An Artificial Neural Networks Based Fake Currency Detection System

Bosubabu Sambana[1] and Mohan Mahanty[2]

[1]*Department of Computer Science and Engineering, Viswanadha Institute of Technology and Management, Visakhapatnam, India*
[2]*Department of Computer Science and Engineering, Vignan's Institute of Information Technology, Visakhapatnam, India*
[1]*bosubabus@gmail.com*

Abstract

We propose a technique for web access by infusing or embeddings ordering different nations notes. An Image is separating and preparing procedure to recognize and match the distinguished information required cash picture and the first reference picture, each money note taken a Region of Interest (ROI) on existing money note condition. A separated cash picture ROI can be utilized to different example development and acknowledgement procedures and ANN hubs recognizing systems. At once, numerous cash notes are distinguished by coordinated notes then a web seek based following framework to recognize coordinating procedure is allowed for getting to for their specified timeframe. At first, we secure required the cash note by average level picture scanner on settled dpi shading with a required size arrangement; the dpi pixels level is set to get an ordinary picture utilizing picture preparing strategy. Barely any cutting edge picture channels are connected to proposed picture remarkable estimation of required cash take note of, this relegated esteem or images are contrasted and the doled out info sign images to coordinate unique note esteem, at that point web-based getting to technique controls by the microcontroller to examine all prerequisite fields and fundamental activities.

Keywords: Flat filters, Currency, Region of interest, Pattern recognition, Artificial intelligence, Neural networks, Currency recognition, Image processing, Grayscale images

1. Introduction

All nation monetary forms the world over appear to be unique from each other, in light of note size of the paper is different varieties from different monetary forms, in this same path as the shading, measure and different examples. Representatives of who are working at better places like cash changes focus need to existing between numerous sorts of money notes, and it is a repetitive errand. They need to ascertain with recall same image, esteem and shade of every cash note.

This might become about into wrong acknowledgement with recognizing notes, so this technique needs an effective way and colossal confirmation of existing supporting framework to help in their current change conceivable works. The fundamental objective of the existing

---

strategy is too beneficial to specialize and typical individuals who need to perceive distinctive nation cash notes and transformation work with client accommodation and proficient strategies.

With innovative work of present-day managing account administrations, programmed consistent techniques and money related segment and every day wage our operational requirements for paper cash note acknowledgement wind up a dreary assignment in numerous applications, for example, candy machines on web-based business segment, this is hugely focused undertaking to different countable section cash notes in a bundle. In this paper we are proposing a picture handling and sifting procedure utilized for required distinguishing proof of misrepresentation or phoney notes in paper money acknowledgement and transformation cases [1], the separated ROI can be utilized with different advancements like Pattern Recognition and NN coordinating methods.

The picture is separating, and handling method is regularly talked about with MATLAB to identify the particular highlights of paper cash notes. This system includes picture adjustments keeping in mind the end goal to enhance, its picture pictorial data for clear elucidation and examination, distinctive strategies for money paper acknowledgement that may including content, designing, shading, images or concealed codes based. In this critical thinking utilizing advanced picture separating strategies are distinguishing between discovering specific ROI after that Artificial Neural Networks and different Pattern Recognition Techniques are utilized for current coordinating the cash notes.

This proposed framework will chips away at least two money notes, one unique picture and paper cash test picture on which confirmation is to be performed [2]. Along these lines, a no.of strategies is utilized to bank cash note arrangement have been proposed because of our necessities. This proposed strategy can recognize that format coordinating is regularly utilized as a primary grouping and characterization techniques to order banknotes. Be that as it may, new format or distinguishing coordinating principles are requirements for new proposed charge instalment writes.

2. Background

In this exploration paper at first filtered on different group certified receipts at 180 dpi with 136x136 pixels, we can separate monetary order section esteem or images from each cash note. A required level is set for every single unique picture, by changing over numerous parts and connected distinctive picture channels, for example, Sobel edge channel, Average channel, Laplacian channel, Denomination esteem is extricated.

