Analysis of Image Classification for Text Extraction from Bills and Invoices

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Abstract— **Optical Character Recognition (OCR) technology offers a complete alphanumeric recognition of printed or handwritten characters from pictures such as scanned bills and invoices. Intelligent extraction and storage of text in structured document serves document analytics. The current research attempts to find a methodology through which any information from the printed invoice can be extricated. The intermediate image is passed over using an OCR engine for further processing. Segmentation extracts written text in various fonts and languages. Image classification helps in making a decision based on the classification results. This paper surveys these techniques and compares them in terms of metrics, algorithm and results.**

Keywords— *Invoice, Machine Learning, Images, Text Extraction, Optical Character Recognition (OCR)*

I. INTRODUCTION

Recent years have seen a growing interest in harnessing advances Machine Learning (ML) and Optical Character Recognition (OCR) to translate physical and handwritten documents into digital copies. The growing adoption of digital documents in academia has introduced a new layer of complexity for the automated digitization of physical documents. Similar to traditional texts written in natural language, with many existing OCR methods, there are also more elements to identify. Furthermore, it appears to be difficult to create digital documents from scratch. Ultimately, aim to find a solution where they can get the simplicity of documents generation while also ensuring the ease of using digital documents.

The original invoice image is initially pre-processed to remove unwanted context detail by secondary rotation and edge cutting. At that point the area of the essential information in the regular image obtained is then extracted by template matching, which is the focal point of the information identification. Optical Character Recognition is used to convert image information into text so that the interpreted information can be used directly. The principle point is to analyze certain ML algorithms and create a processing of texts using those algorithms; categorization and classification is used to process text. The principle work is to get the text as input, process it using ML algorithms and store the output. By utilizing algorithms of ML, specific libraries the input content is liberated from clamors, from stop words and punctuations, analyzed with different statistical methods, classify and filter by targets. Dataset is created, by utilizing the resources.

The literature review for text extraction from image was based on the papers of ML algorithms. In the first step the authors have done research based on optical character recognition [7], the reason for selecting text extraction is mainly focused on converting the image content into text so that the derived content can be used more efficiently compared to other methods of text extraction. The next stage is the implementation of the first step where the study of related literature study and reviewing the proposed extraction methodologies.

II. LITERATURE SURVEY OF TEXT EXTRACTION FROM BILLS

First review was started from the year 2009 based on [1] image segmentation and recognition theory. In general, Chinese bank invoice is a color picture. The color invoice image is implemented using encryption standards. The right angle in the invoice is the main detailed information that consists of 0-9 numbers and 26 English cross-rows. This key information in detail is a unique encoded for each invoice. The rectilinear limits of right-up angle on the invoice are subdivided, where the algorithms for the color image filters are built in the light of the computational formula, which also includes the intensity of the color image. The backdrop color of the invoice is filtered out in the rectilinear region. Thus, with filter effect the color invoice image is converted into monochrome. Every invoice in a database can be retrieved by binarization, image enhancement, sharp, filter, by exactly matching pattern theorem.

In general, first an image is monochrome, second foreground is filterable. The foreground grid must be filtered until the image becomes monochrome, which is a direct image filter technique, because the key number is black, the pixel value is smaller than all the other colors, the average color pixel value is filtered for ground color, it is still a color image with a little noise. Then, the color image may be transformed into a monochrome image. Some methods were reported by the authors for the classification of bank invoice denomination and directions. By means of image processing method, the Chinese bank digitally manages invoices that can be created on a computer. The degree of identification of letters is just 92 per cent.

Furthermore in the year 2018 the paper [2] describes methodologies in which the research seeks to find an approach by which the stamped invoice data can be extracted. The main view and focal point of this terrace is to get a place where the client can compare their healthcare invoice and to identify the pip point the average costs and the extracted details is used to find identical practice victim had been through. Optical Character Recognition (OCR) is a device that gives a precise alphanumeric recognition of stamped or written by hand image characters.

