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Analysis of OMR Sheet using Advanced Intelligent Techniques

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ABSTRACT –

Optical Mark Recognition (OMR) technology has long been employed for capturing data from paper-based forms. However, the manual analysis of OMR sheets poses challenges in terms of time consumption and potential human errors. This paper presents an intricate approach that utilizes advanced image processing techniques and deep learning methods to automate the analysis of OMR sheets. By applying image enhancement, segmentation, and feature extraction algorithms, the proposed system accurately extracts and interprets the marked responses on OMR sheets. Performance analysis is conducted to evaluate individual and group performance, providing valuable insights for educators and researchers. The responses that have been selected for each question aid in the evaluation of the sheet and the display of the final score using a variety of image processing techniques, including median filtering, RGB to Grey, edge recognition, and complement of the image. This solution saves time and money by doing away with the need to install bulky equipment and pricey scanners. Complex challenges related to image noise, handwriting variation, and sheet layouts are addressed through sophisticated algorithms and preprocessing techniques. The system demonstrates its superiority in terms of accuracy and efficiency compared to manual analysis methods through comprehensive experimentation and comparison. Furthermore, potential future enhancements, including cloud-based integration and real-time analysis, are discussed, highlighting the system's potential for improved automation and reliability in assessment processes.

Keywords: Optical Mark Recognition, OMR sheet analysis, image processing, algorithms, performance evaluation.

Introduction –

OMR technology serves as a direct input method for collecting data in various applications, including censuses and surveys [1]. It particularly excels in handling discrete data with a limited set of values [2]. Within the field of education, the OMR technique finds widespread use in processing objective questions during exams, such as the Scholastic Aptitude Test (SAT) , Graduate Record Examination (GRE), and the College English Test (CET) [3,4].

Optical Mark Recognition (OMR) technology is widely employed to scan paper documents and detect marks in specified locations [5]. Over time, OMR has evolved from the use of paper tape and punch cards, which involved physically, punched holes, to modern methods that rely on marked circles. OMR sheets have replaced subjective answer sheets and are extensively utilized as evaluation and grading tools in educational institutions, including schools, colleges, and various other organizations. This technology has significantly simplified the task of grading exams, as examiners no longer need to manually read through lengthy written responses provided by the exam takers. Notably, competitive exams in India, among others, strictly adhere to the use of OMR sheets for accurate calculation of marks [6].

OMR technology has streamlined the grading process, offering numerous advantages over traditional manual evaluation methods. The use of OMR sheets allows for swift and efficient data entry, reducing the chances of human error and enhancing overall accuracy [7]. By relying on predefined answer options and marked circles, OMR eliminates the need for extensive reading and interpretation of subjective responses. This automated approach enables examiners to expedite the grading process and focus on assessing higher-order skills and critical thinking demonstrated through objective questions [8].

In the past, Optical Character Recognition (OCR) systems utilized optical scanners to capture paper documents as bitmap images, with software then attempting to recognize and extract text and images from these scanned images. However, due to the hit-and-miss nature of pattern recognition in these OCR systems, inaccuracies often arose [9].

Moreover, the adoption of OMR technology in competitive exams and educational assessments has facilitated standardized evaluation criteria. OMR sheets ensure consistent grading standards by eliminating potential biases that may arise from subjective assessment methods [10]. Additionally, the use of OMR software and systems enables the rapid processing of large volumes of answer sheets, saving valuable time and resources for educational institutions.

Despite its numerous advantages, OMR technology has limitations that hinder its broader application. It heavily relies on predefined answer options, restricting the processing of open-ended or complex question formats. OMR's dependence on specialized sheets poses logistical challenges for large-scale administration [11]. However, recent advancements in computer-based assessments and online platforms offer flexible question formats, eliminating the need for physical OMR sheets. Integration of machine learning and artificial intelligence enhances grading and performance analysis capabilities, surpassing traditional OMR methods. These developments enable greater versatility, incorporating multimedia elements and interactive components into assessments [12].

This paper addresses the shortcomings of such systems and proposes a solution that improves accuracy and reduces the time required for OMR sheet evaluation. The proposed system presents a precise and cost-efficient approach for evaluating OMR sheets. By analyzing the image provided by the user, the system accurately calculates and assigns grades for evaluation purposes. This system overcomes the complexities associated with traditional OCR algorithms, ensuring a more efficient and reliable evaluation process for OMR sheets.

Methodology –

The methodology will follow an order as per given in figure (i).