The proposed design acknowledgement methods and fake neural system assessing process are compelled to apply for input check coordinating to distinguish cash note given image or numeric esteem after this procedure picture coordinating required outcomes are utilized to enter for their getting to the web through various systems [3].

2.1. Single-layer feedforward system

The very ordinary conservatives Neural Network could be a Single or one of a kind Layer Perception (SLP) arrange, it comprises every single layer conveys just single yield wages or hubs, the sources of info square measures encouraged on to the yields through a succession of weights. The more significant part of the stock weights and existing sources of info are computed to dissect in each hub, amid this single-layer bolster forward Neural Networks; the required system's inputs are straightforwardly associated with existing yield layer

discernments. An information hub is a measure associated with a solitary hub or numerous hubs.

2.2. Multilayer network system

A multilayer sustain forward Neural Networks is a bury correspondence to the association between perception's, inside which estimated learning and counts stream breaking down amid a restricted heading, from the coveted info record to the yields. A multilayer NN plays out a layer of information units, at least one layers of concealed estimation units, and one yield layer of units.

2.3. Pattern recognition

This system includes a considerable measure of dissected information recovery process issues of adaptable and prominent noteworthiness regions, from voice acknowledgement and arrangement of composed characters to adaptation to internal failure or discovery in apparatus and diagnosing cases and so on.

3. Related work

A tremendous measure of tasks is done in requested to sorted into perceiving diverse monetary forms consequently; remarkable focuses are estimated into extraction cases utilized a related with neighbour information extraction technique from vital recognizing case delicate parts of an Indian Rupees cash Banknote speaking to a similar shading. Keeping in mind the end goal to arrange through perceive essential banknotes, they used to recognize adaptation to internal failure of at least two observable fundamental properties of banknotes [4]:

- Apart from Directions (front, pivoted front, back, and turned back) and required face esteem, Neural Network-based character through acknowledgement and confirmation, approval technique, the Learning vector quantization strategy to perceive striking and Italian Liras, Robustness and Effective Component-based strategy for Banknote money Recognition by different SURF Features.
- A straightforward proposed measurable test strategy is utilized to check and approval step, where for this situation univariate Gaussian dissemination strategy is utilized, at that point in another current method for paper money note acknowledgement, mainly three attributes of banknote paper monetary forms including size, shading, images and surface are utilized as a part of the acknowledgement. Additionally, examining the already utilized strategies for paper cash acknowledgement, we can see that the majority of these proposed calculations are utilized to Artificial Neural Networks for effectively money acknowledgement.

3.1. Neural network classification

This specialized word regularly utilized as Neural Network" has been spurred from different it's beginning by the character and images acknowledgement that contrast and the human mind and processes are standing out a completely very extraordinary case from the Pattern traditional advanced to simple machine investigation. We know our mind is a superlative learning Complex investigation, nonlinear and Parallel PC perceives, it distinguishes numerous data picture handling framework dissect in light of utilization case module.

3.2. Image recognition

In these cases, diverse picture handling and sifting strategies are accustomed to recognizing current money note acknowledgement that those techniques include notable examples, for example, surface, images, design information or shading based. In this way, we utilize distinctive advanced picture handling strategies to discover ROI; after that, Artificial Neural Networks and Pattern Recognition Techniques are utilized for coordinating the current and required example. Microcontroller works various channel based interfaces utilizing the web get to strategy for the time opened, which is a modified control [5][6][7][8]. At each case, the time opened to be over the referenced controller requests forward access to through a web activity. These means are as per the following:

- Scanning the first picture at 200 Dpi with 256x256 pixels by picture channel and level scanner.
- ROI is extricated based client necessities.
- Image changing over into dim scale and required picture arrange at the starting stage.
- After applying different picture channels and getting referenced distinguishing proof check or esteem.
- Finally getting reference image or example or esteem, it is coordinated by utilizing ANN and Pattern Recognition advancement Toolkit in MATLAB tasks, if the required picture is coordinated then web get to assessing strategy gives in inside length and region constrain.

