Project Phase II Report

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ELECTRONICS & BIOMEDICAL ENGINEERING
GURU JAMBHESWAR UNIVERSITY OF SCIENCE & TECHNOLOGY
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ABSTRACT

Object detection is one of the most basic and central tasks in computer vision. Its task is to find all the interested objects in the image, and determine the category and location of the objects. Object detection is widely used and has strong practical value and research prospects. Applications include face detection, pedestrian detection and vehicle detection. In recent years, with the development of convolutional neural network, significant breakthroughs have been made in object detection. This paper describes in detail the classification of object detection algorithms based on deep learning. The algorithms are mainly divided into one-stage object detection algorithm and two-stage object algorithm, and the general data sets and performance indicators of object indicators.

Handwritten character recognition (HCR) is the detection of characters from images, documents and other sources and changes them in machine-readable shape for further processing. The accurate recognition of intricate-shaped compound handwritten characters is still a great challenge. Recent advances in convolutional neural network (CNN) have made great progress in HCR by learning discriminatory characteristics from large amounts of raw data. In this paper, CNN is implemented to recognize the characters from a test dataset. The main focus of this work is to investigate CNN capability to recognize the characters from the image dataset and the accuracy of recognition with training and testing. CNN recognizes the characters by considering the forms and contrasting the features that differentiate among characters. Our CNN implementation is experimented with the dataset NIST to obtain the accuracy of handwritten characters.

TABLE OF CONTENT

INTRODUCTION

Computer Vision is the branch of the science of computers and software systems which can recognize as well as understand images and scenes. Computer Vision is consisting of various aspects such as image recognition, object detection, image generation, image super-resolution and many more. Object detection is widely used for face detection, vehicle detection, pedestrian counting, web images, security systems and self-driving cars. In this project, we are using highly accurate object detection-algorithms and methods such as R-CNN, Fast-RCNN, Faster-RCNN,

RetinaNet and fast yet highly accurate ones like SSD and YOLO. Using these methods and algorithms, based on deep learning which is also based on machine learning require lots of mathematical and deep learning frameworks understanding by using dependencies such as TensorFlow, OpenCV, imageAi etc., we can detect each and every object in image by the area object in a highlighted rectangular box and identify each and every object and assign its tag to the object. This also includes the accuracy of each method for identifying objects

Handwriting digits and character recognitions have become increasingly important in today's digitized world due to their practical applications in various day to day activities. It can be proven by the fact that in recent years, different recognition systems have been developed or proposed to be used in different fields where high classification efficiency is needed. Systems that are used to recognize Handwriting letters, characters, and digits help people to solve more complex tasks that otherwise would be time-consuming and costly. A good example is the use of automatic processing systems used in banks to process bank cheques. Without automated bank cheque processing systems, the bank would be required to employ many employees who may not be as efficient as the computerized processing system. The handwriting recognition systems can be inspired by biological neural networks, which allow humans and animals to learn and model non-linear and complex relationships unconstrained handwriting recognition still remains a challenge due to the number of variations found in characters. The handwriting recognition problem can be considered for various alphabets and at various levels of abstraction. The main goal of the work presented in this paper has been the development of an on-line handwriting recognition system which is able to recognize handwritten characters of several different writing styles. Due to the temporal nature of online data, this work has possible application to the domain of speech recognition as well. The work in this research aimed to investigate various features of handwritten letters, their use and discriminative power, and to find reliable feature extraction methods, in order to recognize them. A 22-feature set of sub-character primitive features has been proposed using a quite simple approach of feature extraction. This approach has succeeded in having robust pattern recognition features, while maintaining feature's domain space to a small, optimum quantity. Back propagation neural network (BPN) technique has been used as classifier and recognition rate up to 87% has been achieved even for highly distorted hand written characters.

LITERATURE REVIEW

In the previous study most of them have concentrated towards Object detection (Ben Ayed et al., 2015; Najva and Bijoy, 2016; Ramya and Rajeswari, 2016; Risha and Kumar, 2016; Shen et al., 2013; Soundrapandiyan and Mouli, 2015; Viswanath et al., 2015) ,Object tracking (Bagherpour et al., 2012; Coşkun and Ünal, 2016; Foytik et al., 2011; Lee et al., 2012; Poschmann et al., 2014; Weng et al., 2013; Yilmaz et al., 2006; Zhang et al., 2016) and Object recognition (Chakravarthy

et al., 2015; Elhariri et al., 2015; Gang et al., 2010; Ha and Ko, 2015; Nair et al., 2011) for tracking the object using video sequences.