OpenCV was initially used to isolate the invoice from the image and eliminate the redundant clamor from the image [2]. Then the intimidating image is moved for additional transformation using the Tesseract OCR engine, the optical character recognition engine. The point of Tesseract is to apply Text Segmentation to extricate written content in discrete textual styles and languages.

The origin invoice image is first pre-processed to gather up the unavailing background information by rotating collateral

and edge cutting. Then, the requisite information region in the standard regular image is extricated by the matching of templates, which is the center of information identification. The optical character recognition is used to convert the image content into text so that the information extricated is being used by for further processing [2]. The primary goal is to research Machine Learning (ML) algorithms and to establish text processing using these algorithms, and the processing of text is carried out through categorization and analysis. The prime advancement is to execute Machine Learning and Natural Language Processing (NLP) algorithms in Python [2]. The key task is to get the text as input information, analyze it with ML algorithms and then cache the results.

In the year 2017 text recognition or optical character recognition is a technology where the authors have utilized the handwritten characters or the text categorization methodologies. This is a method of translating a scanned document to machine encoded text. The analysis of scanned images is done in the following steps. Initially, pre-processing involves skew detection. It means the image is coordinated accurately as the text recognition and text segmentation is appropriate, visualization of the image is done accurately. Noise is eliminated from the input image as it is the essential operation observed by eliminating the distortion from the signal. The text detection, localization modules are closely related to each other as shown in Figure 1. Further, the image gets converted into monochrome and then into binary. Second step is the segmentation; where the binary images are overlooked for interline spaces. Histogram is being used to analyze the width of words. Words are later decomposed into characters [3]. The authors have used the Text Binarization method to segment the text object in the framework as shown in Figure 1. In fact, the turnout text binarization is a binary image, where text pixels and the framework pixels appear as two different binary rates.

Subsequently, feature extraction process, where the image glyph (glyph is a symbol which contains a definite set of symbols) is weighed [3]. The height and width of the character is defined. Fourth step is the classification, investigated by the glyph is analyzed by applying set of rules. Later labelling is also done [3]. This report commands different techniques, converting text content of a document to a system readable format. It also tells us the scope and challenges text recognition is undergoing.

In the year 2017, certificate auditing and invoice images are common in ERP applications. Generally, scanned or camera captured images submitted to an ERP application are not of sufficient quality. In order to robotize the auditing of certificates and invoices and to reduce the low recognition rate given by low factor images in all types of certificates and invoices, a mechanized reasoning and processing system is in operation. The simplified flow is shown in Figure 2. This paper includes a method for identifying and deleting low-factor images, leaving only high factor images, increasing the acceptance rate of audit certificates and invoices [4]. Like other image quality evaluation algorithms that only work with masks or noise, the prospective approach comprehensively and technologically considers a number of key variables that have an impact on t h e image quality of the certificates and on the invoice assessment process.
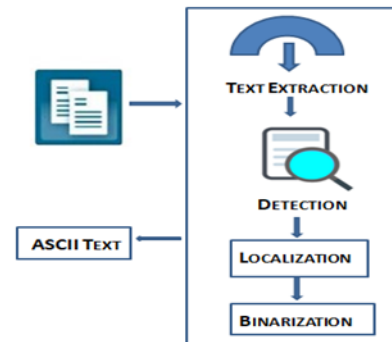

Figure 1: Text Extraction process

The content region and the non-content region is disassociated. The contemplated approach would define a low-quality image and display an image that cannot meet the criteria for auditing certificates and invoices.

