Tour Pinoy Recognition

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Abstract—**Tourism business faces many challenges brought by modern technology (i.e. Internet). As online reservation and booking are growing into a more convenient tool for tourists, we consider developing an image recognition application which helps in promoting the local tourism in the Philippines. While several of these image recognition applications are being implemented, our system introduces another way of delivering tourism facts focusing on the selected tourist destinations by just uploading a photo. The system responds useful information needed by the tourists. The Tour Pinoy covers the top five (5) tourist destinations in the Philippines provided by the Haranah Tours Corporation, a duly licensed tourist transport operator accredited by the Department of Tourism Philippines. Based on the criteria used by the proponents and the implementations suggested, the proponents found out that Tour Pinoy helps in promoting local tourism in the Philippines.**

Index Terms—**tourism promotion, artificial intelligence, computer vision, image recognition**

I. INTRODUCTION

Tourism affects different aspects of a community including businesses, government services, natural environment, cultural amenities and residents. Ref. [1] Murillo also stated in her article entitled: Promoting the Philippines, that the Philippines is a home with lots of cultures and traditions that catches international interest. She also describes the country as a perfect example of a "mixed economy" with its tourist spots as a top potential. Aside from having a good interpersonal relations with the foreign visitors, this country has much to offer beyond you expect, from all year-round festivals to rich culture to natural wonders. But then, if we cannot uphold the Philippines genuinely, the distinct beauty of the country will not equalize the assurance of an upward movement in the economy. That is why the government does its best to uplift the tourism industry in the Philippines. Ref. [2] Because of this, the Department of Tourism Philippines was established to promote the country as a major travel destination. In 2002, the "Visit Philippines 2003", one of the most successful tourism promotion project was initiated by the department of tourism as a campaign advertisement. Since then, the Department of Tourism never stops in planning and implementing projects to promote tourism in the country. Their latest project is the "It's more fun in the Philippines" campaign where it presents not only the beauty of the tourist destinations and its culture but also the reasons why it's really more fun to visit the wonderful tropical place called Philippines. They also used some promotional tools such as leaflets and billboards, commercial T.V. ads and even internet by means of advertisements featuring famous tourist spots in the Philippines like: visitmyphilippines.com, itsmorefuninthephilippines.com and tourism.com.gov.ph. These websites and commercials about the tourist destinations in the Philippines are being featured together with its pictures. All of the methods used by the department of tourism have only one goal: to showcase the magnificence and distinctness beauty of the Philippines.

With the promise of the continual growth of technology and the advancements in the field of artificial intelligence and computer vision, we prompted the use of which to promote tourism, particularly image recognition where it's a branch of computer vision that deals with the science and technology of machines that see and extract information by mimicking the human's sense of sight. Ref. [3] Seemann also defines Digital image processing that concerned primarily with extracting useful information from images. Ideally, this is done by computers, with little or no human intervention. According to a well-known online encyclopaedia, Computer vision has many applications, from medicine field where it is being used to extracts info's for further medical diagnosis of the patient, in industry where it is used for manufacturing process to robotics where it is being used to guide the driver or pilot in some situations that is being encountered by the robot. Even in mobile applications, image recognition is widely used because of its new way of delivering information to the users. Ref. [4] One of the best examples of this is the Google Goggles. It was developed by Google and was launched last October 2010. Ref. [5] Google Goggles can determine various landmarks and labels and provide brief information to the users. Ref. [6] Because of its impressive functionality, the Metropolitan Museum of Art announced that they have been collaborating with Google Goggles to provide information the artworks found in their museum through their website direct links.

Back to tourism promotion, though the tourism promotion methods used nowadays are helpful, still we know that the technology is fast pacing. Because of this, the tourists become tech savvy in a sense that they want something which can provide information in a new way, this may be helpful in making the local tourism more

interesting. Ref. [7] It was proved and further revealed by Molina *et al.* that the new technologies impact the growing number of the tourist destination and its competitors among the different destinations and the alteration of the tourist consumer behaviour gives a great transformation to the information sources for tourism activities over the past fifteen years. Ref. [8] It was also explained by Goeldner *et al.* that one of the most successful in using the modern technology (i.e. Internet) to advertise its products is the travel industry. Aside from surpassing the other sectors in marketing their product electronically, we can see that both large and small businesses ability to communicate with the consumer with their promotional messages has already improved.

