

Currency Note Verification and Denomination Recognition on Indian Currency System

Kaza Deepthi Sudha, Pooja Kilaru, Manna Sheela Rani Chetty

Abstract— Generally Automatic currency note recognition system is a very useful and important utility in many of the places like banking systems Post offices etc., Fake currency notes in India with many denominations such as Rs.10, 50, 100, 500 and 2000 are being overwhelmed in the process. In this course of recent years, consequences of the incredible innovative advances in shading printing, copying, and filtering, forging issues have turned out to be increasingly genuine. Here, recognition of notes using the assistance of advanced digital image processing techniques is explained. Two Attributes of Indian paper currency note is chosen for fake detection included ID mark and currency note serial number. The identification mark will help identify the currency note denomination is performed. The feature extraction on the currency note images and then compared with characteristics of non-duplicate currency note. Characteristic extraction is done using canny operator with gradient magnitude. The currency notes are examined by using digital image processing techniques. This methodology consists of a number of steps which includes image processing, edge detection, characteristic extraction, image segmentation, comparing images.

Index Terms— Automatic Currency note Recognition System, Denominations, Advanced Digital Image, Processing Techniques, and Fake Detection.

1. INTRODUCTION

Paper cash was introduced by Indian Government in the year 1861 by releasing Rs.10 notes. In the year 1864, Rs.20 note, Rs.5 in 1872, Rs.10,000 in 1899, Rs.100 in 1900, Rs.50 in 1907 and Rs.1000 in 1909[3]. Present, Indian currency note framework has category 5, 10, 20, 50, 100, 500, and 2000 rupees. Indian cash notes are having their very own highlights, for example, division, shape, shading and so forth[2]. Daze individuals likewise can distinguish the group of Indian cash dependent on exceptional recognizable proof imprints. At the upper right end each Indian cash note has its settled category that one can feel by touchy touch[4]. Yet, marker may get blur after numerous disseminations. It is critical to create robotized framework to extricate include and perceive Indian money note in various zone, for example, transportation, railroad station, shopping center, saving money and ATM(Automated Teller Machine) machines[7]. RBI(Reserve Bank of India) has given valuable tips for

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identifying a phony Indian currency note as given below:

- Optical Variable Ink
- Latent Image
- Security Thread
- Micro lettering
- Watermark

The most ideal approach to acknowledge a note is that the bromide string that runs vertically through a cash note. Counterfeit money notes can generally have silver- shaded band painted rather than the silver string [1]. A real note has AN clear string with raised 'RBI' markings created on that in English and Hindi. Likewise, in an exceedingly real note, the shade of the string shifts from inexperienced to blue once seen from numerous edges[5]. Robotized paper cash acknowledgment framework can be a decent utility in saving money frameworks and another field of trade. Since numerous years falsifying of paper cash difficulties the money related arrangement of each nation in various divisions, India is likewise one of them. Modernization of the monetary framework is a turning point in ensuring the financial success and keeping up social congruity[6]. Programmed machines equipped for perceiving banknotes are enormously utilized in programmed gadgets of various distinctive items, running from cigarettes to transport tickets, and in numerous programmed saving money activities[11]. The requirements for programmed banknote acknowledgment frameworks urged numerous scientists to create comparing vigorous and dependable systems. The innovation of cash acknowledgment expects to pursuit and concentrates the obvious and shrouded blemishes on paper money for effective order. As of not long ago, there are numerous techniques proposed for paper money acknowledgment[10]. The least complex route is to utilize the noticeable highlights of paper cash, for instance, the size and shade of paper money. Computerized paper cash acknowledgment framework can be a decent utility in keeping money frameworks and other field too. Counterfeit notes in India in sections of 100, 500 and 1000 rupees are being overflowed into the framework. In the course of recent years, as aftereffects of the extraordinary mechanical advances in shading printing, copying, and checking, forging issues have turned out to be increasingly genuine[8].

Programmed techniques for paper cash acknowledgment end up essential in numerous applications, for example, computerized teller machine and mechanized products vender machines. This framework is intended to perceive and check the Indian paper cash.



