A DEEP LEARNING MODEL FOR DEVELOPING SMART TOURISM GUIDANCE SYSTEM FOR PETRA

by

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DEDICATION

I dedicate my dissertation work to my family and who teach me.

A special feeling of gratitude to my loving husband, whose words of encouragement and push for tenacity ring in my ears.

My mother has never left my side and is very special.

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LIST OF ABBREVIATIONS

Symbol	Description
AI	Artificial Intelligence
ANN	An Artificial Neural Network
Open CV	Open Source Computer Vision Library
DNN	Deep Neural Networks
DNNs	Deep Neural Networks
GDP	Gross Domestic Product
GPUs	Graphical Processing Units
RCNN	Recurrent Convolutional Neural Networks
RNN	Recurrent Neural Network
SGD	Stochastic Gradient Descent
STGS	Smart Tourism Guidance System
SVM	Support Vector Machine

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ABSTRACT

Recent advancements in hardware and software platforms have paved the way for smart and interesting applications development in Computer Vision and Image Processing fields. For example, the majority of mobile phones are recently equipped with High Definition (HD) cameras which are capable of acquiring high-quality scenes and images. These images are processed, improved and manipulated in a prompt response time using high-performance Central Processing Unit (CPU), such as a multi-core Graphical Processing Unit (GPU).

Image recognition is a topic of "Computer Vision" that aims to find and identify one or several specified objects, object classes, features or activities in a given input image or video frame, even if it's partially obstructed from view. Deep Convolutional Neural Networks is the-state-of-the-art technique for Image recognition, but it requires a lot of training time and computing power to converge.

There are several applications for image recognition in different domains, such as Face recognition, Optical Character Recognition, Manufacturing automatic inspection and Quality Control, and Medical diagnosis. In this thesis, a Smart Guidance System is proposed in an application which identify the images of Petra (Khazna and Theater) sites from other images by using supervised deep learning techniques that achieved the accuracy and speed suitable for the use of tourists.

Most of the time, Jordan tourists rely on local guides and other people to enlighten them about the different historical sites, the tourist needs to access information in a specific language upon request, while some of them prefer more privacy in his/her journey. In

this case, tourists have to search for tourism information from the internet or other resources. Due to the lack of such resources, tourists are enforced to pay an amount of money of traveling budget to local guides and agents to get such services.

A smart tourism application has been developed that its objective is self-contained and capable of providing Jordan tourists with all information that they may need, referred to as the Smart Tourism Guidance System (STGS for short). The STGS objectives are to provide an intelligent tourism guiding system using deep learning techniques, provide the tourists with sufficient information and objective understanding of the places visited together with better value and satisfaction of his tour.

The importance of this application comes from the raising popularity of smart phones equipped with cameras, where snapping a picture is far more convenient than typing description and provide the tourists with sufficient information and objective understanding of the places visited together with better value and satisfaction of his tour. In order to suit the application considered in this thesis, we have researched and study hard about the deep learning in terms of image and object classification, the training models that used for this purpose and the image process that can be apply. The proposed model has two major elements, the first one is the well-known Inception V3 model, as it has been modified by added extra layers. The second step is to enhance the images utilized in this model by applying image process techniques. The proposed model is extensively compared with the VGG and the inception V3 models in terms of accuracy and training delay. Results presented in this thesis demonstrated that the proposed model (Modified Inception V3 with Image Processing techniques) significantly outperformed VGG & Inception V3 models for the selected metrics.

The proposed model shows improved accuracy compared with other models. The proposed model which is called (inception with image processing) has 91.84%, the

inception v3 which is called (inception original) has 89.13% and the VGG model has 83.11%.

As the long-term sustainability of tourism rests on the ability of community leaders and tourism professionals to maximize its benefits and minimize its costs. The goal of developing the tourism industry in the community is maximizing selected positive impacts while minimizing potential negative impacts. For a tourism-based economy, the residents should be willing to partners in the process. One of the new services that has a significant impact on tourism worldwide is mobile application that provides instant and informative information to the tourists. The tourism industry is complex partially because of the competition between countries in the Middle East to attract a large number of tourists. The picture painted by a tourist through his or her first impression is very important. Tourism in Jordan is slow relative to its peers. Since 2004, the Ministry of Tourism and Antiquities has been leading a national tourism strategy, which targets high-end tourists and promotes eco-tourism, adventure tourism, health tourism, leisure and wellness tourism, religious tourism, and volunteer tourism. Despite efforts from both the private and public stakeholders in the tourism cluster, (19.7% of Gross Domestic Product (GDP)) in 2017.

CHAPTER ONE

INTRODUCTION

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1.1 Introduction

The United Nations World Tourism Organization (UNWTO) estimates that internationally there were just 25 million tourist arrivals in 1950. 68 years later this number has increased to 1.4 billion international arrivals per year. This is a 56-fold increase. Tourism is the strongest and biggest industry within the worldwide economy world, creating an evaluated 11% of the worldwide net residential item (GDP), utilizing 200 million individuals and serving 700 million visitors worldwide, a figure which is anticipated to twofold by the year 2020 [48,49].