In relation with this, we, the proponents developed an application software called: "Tour Pinoy Recognition", an image recognition-based and tourist spot identifier application software which can help better enhance the quality of promoting the tourism industry in the Philippines by providing relevant information to the tourist by just uploading a sample picture of the place. In this paper, it explains what is the algorithm used in this software, how the program works, the criteria being used to test the functionality of the software and it's results, the language and environment of the software and the scope and it's limitation.

II. MATERIALS AND METHODS

In this part, we will discuss the methods and materials used in this program by dividing it into four parts: the algorithm, the system procedure, the criteria and the language and environment used for the software development.

A. Algorithm

Before we develop the system of course, we need to specify how system should work. Since one of our primary goals is to find an algorithm that extract information faster, we have found out that among the image processing algorithms presented in computer vision technology, SIFT and SURF, SURF is the common algorithm used hence we have decided to picked the SURF algorithm by Herbert Bay *et al.* for the image processing part of our system because of its speed in recognizing images comparing to SIFT algorithm by David Lowe. To further understand why we choose SURF as the image processing algorithm for Tour Pinoy Recognition and to explain how the two algorithm works, here's is a flowchart which describes the workflow of the SURF algorithm that based on Chris Evan's Notes on the Open SURF Library and SIFT algorithm based on the Paper entitled: A comparison of SIFT, PCA SIFT and SURF by Juan *et al.*:

The SIFT algorithm (see Fig. 1) consists of four major stages, namely: the Scale-space extrema detection, keypoint localization, orientation assignment and finally the keypoint descriptor. Ref. [9] First, the algorithm identifies the potential interest points using the difference-of-Gaussian or DOG. SIFT used the DOG function over the Gaussian to improve the computation

speed. Next, in the keypoint localization step, the algorithm discards the low contrast points and eliminates the edge response. Ref. [9] After that, it computes the principal curvatures using the Hessian matrix and discards the keypoints that have ration between the principal curvatures greater than the ratio. Then, in order to get an orientation assignment, an orientation histogram was made from the gradient orientations of sample points within a region around the keypoint.
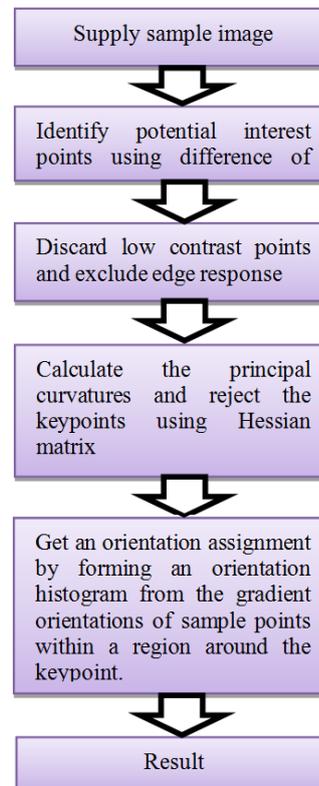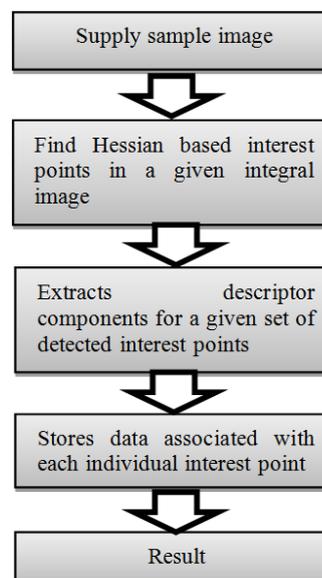

Figure 1. SIFT Algorithm

Figure 2. SURF Algorithm

SURF algorithm (see Fig. 2), on the other hand, has 3 main parts namely: Integral Images, Fast-Hessian

Detector and Interest Point Descriptor. Ref. [10] First, the integral image representation is created from uploaded image and then, the algorithm computes the pixel sums over upright regular areas. Next, the algorithm builds the determinant of Hessian response map. After which, it performs a non-maximal suppression to localize interest points in a scale-space. Points are detected by the Interpolation to sub-pixel accuracy. In SURF Descriptor stage, Haar wavelet and dominant orientation of an interest point are computed then extracts 64-dimentional descriptor-based on the sums of wavelet responses. Lastly, Interest Point part, it generates Accessor or Mutator methods for data.

Though SIFT and SURF algorithm are widely used for image processing, SURF works slightly different over the SIFT algorithm Ref. [11] where the SIFT algorithm builds an image pyramid, filtering each layer with Gaussians of increasing sigma values and taking the difference. In SURF algorithm, on the other hand, creates a "stack" without the two is to one (2:1) down sampling for higher levels in the pyramid resulting in images of the same resolution. In addition, we also choose the SURF algorithm since it is more optimized than the SIFT because it uses box filters. Ref. [9] SURF is also useful as a fast tracking algorithm which is very essential in processing and extracting information for the tourist.

