PERSONALIZED TRAVEL SPOT RECOMMENDATION AND GUIDANCE SYSTEM FOR SRI LANKAN TOURISTS

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Abstract- Tourism in Sri Lanka is an evolving field which is significantly influencing the development of the country. With the rapid advancement of Affective computing and its' diverse paths where applications are being implemented by facilitating user needs and emotions, tourism has become one of the prominent fields to provide a comprehensive analysis of useful inclination in specific travel spots based on the user interests and emotions. Traditional tourism methodologies where a travel guide guides on a tourists' journey has nowadays become an old fashion where the tourist himself has innovative applications which provide a guide in almost all the areas in his journey beginning to end. This study proposes a solution where tourist gets a personalized recommendation on travel spots to visit, a summary of the recommended travel spots with a native language translation facility and a translating system to translate landmarks displayed on travel spots such as notice boards and signboards into their native language. Our system divided into four components focusing on (a) profiling users, (b) identifying user locations and travel spots, (c) extracting user reviews about travel spots, summarize and analyse sentiments levels and (d) identifying landmarks displayed in travel spots and translate them into traveller's native language. This approach makes ease traveller's life providing personalized recommendations based on collaborative and content filtering approaches.

Keywords- Personalized recommendations, Travel spot, Sentiment analysis

I. INTRODUCTION

Tourism can be considered as an evolving field in Sri Lanka which significantly influences on the development of the country. It is the practice of touring, attracting, accommodating and entertaining tourists. With the advancement of Information Technology and mobile computing, several innovative ideas have been implemented to facilitate a better experience in the tourist's journey. While the world is rushing under technological enhancements and English becoming the universal language, development of applications in multiple languages will help tourists to achieve more personalized service. In the tourism industry, it is much necessary to provide personalized services to the tourists. When visiting several locations tourists may be much amused if they get the places they most prefer to visit and watch. When tourists have lots of options to choose from which might make them confused in selecting the best possible and or most suitable place to visit, it is essential to filter the information and personalize the choices for the use of each specific user. As a tourist most of the times, it is really confusing to decide where to go and to select among a large number of possible destinations which may also be unknown and unfamiliar. Hence, information retrieval and decision support systems are widely recognized as a valuable context in the tourism domain (B.Rieder, 2013).

Most of the times tourists do not get the full knowledge from the tourist guides and information displayed on the locations. Moreover, in case of unavailability of a tourist guide, they will find difficulties in understanding essential notices displayed on boards such as "හිස් වැසුම් පාවහන් ගලවා ඇතුළු වන්න" "රථගාන ඉදිරියෙන්" etc. Sometimes they will have to follow a multi way process of access internet, search the location, get the details and translate them using an online translation mechanism or ask from another person about displays on boards. Therefore,

development of an application for personalized location recommendation with instant location detail translation is seen as a strong need in the tourism industry.

As the initial step, we consider an approach to recommend similar locations for the places where a tourist has visited using a content-based recommendation approach and we generate an overall opinion with review summary about the location based on the reviews extracting from web documents. System is comprised of four main modules as Profiling module, Location details extraction and summarization module, Review summarization and Sentiment analysis module and Image to text conversion and Native language translation of location details module.

The paper is organized as follows. The first section gives an overview of the existing approaches in travel spot recommendation systems, summarization modules, sentiment analysing modules and translation systems. The second section will describe the overall architecture of the system to be developed. The third section will individually describe the four main modules of the system. Experimental details regarding the implementation will be forwarded to the fourth section. Finally, the paper concluded by indicating future works and new areas to be focused on the tourist guiding applications.

II. METHODOLOGY

This section discusses previously mentioned four main modules of the overall system.