It consists of multiple steps including image acquisition, segmentation of image, feature extraction, edge detection, grey scale conversion and picture comparison. It is a difficult task for system designers per annum tally (RBI - Reserve bank of India) face the fake currency notes or destroyed notes. Handling of huge number of counterfeit notes imposes extra issues. Hence, involving machines (independently or as help to the human experts) makes notes identification method less complicated and economical.

2. RELATED WORK

One of the initial steps of PC supported frameworks is heartily recognize the anatomical limits. Writing has a few effective vitality minimization based calculations which are connected to therapeutic pictures. Nonetheless, these calculations rely upon parameters which should be tuned for a significant arrangement. One of the essential parameters is the regularization parameter (λ) which is for the most part assessed in a specially appointed way and is utilized for the entire informational collection. In this paper we guarantee that can be learned by nearby highlights which hold the local characteristics of the picture[14]. We propose an estimation framework which is demonstrated as a multi-class arrangement conspire. We exhibit the execution of the methodology inside diagram cut division system by means of subjective outcomes on chest x-beams. Exploratory outcomes demonstrate that anticipated parameters create better segmentation results[1].

The chest films contain essential data about the state of the patients. Be that as it may, their translation isn't trifling which urge the scientists to create PC calculations to help the radiologist in conclusion process. Programmed division of anatomical fields is one of the initial steps of such PC helped frameworks[1]. A portion of the abnormalities and symptomatic data can be straightforwardly extricated from the anatomical limits, for example, Total Lung Capacity which helps in recognition of pneumonia, aspiratory atelectasis or obstructive aviation routes maladies[3].

The methodologies in writing adjust the regularization parameter utilizing a solitary component or a heuristic blend of a couple of highlights[7]. We show the attributes of the picture districts with highlight vectors which incorporates haar include for edge, neighborhood paired patten for surface and hessian for shape data of nearby locales[12].

A vigorous technique for plate division in a License Plate Recognition (LPR) framework is introduced, intended to work in an extensive variety of securing conditions, including unlimited scene situations, light, viewpoint and camera-to-vehicle remove. Despite the fact that this novel content district division method has been connected to a quite certain issue, it is extensible to more broad settings, as troublesome content division errands managing characteristic pictures[13]. Broad experimentation has been performed with the end goal to appraise the best parameters for the job needing to be done, and the outcomes got are exhibited. The division technique proposed can be likewise valuable for identifying any sort of content locales in normal and complex pictures. In any case, since we are worried about an exceptionally specific undertaking, every one of the

parameters have been particularly adjusted to enhance the location of content locales which coordinate the imperatives forced by the shape and substance of a normal vehicle tag. As it will be appeared in the examinations segment, extremely encouraging outcomes have been accomplished for the division stage, in this manner the subsequent stage in the plan of a total tag acknowledgment framework requires further work on the structure of a corresponding acknowledgment stage ready to take advantage of the numerous information (different speculation) given by this division[10].

The strategy proposed for the programmed area of the tag depends on a managed classifier prepared on the highlights of the plates in the preparation set[4]. To diminish the computational load, a preselection of the applicant indicates that are more probable have a place with the plate is performed. The first picture is liable to three tasks. Initial, a histogram evening out is completed to standardize the brightening.

Each component vector of the preparation set is named as having a place with one of two classes: positive (pixel in a tag district), or negative (some other area). Clearly this offers ascend to an enormous arrangement of negative examples, contrasted with the generally little arrangement of vectors of the "plate" class. A significant number of the negative examples can be fundamentally the same as and increase the value of the "non-plate" class portrayal on the off chance that they originate from regular foundation territories, for example, vehicle bodies, structures, and so on[9]. From the examinations performed, it very well may be presumed that a decent tradeoff between division exactness and calculation cost can be gotten for a plate standardization size of 100x25 pixels and a nearby window of 40x8 pixels for the element vectors.

