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Research Paper

## RECOGNIZING TEXT BASED TRAFFIC SIGNS

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In the proposal a novel system of the automatic detection and recognition of text in symbols. Scene picture is used to locate the search regions with in the image in which traffic symbol candidate are then found. Maximally Stable Extremal Regions (MSERs), saturation, and value colour thresholding are used to identify the large number of candidates, which are then reduced by applying constraints based on temporal and picture information. A recognition stage interprets the text contained within detected candidate location. Single text characters are identified as MSERs and are combined into lines, before being interpreted using Optical Character Recognition (OCR). The method is comparatively evaluated and achieves an overall frequency measure of 0.87.

**Keywords:** Maximally stable extremal region, Scene, Picture, Text detection, Optical character recognition, Traffic text symbol recognitions

### INTRODUCTION

The purpose of this project is to take handwritten English characters as input, process the character, train the neural network algorithm, to recognize the pattern and modify the character to a beautified version of the input. This project is aimed at developing software which will be helpful in recognizing characters of English language. This project is restricted to English characters only. It can be further developed to recognize the characters of different languages. It engulfs the concept of neural network. One of the primary means by which computers are endowed with humanlike abilities is through the use of a neural

network. Neural networks are particularly useful for solving problems that cannot be expressed as a series of steps, such as recognizing patterns, classifying them into groups, series prediction and data mining. Pattern recognition is perhaps the most common use of neural networks. The neural network is presented with a target vector and also a vector which contains the pattern information, this could be an image and hand written data. The neural network then attempts to determine if the input data matches a pattern that the neural network has memorized. A neural network trained for classification is designed to take input samples and classify them

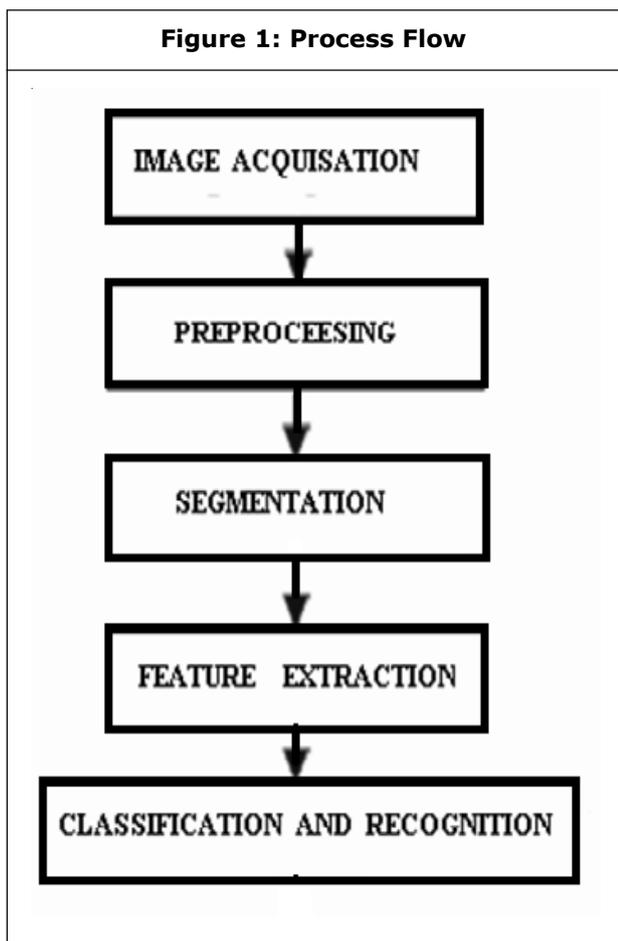
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into groups. These groups may be fuzzy, without clearly defined boundaries. This project concerns detecting free handwritten characters. To provide an easy user interface to input the object image User should be able to upload the image System should be able to pre-process the given Input to suppress the background. System should detect text regions present in the image. System should retrieve text present in the image and display them to the user.

