Currency Based Internet Access System Using Neural Networks

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Abstract

This paper proposes a system which provides internet access by inserting the currency note. Image processing technique to match the input currency's image and the reference image. For each currency a Region of Interest (ROI) is taken. The extracted ROI can be used with Pattern recognition and Neural Networks matching technique. Once the two currencies are matched then internet is granted for accessing for a particular period of time. First we acquire the image by simple flat scanner on fix dpi with a particular size, the pixels level is set to obtain image. Some filters are applied to extract denomination value of note. Then this value is compared with the input value to match the currency. Then the internet access is controlled by means of microcontroller.

Key words: ROI, Pattern Recognition, Neural Networks, Image Processing, Gray scale Images

INTRODUCTION

In this paper we scanned the different denomination notes at 150 dpi with 128x128 pixels. We extract denomination value from each note. A level is set for all images. By converting compliments, applying different filter i.e. sobel edge filter, average filter, laplacian filter, denomination value is extracted. The pattern recognition and neural network process is applied for matching to identify note value. Then this matching result is used as the input for providing access to the internet.

IMAGE RECOGNITION

There are various technique for currency recognition that involve texture, pattern or color based. We use digital image processing techniques to find region of interest, after that Neural Network and Pattern Recognition Technique is used for matching the pattern. Microcontroller is used to interface the internet access for the time which is programmed. At once the time is about to be over the controller asks for further actions. The steps are:

1. Scanning the image at 150 dpi with 128x128 pixels by simple flat scanner.
2. ROI is extracted
3. Converting image to gray scale image and setting up a level.
4. Applying sobel edge filter, average filter, laplacian filter and getting reference value.
5. After obtaining reference value, it is matched by using Neural Networks and Pattern Recognition Tool in Mat lab, if the image is matched then internet access is provided.

PATTERN RECOGNITION METHODS

Pattern recognition include a lot of methods which impelling the development of numerous applications in different filed. Models opted for pattern recognition can be categorized in to different categories depending upon the method used for data analysis and classification. Models can be independently or dependently used to perform a pattern recognition task. The different models used for pattern recognition task are given as follows

1. Statistical Model
2. Structural Model
3. Neural Network Based Model
4. Fuzzy Based Model
5. Hybrid Model

Statistical model

In Statistical method of Pattern Recognition each pattern is described in terms of features. Features are chosen in such a way that different patterns occupy non-overlapping feature space. It recognizes the probabilistic nature both of the information we seek to process, and of the form in which we should express it. It works well when the selected features lead to feature spaces which cluster in a recognizable manner, i.e. there is proper interclass distance.

After analyzing the probability distribution of a pattern belonging to a class, decision boundary is determined. Here patterns are projected to pre-processing operations to make them suitable for training purposes. Features are selected upon analyzing training patterns. Test patterns are applied to check suitability of system to recognize patterns. Feature measurement is done while testing, then these feature values is presented to

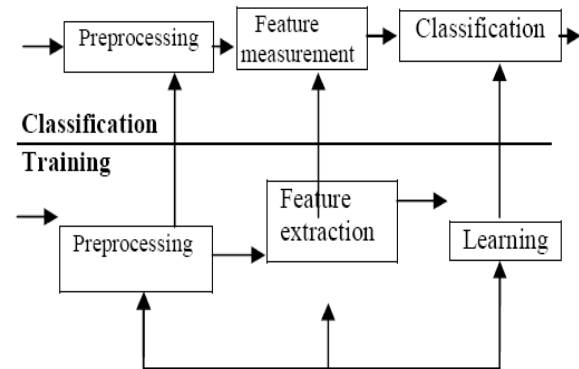learned system and in this way classification is performed.

