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Automating Identity Document Validation and Verification Using Computer Vision

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Abstract - The research paper presents a practical solution for identity document validation and verification that can be applied to various types of documents, including driving licenses, passports, and IDs from different countries. The proposed system aims to overcome the challenges of real-life identity document validation and verification by taking into account the unique features of each type of document. The paper outlines three main contributions: document detection, document validation, and verification. To test the proposed solution, the researchers have used their institute's Student Identity Card as a case study. By implementing the proposed system, the researchers were able to validate and verify the selected documents accurately. The proposed solution can have significant implications for various industries that rely on document validation and verification, such as banking, insurance, and government.

Keywords:- *Computer Vision, Deep Learning Model, Identity Document, Validation, Verification.*

1.INTRODUCTION

The process of identity document validation and verification is a critical aspect of various industries, such as banking, insurance, and government. It involves verifying the authenticity and accuracy of the information provided in a document, such as a passport, driving license, or identification card. Manual document verification processes can be time-consuming, expensive, and prone to errors. As a result, there is a need for automated systems that can effectively and efficiently validate and verify documents [5].

This research paper proposes a practical solution for document validation and verification using computer vision techniques. The goal of this system is to design a complete solution that takes into account the challenges of real-life identity document validation and verification and can be easily adapted to different types of documents from various countries. The proposed system's contributions are threefold: document detection, document validation and verification.

The paper presents insights gained from implementing pure computer vision techniques for document detection and pre-processing images from real-life scenarios. The proposed system is evaluated on a case study using the researcher's institute's Student Identity Cards.

The proposed solution can have significant implications for various industries, helping to reduce the time and cost associated with manual document verification processes while improving accuracy and reducing errors.

2. LITERATURE REVIEW

Automating document validation and verification procedures has drawn more attention in recent years. Several studies have suggested various methods to approach this issue using computer vision techniques. In this section, we examine some of the literature already in existence on computer vision-based document validation and verification.

There has been significant research in the area of computer vision-based identity document validation and verification. Nguyen et al. (2019) developed a system that uses a combination of texture and geometric features to validate Vietnamese ID cards. Their approach achieved an accuracy of 99.5% in identifying genuine ID cards.

To verify the authenticity of genuine ID cards Yang et al. (2019) proposed a method to verify the authenticity of Chinese ID cards by analysing the holographic patterns on the card. Their approach achieved an accuracy of 98.8% in verifying the authenticity of genuine ID cards. Similarly, Bhattacharya et al. (2020) proposed a deep learning-based approach to verify the authenticity of Indian passports by analysing the text and image features on the passport.

One of the challenges in automating identity document validation and verification is dealing with variations in lighting, perspective, and other environmental factors that can affect the quality of the image. To address this challenge, Li et al. (2020) proposed a deep learning-based approach that uses adversarial training to improve the robustness of the model to variations in lighting and perspective. Their approach achieved an accuracy of 98.2% in identifying genuine ID cards under challenging lighting and perspective conditions.

3. PROPOSED METHODOLOGY

i. Workflow:

In this proposed solution, our main goal is to use the Computer Vision techniques to perform validation and verification of documents which involves multi-step process that requires expertise in computer vision, deep learning, and image processing [3]. The design of the process involved are shown in Fig. 1.