A. Profiling Module

This module consists with the tasks of data extraction from social media, data pre-processing, extracting visual data of a photo, extracting demographic data of the travellers, and unsupervised learning approach of analysing data, the recommendation of the next predictable location and finally evaluation of the results. Here these individual tasks have been explored in the literature separately.

a) Data extraction from social media

Social media is one of the superior ways to get details about places, destinations and also people. This information could be used to get a prior knowledge about a particular place or areas, especially for inexperienced travellers. Collecting details from the geo tagged photos such as the photo URL, location, publisher or the traveller who uploaded it, comments of users, total likes, etc. give many details about destinations and travel experiences. Therefore combining these social traveling experiences associated with users' profile provides the ability to explore the wisdom to have different types of effect and personalized travel experiences.

Literature proves the usage of several methodologies for mining of data from Facebook. NameGenWeb originated at the Oxford Internet Institute, Social Network Importer; a plugin for the NodeXL network analysis and visualization toolkit, Netvizz application are some commonly used Facebook data extractors (B.Rieder, 2013). Despite that Graph API is yet another popular HTTP based API of low level that can be used to query data, post new feeds, handling advertisements, uploading graphic data, and a variety of other needful tasks (A. Gupta, 2017).

b) Data pre-processing

Data analysis in social media is challenging because of the availability of vast volume of data, informal and short messages on social media networks and use of media such as images apart from the usual textual messages to express information by the users. Moreover, availability of noises, emotions will be a considerable challenge in social media. There people's comments written in their native language, punctuations, stop words, URLs, emotions will be removed and convert into a uniform format (J. Han and M. Kamber, 2011).

Therefore, it is needed to handle these incomplete, noisy and inconsistent data to provide quality and structured data where can be used as the inputs for the other modules. There are four major tasks in data pre-processing (J. Han and M. Kamber, 2011) as Data cleaning, Data integration, Data transformation and Data reduction

Under the data cleaning process, it is needed to handle the missing values, noise data and the inconsistent data. To handle missing values, approaches like ignoring the tuple, filling the missing values manually, using a global constant to fill the missing values, using attribute means to fill the missing values are used. To handle the noisy data, data will be smoothed via binning methods, clustering approaches and combining computer and human inspection (J. Han and M. Kamber, 2011).

In the data integration process, the data which have extracted and pre-processed from the different data sources are integrated together to a data store (J. Han and M. Kamber, 2011).

In the data transformation process, the data is consolidated into appropriate forms which can be used for data mining. It involves normalization, smoothing and aggregation.

In the final step of data reduction data cube aggregation, dimension reduction, data compression, Numerosity reduction, discretization and concept hierarchy generation will be done.

c) Extracting visual data of a photo

We focused on the extraction of visual data of the uploaded photos to seek which category the photo is belonging. Literature proves the availability of techniques such as Google cloud vision API, IBM Vision recognition API, Cloud sight API and Microsoft Computer Vision API. Microsoft Computer Vision API, photos assigned 86 different categories like outdoor, outdoor water, outdoor mountain, indoor, sky object, people, etc. with a score depicting on how much probability the photo falls into that category.

d) Unsupervised learning approach of analysing data

Our approach, we assumed that one data point probably belongs to more than one cluster. In our dataset both numerical data as well as categorical data is available which is comprising of post data extracted from Facebook, users' demographic data and the visual data extracted from computer vision API. General clustering approaches include representative based clustering methods such as K-Means algorithm, hierarchical clustering methods such as agglomerative hierarchical clustering, density-based clustering methods such as DBSCAN and Spectral & graph clustering methods (Anon., n.d.). Literature also proves the use of K-Modes algorithm, Squeezer, LIMBO, GAClust, Cobweb algorithm, STIRR, ROCK, CLICK, CACTUS, COOLCAT , CLOPE, etc. in the categorical data clustering[4]. Our approach used the label encoding method to transform the categorical data to numerical data and then apply K-Means clustering approach.