3. PRESENT SYSTEM

In Existing methodology SIFT Feature extricating strategy for cash examination has been dead. Scale-invariant feature Transformation (or SIFT) may be a calculation in computer vision to acknowledge and portray near highlights in footage[1]. The SIFT highlights are separated from each one of the countenances within the information. At that time, given another face image, the highlights freed from that confront are thought of against the highlights from every face within the information. The face within the information with the largest range of coordinative focuses is taken into account of the face and is used for the order of the new face. A part is viewed as coordinated with another element once the separation to it embrace isn't specifically a selected portion of the separation to the subsequent component[2]. This ensures

we have a tendency to diminish the number of false matches. this can be on the grounds that within the event of a false match, there'll be numerous alternative shut



highlights with shut separations, attributable to the high spatial property of the highlights. Then again, if there ought to arise an event of a right match, it's in all probability not reaching to discover another part that's overly shut attributable to the terribly clear nature of SIFT highlights. Another important traditional for these highlights is the relative positions between them within the initial scene should not amendment beginning with one image then onto consecutive[14]. As an example, if simply the four corners of associate degree entry were utilized as highlights, they might work paying very little mind to the entryway's position; however on the off probability that focuses within the edge were to boot utilized, the acknowledgment would come back up short if the entry is opened or shut. So also, highlights located in explained or flexible articles would commonly not work if any adjustment within their within pure mathematics happens between 2 footage in the set being ready. still, much speaking SIFT identifies associate degreeed utilizes an plenty larger range of highlights from the photographs, that lessens the commitment of the blunders caused by these near varieties within the traditional mistake of all part coordinative blunders[6].

4. PROPOSED SYSTEM

Within the proposed strategy qualities of paper financial standards are utilized by people for separating numerous Federal Reserve note divisions. primarily, initially example, people might not specialize in the points of interest and proper attributes of banknotes for his or her acknowledgment, rather they think about the fundamental qualities of banknotes, as an example, the size, the inspiration shading (the elementary shading), and surface gift on the banknotes. during this technique, these attributes are utilized to separate between numerous Federal Reserve note divisions. Our cash confirmation framework has six imperative elements Preprocessing, Edge Detection, Segmentation, Feature Extraction, Classification, Performance live. The recognizable proof check likewise chooses the money section. On the image of the money the attributes extraction is performed and it's contrasted and therefore the qualities of the certified cash. The clever administrator with slope size is used for trademark extraction[11]. The money are checked by utilizing image handling strategies. The methodology contains of assorted segments together with image getting ready, edge location, image division, trademark extraction, staring at footage. Vigilant edge administrator is utilized to location the money note edges. Next one is some fluffy procedure based division techniques are examined and actualized and some fluffy c implies grouping based division calculations are created in this postulation to smother high and low uniform irregular commotion. The explanation behind not creating fluffy principle based division strategy is that they are application subordinate[7]. The third technique is Local paired examples (LBP) are a kind of highlight utilized for order in PC vision. LBP is the specific instance of the Texture Spectrum demonstrates proposed.

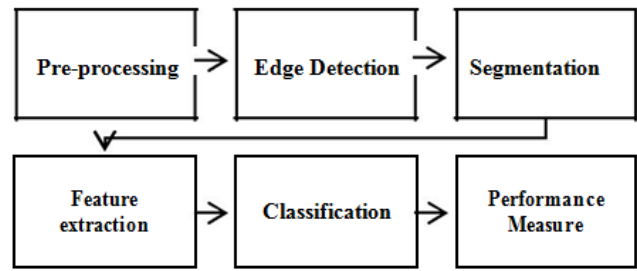


Figure- 1: Proposed Strategy

The LBP administrator relegated a mark to each pixel of a dark dimension picture. The mark mapping to a pixel is influenced by the connection between this pixel and its eight neighbors of the pixel. A probabilistic neural system (PNN) could be a feed forward neural system, that was gotten from the Bayesian system and a measurable calculation referred to as Kernel Fisher discriminant investigation. The precision, affectability and specificity of the classifier is calculable. The exactitude speaks to the proficiency of the procedure[6].