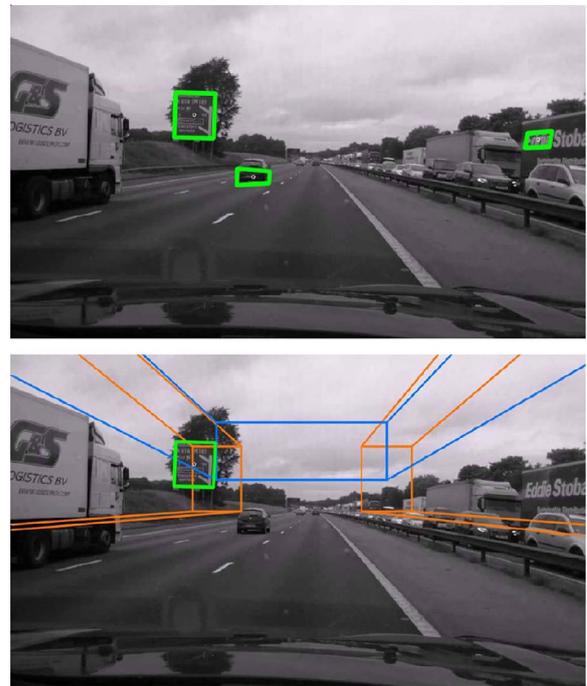
The proposed method comprises of 4 phases:

1. Pre-processing.
2. Segmentation.
3. Feature Extraction.
4. Classification and Recognition.

**Figure 1: Process Flow**



**Figure 2: Assign the Road Sign**



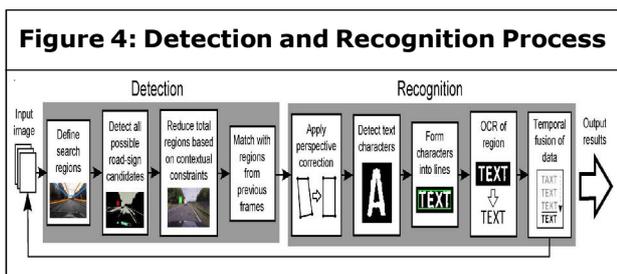
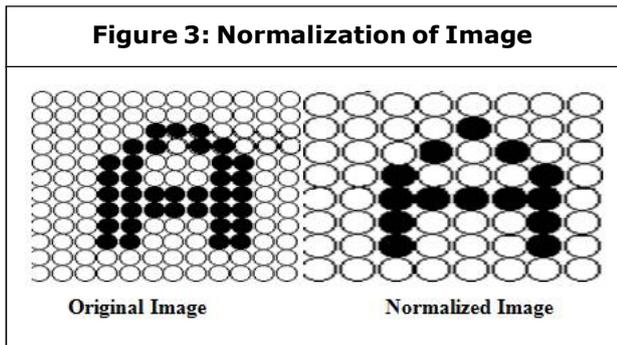
**Pre-Processing**

The pre-processing is a series of operations performed on scanned input image. It essentially enhances the image rendering it suitable for segmentation. The role of pre-processing is to segment the interesting pattern from the background. Generally, noise filtering, smoothing and normalization should be done in this step. The pre-processing also defines a compact representation of the pattern. Binarization process converts a gray scale image into a binary image. Dilation of edges in the binarized image is done using sobel technique.

**Segmentation**

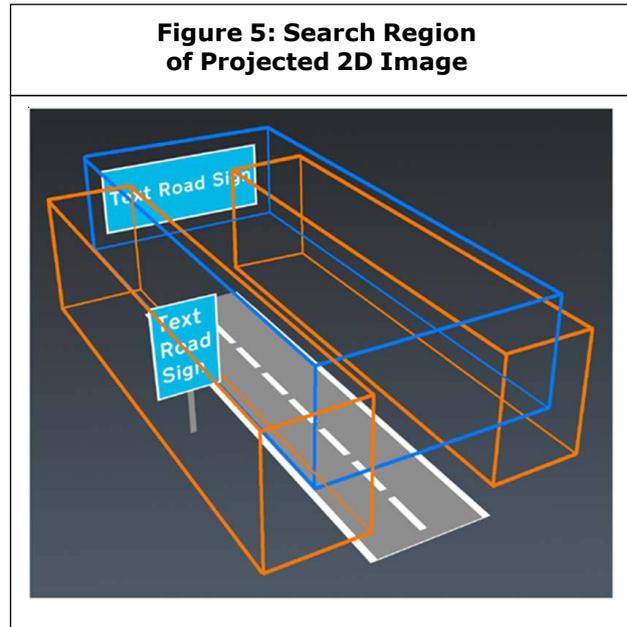
In the segmentation stage, an image of sequence of characters is decomposed into sub-images of individual character. The pre-processed input image is segmented into isolated characters by assigning a number to each character using a labeling process. This labeling provides

information about number of characters in the image. Each individual character is uniformly resized into pixels. Normalization: After extracting the character we need to normalize the size of the characters. There are large variations in the sizes of each Character hence we need a method to normalize the size.