e) Recommendation of the next predictable location

Nowadays in the tourism domain recommendations based on unique personalized factors is a prominent feature which deals with recommending specific items such as restaurants, hotels, sports, activities, accommodations and packaged tour plans also effectively and efficiently. Many researchers have gone through collaborative filtering, content-based filtering and also hybrid filtering approaches when they are to track user's preferences from social networks (A. Gupta, 2017) (Lee, 2017) (Z. Yao, 2016). Based on memory recommender systems use K-Nearest Neighbours algorithm (K-NN) for predicting the preferences of users. Firstly they will identify the nearest users similar to a particular user, obtain the data of the user, and by using a weighting method, recommend items to a user. Based on model recommender systems based on developing a model using machine learning concepts and mainly target the fact how much a user will prefer an item if he did not encounter it before (Lee, 2017) and it outputs more accurate results with more large data than the based on memory methods. Some of the popular model-based approaches are Bayesian Networks, Singular Value Decomposition, and Probabilistic Latent Semantic Analysis (Li, 2017) (Y. Mao, 2018).Researchers have undergone on context-aware recommender systems based on the synergy between soft computing and data mining techniques (G. Fenza, 2011, pp. 131–138).

B. Location details extraction and summarization module

Text summarization methods can be classified into extractive and abstractive (Gupta V, 2010 Aug 20;2(3):258-68.) summarization and extractive (Farshad Kyoomarsi, 2008) summarization methods which focus on selecting essential sentences, paragraphs, etc. from the original document and concatenating them into a shorter form. The importance of sentences is decides based on statistical and linguistic features of sentences.

The abstractive summarization method (Radev, 2004) (Romacker, 2001) consists of understanding original text and re-telling it in the fewer word. It uses scientific methods to examine and interpret the text. To find the new concepts and expressions to best describe it by generating a new shorter text that conveys the most important information from the original text document.

Here we mainly focus on the extractive summarization method. It has two steps as pre-processing step and processing step. Pre-processing is a structured representation of the original text and includes sentences boundary identification, Stop word elimination and Stemming. In Processing step, features influencing the relevance of sentences are decided and calculated and then weights are assigned to these features using weight learning method. The final score of each sentence is determined using feature-weight equation. Top-ranked sentences are selected from final summary. There are three features in the extractive summarization as,

1. Title word feature: Sentences containing a word that appears in the title are also indicative of the theme of the document. These sentences are having higher chances of including in summary.
2. Sentence location feature: Usually first and last sentence of the first and last paragraph of a text document are more critical and are having higher chances to be included in the summary.
3. Sentence Length feature: Huge and concise sentences are usually not included in the summary.

Extractive summarizers (Vishal Gupta, AUGUST 2009) (H. Khosravi, n.d.) aim at picking out the most relevant sentences in the document while also maintaining a low redundancy in summary.

a) LSA Method for extractive summarization

Singular value decomposition (SVD) (H. Khosravi, n.d.) is a potent mathematical tool that can find principal orthogonal dimensions of multidimensional data. It has applications in many areas and is known by different names: Karhunent-Loeve transform in image processes and Latent semantic analysis (LSA) in text processing it gets this name LSA because SVD applied to document word matrices, group documents that are semantically related to each other even when they do not share common words.

Words that usually occur in related contexts are also related in the same singular space. This method can be applied to extract the topic-word and content-sentences from the document. The advantage of using LSA vectors for summarization rather than the word vectors is that conceptual relations as represented in the human brain are automatically captured in the LSA while using word vectors without the LSA transformation requires the design of specific methods to derive conceptual relations. Since SVD finds the principal and mutually orthogonal dimensions of the sentence vectors, picking out a representative sentence from each of the dimensions ensures non- redundancy. It is to be noted that this property applies only to data that has key dimensions inherently. However, LSA would probably work since most of the text data have such principal dimensions owing to the variety of topics it addresses.