The affectability indicates how the calculation gives rectify characterization. The exploratory outcomes appeared as diagram after examination of the highlights and computing the quantity of dark pixels in the portioned highlights of unique cash and test money[2]. Essentially six highlights are extricated including ID check, security string, watermark, numeral, botanical structure, smaller scale lettering from the picture of the cash. The procedure starts from image getting and finish at correlation of highlights[9]. When confirmed, the consecutive variety of the currency is removed. The employment of consecutive variety extraction is that if any faux note is older we are able to promptly send the report that faux note. This technique is employed to untangle six qualities of paper money as well as recognizable proof check, security string, flower structure, numeral watermark, and watermark, miniaturized scale piece of writing in security string. The framework might separate the hid highlights i.e. idle image of the paper money. The projected work could be a push to suggest a strategy for the trademark extraction of Indian folding money[13]. Purpose by purpose approach is usually recommended from the earliest place to begin of image acquisition to dynamical over it to dim scale image and up to trademark highlights extraction. the fundamental leadership is finished within zero.5 seconds. The framework planned could be a nominal effort framework. The framework will untangle the highlights even the note has scribblings thereon. The framework will take away includes even the check image sizes area unit distinctive once contrasted with reference image.

5. SYSTEM ARCHITECTURE

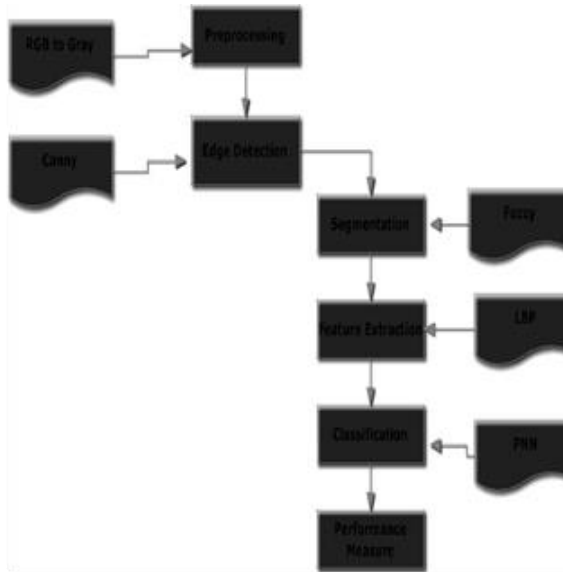


Figure- 2: System Architecture

6. PERFORMANCE MEASURE

Accuracy

The accuracy, sensitivity and specificity of the classifier is measured. The accuracy represents the potency of the method. The sensitivity shows however the rule provides correct classification. The specificity shows however the rule rejects the wrong classification results. we have a tendency to designed a abstraction consistency constraint during a graphical model to boost the detection performance. Our lesion characterization technique relies on the multi-atlas approach. we've improved the looks constraint for higher structure estimation and lower technique complexness while not the extra structure delineation step.

The performance of the method is measured supported the calculation of Accuracy, space below curve of the method.

Sensitivity

Sensitivity refers to the tests ability to properly locate sufferers who do have the circumstance. Consider the example of a scientific test used to perceive a disease. The sensitivity of the test at is the percentage of individuals who test advantageous for the sickness amongst those who've the disorder.

A negative lead to a test at with high sensitivity is beneficial for removing unwellness[1]. A high sensitivity test at is acceptable once their result's negative, since it seldom misdiagnoses those that have the unwellness. A test at with 100% sensitivity can acknowledge all patients with the unwellness by testing positive. A negative test at result would definitely remove out any of the unwellness during a patient[11].

A positive lead to a test at with high sensitivity isn't helpful for removing in unwellness. For example, a 'bogus' test at kit is intended to indicate only 1 reading, positive. once used on morbid patients, all patients test at positive, giving the take a look at 100% sensitivity[4].

Precision

In the field of data recovery, accuracy is the portion of recovered records that are significant to the question[2]. Precision takes all retrieved documents under consideration, however it may also be evaluated at a given cut-off rank, considering solely the upmost results came by the system.

$$\text{precision} = \frac{|\{\text{relevant documents}\} \cap \{\text{retrieved documents}\}|}{|\{\text{retrieved documents}\}|}$$

This live is named exactness at n or P@n. exactness is additionally used with recall, the % of all relevant documents that's came by the search. the 2 measures square measure generally used along within the F1 Score (or f-measure) to produce one measuring for a system. Note that the that means and usage of "precision" within the field of knowledge retrieval differs from the definition of accuracy and exactness inside different branches of science and technology[3].