### Detection of Text-Based Traffic Signs

The first stage of the proposed system detects candidates for text-based traffic signs. This consists of three phases, determination of search regions (regions of interest where the text sign is expected to be found), detection of all possible candidates within these regions, and reduction of candidates using contextual constraints. Search regions of interest for traffic signs are found within the image, by first locating the sides of the road in the image and then defining 3-D search boxes, which are projected back onto the original 2-D frame. These search regions, where the orange region is for traffic signs on either side of the road, and the blue box is for overhead gantries.



## CLASSIFICATION

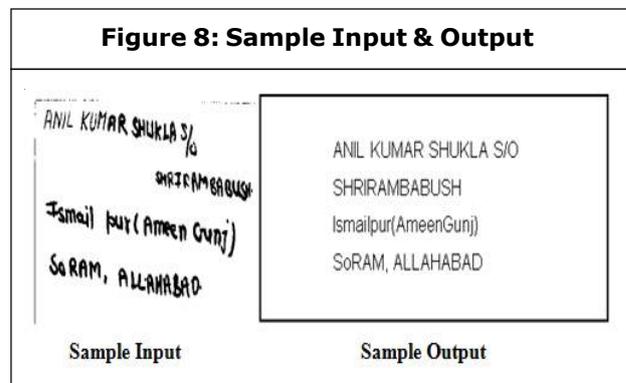
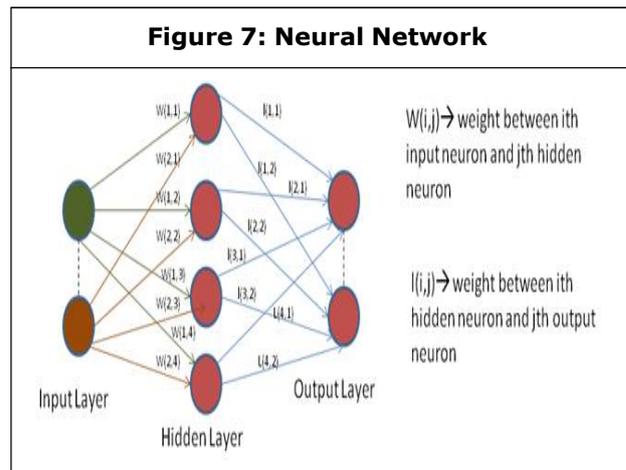
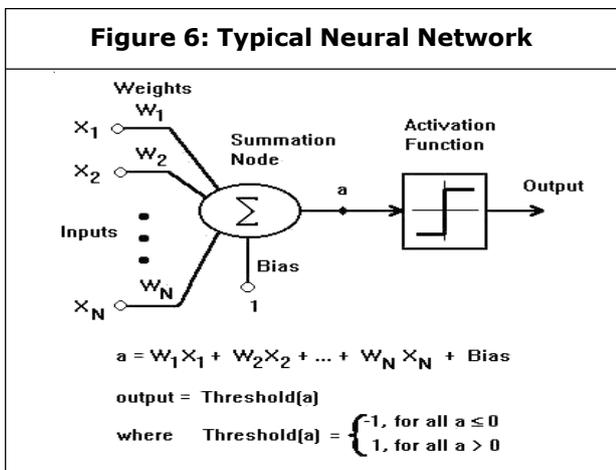
### Artificial Neural Network

Animals recognize various objects and make sense out of large amount of visual information, apparently requiring very little effort. Simulating the task performed by animals to recognize to the extent allowed by physical limitations will be enormously profitable for the system. This necessitates study and simulation of Artificial Neural Network. In Neural Network, each node perform some simple computation and each connection conveys a signal from one node to another labeled by a number called the “connection strength” or weight indicating the extent to which signal is amplified or diminished by the connection.

Different choices for weight results in different functions are being evaluated by the network. If in a given network whose weight are initial random and given that we know the task to be accomplished by the network , a learning algorithm must be used to determine the values of the weight that will achieve the desired task.

Learning Algorithm qualifies the computing system to be called Artificial Neural Network. The node function was predetermined to apply specific function on inputs imposing a fundamental limitation on the capabilities of the network. Typical pattern recognition systems are designed using two pass. The first pass is a feature extractor that finds features within the data which are specific to the task being solved (e.g., finding bars of pixels within an image for character recognition). The second pass is the classifier, which is more general purpose and can be trained using a neural network and sample data sets. Clearly, the feature extractor typically requires the most design effort, since it usually must be hand-crafted based on what the application is trying to achieve.