The results indicate that the system used can detect low-quality image, screen an image that cannot meet the standards for auditing certificates and invoices, and maintain fair impartiality and high sensitivity [4]. Figure 2 depicts the implementation flow of this algorithm that would require the certificate and invoice image audit to be carried out automatically, improve the accuracy of the certificate or bill image recognition process, and save manpower, time and boost performance.
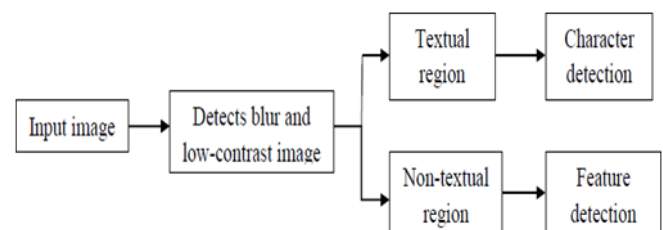

Figure 2: Image quality assessment process

Eventually in year 2018, the text processing step the data should be given as input to the system and if the data is in the digital form it would ease the job. The main concern is that the text is in non-digital form, such as the image form [8]. Therefore, a method is often required in order to be able to identify the text on the images, in advance of the creation of the text that can be interpreted by the computer.

Convolution Neural Networks (CNN) is the preferred approach for this study to classify the text. When entering the recognition process, the input image must undergo different pre-handling and post-preparing stages to select which content to be shown as an outcome [8]. The assessment approach uses invoice images taken at a distance of between 10cm and 12 cm. The main aim is to check the accuracy of the image for a selected text extraction region based on the CNN.

Sypth proposed in 2018 is a general individual folio that is separately parsed by a lateral Optical Character Recognition (OCR) device that separates textual characters and their corresponding real-document locations. The image and OCR content are given as input, our model calculates the most likely value for a given query sector. Field style information is integrated into the model through token level filtering i.e date, integers [6]. Each query field selects a subset of tokens as candidates and predictions depending on the form of target field. For eg, do not accept currency denominated values as candidate fields in the date sector. Train the algorithm with sampling instances at the token level.

The aim is to explain how the collection of alternate extraction framework deals with different invoice formats. Sypth validate was used to produce about the labels for a task, somewhere in the range two and four annotators for every field subject to an inter-annotator agreement.

Validation of the Sypht API may set a certainty threshold at which uncertain predictions are human approved before satisfaction [6]. Yield a JSON organized object containing extricated field-esteem sets, model certainty and bounding-box data for every expectation is returned through an API call [6]. The comparison with substitute extraction systems demonstrate both high precision and lower dormancy across extracted fields–empowering applications in real-time continuously for invoice installment.

In 2019, the proliferating use of invoices made needless claims on work and material assets in the financial industry. This paper offers a technique for logically distinguishing invoice data based on template matching, which retrieves the requisite information by image pre-processing, template matching, optical character recognition, and exporting information [5]. The initial invoice image is pre-processed first to remove the impracticable context information by secondary rotation and edge cutting. The area of the related information in the regular image obtained is then extracted by template matching, which is the center of the intelligent invoice information recognition [5]. The authors have done the optical character recognition to move from image information to text with the intention that the interpreted information can be used precisely. Text information will be exported for backup and future use in the final stage.

The Figure 3 describes the entire system that consists of four steps: pre-processing, template matching, optical character recognition, and information export. Identification problems, including secondary rotation, contour extraction and branch details were explored [5]. Exploratory tests assess the accuracy and speed of the normalized correlation coefficient alignment technique, which is the best choice for template matching. The pioneer image of the invoice is pre-processed due to irregularity. As shown in Figure 3 the pre-processing step includes mainly secondary rotation and edge cutting. The QR code information is placed to rotate the invoice. Optical character recognition (OCR) is a technique used to translate text to images with high precision.