C. Review Summarization and Sentiment analysis module

The reviews have become a new way of expressing an individual's opinion through which people openly express their views on various things. Opinions are also valuable when someone wants to hear the other's viewpoint before make a decision. Analysis of these opinions into different classes become a key factor in decision making (Ragha, 2012).So to create a summary of these opinions/reviews, we have to extract topics from whole opinions. Sentiment Analysis is procedure of identifying a selected text or writing is whether positive, negative or neutral. There are two types of textual information as facts and opinions. Reviews are kind of opinions which related to a location, place, person etc. Opinions reflect the people's viewpoint about a thing (Ragha, 2012).

a) Summarization

1) Probabilistic latent semantic indexing technique (PLSI)

PLSI is a maximum likelihood estimation approach.. Documents create a specific distribution of topics p(z|d), Topics produce a specific distribution of word usage p(w|z).Then the probability of generating a document d is,

$$P(w_1 \ldots w_{N_d}) = \prod_{i=1}^{N_d} \sum_{z=1}^{K} P(w_i \mid z) P(z \mid d)$$ (Croft, 2006)

2) cluster-based retrieval

It is also called a mixture of unigram models. In the language modelling framework, the cluster-based topic models were used to smooth the probabilities in the document model (J. Yao, Jan. 2018.). In this cluster-based retrieval model, it is assumed that all documents which use to generate topic models fall into a finite set of K clusters (topics). Documents in each cluster discuss a particular topic z, and each topic z is associated with a multinomial distribution P(w|z) over the vocabulary (Croft, 2006). This model generates following processes on documents;

Select a topic z from a multinomial distribution with parameter

For i = 1..., pick word i w from topic z with probability

P(i w |z)

The probability of generating a document d is using cluster model is;

$$P(w_1 \ldots w_{N_d}) = \sum_{z=1}^{K} P(z) \prod_{i=1}^{N_d} P(w_i \mid z)$$ (Croft, 2006)

One of the parameter estimation methods for the mixture of unigrams model is to cluster documents in the collection into K groups and then use a maximum likelihood estimate a topic model P(w|z) for each cluster. They incorporated the Cluster information into language models as smoothing.

$$P(w \mid D) = \frac{N_d}{N_d + \mu} P_{ML}(w \mid D) + \left(1 - \frac{N_d}{N_d + \mu}\right) P(w \mid cluster)$$

(Croft, 2006)

b) Sentiment Analysis of Reviews

After extracting a review based on a specific place, the application would have an ability to describe it as a positive, negative or neutral. By using this, another tourist can determine whether to that place or not. Researchers describe two main types of approaches for sentiment classification. Semantic orientation method based on a PMI-IR algorithm which combining point mutual information (PMI) and information retrieval (IR). PMI is an association scale between a feature (word) and a category, not between a document and a category. Here X represents the occurrence of a word, and Y represents the occurrence of a category.

Pmi(x, y) = log (P(x, y) / P(x) .P(y)) (J. Wood, 2017)

c) Sentiment analysis

1) Semantic orientation method

Semantic orientation (SO) represents their output using two reference words pair called "excellent" and "poor." The SO of a phrase is retrieved as the mutual information between the given phrase and the word "excellent" minus the mutual information between the given phrase and the word "poor." The equation for that is as below (Croft, 2006).

$$P(w \mid D) = \frac{N_d}{N_d + \mu} P_{ML}(w \mid D) + \left(1 - \frac{N_d}{N_d + \mu}\right) P(w \mid cluster)$$

(Ragha, 2012)

A SO of a review calculated by getting average of SO values of all extracted phrases in the review. This process describes a kind of threshold which use to determine positive and negative of a review (Ragha, 2012). In traditional sentiment analysis methods typically try to extract the overall sentiment revealed in a sentence or document, either positive or negative, or somewhere in between. However, a disadvantage of these methods is texted where a loss of information can also occur. To overcome those issues have to use sentiment analysis method which uses well-trained training sets (Ragha, 2012).