Back propagation was created by generalizing the Widrow-Hoff learning rule to multiple-layer networks and nonlinear differentiable transfer functions. Input vectors and the corresponding target vectors are used to train a network until it can approximate a function, associate input vectors with specific output vectors, or classify input vectors in an appropriate way as defined by you. Networks with biases, a sigmoid layer, and a linear output layer are capable of approximating any function with a finite number of discontinuities.



Output will be the beautified version of the uploaded image and will be saved in a .doc or in text file.

## IMAGE

Image Processing Toolbox supports a diverse set of image types, including high dynamic range, giga pixel resolution, embedded ICC profile and tomography. Visualization functions let you explore an image, examine a region of pixels, adjust the contrast, create contours or histograms, and manipulate Regions of Interest (ROIs). With toolbox algorithms you can restore degraded images, detect and measure features, analyze shapes and textures, and adjust colour balance. Image Processing Toolbox is included in MATLAB and Simulink Student Version

## Neural Network Toolbox

Neural Network Toolbox™ provides functions and apps for modelling complex nonlinear systems that are not easily modelled with a closed-form equation. Neural Network Toolbox supports supervised learning with feed forward, radial basis, and dynamic networks. It also supports unsupervised learning with self-organizing maps and competitive layers. With the toolbox you can design, train, visualize, and simulate neural networks. You can use Neural Network Toolbox for applications such as data fitting, pattern recognition, clustering, time-series prediction, and dynamic system modelling and control.

## Rational Rose

Rational Rose is an object-oriented Unified Modelling Language (UML) software design tool intended for visual modelling and component construction of enterprise-level software applications. In much the same way a theatrical director blocks out a play, a software designer uses Rational Rose to visually create (model) the framework for an application by blocking out classes with actors (stick figures), use case elements (ovals), objects (rectangles) and messages/relationships (arrows) in a sequence diagram using drag-and-drop symbols. Rational Rose documents the diagram as it is being constructed and then generates code in the designer's choice of C++, Visual Basic, Java, Oracle8, Corba or Data Definition Language.

## EXPERIMENTAL SETUP

### Software and Hardware Used

**SOFTWARE :** MATLAB VERSION 13 (R2013a)

**PROCESSOR :** INTEL i3

**RAM :** 2 GB

**DISK SPACE:** 1 GB for MATLAB only, 5 GB for a typical installation

**GRAPHICS ADAPTER:** A 32-bit or 64-bit OpenGL capable graphics adapter is strongly recommended.

### Software Development Platform

MATLAB is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of-the-art in software for matrix computation.

### MATLAB Language

This is a high-level matrix/array language with control flow statements, functions, data structures, input/output, and object-oriented programming features. It allows both "programming in the small" to rapidly create quick and dirty throw-away programs, and "programming in the large" to create complete large and complex application programs.

### MATLAB Working Environment

This is the set of tools and facilities that you work with as the MATLAB user or programmer. It includes facilities for managing the variables in your workspace and importing and exporting data. It also includes tools for developing, managing, debugging, and profiling M-files, MATLAB's applications.

### MATLAB Image Processing Toolbox

We have used MATLAB Image Processing

Toolbox for the development of this software. Image processing involves changing the nature of an image in order to improve pictorial information of the image for human interpretation for autonomous human perception. The Image Processing Toolbox is a collection of functions that extend the capability of the MATLAB numeric computing environment. The toolbox supports a wide range of operations on the image.

### **Key Features**

Image enhancement, including filtering, filters design, deblurring and contrast enhancement. Image analysis including features detection, morphology, segmentation, and measurement. Spatial transformations and image registration. Support for multidimensional image processing. Support for ICC version 4 color management system. Modular interactive tools including ROI selection, histograms and distance measurements. Interactive image and video display. DICOM import and export.

### **MATLAB Neural Network Toolbox**

Supervised networks, including multilayer, radial basis, Learning Vector Quantization (LVQ), time-delay, nonlinear autoregressive (NARX), and layer-recurrent Unsupervised networks, including self-organizing maps and competitive layers. Apps for data-fitting, pattern recognition, and clustering Parallel computing and GPU support for accelerating training (using Parallel Computing Toolbox) Preprocessing and post processing for improving the efficiency of network training and assessing network performance Modular network representation for managing and visualizing networks of arbitrary size Simulink blocks for building and evaluating neural networks and for control systems applications.

### **MATLAB Mathematical Function**

This is a vast collection of computational algorithms ranging from elementary functions like sum, sine, cosine, and complex arithmetic, to more sophisticated functions like matrix inverse, matrix eigen values, Bessel functions, and fast Fourier transforms.