A tourist information center, providing visitors to a location with information on the area's attractions, lodgings, maps, and other items relevant to tourism. Often, these centers are operated at the airport or other port of entry, by the local government or chamber of commerce. However, the visitors could not utilize this information when they are on the move. Subsequently, we propose to construct a portable visitor direct framework presenting Petra as a case and all authentic places afterward.

There's no doubt that over the years technology has been responsible for creating amazingly useful resources which put all the information we need at our fingertips. The development of technology has led to so many mind-blowing discoveries, better facilities, and better luxuries, but at the same has dramatically changed our daily lives. This has led people to become more and more dependent on their smartphones and mobile devices. In the same context, the use of smartphone technology, social media and other mobile applications ("apps") is developing quickly. This has ended up progressively clear within

tourism field, because it is regarded as one of the greatest divisions across the world, generating an estimated of eleven percent of the global gross domestic product [6]. Today most tourists relay on static information such as Guide Bot. These sources of travel information have many problems; outdated information is one of them [52]. In addition, it mainly relies on a tourist guide, an individual who guides guests within the dialect of their choice, and translates the social and common legacy of a region. The tourist guide must have qualification in different aspects, especially in language competence and in terms of wide common information with particular reference to the history, topography, craftsmanship, engineering, financial matters, legislative issues, religion and humanism of the region of capability.

In this research, we develop a smart guidance application that is capable of granting a real-time efficient tourists information. The proposed system is referred to as Smart Tourism Guidance System (STGS for short). The STGS is a mobile application that utilizes AI and Image processing to identify and classify images by taking photos directly from the phone and able to determine the name of the object. Hence, when a tourist demands some information about a specific historical site, he/she needs only to have a picture for this site and then the required information about this site will be automatically provided in a specific format, like video, audio, and text. The STGS will be developed as a mobile application, so it can be used in different platforms such as smart mobile phones, Laptops, Tablets, etc.

1.2 Problem Statement

In Jordan, the tourism segment represents a major part of the total national income [7,50]. Most of the time, Jordan tourists rely on local guides and other people to enlighten them about the different historical sites. However, this information - most of the time- is not

sufficient to tourists since they are frequently experienced travelers with expectation to have a full understanding regarding the areas they visit.

The tourist needs to access information in a specific language upon request, while some of them prefer more privacy in his/her journey. In this case, tourists have to search for tourism information from the internet or other resources. Due to the lack of such resources, tourists are enforced to pay an amount of money of traveling budget to local guides and agents to get such services.

1.3 Research Importance

The application aims to create a direct framework for the tourist to provide information about the archaeological sites and the direction of access to them on his own, as the tourist cannot find these data during the process of mobility, especially if there is no internet connection, and the Petra city was chosen as the study sample for this application.

1.4 Research Objectives and Limitations

Within the tourism industry, visitor data is gotten primarily through daily news, magazines, radio and other basic ways that are accessible effectively. But the issue is that tourists are not able to urge travel data opportune when they are on the move. Whereas today's versatile gadgets are getting to be more brilliantly compared with PC, they have some restrictions in the screen size and console, limited CPU capacity, limited memory space, moderately and erratic Web association. Even through, the old mobiles versions have similar tourist application, but the efficiency of these applications were limited due to processing power and memory capacity [53]. Hence, the portable end-user's operation is exceptionally troublesome and the substance show on the screen of the portable gadget is constrained.

This thesis is achieved the following objectives:

- Develop a smart tourism application that is self-contained and capable of providing Jordan tourists with all information that they may need, referred to as the Smart Tourism Guidance System (STGS for short).

- The STGS is supposed to provide an intelligent tourism guiding system using deep learning techniques.

- Provide the tourists with sufficient information and objective understanding of the places visited together with better value and satisfaction of his tour.

STGS was built using modified Inception V3 model with pre-image processing algorithm. The model utilizes 519 number of images. The first step was to enhance and improve the image quality by applying image process, such as, bilateral filter and brightness enhancement. The next step is to it modify Inception V3 by adding extra layers such as, drop out-layers and batch normalization layers that assist in improving the model accuracy and efficiency. The third step was to train the model on Petra images (Kaznah and Theater). After the model was built and run, we encountered some technical problems, which consisted of blocking its outputs between the Kaznah and the theater, and not recognized any other images. To avoid this problem, we added the Image Net model and tested it on many monuments to saving the labels names, then we selected the top ten labels that showed when applying the model on Petra landmarks to be examined during the operation of the model, so when the model takes an image it tests its label if its include one of those labels, and the confident is more than 20% that it's an archaeological site. It entered into our model, if not the Image Net displays the top three possibilities for the taken image.