B. System Procedure

In this part, it explains how the program works including the input, its process and the final output of the software.

The program pseudocode: Below, is the program pseudo code which elaborates the important parts of the software. It is divided into eight (8) distinct yet interconnected parts:

Main Algorithm

Generate train set data
Generate test image match versus train set data
For each generated match data in temporary file
    Insert to temporary repository (TR) [train image id, matches, difference]
    Insert to temporary statistics (TS) [train image id, execution time]
For each data in TR
    If match<3, remove
Sort data in TR by matches in descending order
For each data in TR
    If match = next match, sort by interest point difference
Add TS execution time as total processing time
Average TS execution time as mean processing time
Display total processing time and mean processing time
If items in TR are non-Zero, display as match
Else, display as no-match

Instantiation of Variables

If user image exists, Delete existing image
Copy user image to user upload path
If system image exists, Delete existing image
Convert user image to grayscale, resize if necessary
Save modified image to system path as system image

Train Set Data Generation

Clear temporary data
For each train image
    If interest point data exists, store data then continue loop
    Define train image as parameter
    Convert image to interest point data
    Store data

Matching Data Generation

Set matching parameter as null
For each train set data
    Execute OpenSURF
    Append computed result to temporary file

Grayscale Conversion (By Brandon Cannaday)

Create a new blank image
Define converting color matrix
Instantiate a blank image attribute
Set the color matrix to the image attribute
Reference the image attribute to the supplied image
Save result as the blank image

Image Resize (By Charlie Key)

Calculate image dimension versus desired dimension ratio
Set Max (calculated width, calculated height) as percent variable
Define new dimension as image dimension * percent variable
Instantiate new bitmap with new dimension as parameter
Save bitmap as image

Image to SURF Data Conversion

Load Image
Generate interest points (IPts) using OpenSURF
Save IPts

Test Image vs Train Set Matching

Load test image
Generate interest points (IPts) using OpenSURF
Count IPts
Open temporary file (TF) as blank
For each train set data
    Start clock
    Load IPts data
    Generate matches
    Difference = IPTs count - loaded IPts size (count)
    End clock
    Execution time = (end time – start time)/Clock per second constant
    Append train set id, matches, difference, and execution time to TF
Close TF to save changes

The program flowchart of the software (see Fig. 3) shows how the system process works.

First, the tourist will upload an image to the software. Then, the software will start the image processing by converting the supplied image to grayscale and resize the image to 640x480 px if the supplied image is larger than the required image size by the system. This is done to ensure efficiency in the computation process throughout the software. After that, using the SURF algorithm, the system can now compare the supplied image and the

sample image from the database. If the image matches to the set threshold of the artificial intelligence, the software will display the image matched together with the relevant tourist spot information (matched tourist destination top view snapshot, the brief history , promotional video and facts about the matched tourist destination). If the image does not matched in the given treshold, it will display "No Match Found" dialog box. The software will also display the time elapsed from the image matching right after the image matching and before it display the results window to showcase the computing efficiency of the system and assure precision to the users.
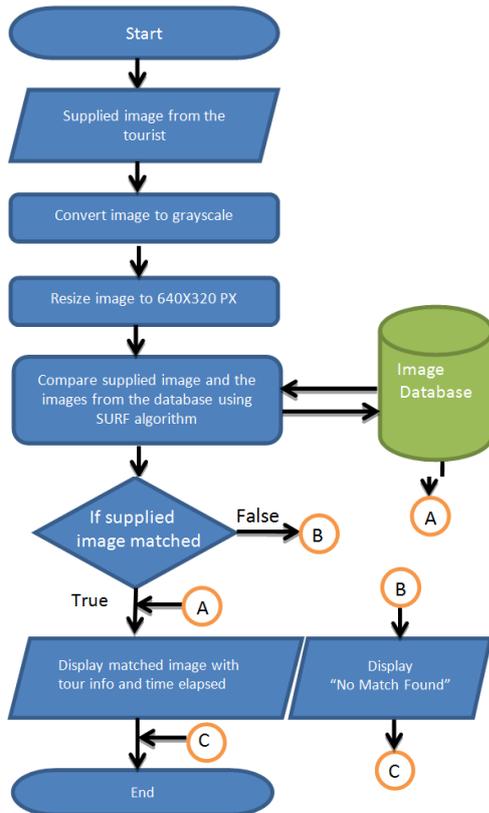

Figure 3.   Program Flowchart

C.   Criteria

To test the functionality of the software, the proponents used the following criteria: (1) number of interest points, (2) number of matches from the top result, (3) matching accuracy, and (4) total processing time. Ref. [12] The proponents used 80 test images that was gathered randomly from Google images pertaining to the tourist spots found in the Philippines for this experiment.

