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RESEARCH ARTICLE

MONUMENT RECOGNITION SYSTEM

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Abstract

As different monuments have different architecture, so it is quite challenging to classify images of different monuments in monument recognition. Many researchers have carried on their researches and have made models with good accuracies which classify the monuments. This paper proposes a technique to recognize the monument in the image using machine learning. The dataset used is of Indian monuments which is collected from different sources. The dataset consist of 40 monuments with approximately 10000 images with different angular views. All the images of the dataset are cropped and then further divided into two parts, i.e. training and testing. In this paper we have used CNN as our approach for image classification with 50 epochs. Experiments have been carried out which shows the performance of the model achieving an overall accuracy of 84% for the dataset which is considered for classification.

Keywords: Monument Recognition, Convolutional Neural Networks

Introduction

Talking about monument it is just not construction of a structure. It simplifies and explains various historic events or social and political cause occurred at that time People of different religion and culture in our country are proud of the events occurred in the past and monuments for them are something they worship. It is not just tied with emotions of the people; it is also a great deal for tourism as tourists from all over the world arrives here to just witness such historic things & get to know much more about them. Monuments are also a representation of achievements in art & architectures. It is therefore very important to preserve them so that the future generations could learn about the diversity our country has. There are various monuments in

India which is connected with religious feeling of the people like The Sanchi Stupa and the Khajuraho Temples.

A monument implies a structure that has been constructed in order to recall a person or an event. The term 'monument' is often applied to the buildings or structures that have been considered as examples of an important architectural and cultural heritage. The people belonging to the various cultures, castes, creeds and religions take pride in their culturally rich heritage bestowed upon them in the form of monuments. Monuments are also the tourist destinations in any country. They even are representations of great achievements present in art and architecture. It is therefore important to preserve them to help the present and the future generations understand and respect people who lived in different eras with different habits and traditions. Preservation of these monuments can happen by recognition of these different monuments and spreading the information about it to the other fellow citizens and tourists. A Convolutional Neural Network (ConvNet /CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

Methodology

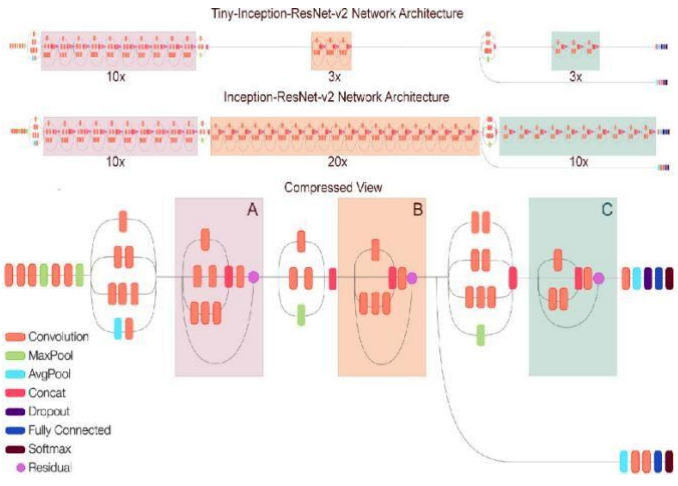


Fig.1. Inception v2

The various methods used to recognize monuments have been explained in this section.

We have opted for the Inception v2 architecture in for classification, shown below in Fig 1. The Inception architecture encompasses a multitude of different layers used to refine the image dataset constantly to obtain a better model.

The different layers have been briefly described as follows:

Convolution Layer- is a mathematical operation that's used in single processing to filter signals, find patterns in signals etc. In a convolutional layer, all neurons apply convolution operation to the inputs, hence they are called convolutional neurons. The most important parameter in a convolutional neuron is the filter size.

Pooling layer- is mostly used immediately after the convolutional layer to reduce the spatial size (only reduced. Also, less number of parameters avoid over fitting. The most common form of pooling is Max pooling where we take a filter of size FF and apply the maximum operation over the FF sized part of the image.

Fully Connected Layer- If each neuron in a layer receives input from all the neurons in the previous layer, then this layer is called fully connected layer. The output of this layer is computed by matrix multiplication followed by bias offset.

In our Project we have created a main method and inside that we have defined the whole process—

First of all we will take Image then we will replace it with numbers with the help of PIL library the that number is converted to Numpy and then Numpy provides the matrix to algorithm then algo identifies some pattern in that matrix so that it can classify the image and on the basics of that it can generate the model and then the model identifies the image class.

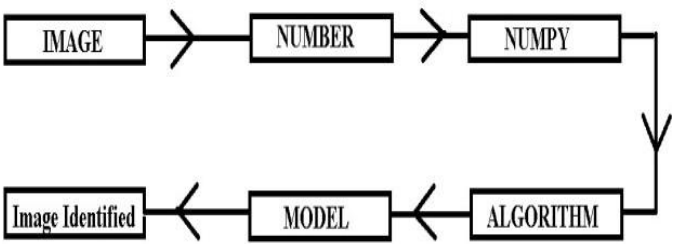


Fig. 2

Also there are several libraries that has been used here:

Keras ⟶ Keras is a powerful and easy-to-use free open sure Python library for developing and evaluating deep learning models.