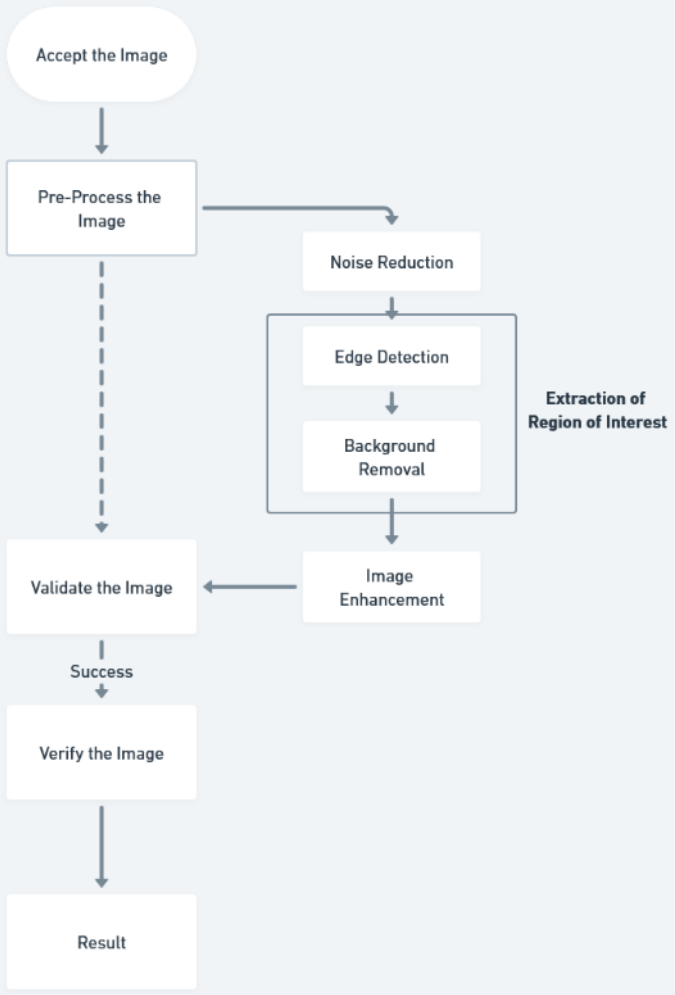

Figure 1. Architecture of Proposed Solution

ii. Collect Input:

This is the initial step where we need to capture the input from the user. Here we can allow the user to either upload his documents for we can connect ask the user to capture the document via Camera. This system can be easily implemented using the OpenCV library available.

iii. Pre -Processing of Input Data:

To validate and verify the document first it needs to be processed as it may contain noise and other objects other than desired documents which can affect the validation process. The pre - processing involves the following steps:

a) Noise Reduction: -

Noise in an image refers to any random variation in pixel values that is not related to the actual image content. Here the noise will be eliminated using Bilateral Filter. The bilateral filter is a type of image filtering technique that is often used for removing noise from images while preserving their edges and details. It works by replacing each pixel in an image with a weighted average of its neighboring pixels, where the weights are determined by both the spatial distance and the intensity similarity between the pixels. From the studies it was concluded that the Bilateral Filter is best suitable for situations where noise has to be eliminated but the details of the image is needed to be preserved [8] .

b) Edge Detection:

Now when the noise is removed from the image, we need to extract the region of interest from the image . For this we will be using the Canny Edge Detection algorithm [9]. The Canny Edge Detection algorithm is a widely used edge detection technique that is known for its accuracy and robustness. This algorithm use s the hysteresis thresholding concept, which helps to remove spurious edges and connect weak edges to strong edges. This helps in getting better and accurate detected edges. For more accurate results, we will be converting the image into grayscale format and then use the algorithm for edge detection.

c) Background Removal:

Background removal is an optional step but during our analysis, we found that removal of background helped us to improve the accuracy of the system. The background removal is done after edge detection. We collect all the dimensions of edges detected and then sort the dimensions with the required ones. Once the dimensions are obtained, we crop the noise reduced image using the dimensions [10] . This method give s low noise image of the document without any other object in the frame.

d) Image Enhancement:

Image enhancement is a technique in image processing which is used to enhance the features of the images. Image Enhancement involves various techniques. Here we will be particularly using the Image Sharpening technique. For Image Sharpening, Gaussian Filter Algorithm is used . The steps involved in Sharpening the image using Gaussian Filter are:

1. Apply a Gaussian filter to the original image to create a blurred version of the image.
2. Subtract the blurred image from the original image to create an image with enhanced edges and details.
3. Adjust the contrast and brightness of the sharpened image to make it visually appealing.

It's important to note that while image sharpening using a Gaussian filter can enhance the edges and details of an image, excessive sharpening may emphasize the noise and artifacts [4].

iv. Document Validation :

Document validation is an important step in the identity document validation and verification process. One approach to document validation is to use structural similarity and template matching techniques to compare the document being validated with a template or reference image [1]. These techniques involve analysing using the structural features of the document, such as the size, shape, and location of specific elements, to determine whether the document is genuine or not.

Structural similarity is a technique that measures the similarity between two images by comparing their structural information, such as edges and contours. This technique can be used to detect alterations or modifications made to the document, such as changes in text or images, by comparing the original document with the document being validated.

Template matching involves comparing the document being validated with a reference image or template that represents the genuine document [2] . This technique can be used to detect deviations from the genuine document, such as changes in the position or size of specific elements, by analyzing the correlation between the document being validated and the reference image.

In our research with the researcher's Institute Student Identity card, the card dimensions were 8.5 cm * 5.5 cm. The template of the card is shown below .