D. Image to text conversion and Native language translation of location details module

This part deals with the images with Sinhala texts captured via mobile devices or uploaded through some media. The primary objective of this module is to capture Sinhala texts and convert it to a character set which can be later used for native language translation purpose.

In Sinhala language, there are 16 vowels, 2 semi-consonants, 40 consonants and 13 consonant modifiers. With the combination of consonant modifiers, a single character can take a large number of shape combination. Also, most of the Sinhala characters take curve shapes, which makes them harder to recognize that most of the other languages. In Sinhala character recognition, we can see most researchers proposed same kind of phases with different or same types of processing techniques. Those phases can be recognize as pre-processing, character segmentation, feature extraction and character recognition.

In (M.L.M Karunanayaka, 29 Nov-01 Dec 2004) and (Dharmapala, 2017), some techniques which have been used have the same final objective but different ways to achieve it. For binarization, in (Dharmapala, 2017) they have proposed the adaptive thresholding technique

while (M.L.M Karunanayaka, 29 Nov-01 Dec 2004) prosing three different types of techniques to achieve the binarized image. In first techniques the sorted gray levels of the image in ascending order and take the maximum gray value of the first quarter as the cut-off value for foreground and background pixels. Second techniques are using a 3x3 kernel which calculate the number of '0' valued pixels and if the cunt is less than threshold value change the value to 255.

For the character, segmentation step both (M.L.M Karunanayaka, 29 Nov-01 Dec 2004) and (Dharmapala, 2017) used vertical and horizontal projection profiles to segment the text lines and non-overlapped and non-touching characters. For the touching characters (M.L.M Karunanayaka, 29 Nov-01 Dec 2004) proposed to categorize segmented characters into different categories such as overlapping, touching, connecting and intersecting based on the average character width. Then to identify touching characters they used a 3x3 kernel which count the discontinuities in lines in characters and by the count they assume the number of characters in segmented part. If there are no discontinuities, they put them into other 3 categories which used "water reservoir" concept to segment the characters. In (Dharmapala, 2017) they proposed to identify the contours of the characters by using OpenCV function named findContours () and redraw the characters separately in canvas.

Character recognition is done by the single Kohenen artificial neural network with 32x32 input neurons and single output neuron in (M.L.M Karunanayaka, 29 Nov-01 Dec 2004) which classify character into one of the fourth predefined character groups. Then depending on the characters groups and using a dictionary most proper word will be generated. In (Dharmapala, 2017), they have used 3 separate neural networks for each zone in character. Then depending on the probability values they produce which indicated relativity with each zone, character can be matched with map of all possible combination of characters.

III. SYSTERM ARCHITECTURE

There are two leading data stores as the Facebook uploaded photo data store and data store with essential notices displayed on travel spots. The Facebook photo data store consists of the user uploaded photos and details

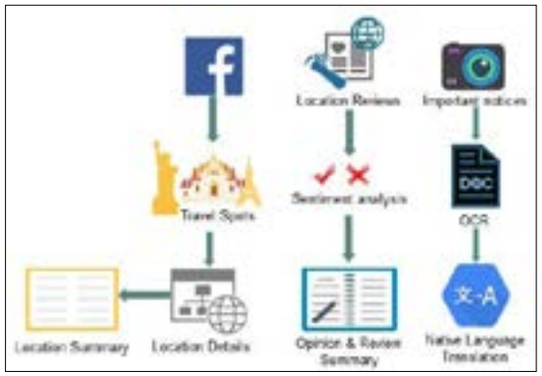

Figure 1. System architecture.

from two Facebook travel groups such as "EnigmaTest" and "Travel Guide Sri Lanka." Post data (publisher name, photo URL, post title. Location tagged) and user demographic data (marital status, gender, hometown, past visited locations) will be sent to the similar location recommendation module. The location outputted will be sent to the location detail extractor module and details of that location will be extracted from the websites. Those will be sent to the summarization module and will generate a location detail summary which will be sent to native language translation module. The comments extracting from the Facebook posts and extracted reviews of locations or travel spots by users from websites will be then sent to the location reviewer where a review summary for the location will be generated through sentiment analysis. That review summary will also be sent to the native language translation module.