Figure 1.Statistical model

Structural model

Structural pattern recognition systems have proven to be effective for data which contains an image data and time series data (which is organized by time). The usefulness of structural pattern recognition systems, however, is limited as a consequence of fundamental complications associated with the implementation of the description and classification tasks.
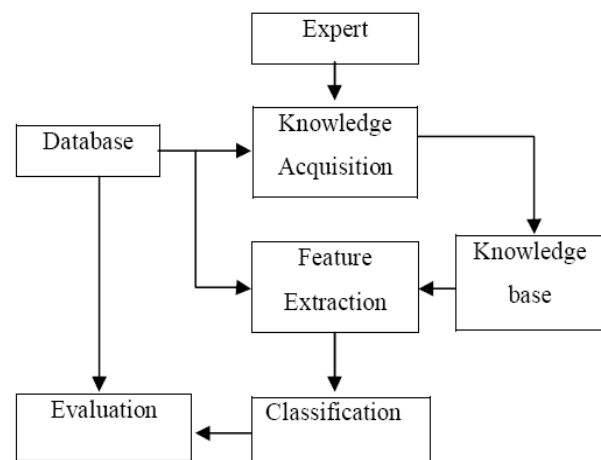

Figure 2.Structural model

Some structural pattern recognition systems justify the use of a particular set of feature extractors by claiming that the same set had been used successfully by a previous system developed for a similar application within the same domain; such claims simply shift the burden of feature extractor development onto previously implemented systems. Simplistic primitives are domain independent, but capture a minimum of structural information and postpone deeper interpretation until the classification step. Domain and application specific primitives can be developed with the assistance of a domain expert, but obtaining and formalizing knowledge from a domain expert, called knowledge acquisition, is very difficult.

Fuzzy based model

Syntactic techniques are utilized when the pattern sought is related to the formal structure of language. Semantic techniques are used when fuzzy partitions of data sets are to be produced. Then a similarity measure based on weighted distance is used to obtain similarity degree between the fuzzy description of unknown shape and reference shape.

Hybrid model

In most of the emerging applications, it is clear that a single model used for classification doesn't behave efficiently, so multiple methods have to be combined together giving result to hybrid models. Primitive approaches to design a Pattern Recognition system which aims at utilizing a best individual classifier have some drawbacks. It is very difficult to identify a best classifier unless deep prior knowledge is available at hand. Statistical and Structural models can be combined together to solve hybrid problems. In such

cases statistical approach is utilized to recognize pattern primitives and syntactic approach is then used for the recognition of sub-patterns and pattern itself. Fu gave the concept of attributed grammars which unifies statistical and structural pattern recognition approach. To enhance system performance one can use a set of individual classifiers and combiner to make the final decision.
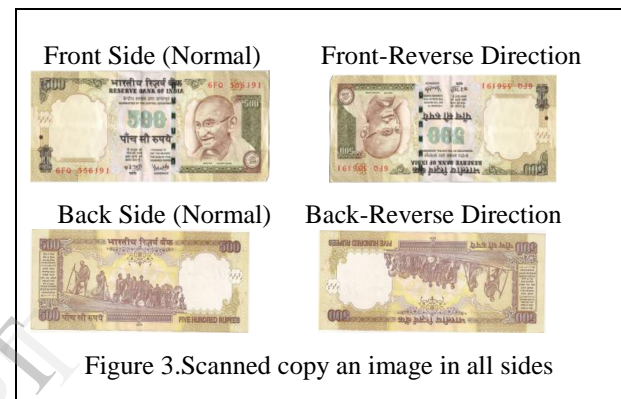

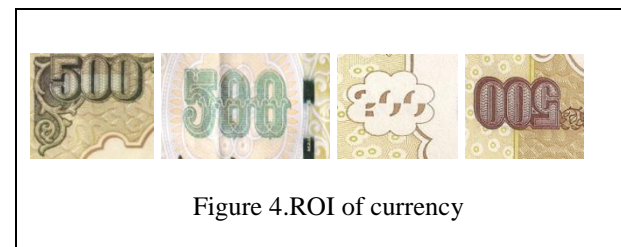
Figure 3.Scanned copy an image in all sides