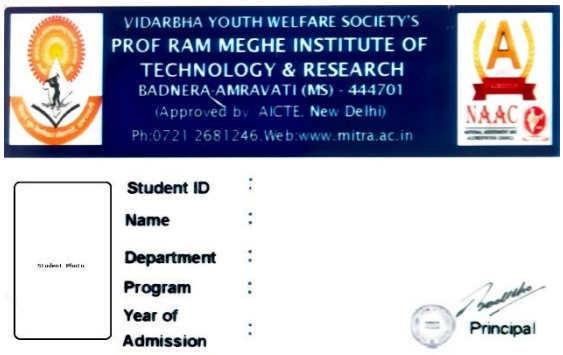

Figure 2. Template of ID Card

The combination of structural similarity and template matching can provide a powerful approach to document validation, allowing for accurate detection of forged or fake documents. However, these techniques require careful selection and pre - processing of the reference images and templates, as well as appropriate threshold values for the comparison metrics. In addition, these techniques may not be effective in detecting more sophisticated forms of document forgery or tampering, such as digital manipulation. Therefore, we have used these techniques for the validation purpose only.

v. Document Verification:

Now at this stage it is a crucial step to verify the document. The verification part requires decision making situations and sometimes complex situations may arise. To handle this, one of the approach to is to use computer vision techniques based on deep learning algorithms to detect and classify the features of the document which helps in decision making [5]. In particular, object detection models can be trained to identify and locate specific elements in the identity document, such as text, images, and signatures.

Faster R-CNN algorithm is a popular deep learning algorithm that can be used to train custom object detection models for identity document verification. This algorithm involves a two-stage process, where an initial region proposal network (RPN) is used to generate potential regions of interest (ROIs) in the image, followed by a second stage CNN that classifies and refines these ROIs into object detections.

We need to train our custom Object Detection Model and we have chosen TensorFlow Object Detection API as it is trained on high performance deep learning library and contains multiple detection models [7].

Steps to train a custom object detection model:-

Step 1: Collection of comprehensive dataset concerning the ID Card. While creating a dataset, Quality of image should be given priority than Quantity of Images.

Step 2: After the dataset is created, we need to label it. For this purpose we have used the tool "Labelimg". We labelled the images in 5 different categories namely "logo", "details", "naac", "photo" and "sign".

Step 3: Now we are ready to train our model. This requires a lot of computational power and is a time-consuming process. We have used Google Colab for this purpose as it provides a platform for doing high computational tasks along with TensorFlow Object Detection model for core processing of "Faster R-CNN ResNet101" algorithm. This model's accuracy compensate for the extra computational power used. We divide the data-set into two parts: 1st for Training the model and 2nd for Testing the model. After executing the specified commands we get our Customed Trained Model.

Now the model has learned to recognise the features and is ready for the verification of documents. The trained model is used to verify whether the input document is a valid ID Card or not based on the features defined.