### **Graphics**

MATLAB has extensive facilities for displaying vectors and matrices as graphs, as well as annotating and printing these graphs. It includes high-level functions for two-dimensional and three-dimensional data visualization, image processing, animation, and presentation graphics. It also includes low-level functions that allow you to fully customize the appearance of graphics as well as to build complete graphical user interfaces on your MATLAB applications.

## **RESULTS AND DISCUSSION**

An image is represented as a two dimensional function  $f(x, y)$  where  $x$  and  $y$  are spatial coordinates and the amplitude of 'f' at any pair of coordinates  $(x, y)$  is called the intensity of the image at that point.

### **IMAGES TYPES**

The toolbox supports four types of images:

1. Intensity images;
2. Binary images;
3. Indexed images;
4. R G B images.

Most monochrome image processing operations are carried out using binary or intensity images, so our initial focus is on these two image types. Indexed and RGB color images.

### **INTENSITY IMAGES**

An intensity image is a data matrix whose values have been scaled to represent intentions. When the elements of an intensity image are of class unit8, or class unit 16, they have integer values in the range [0, 255] and [0, 65535], respectively. If the image is of class double, the values are floating point numbers. Values of scaled, double intensity images are in the range [0, 1] by convention.

### **BINARY IMAGES**

Binary images have a very specific meaning in MATLAB. A binary image is a logical array 0s and 1s. Thus, an array of 0s and 1s whose values are of data class, say unit 8, is not considered as a binary image in MATLAB. A numeric array is converted to binary using function logical. Thus, if A is a numeric array consisting of 0s and 1s, we create an array B using the statement.

B=logical (A)

If A contains elements other than 0s and 1s. Use of the logical function converts all nonzero quantities to logical 1s and all entries with value 0 to logical 0s.

Using relational and logical operators also creates logical arrays. To test if an array is logical we use the I logical function: is logical (c). If c is a logical array; this function returns a 1. Otherwise returns a 0. Logical array can be converted to numeric arrays using the data class conversion functions.

### **INDEXED IMAGES**

An indexed image has two components: A data matrix integer, ex. color map matrix, map. Matrix map is an m\*3 arrays of class double containing floating\_ point values in the range [0, 1]. The length m of the map are equal to the number of colors it

defines. Each row of map specifies the red, green and blue components of a single color. An indexed images uses “direct mapping” of pixel intensity values color map values. The color of each pixel is determined by using the corresponding value the integer matrix x as a pointer in to map. If x is of class double, then all of its components with values less than or equal to 1 point to the first row in map, all components with value 2 point to the second row and so on. If x is of class units or unit 16, then all components value 0 point to the first row in map, all components with value 1 point to the second and so on.

### **RGB IMAGE**

An RGB color image is an M\*N\*3 array of color pixels where each color pixel is triplet corresponding to the red, green and blue components of an RGB image, at a specific spatial location. An RGB image may be viewed as “stack” of three gray scale images that when fed in to the red, green and blue inputs of a color monitor

Produce a color image on the screen. Convention the three images forming an RGB color image are referred to as the red, green and blue components images. The data class of the components images determines their range of values. If an RGB image is of class double the range of values is [0, 1].

Similarly the range of values is [0, 255] or [0, 65535]. For RGB images of class units or unit 16 respectively. The number of bits use to represents the pixel values of the component images determines the bit depth of an RGB image. For example, if each component image is an 8bit image, the corresponding RGB image is said to be 24 bits deep.

Generally, the number of bits in all component images is the same. In this case the number of possible color in an RGB image is  $(2^b)^3$ , where b is a number of bits in each component image. For the 8bit case the number is 16,777,216 colors

## CONCLUSION

- The effectiveness of the method that uses feature extraction using character geometry and gradient technique from scanned images containing handwritten characters is presented.
- The feature extraction methods have performed well in classification when fed to the neural network and preprocessing of image using edge detection and normalization are the ideal choice for degraded noisy images.
- The method of training neural network with extracted features from sample images of each character has detection accuracy to a greater extent.
- The proposed methodology has produced handwritten text on Intel dual core computer.
- The method is advantageous as it uses nine features to train the neural network using character geometry and twelve features using gradient technique.
- Good results for images containing handwritten text written in different styles, different size and alignment with varying background.
- The system is developed in MATLAB and

evaluated for a set of sample images containing.

## Applications

Moving object detection is a fundamental task required for many image and video processing applications like:

- Video Surveillance
- Medical Imaging
- Satellite Imaging
- Biometric Identification

Automated Inspection In Industry Products etc.

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