Subsequently, in the year 2019, a new proposed approach started with pre-processing, which comprises of two main stages: the proposed area and the text recognition of the

character distinction followed by character classification [7]. Each paper invoice will be scanned from two sides by a machine with two desirable directions, and each two desirable orders will be put on each page. Initially, the image is cropped by eliminating the dusky backdrop, which can be conveniently measured using the disparity in brightness to locate the boundary [7]. BPN (Block-wise prediction networks) will anticipate content and non-content regions for each block. For each invoice of four Potential RoIs, one of them with bank SN (Serial Number) can be conveniently inferred by displaying the block-wise performance forecast.
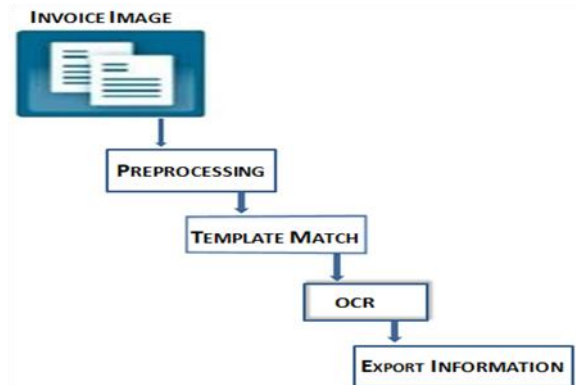

Figure 3: Text Extraction process for template match

In 2019, proposed end to end training framework called EATEN for the elimination of EoIs in pictures [9]. The utilization of CNN is to remove significant level visual portrayals and an entity-aware network to decrypt EoIs. The use of the consideration component is to acquire the context feature, and later model the groupings to set the context highlight with an LSTM. A dataset of three true circumstances has been set up to validate the feasibility of the suggested technique and to support the study of EoI extraction [9]. In contrast to conventional methodologies which relay on content exploration and content identification, EATEN is efficiently prepared without bounding boxes and complete material descriptions, and explicitly predicts the target substances of the information picture in a single shot without extravagant accessories. It shows predominant execution in all cases and displays the maximum extent of eliminating EoIs from images with or without a fixed style. The whole process gives different point of view on content acknowledgment, EoI extraction, and basic data extraction.

This paper has introduced the first table recognition strategy dependent on auxiliary data without utilizing the crude substance of the content [10]. The hidden structure of the report is demonstrated as a diagram; at that point, table recognition is discussed as a node classification issue where adjacent node configurations explain the layout of the table. The proposed table discovery framework consists of an Embedding layer, three Graph Residual Blocks and two different nodes and edge classifiers [10]. Graph Neural Networks [GNN] provide methods for finding neighborhood structures from a node that has a position with tables. In

addition, the methodology can manage anonymized information, since it doesn't utilize the printed substance.

In the year 2017, taking everything into account, a framework is planned that precisely distinguishes both the nation of root and the group a given banknote [11]. The framework as of now bolsters up to twenty of the most widely recognized monetary standards. When contrasted and the unrefined calculation of pixel by pixel examination is progressively exact and takes less time. The picture has experienced pre-processing, to distinguish the nation of beginning, and format to coordinate it against the layouts of the considerable number of nations inside its gathering. When the nation has been resolved, the section ought to be distinguished [11]. This can be founded on shading, size, or content extraction. The utilization of Tesseract is to prepare the framework with the fundamental data. Resize and remove noise in it with the goal that foreground noise is removed. Finally, the picture is then trimmed to the territory containing the content. The content peruses the division of the note into words.

Subsequently in the year 2019, a bounding box of a credit card is being recognized. This bounding box shows to the client how near the camera the card must be held [12]. Camera captured picture must be flipped around the vertical pivot with the goal that client looks at the mirror reflection and to maintain a strategic distance from disarray in regards to left and right development. The record scanned and it is pre- processed [12]. The picture is changed over to a dark scale picture and afterward to a binary image. The pre-handling process, a convolution activity is done on the picture utilizing a Laplacian channel. The change of this activity is utilized to decide if the picture is hazy or not.

The picture is the changed over into a grayscale picture utilizing capacities from the openCV2 library. It looks at the estimation of the deciphered picture with all the formats which are preloaded into the framework[12]. The examination is done, the perceived characters are loaded in the content organization.