It is the part where we have stored all the algo code, mathematical calculation, formulae and implementation.

PIL ⟶ Python Imaging Library is a free and open source additional library for the Python programming language that adds support for opening, manipulating, and saving many different image file format.

NUMPY ⟶ It is a library for the Python Programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

Matplotlib ⟶ Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python. Matplotlib makes easy things easy and hard things possible.

Sklearn ⟶ Scikit-learn (Sklearn) is the most useful and robust library for machine learning in Python. We have used this for accuracy purpose.

After the monument is detected the name of the monuments has been passed as a keyword in GOOGLE API. Further we have integrated it with href tag, due to which whenever we click on the name of the detected monuments a new page is displayed which contains the required information of the detected monuments.

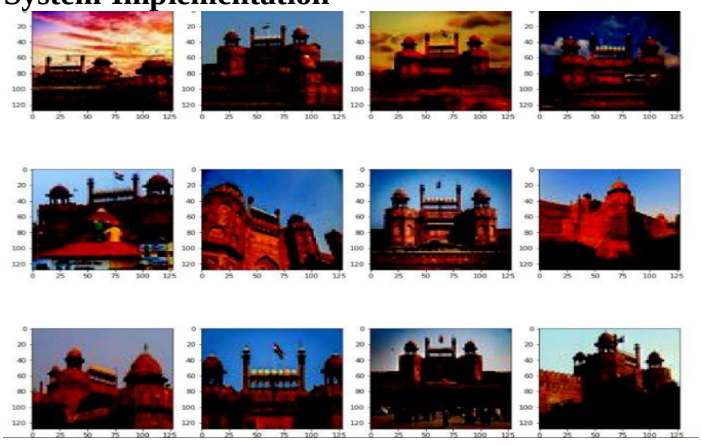
href tag ⟶ The href attribute specifies the URL of the page the link goes to.

If the href attribute is not present, the <a> tag will not be a hyperlink.

Dataset Description

A database comprising of 40 folders with each folder having around 120 images per monument is created, where each image is of size 64x64 pixels. These images are chosen from the online available dataset- https://shorturl.at/mv C39 Mostly, the famous Indian monuments were considered for dataset. The naming of each folder is done according to the name which corresponds to the monument. The membership of each monument in its respective category was verified using Wikipedia. The dataset is manually pruned to remove duplicates and incorrectly retrieved images. The dataset includes images of interior and exterior part of these monuments from varying angles and illumination to ensure that extracted features pertain only to the architecture of the monument. Furthermore, using both interior and exterior parts of monuments, the classifier can identify texture and wall art patterns that are distinctive features. Also, both high and low resolution images have been included to make the dataset robust.

System Implementation



The user is allowed to choose an image from the set of images. The image chosen is fed into CNN architecture. The image is analysed in the CNN architecture and the corresponding feature vector is formed. This feature vector uniquely identifies each image. This feature vector is classified as a corresponding monument and the result is displayed on the user interface. The user is allowed to then type a query to know more about the monument. The corresponding query is processed and the required answer is displayed on the user interface.

The system is trained for default set of questions and corresponding answers to it. When the user types a question is corresponding answers from the set of trained answers is displayed. Thus, the monument is recognised and the user learns about the monument through its details. The architecture of system implementation is shown in figure 4.

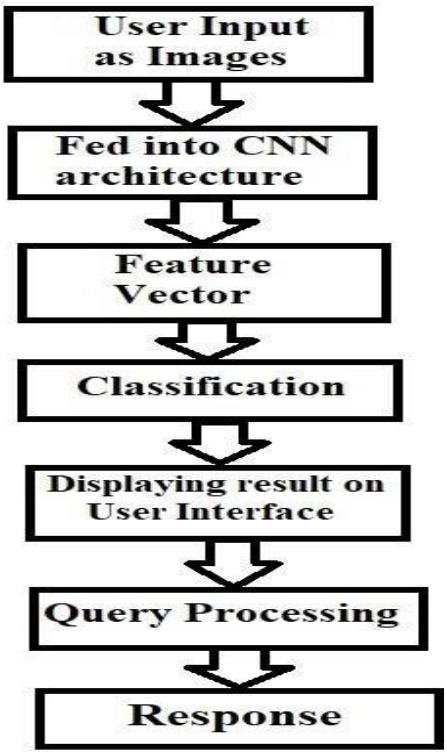


Fig. 4. Architecture of System Implementation

Experimental Platform

The model was implemented on Intel(R) Core (TM) i3- 7020U CPU with a 8GB of memory. The GPU consisted of 2GB of memory. The operating system was Microsoft windows 10. The software used is python IDE version 3.6.7.