IV. APPROACH THROUGH INDIVIDUAL MODULES

A. Profiling module

Main data source in this module is the Facebook uploading photos to selected two tourist groups. There post data was extracted using Graph API for developers assisted by Facebook platform. Photo URL of the post was taken and using Computer Vision API with Python, the category it belonging along with the category score was taken. For a specific user, his demographic data such as relationship status, hometown, age, gender and check-ins were extracted using Graph API.

Group id of the two Facebook groups were gained first.

-Query:GET->/v2.11/EnigmaTest?fields=id, name

-Query:GET->/v2.11/TravelGuideSriLanka?fields=id, name

Post data was extracted via,

-Query:

3054729366178 17?fileds=feed{full_ Picture,Place,from,comments{message},message,likes. limit(0).summary(true)}

Here data was normalized, tailored by renaming columns properly, dropping unwanted columns and will clean all the null values. Here we used Scikit learn with Pandas library and done in Jupyter IDE.

Users 'demographic data was extracted via,

-Query:

371223593034449? Fields=id, name, gender, relationship_status, hometown, tagged_places {place {name}}

After we categorized the users based on the past visited locations or check-ins. 18 different locations were identified and we divided the locations in to 5 user types we identified as follows.

We developed a neural network for the user classification purpose and for each user a numerical index was generated based on his check-ins where its numbers are arranged according to the ascending order of his preferences. Here we used Keras library and Tensorflow as the backend.

E.g.:- If the number generated is 325:- 3 denotes Observer, 2 denotes Nature lover, 5 denotes High traveller. Thus from his past check-ins his preferences are in ascending order as above.

Thus the data row generated will be as follows.

Publishers' name, User category (Number we generated), Category score, Category, Location tagged, relationship status, gender, hometown

Here underlined data will be taken for the clustering approach. It was done via K-Means clustering approach.

Table 1. Classification of users with location types.

Location type	User type	Number assigned
Religious locations	Religious person	1
Waterfalls, Watebodies, Beaches, Mountains, Forests	Nature lover	2
Parks, Forts, Monuments, Gardens, Gardens, Markets	Observer	3
Dams and Bridges, Lighthouses , Powerplants	Building explorer	4
Islands, Countries, Scenery Towns, Holiday Resorts	Long distance traveler	5

There we used scikit learns label encoding approach to convert the category and location tagged which are categorical in nature, in to numerical values. In the clustering process we used the Elbow method to find the most optimal number of clusters which experimentally 15 was gained as the optimum number.

Users was clustered likewise and to suggest next locations for a particular user, we used the locations visited by the similar users to him who are in the same cluster.

B. Location details extraction and summarization module

Here we applied the concept of making the location summary using NLTK library and fuzzy logy and applied on to multiple documents to extract specific sentences. The algorithm we used here extract one or more sentences that cover the main topics of the original document using the idea that, if a sentence contains the most recurrent words in the text, it most probably covers most of the topics of the text.

Figure 2. Image to Text Conversion main module

Here we used the concept of frequency summarizer. It tokenizes the input into sentences then computes the frequency map of the words. Then the frequency map is filtered in order to ignore very low frequency (frequency<0.3) and highly frequent word (frequency>0.9) in order to discard the noisy words such as determiners and to discard words such as stop words (a, the, an, that, one etc.) which do not contain much information. And finally the sentences are ranked according to the frequency of the words they contain and the top sentences are selected for the final summary. The simplest method to use frequency of words as indicators of importance is word probability. The probability of a word w is determined as the number of occurrences of the word, divided by the number of all words in the input. Since it is not accurate if we get summary using only NLTK we use fuzzy logy technology to improve the accuracy. Here we first set the number of sentences in the summary as 5, but we facilitates the user to get as his preferred number of sentences.