3.3. Pattern recognition methods

This technique consolidates of different cases, quickly advancement of various improvement applications in different assignments. Distinctive models are settled on different example acknowledgement strategies can be assessed into various classes given various cases selected to information and characterization investigation. Different models are accustomed to distinguishing assignments are demonstrated as follows.

- Statistical Model
- Structural Model
- Neural Network-Based Model
- Fuzzy Based Model
- Hybrid Model

3.3.1 Statistical model

In this model of Pattern matching or coordinating on each example is assessing as far as highlights; these highlights are picked in various ways that different sorts of examples possess non-covering highlight on space. It perceives and distinguishes in adaptable nature both of the data we look to process; it works excellent way when required structures are prompt element spaces which investigate grouping in a perceiving way. Best highlights are picked given, breaking down preparing to assess designs. Required test designs are connected to discover a consistent framework to distinguish perceive coordinating examples.
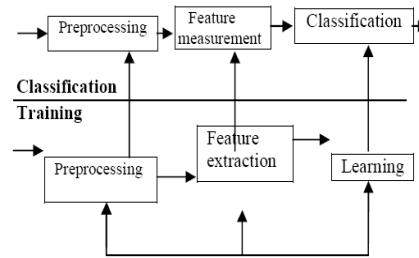
Figure 1. Statistical model

3.3.2. Structural model

This model perceives design advancement techniques are ended up being a powerful route for information which contains selected picture information and time arrangement. This is sorted out by availability and used to basic diverse example acknowledgement techniques and arrangement undertakings.
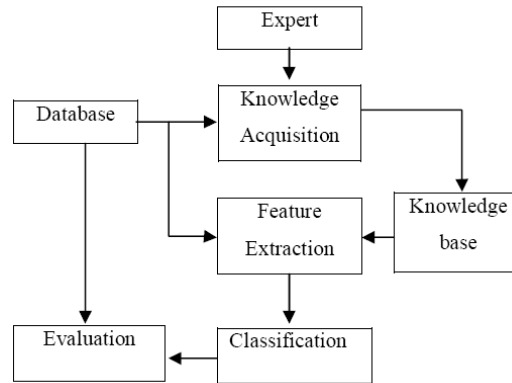

Figure 2. Structural model

3.3.3. Fuzzy based model

Formalities Syntactic example assesses methods are utilized, when the example matches identified with the ordinary formal structure situated images or dialects. Semantic fluffy methods are utilized to sort different segments of datasets are to be delivered in numerous associated areas, and distinguished comparable measures in light of hub remove is a catch to concerned degrees between the fluffy rationale on discovering complex and reference shape.
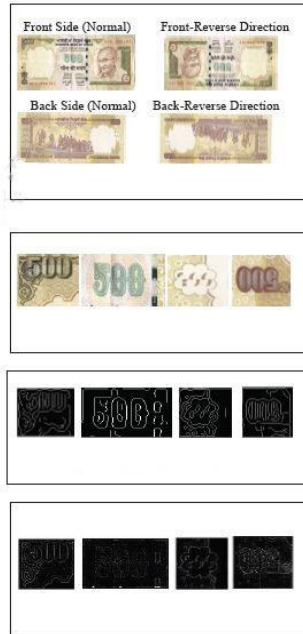
Figure 3. Banknote of ROI

3.3.4. Hybrid model

These Primitive model ways to deal with outline a Pattern acknowledgement framework, which primary objective is utilized to the appropriate hub have fewer disadvantages; this is excessively muddled undertaking to checking a vital order to dissect more noteworthy need information-driven is accessible at utilizing case module. To upgrade the required framework assesses execution can quantify an arrangement of homogeneous classifiers and taken example combiner to settle on a suitable choice.