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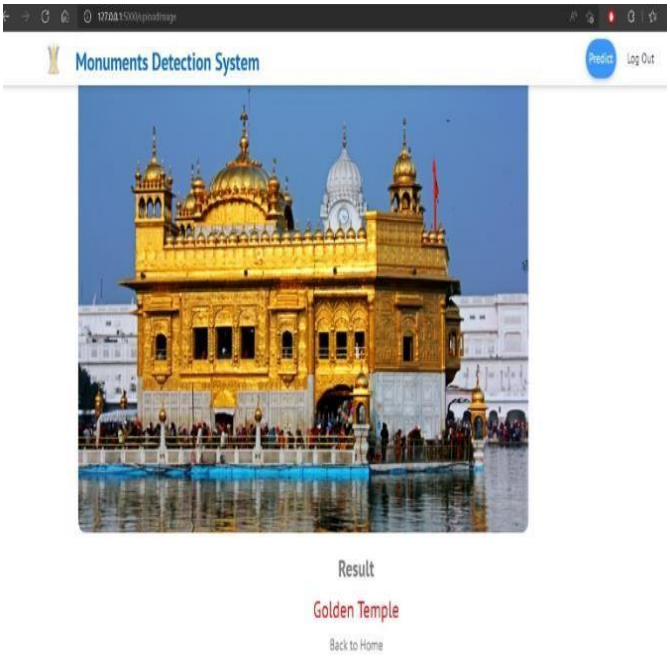

Results

The following are the few outputs obtained. The user when clicks on the button ‘choose file’, a window opens from where the user is allowed to choose the required image for recognition. once the image is chosen the button ‘submit’ is clicked. the image is displayed along with its label de- scribing the name of the monument. also we have integrated google api which works as search engine for the recognized images name and it shows details about that recognized image. thus, the image is recognised. figure 5 show the images of golden temple respectively which are being recognised by the model.

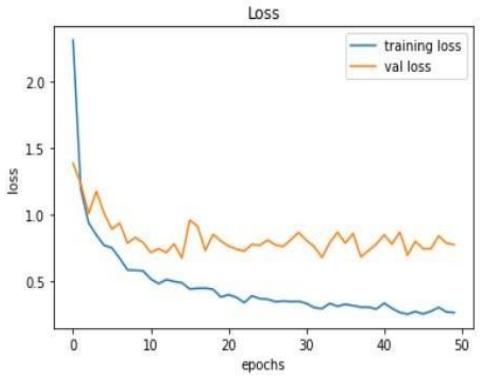

Fig. 5

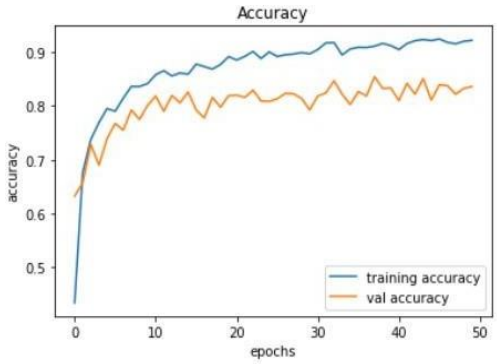

Fig. 6

Result the prediction percentage and the accuracy of the bounding boxes in the results depends on the following: 1.Batch size: It is the number of images that are trained per batch in one iteration of training. Batch sizes were not used in this experiment as the dataset was small. The batch size used here is 32.2 learning Rate: It is the training parameter that controls the size of weight and bias change during learning. The learning rate of weight and bias change during learning. It is the number of iterations used is 20. The following graph shows the loss rate with increase in number of epochs. As the number of epochs increase the loss rate during the training decreases. The ideal number of epochs is 20. The accuracy of the model is shown in the figure 6 with respect to number of epochs. As the number of epochs increase, the percentage of accuracy increases. The figure 6 and 7 shows a snap of the training displaying the number of epochs, accuracy and loss.

Conclusion

Our proposed systems have used Convolutional Neural Networks which is basically used to detect and classify different monuments across India. Multiple steps have been followed to achieve the objective of the proposed system. Observing the results of the training and testing accuracy, we can say that the monuments can be accurately identified using this model. Using the Inception v2 architecture, the performance of the model is commendable as it is having the ability to classify the monuments. The proposed model is trained and tested on an Intel Core i5-1135G7@2.4GHz processor with dataset consisting of approximately 10000 images on the Inception model. Overall, this model consists of the potential for classification of monuments accurately.

Future Work

The proposed system gives a method for recognition of various Indian Monuments. Some future enhancements for the proposed system can be to: 1) Increase the dataset and improve the scope of the model. 2) Make the system more user friendly by creating an application of the same. 3) Improve the information about the retrieval of the monuments by providing dynamic information from internet. 4) Help the tourists by providing directions to the monuments and live tracking the tourists using Global Position Service (GPS). 5) Improving the dynamicity of the images by live capturing and instant monument detection. The proposed system can be evolved to meet several other operations which are not included in this project. Expanding the system will result in more efficient and hassle free operations.

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