The proposed novel methodology for arrangement of private and open checked reports utilizing EAST content discovery and content acknowledgment in the identified area dependent on Tesseract OCR library [13]. Tesseract is a default page- division mode as it completely generates the programmed page division, yet no direction and content identification. In order to enhance the nature of the content division, the authors have opted to utilize the TensorFlow re-use of the EAST content locator [13]. It is recognizable that our execution of EAST indicator improved the nature of printed regions.

With respect to content acknowledgment, in both cases the use of the OCR library from image to string mode. Furthermore, the LSTM Engine mode is designed to capture characters from pictures. Tesseract content identification couldn't extricate content portions precisely. In any case, an execution of EAST content indicator can conceivably improve the nature of grouping by coordinating with watchwords.

The authors [14] proposed new HTA algorithm, is designed to tilt and recover the skewed invoice image in the natural environment and to change the input image during pre-processing in the year 2019. Excellent achievement and tremendous influence in the area of smart financial reimbursement [14]. Introduction of the YOLOv3 deep learning system for smart positioning, segmentation and interception of invoice images. The redundant invoice information has been deleted, and the key information areas have been properly identified.

Subsequently CTPN text detection network, Dense- Nets and CTC text translation algorithm used and a similar character cast algorithm to improve text recognition accuracy [14]. The proposed RMRS algorithm relies on regular expression, which outputs the normal format characters on the text information of the misalignment or specifics of the misalignment on the invoice . The average precision of the optical character recognition in all block areas on the invoice is as high as 0.991 with a minimum of 0.962. Comparative tests have found that the text recognition is more effective than online text recognition platforms, and offline text recognition applications.

In 2018 an element extraction approach is a filtered solicitations perceived by OCR. The framework indicates the structure division mistakes. The auxiliary connections and the charts worked for nearby elements is being end up with efficient improve in the extraction procedure [15]. The adjustment module dependent on tokens was successful in expanding the exactness of the extraction procedure. In few cases the framework experiences some incorrect outcomes. This disappointment is expected in huge segment to OCR mistakes particularly in Arabic invoices [15]. Regardless of its efficiency, the framework lost numerous outcomes because of the OCR mistakes in Arabic invoices on account of their complex attributes. As is established, the achievement of the extraction process relies heavily on the accuracy of the material recognition system. Since Arabic text is cursive, it is difficult to track and recognize.

The scanned invoice is checked by a device starting with different views of two potential directions, and individual face likewise bear two potential requests. To begin with, each side the picture is trimmed by evacuating the dark foundation, which can be distinguished effectively by utilizing brilliance contrast to discover its limit [16]. Second, four possible RoIs, outlined with red and green square shapes are used to discuss four potential areas bank SN (Serial Number). Finally, these four Potential RoIs are taken care of in the following phase of our acknowledgment framework. Block-wise prediction networks (BPN) divides all Potential RoIs, each with a scale of 8×16 pixels. Provided the Potential RoI as details, BPN will predict content or non- content for each square.

Subsequent to acquiring a bank SN, character detachment is done with the use of the corresponding component investigation, and Otsu thresholding is applied to acquire a parallel image previously seen [16]. The present stage framework for bank SN acknowledgment which offers exceptionally serious precision working at 10.65ms in GPU and 108.8ms in CPU individually. Although BPN streamlines the content restriction as straight forward block-wise prediction networks, contributing component with just

a closer view that empowers the classifier to produce better performance. The authors have done an analysis, that the BPN can also be additionally embraced through generic content confinement, and also article recognition, which is under scrutiny.

The paper describes the information on the shading picture, a few pre-processing tasks is performed very first: red stamps evacuation realises upon the pixel resolution of RGB value , binarization relies upon entropy investigation of flat projection in a few revolution edges, and clamour reduction based on connected component (CC) [17]. At that point the authors have utilized to extricate content lines dependent on level projection histogram investigation. From that point, all segments in the area are generally portioned for the most part by blank area investigation in a base up way. At that point ROI digit sections are extricated by geometric and semantic information [17]. At last, logical information on ROI table cells is analyzed to refine the OCR that finishes in the post- processing to create an electronic table.