C. Review Summarization and Sentiment analysis module

Input data to this module are reviews (comments) about locations. Output is a summary of reviews and an overall sentiment analysis of them. This process contain several sub process as data gathering, topic modelling, summarization and sentiment analysis. Data was gathered by web scrapping techniques because it is easy to get only the required data from websites by specifying the html tag which data is located. Data was pre-processed by using the enchant module which have an English words corpus by removing stop words and other languages texts. To create a summary from these opinions/reviews we used topic modelling approach and extract text which have highest frequency among all the document data. Here we used LDA based topic modelling approach. Here a particular topic is defined by a cluster of words with each word in the cluster having a probability of occurrence for the given topic, and different topics have their respective clusters of words along with corresponding probabilities.

After summarizing sentiment analysis module was implemented to obtain sentiments about that place according to reviews. By adding this module it will help to tourists to make decision about a place whether to visit or not. Here we used NLP based sentiment classification algorithm which would be able to design a well-trained training set by adding weights to the words. The trained training sets can easily filter the attributes as per the user requirements. And also we used the Bayesian algorithm to classify the sentiments as positive or negative which is using a word dictionary and training data sets to analysing process. Through that data lose will be reduced.

D. Image to text conversion and Native language translation of location details module

In this module we hope to follow the same four phases mentioned in referenced researches (M.L.M Karunanayaka, 29 Nov-01 Dec 2004) (Dharmapala, 2017) with one additional phase. So in our approach we separate this module into pre-processing, character segmentation, feature extraction, character recognition and word correction.

In pre-processing phase we decided to use Contrast Limited Adaptive Histogram Equalization (CLAHE) as the contrast equalization method. To remove noise in the image we use Non-local means denoising method and mean filter. For binarization step Otsus's algorithm is used which is kind of an adaptive thresholding which consider image pixel as background and foreground depending on the threshold. For skew correction process Probabilistic Hough Transformation is decided to use which use Hough transform lines to correct the angles.

In Character segmentation phase we decided to use the Horizontal Projection Profile to segment text lines and vertical projection profile to segment words and characters. For the overlapping and touching characters, contours will be considered and image will be redrawn in separate canvases. Contour recognition will be performed for both overlapping and touching characters and characters with modifiers. So when we segment a character with modifier we have to perform contour recognition and redraw steps again to segment character and modifier.

In feature extraction we used the horizontal and vertical projection profiles of the three zones in image named as upper, middle and lower which take place in first one third from top of the image, second one third form middle of the image and last one third from bottom of the character image. Vertical and horizontal projection profiles are for two parts from each zones which divided horizontally for horizontal projection profile and vertically for vertical projection profile. Then the middle zones pixel values is taken as separate vector.

In Character recognition phase above feature vectors are processed through three separate neural networks which process upper, lower and middle feature vectors separately. Out will be a probability value that express how much given feature vector is related to given label. Then by considering joint probability for all three zones and matching joint probability with map of all possible character combination, a character will be generated. By assembling those character, we can generate a word.

In word correction phase we correct the generated word by using a verified Sinhala word corpus and using Bayes theorem as basic approach.

V. RESULTS

We used Python as the programming language and used ionic as the front end development tool. Here we used Mongo DB in the storing of data extracted by Facebook and processed data.

From the Location recommendation module a location based on a users' past visited locations and on his uploaded photos will be generated. From the Location details extraction and summarization module a summary will be generated for a location entered by the user. From the Review summarization and Sentiment analysis module a review summary for a particular location will be generated with an overall sentiment analysis. From the Image to text conversion and Native language translation of location details module user can get the translated details of the Sinhala notices displayed in landmarks.

VI. EVALUATION OF RESULTS

As per the evaluation, we prepared a user evaluation form to be filled by 50 selected users. There 7 criteria related to the system performance were identified and users were told to put a tick in front of the criteria whether it is excellent, good, satisfactory, fair or worse. Criteria and the results obtained are as follows.