Online handwriting recognition online handwriting recognition, where existing challenges are to cope with problems of various writing fashions, variable size for the same character, different stroke orders for the same letter, and efficient data presentation to the classifier. The similarities of distinct character shapes and the ambiguous writing further complicate the dilemma. A solitary solution of all these problems lies in the intelligent and appropriate extraction of features from the character at the time of writing. A typical handwriting recognition system focuses on only a subset of these problems. The goal of fully

PROBLEM DEFINITION

Iterating over the problem of localization plus classification we end up with the need for detecting and classifying multiple objects at the same time. Object detection is the problem of finding and classifying a variable number of objects on an image. The important difference is the "variable" part. In contrast with problems like classification, the output of object detection is variable in length, since the number of objects detected may change from image to image. In this post we'll go into the details of practical applications, what are the main issues of object detection as a machine learning problem and how the way to tackle it has been shifting in the last years with deep learning.

Handwriting character recognition is one of the research fields in computer vision, artificial intelligence, and pattern recognition. A computer application that performs handwriting recognition can be argued to have the ability to acquire and detecting characters in pictures, paper documents, and other sources and convert them into electronic format or machine-encoded form. The system may obtain Handwriting sources from a piece of paper through optical scanning or intelligent word recognition. Also, the system may be designed to detect the movement of the pen tip on the screen. In other words, handwriting recognition may involve a system detecting movements of a pen tip on the screen to get a clue of the characters being written.

Handwriting recognition can be classified into two:

- **Offline recognition**

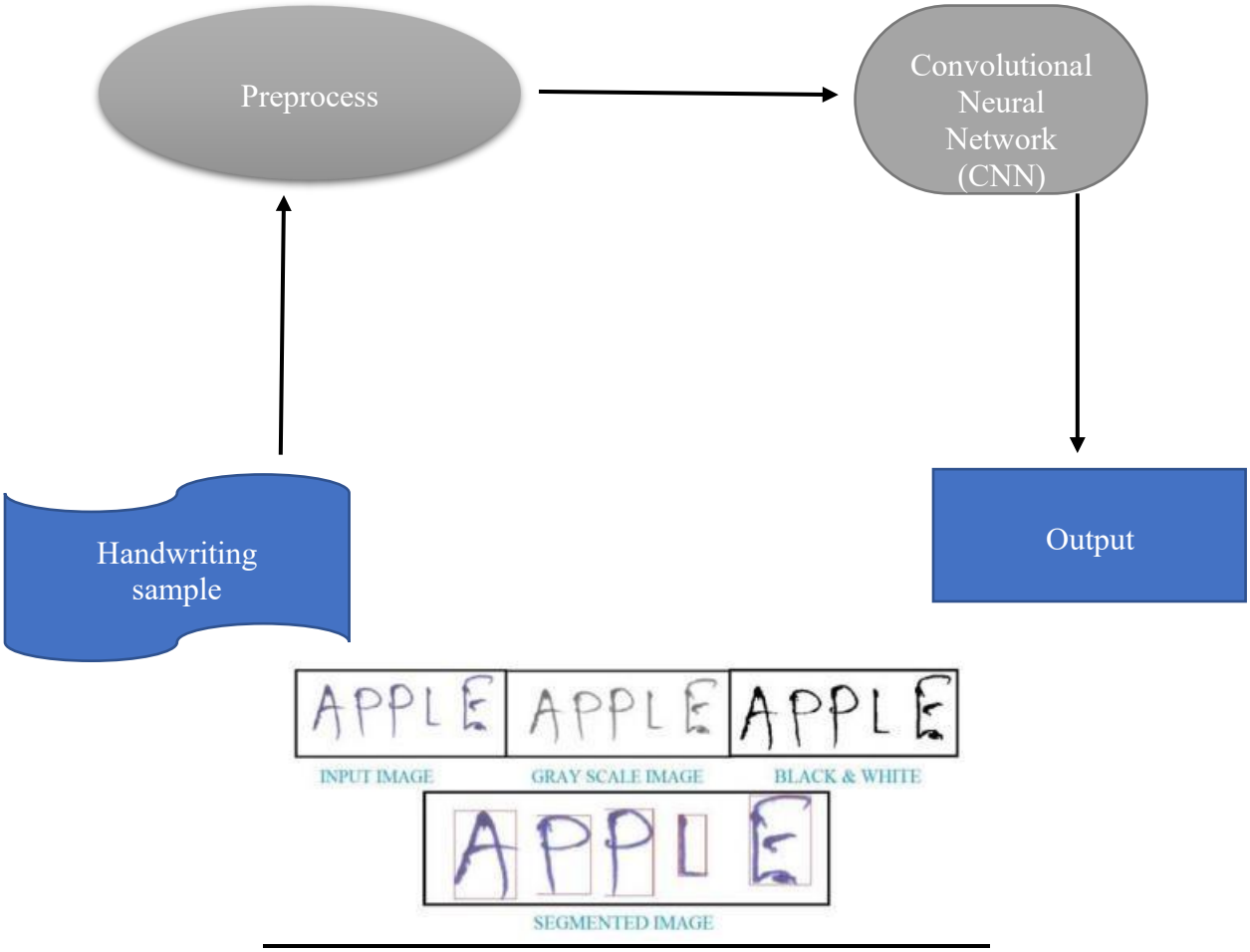
Offline handwriting recognition involved the extraction of text or characters from an image to have letter codes that can be used within a computer. It involves obtaining digital data from a static representation of handwriting. A system is provided with a Handwriting document to read and convert the handwriting to a digital format.