Figure 4.   Candaba swamp

Figure 5.   Baguio city cathedral

Figure 6.   Paoay church

Figure 7.   Mayon volcano

Figure 8.   Villa escudero

Five of the 80 sample images (see Fig. 4 to Fig. 8) used for the criteria.

1) Accuracy

Table I below shows the accuracy in determining the tourist spot by conducting an image recognition software test based on the sample images used in the testing.

2) Time Elapsed from Sample Images

Table II shows the overall average of the total execution time in seconds, the mean execution time by milliseconds and its rating. The total average time elapsed is based on the sample images that was used.

TABLE I.   ACCURACY

Matched Images	Unmatched Images	Correct Match	False Match	Accuracy (%)
54	26	71	9	88.75

TABLE II.   OVERALL AVERAGE OF THE TIME ELAPSED FROM SAMPLE IMAGES

Total Items	Average Total Time (seconds)	Average Mean Time (milliseconds)
80	20.79	424.36

D. User Requirements

Purpose: to provide necessary information for the users who wants further facts regarding the tourist spots that depicts to the photos they have taken.

Scope: the software only covers five of the Famous tourist destinations in the Philippines, which includes Baguio City Cathedral in Baguio City, Paoay Church in Ilocos Norte, Mayon Volcano in Bicol, Calle Crisologo in Ilocos Sur and Villa Escudero in Laguna.

Functional specification: some of the information to be provided by the software are:

- Brief History: describes the noteworthy history of a tourist spot.
- Trivia: Facts about the tourist spot.
- Other info's: This information includes the festivals, special delicacies, accommodations (Hotels, Restaurants etc.), suggested links (video clips or online articles about the tourist spot) and how go on that tourist spot (by land and/ or air).
- Sample screen shot location of the tourist spot from Google maps.

System Constraints: the software will run as a standalone application which will be installed in a computer unit as kiosk or just an application software. The software is implemented in its preliminary stage.

Users: the Local and Foreign Tourists who are interested to visit the magnificent beauty of the Philippines and exemplify their experience of the beauty of the Philippines.

E. Language and Environment

The proponents used the following for developing the software:

- Visual C# and Visual C++ Express Edition- Ref. [13] Visual C# Express is an easy-to-use, free, lightweight, integrated development environment (IDE) designed for beginning developers, hobbyists and student developers. Visual C# and Visual C++ is used for Windows and Game development.
- OpenSURF- is an open source image processing program developed by Christopher Evans where he used SURF algorithm to determine or detect Feature points of an image. The program is available in his website (URL) Ref. [14]. The program is available in C++, C#, Android and Python.

III.   RESULTS AND DISCUSSIONS

Based on the criteria used to test the functionality of the software, the proponents found out that:

- Number of matched images > number of unmatched images meaning: 54 out of 80 testing images were matched and 26 out of 80 images were not matched.
- Number of correct match > number of false match meaning: 71 out of 80 testing images were considered as the correct match and 9 out of 80 testing images were false match.
- The average total time from the sample images that were tested is 20.79 seconds.
- The average mean time from the sample images that were tested is 424.36 milliseconds
- The system has 88.75% accuracy when it comes in recognizing images from the supplied image by the tourist.

IV.   CONCLUSION

Based on the analysis and interpretation done by the proponents using the results noted from the experiment, it proves that the software can identify the tourist spot depending on the photo that will be supplied by the tourist with an accuracy of 88.75%. The software provides information from the uploaded photo depicting one in a short period of time where it extracts information (identify the tourist destination from the uploaded image) for within 30 seconds. The images, regardless of disorientation, were successfully identified by the software so long as the image detail is clear for the algorithm to work through.

V.   FUTURE PLANS

- To implement the software from standalone to online, mobile and tablet application.
- To expand the number of tourist destinations covered by the software.
- To implement the software in a computer unit used as kiosk in every tourism office in the Philippines and in abroad.
- To provide an access in social networking sites like Facebook and Twitter where the tourist can post the photos they uploaded in the proposed software and add some caption on it.
- To optimized further the current algorithm processing to make it a multi-threaded application.
- To include audio, video and animation in the software to make it more attracting to the tourist.

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