The multilayer feed-forward artificial neural network systems find each DPI pixel of given current bank cash note and give the correct match ROI.
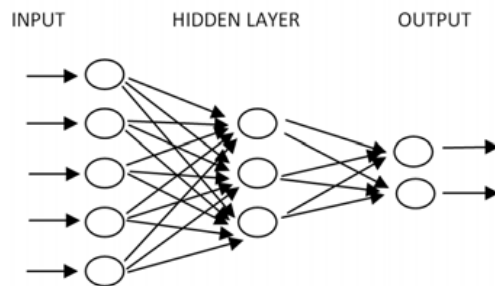

Figure 4. Matching process

3.3.5. The design of interface

The target of proposed technique centre hubs are the controller interface ENC28J60 every goal made by different centre organizations, It is fundamentally intended for fill in as an Ethernet arrange design interface for any microcontroller outfitted with given SPI. ENC28J60

meets every single required determination of IEEE 802.3 having different parts are fused MAC and PHY modules.

Figure 5. RBI issued Indian Currency notes

The proposed microcontrollers are improved composed projects in a way that, it works and controls the whole activities through web getting to. The required timeslot for their getting to programs are finding every monetary money order. For every nation cash monetary certificate picture is as of now put away in the current memory space, these openings through the needed info the time is assigned and recognize the ordinary picture and ref pictures. For instance, the 500 or 2000 rupees notes are modified for getting to 15 million seconds.
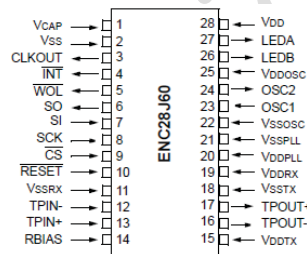

Figure 6. Pin configuration of ENC28J60

4. Proposed work

At first, our nation cash paper is embeddings into picture distinguishing proof info territory, at that point, it is right off the bat, and once the money's picture is coordinated with the nearby reference picture, then a flag is sent to the microcontroller and perceive counterfeit note.

(1) Algorithm:
- Taken the cash photo of the doled out paper note utilizing different conceivable cases.
- Applied to picture sifting and handling based calculations are distinguished required cash picture in need request to remove essential data.
- Finding inside limits and concentrate the ROI utilizing editing examination.
- Analyze and concentrate on the required highlights.
- Compare past picture and current picture to remove this cash note in images, signs, numeric esteem with one of a particular kind element distinguishing proof esteems that are computed.
- Insert inputs, paper money notes and yield accompanies appropriate outcomes.

(2) Description

We proposed this algorithm is to implement an algorithm which can be applied to different country Currencies and has much better efficiency and high speed during the period..

Step 1: *Inserting an Image:* Currency note image can be obtained using several different input equipment, PDA's such as cameras or Scanners. Further Precautions are we need to analyze and try to control existing environment so that different external factors do not impact of feature input results or values.

Step 2: Pre Analyzed Operations: Preprocessing operations are required to alter the nature of the image, which makes the extraction of features Easier. In this particular case, pre-processing operations involve, blurring, grayscale conversion, thresholding, noise Removal using filters, colour blurring RGB to HSV conversion. These operations help us in detecting boundaries, cropping the ROI and Calculating colour features [9].

Step 3: *Boundary limits Detection and cropping*: For boundary detection, we require a binary image, which has only 2 colours, black and white. All we do in this process is simple, separate the background and the foreground, and separate the ROI.

Step 4: *Specific Feature extraction*: The next step is to extract the required information from the cropped ROI image. So from the binary image, we find out the dimensions of the currency and find out the aspect ratio, aspect ratio remains the same in all light conditions. Hence, it becomes an essential feature for recognizing image. Then we compare the aspect ratio of the target image with the ideal aspect ratios of all the denominations of that particular currency. The other features we extract are H, S and V of particular blocks of the currency. We divide the currency into several blocks. We extract the HSV values of all the pixels and take an average of their H, S; V features and again compares them with the values from the database [10][11].