- **Online recognition**

Online handwriting recognition, on the other hand, involved automatic detection or conversion of characters as they are written on the specialized screen. In this case, the system sensors movement

of pen-tip to detect characters and words. Different methods and techniques are used to ensure that computer systems can read characters from Handwriting images and documents. Among the existing techniques that are used to model, and train Handwriting character recognition include neural network, Hidden Markov Model (HMM), Machine Learning, and Support Vector Machine, to mention a few. This paper focuses on artificial intelligence networks, machine learning, Hidden Markov Model, and the Support Vector Machine.

DESIGN AND ARCHITECTURE This section discusses the design and architecture of the proposed handwritten character recognition system that will be using the neural network approach. The proposed system comprises input pre-processing, CNN, and output sections as shown below:



OBJECTIVES

The main purpose of object detection is to identify and locate one or more effective targets from still image or video data. It comprehensively includes a variety of important techniques, such as

image processing, pattern recognition, artificial intelligence and machine learning. It has broad application prospects in such areas such as road traffic accident prevention, warnings of dangerous goods in factories, military restricted area monitoring and advanced human–computer interaction. Since the application scenarios of multi-target detection in the real world are usually complex and variable, balancing the relationship between accuracy and computing costs is a difficult task.

The key contributions of our work are as follows:

1. The novel deformable convolution structure replaces the ordinary normal convolution operation for object detection. It effectively lets the CNN improve the generalization ability of extracting image features under different geometric deformations. Also, the new network automatically trains the offset of the convolution without wasting a large amount of computation time and cache space. Thus, significant performance gains on computer vision tasks, such as object detection and semantic segmentation, are observed.
2. An up-sample is applied to the feature pyramid to merge the multi-scaled feature information. This increases the accuracy of small target object detection by avoiding the loss of information of small target objects after multiple convolution and pooling operations. It also provides an important scheme for the detection of dense objects with overlapping occlusion in complex scenes.

The goals of object detection are multifarious:

1.) One of the many so-called goals of 'AI' or machine learning is to describe a scene as precisely as a human being. One of the stepping stones towards this goal is object detection wherein the different objects of significance in the scene are detected and it is attempted to understand underlying semantics in the semantic.

An effort in this direction is *object detection* and *subsequent labelling/captioning*. A few benchmark datasets are Common Objects in Context (COCO), PASCAL Visual Object Classification (PASCAL VOC). The most prominent algorithms for detection on these standard datasets are Region-based Convolutional Neural Network (R-CNN), Fast Region-based Convolutional Neural Network (Fast R-CNN), Faster Region-based Convolutional Neural Network (Faster R-CNN), You Only Look Once (YOLO), Region-based Fully Convolutional Network (R-FCN), Single Shot Detector (SSD), and finally, Neural Architecture Search (NASNet).

2.) Another aim of object detection is the detection of defects/anomalies in certain contexts. One great application of this is the automatic survey and maintenance of architectural sites. The abovementioned algorithms are often extended to such contexts for civil and structural engineering applications. (I personally have been working on Q-learning based neural network architecture search for defect detection in bridges).

3.) Object detection also finds use in tracking of objects through video sequences like prediction of object's future position after detecting it in the past video frames, automatic annotating of faces in live video for further analysis (recognition and labelling) etc.

The main objective of handwriting recognition system is to recognize online handwritten documents, which includes characters, words, lines, paragraphs etc. There is extensive work in the field of handwriting recognition, and a number of reviews exits. Our approach is to recognize handwriting by using templates. Along with this we maintain a unique user accounts, which enables a particular user to create his/her training sets.

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