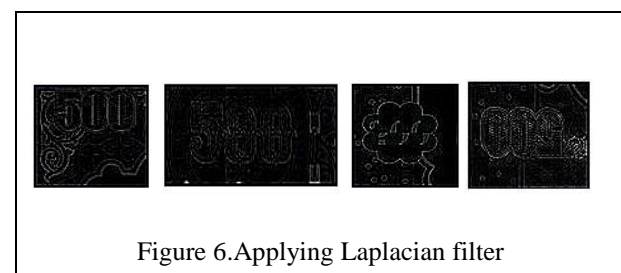Figure 4.ROI of currency

Figure 5.Applying Sobel edge filter

Figure 6.Applying Laplacian filter

The multilayer neural network match each pixel of given sample and provide the exact match.
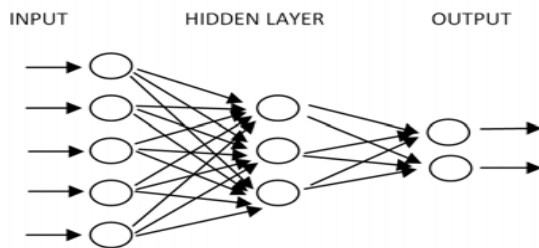

Figure 7.Matching process

The design of interface

The main element is the controller interface ENC28J60 made by Microchip company. It is designed to serve as an Ethernet network interface for any controller equipped with SPI. ENC28J60 meets all specifications of IEEE 802.3 having incorporated MAC and PHY modules. It also provides an internal mode DMA for fast data transfer and hardware for TCP/IP. The Enc28J60 has a clock at 25MHz. The Microcontroller is programmed in a way that it controls the accessing of internet. The time for access is programmed for each currency. Each currency's image is already stored in the memory. Based on the given input the time is allotted. For example the 10 rupee note is programmed for accessing 15 minutes.
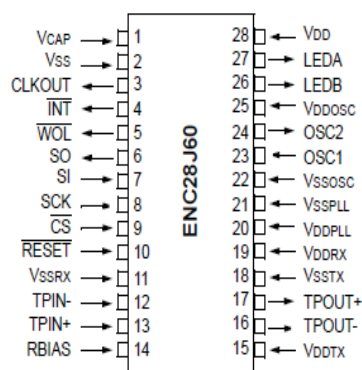

Figure 8.Pin configuration of ENC28J60

Once the note is inserted the image processing is started and once the currency's image is matched with the reference image then a signal is sent to the microcontroller. The microcontroller is used to control the time management and accessing internet. The time is programmed and it allocated based on the input. Once the time is about to expire, the microcontroller asks the user whether to continue or not. If the user wishes to continue, another currency has to be inserted. Now again the image processing is started. Once the user doesn't wish to continue, the Microcontroller stops accessing the internet. Suppose the user has only a 20rupee note and needs to operate only for 15minutes (for only 10 rupees), then the user has to get the balance 10rupees. This is also programmed in the Microcontroller to provide the balance money. The corresponding currency will be sent out through the control of Microcontroller. This also includes the image processing technique.

The aim to show how to make Ethernet interface with microcontroller automation systems. Are given at all stages of design, implementation and programming interface. The only requirement is that the microcontroller to have SPI interface (Serial Peripheral Interface). SPI is a standard synchronous high speed interface that operates in full duplex and can operate with one master device and one or more slave devices.

CONCLUSION:

The Microcontroller interface now offers an effective solution, making low-cost (about 10euro), robust in operation. The system can be used for monitoring and remote control is accessible through any Internet connection. We can connect to the microcontrollers or microprocessors and other thereby

improving data processing speed. Ordering system can be used remotely via the internet to different facilities or equipment used for household use.

A comparative view of all the models of pattern recognition has been shown which says that for various domains in this areas different models can be used. In case of noisy patterns, choice of statistical model is a good solution. Structural model depends upon recognition of simple pattern primitives and their relationships represented by description language. To recognize unknown shapes fuzzy methods are good options. Hybrid model is combination of both statistical and structure model. So it is best method to solve the many problems. We use hybrid error model for super resolution of images.

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