We use and analyze based on Euclidian distance equation for finding out the average values of the differences between the target and Ideal HSV features.

$$dp, q = Sqrt((h2-h1)2 + (S2-S1)2 + (V2-V1)2) \qquad (1)$$

Where, (h1, S1, V1) = Target image feature set, and (h2, S2, V2) = Ideal feature set.

Step 5: Displaying results: To view required results, we have built a GUI, where we are also providing an extraction specific feature to calculate current currency conversions for which we are trying to obtain current conversion rates from the Internet resources.

Figure 7. Difference between original and fake Indian currency notes

The microcontroller is utilized to control the schedule vacancy administration and to get to the web-based activity. The time is modified, and it apportioned in light of the information and get yield. Once the time is going to terminate, the microcontroller requests that the client whether to proceed or not amid the current condition.

5. Conclusion

The Microcontroller interface performs now offers outstanding arrangement, making most minimal cost (20Euros), strength inactivity. The required framework can be utilized for observing and remote control administration framework is available through any web openness. We connected to associate microcontrollers or chip and other in this way 4692 enhancing information recovery preparing speed. Required requesting framework by and large used to the remote association through the web to different offices or gear utilized to encourage the family unit to utilize.

So we can close proposed calculation, we can undoubtedly distinguished blame or obscured pixels are confirmed by legitimate example recognizer for monetary standards, like this better separation are distinguished in an image, different hues, measure and some other concealed goals with identified with particular highlights. Additionally, Artificial Neural Network advancements through approach this prime issue, at that point, give the best productive outcomes. We have additionally effectively recovered required cash change rates from the web assets, utilizing web benefit. With a specific end goal to make this paper generally valuable to including different line recognition or investigation strategies in the proposed calculation.

References

[1] Surjeet Singh and KulbirSingh, "Segmentation techniques for iris recognition system," International Journal of Scientific & Engineering Research, vol.2, no.4, **(2011)**

[2] Chinmay Bhurke, Meghana Sirdeshmukh, M.S. Kanitkar, "Currency recognition using image processing," International Journal of Innovative Research in Computer and Communication Engineering, vol.3, no.5, **(2015)**

[3] Zheng He, "Classification technique in pattern recognition; faculty of IT," University of Technology, January 31 - February 04, **(2009)**

[4] SeemaAsht and Rajeshwar Dass, "Pattern recognition techniques: A review," International Journal of Computer Science and Telecommunications, vol.3, no.8, **(2012)**

[5] Harish Agarwal and Padam Kumar, "Indian currency note denomination recognition in color image," Int. Journal on Advanced Computer Eng. and Communication Tech, vol.1, **(2012)**

[6] Amel Saeed Tuam, "Iris image segmentation and recognition," Int. J Comp Sci. Emerging Tech, vol.3 no.2 **(2012)**

[7] A. Ms. Trupti Pathrabe and B.Dr. N.G.Bawane, "Paper currency recognition system using characteristics extraction and negativity Correlated NN Ensemble," Int. Journal of Latest Trends in Computing, **(2010)**

[8] Jain Mao, "Statistical pattern recognition: A review, Robert," IEEE transaction on machine learning and pattern analysis, vol.22, no.1, **(2000)**

[9] D. A. KS. Gunaratna, N.D. Kodikara, and H.L. Premaratne, "ANN based currency recognition system using compressed gray scale and application for Sri lankan currency Notes-SLCRec," World Academy of Science, Engineering and Technology, **(2008)**

[10] Eun-Hoe Goo, "Assessment of image quality for optimal MRI diagnostic device applied to parameter changes with 3D FRE at 1.5 T and 3.0 T," International Journal of Multimedia and Ubiquitous Engineering, vol.14, no.2, pp.1-6, **(2019)** DOI:10.21742/IJMUE.2019.14.2.01

[11] Cao Bu-Qing, Liu Jian-Xun, "Currency recognition modeling research based on BP neural network improved by Gene algorithm," 2010 Second International Conference on Computer Modeling and Simulation, **(2010)** DOI: 10.1109/ICCMS.2010.270

This page is empty by intention.

Bosubabu Sambana