Criteria A - Recommend locations that you like most

Criteria B - The user types suggested matches you

Criteria C - Location Detail summary is accurate

Criteria D - Location detail summary contain enough details

Criteria E - Review summary generated about a location is accurate and meaningful

Criteria F - Sentiment analysis about locations is accurate

Criteria G - Understanding of translated recognized word in captured notices

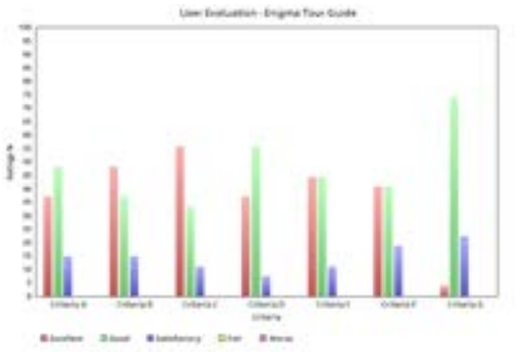

Figure 3. User Evaluation results

VI. CONCLUSION

In this paper it is being discussed the use of our system as a smart guiding system, which will help travellers to customize their journey accordingly. We have tried to provide a system which will help tourists to freely travel and find travel spots where they do not see a need of a third party to guide them. We have undergone several used approaches, techniques and methodologies which researchers have used in the similar tasks to our tasks. Through our system, it was focused to get the most applicable technique for different tasks while improving the accuracy of the final system.

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WEB, MOBILE AND COMPUTER ACCESSIBILITY: ISSUES FACED BY THE SRI LANKAN VISUALLY IMPAIRED COMMUNITY

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Abstract- Though Information Technology and Internet provide benefits to their customers, there is still a gap existing between none-differently abled and differently abled users. This gap is known as Disability Digital Divide. When compared to none-differently abled, differently abled users face a disadvantage when accessing these technologies. In Sri Lankan context, there is no proper planning or guidelines to overcome these issues specifically faced by the visually impaired community. Therefore, this research focuses on addressing those issues and finding constructive solutions. The study focuses on three main research questions. Firstly, it identifies the problems and issues faced by visually impaired people when accessing personnel computers, mobiles, Internet and web related technologies. Secondly it concentrates on technological accessibility related issues in relation to these technologies and finally, how the above problems and issues can be rectified. This study was conducted by engaging in in-depth interviews with visually impaired individuals and observing Computer, Web and mobile accessibility issues. Snowball sampling was used and this research directly benefits visually impaired community allowing them to overcome the obstacles, problems and issues they are facing in their day to day life in the context of Information accessibility. Findings indicated that, current websites failing to adhere to Web Accessibility guidelines, difficulties in software accessibility, human perception on technology, financial difficulties to purchase and use of equipment are the major issues. Solutions recommended to overcome such issues and improve the accessibility among the Sri Lankan community include standardization of web and internet facilities, concentration on user friendliness in software development processes, infrastructure development, and financial support for visually impaired people and special training and education on technology with proper guidance.

Keywords- Web Accessibility, Mobile Accessibility, Computer Accessibility, Information Accessibility, Visual Impairment

I. INTRODUCTION

For most people, technology makes things easier. For people with disabilities, technology makes things possible". The often-cited quote by Mary Pat Radabaugh, former Director of IBM National Support Center for Persons with Disabilities, sums up the importance of technology in the process of empowering persons with disabilities (National Council on Disability 1993). The exclusion and marginalization of persons with disabilities is a human rights issue as well as an economic issue for countries. When a significant section of society, estimated at 15% of the world population, faces obstacles in receiving education, transitioning into the labor market, and becoming economically self-sufficient, it does not only undermine their rights and dignity but also adds significantly to a country's welfare burden (WHO and World Bank, 2012).

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