This paper presents an information based methodology for perceiving Chinese bank explanations picture. Semantic information about earlier arrangement of acknowledgment outcomes from a quick digit OCR is often used to support and recognize specific digit sections. Even the exploratory outcomes of bank articulations indicated the good accuracy of the framework.

III. COMPARISION OF TEXT EXTRACTION

The paper describes the analysis of different text extraction methodologies based on Machine learning algorithms. Table I presents a brief survey of the research methodologies in various fields along with experimentation into few selected fields. The research is to separate the content from imprinted invoice and manually written bills and invoices. The downside of the inspection is that, even though the picture consist a document that is not a bill, a rectangular slip to paper or an object, the inspection will recognize the object and find it to be necessary bill or receipt, the substance of which will be deleted. Table I compares and discusses some recent proposed OCR applications based on Neural Networks. The fact that the further text analysis can be implemented and identify if the extricated content is of a bill or invoice.

This is our small way to assist people understand their bills or invoice and to bring about some level of transparency in the markets. The authors believe that with every small step can reduce the level of possible errors.

IV. CONCLUSION

The work concludes that the proposed methodologies are based on Machine learning algorithms of different text extraction methodologies. The limitations of these technologies are reviewed and research challenges are identified. The results of this research show that there are many opportunities to improve the quality of automatic receipt analysis. The system should be effective in identifying invoice or bills that are mutilated such as experiment results show that local thresholding methods have relatively good results. The binarization methods allow to perform brightness adaptation. This adaptation is very important for character recognition. The speed-up of

Table 1. Comparision of Text Extraction from bills

Paper	Metrics	Algorithm	Results
[3]	Convert binary text object into ASCII	OCR	Extract all kinds of blur images
[2]	Canny edge detector for image data identification	Open CV, Tesseract OCR	Extract all kinds of images, failed for handwritten bills and invoices.
[1]	Number and letter segmentation	Tanimoto measure theory	Rate of numeral recognition 99% and rate of letter recognition 92%.
[4]	Detecting and filtering images with low quality	Definition evaluation algorithm based re-blur	Detect low quality image and screen out the image which cannot meet the requirements
[5]	Secondary rotation, rotate image, degree of rotation	OCR data is exerted as excel format	The accuracy of this method can be reached upto 95. 92%.
[6]	Various documents formats	Combination of heuristic filtering & OCR	Best result with an average accuracy of 92%.
[7]	block level image into individual characters	Softmax CNN classifer	Best result with an accuracy of 99.92%.
[8]	accuracy of the image for a selected text extraction region	OCR based CNN	The accuracy rate is 95% for taken at a distance of 10km.
[9]	CNN to remove the visual portrayals, entity-aware network to decrypt EoIs	Entity –aware mechanism for feature extraction and LSTM as input	The accuracy for model trained over real data is about 95.8%.
[10]	Graph Neural Network to define the table structure	graphlet discovery algorithm	Accuracy related to table detection is about 97%.
[11]	Determine denomination based on K-means clustering	Tesseract for text extraction framework	Accuracy rate is 93.3%
[12]	Bounding box is designed for specific elements	OCR	Accuracy after pre-processing is about 87.5%
[13]	FCNN and LSTM for text classification	Text detection/ Recognition Tesseract 4. 0 & EAST detector	Best result with an accuracy 83.3%.
[14]	Dense Nets & CTC for text conversion	Area extraction- YOLOv3	Average accuracy of recognition is about 0.96.
[15]	Entity extraction by labelling Regexp patterns	OCR	Arabic text is cursive difficult to determine accuracy
[16]	BPN predict text or non-text area block wise	OCR	Recognition accuracy is 99.24%
[17]	Column based character segmentation	Text recognition with OCR	Character recognition accuracy 89% & table recognition is 98%.

character recognition of target needs to be investigated. In addition, a GUI needs to be added as a support defining new layout styles by users. The extension of these limitations can be used to process medical insurance bills will also be considered.

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