions we can use to identify faces in the geotagged Instagram photos and determine the emotions in those images.

One option is to use FaceTracker, a C++ API for non-rigid face tracking created by Kyle McDonald and Jason Saragih. This will identify the faces in an image, but will not identify emotions. However, once the algorithm finds the faces in the image, we could develop our own algorithm to determine the emotion by using the triangulation points of certain facial features located by the software.

Another option would be Microsoft Azure's Emotion API, which allows you to upload an image to the cloud, where it runs a face recognition algorithm followed by a neural network that classifies the emotions in each of the faces. The API then returns a response with probabilities for any emotions detected.

A third option would be to develop our own solution. This would identify the faces in an image, and then run each face region through a machine learning model that would assign an emotion label to the face. This solution would be the most difficult out of the three options and is likely out of the scope of our project, so we will probably use one of the first two options.

4.2 Summarization of Data

After the algorithms are finished and results calculated, we will use MATLAB to generate charts displaying the result of our algorithms, which can then be placed in the presentation and report. The data points can be plotted on a 2d scatter plot to show weather factor vs. happiness factor.

5 References

Roser, Martin, and Frank Moosmann. "Classification of weather situations on single color images." IEEE Intelligent Vehicles Symposium (2008): 798-803. IEEE Xplore Digital Library. Web. 27 Mar. 2017.

McDonald, Kyle and Saragih, Jason, FaceTracker, (2017), GitHub repository, https://github.com/kylemcdonald/FaceTracker

Suchitra, Suja P. and S. Tripathi, "Real-time emotion recognition from facial images using Raspberry Pi II," 2016 3rd International Conference on Signal Processing and Integrated Networks (SPIN), Noida, 2016, pp. 666-670.