VI. RESULTS

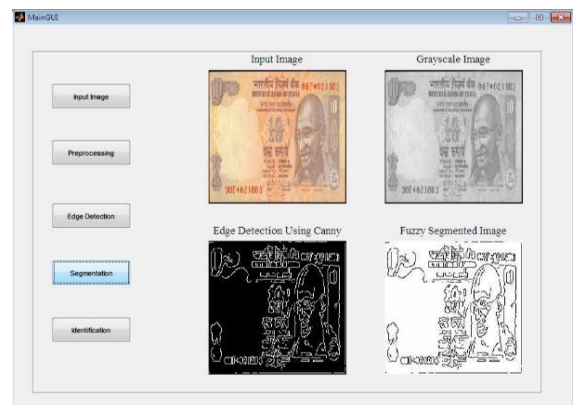


Figure- 3: Input selection and Pre- processing Stage Outputs

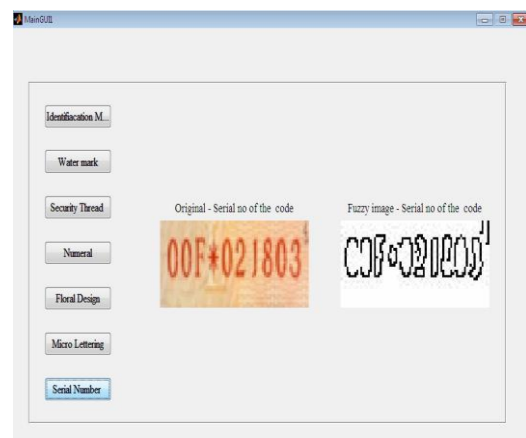


Figure- 4 : Different validations check output snap



Figure- 5: Final Currency note Verification and denomination Recognition.

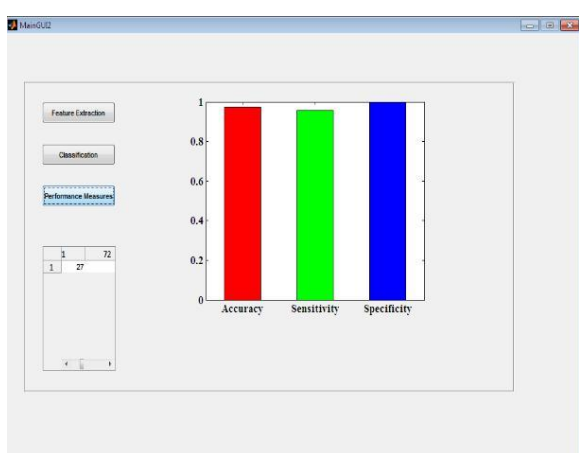


Figure- 6: Performance Analysis Graph

VII. CONCLUSION

The experimental results shown when comparison of the options and scheming the amount of dark pixels within the divided highlights of distinctive money and take a look at cash. In this article, the confirmation of Indian paper money is represented by applying image making ready systems. The procedure starts from image securing and finish at correlation of highlights. When confirmed, the serial range of the note is free. The use of serial range extraction is that if any faux note is veteran we will promptly send the report this faux note. The highlights area unit removed utilizing edge based mostly division by Sobel administrator and functions laudably within the entire procedure with less calculation time. the whole technique works for Indian class twenty, 50,100, five hundred and one thousand. The strategy is extraordinarily simple and easy to execute. This technique is employed to get rid of six qualities of paper currency as well as distinctive proof stamp, security string, flower structure, numeral watermark, and watermark, smaller scale writing in security string. The framework could untangle the shrouded highlights i.e. idle image of the paper money. The projected work may be a push to suggest a strategy for the trademark extraction of Indian paper money. purpose by purpose approach is suggested from the earliest start line of image securing to dynamical over it to dim scale image and up to trademark highlights extraction. the fundamental leadership is

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