4. RESULTS

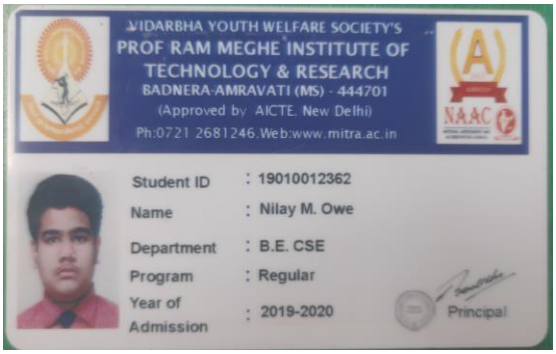

Figure 3. Input Image

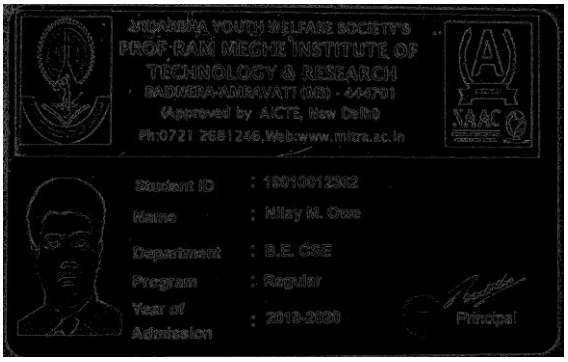

Figure 4. Canny Edge Detected Output

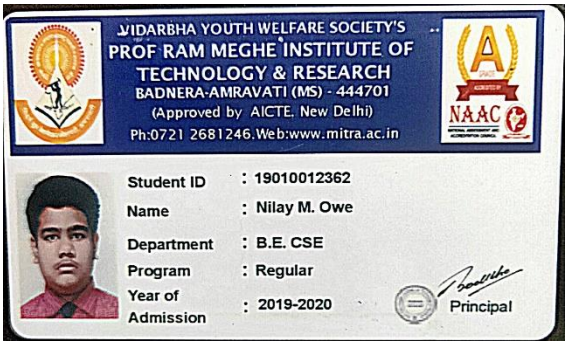

Figure 5. Enhanced Image

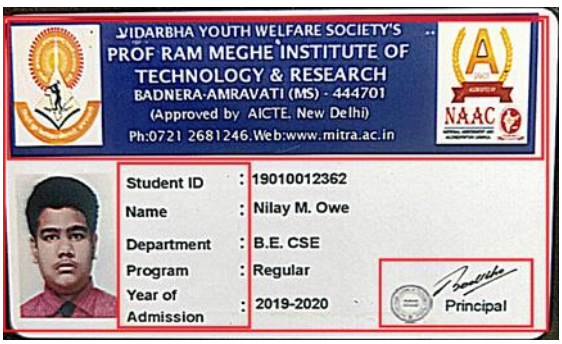

Figure 6. Template Matched Output

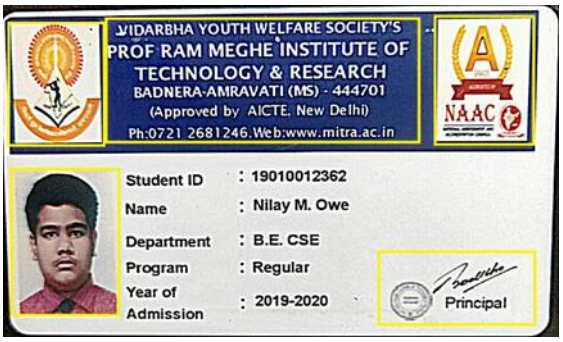

Figure 7. Output of Custom Trained Model

5. FUTURE SCOPE AND CONCLUSION

In this research, we were successfully able to implement our proposed solution for Automation of Identity Document Validation and Verification. During our manual testing of the system, we were able to generate an accuracy of almost 92%. The accuracy of system will increase when the model is trained on a larger dataset with more number of Identity documents accepted. However, we were successful in providing a structural flow which helps in document validation and verification using computer vision.

In future, we would work further in order to extract the text from the documents and then validate, verify it. We also plan to incorporate a lot more documents in the system which will help to create a robust system [6] that validates and verifies the documents through-out. A further addition to the system can be done which will only allow the user to capture the image rather than uploading. This will prevent users from engaging in fraudulent activities.

REFERENCES

1. Nguyen, T. H., Do, T. T., Tran, D. H., & Nguyen, T. L. (2019).Vietnamese identity card recognition using texture and geometric features. In International Conference on Advanced Technologies for Communications (pp. 543-548). Springer.
2. M. Ryan and N. Hanafiah, “An Examination of Character Recognition on ID card using Template Matching Approach,” Procedia Computer Science, vol. 59, no. Iccsci, pp. 520–529, 2015.
3. W. Satyawan, M. Octaviano Pratama, R. Jannati, G. Muhammad, B. Fajar, H. Hamzah, R. Fikri, and K. Kristian, “Citizen Id Card Detection using Image Processing and Optical Character Recognition,” Journal of Physics: Conference Series, vol. 1235, p. 012049, 2019.
4. Alejandra Castelblanco, Jesus Solano, Christian Lopez, Esteban Rivera, Lizzy Tengana & Martín Ochoa (2020). Machine Learning Techniques for Identity Document Verification in Uncontrolled Environments: A Case Study. Springer.
5. Bhattacharya, U., Saha, S., Das, A., & Konar, A. (2020). A deep learning-based approach to passport authentication and verification. Multimedia Tools and Applications, 79(27), 19669-19686.

6. Li, Y., Tang, Y., & Wang, W. (2020). Adversarial training for robust ID card recognition. In International Conference on Neural Information Processing (pp. 524-534). Springer.
7. Shiva Thavani (2020). Document Verification for KYC With AI-OCR & Computer Vision Tool. Medium.
8. C. Tomasi, C. Tomasi (1998). Bilateral Filtering for Gray and Color Images. IEEE.
9. John Canny (1986). A Computational Approach to Edge Detection. IEEE.
10. Zhao Fei Li, Jiang Qing Wang (2014) Image Background Removal by Contour Feature. Scientific.net.