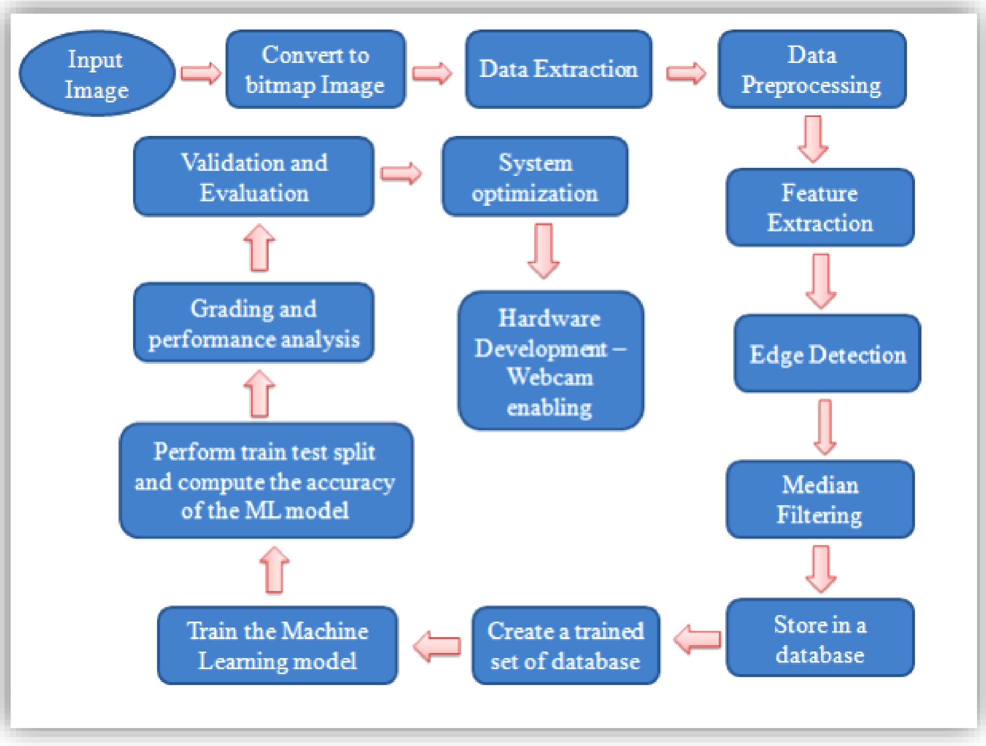

Figure (i) – methodology

The proposed methodology aims to automate the grading and performance analysis of OMR sheets using advanced intelligent techniques. The process involves several key steps:

Firstly, the OMR sheets are scanned or captured as digital images, and preprocessing techniques like median filtering are applied to enhance image quality and reduce noise. Edge detection algorithms are then employed to identify and highlight the boundaries of answer bubbles and question labels.

Next, the preprocessed images undergo further processing, including thresholding, normalization, and resizing. These steps help standardize image sizes and improve accuracy by minimizing variations in lighting and background.

Relevant features are extracted from the processed images, such as the shape, size, and position of answer bubbles, using advanced techniques like contour detection and feature descriptors. These features capture important information from the OMR sheets, aiding in accurate grading and performance analysis.

A labeled dataset is prepared by manually grading a subset of OMR sheets. The extracted features from the labeled sheets are paired with their corresponding grades to train a machine learning model.

Supervised learning algorithms, such as support vector machines (SVM) or convolutional neural networks (CNN), are trained on the labeled dataset. The model learns to classify and grade the OMR sheets based on the extracted features.

The trained model is then utilized to automatically classify and grade unseen OMR sheets. Performance analysis is conducted to calculate overall grades and assess individual and group performance.

Validation and evaluation of the proposed system are performed using various metrics, such as precision, recall, and F1 score. The results are compared with manual grading methods to evaluate the effectiveness of the automated approach.

To optimize and refine the system, adjustments are made based on the evaluation results. This may involve fine-tuning the machine learning model or adjusting preprocessing techniques to improve accuracy and efficiency.

By combining image processing techniques, including median filtering, edge detection, and feature extraction, with machine learning algorithms, the proposed methodology provides a reliable and efficient solution for automating OMR sheet grading and performance analysis.

Results and Discussions

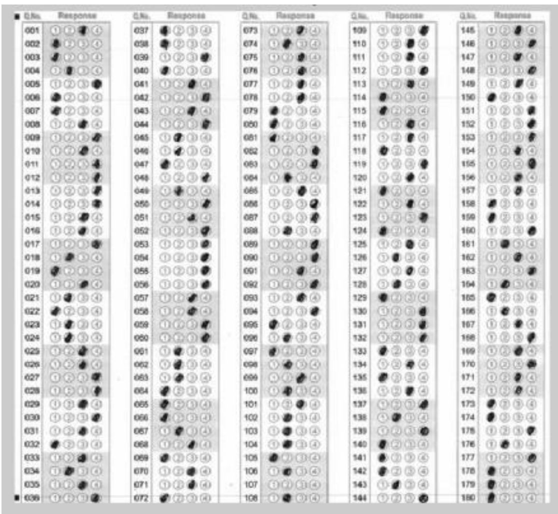

Figure (ii)- Grayscale Image

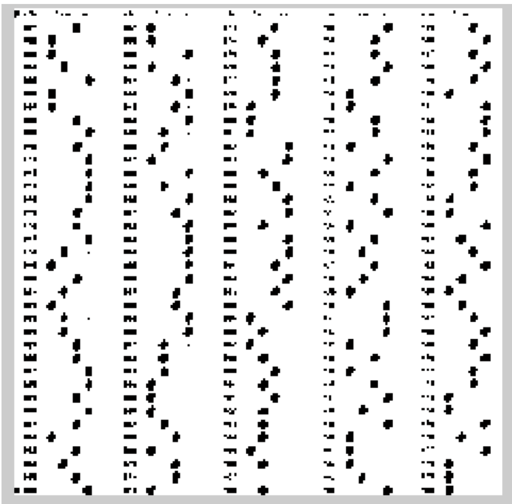

Figure (iii)- Image Thresholding

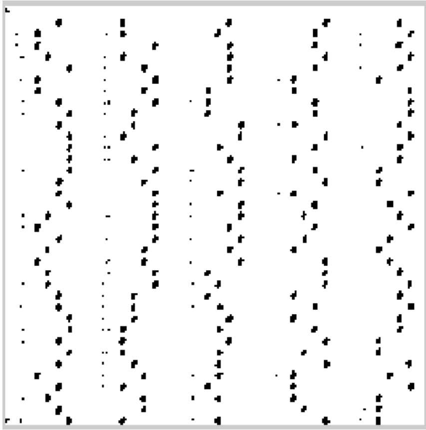

Figure (iv) – Image Segmentation

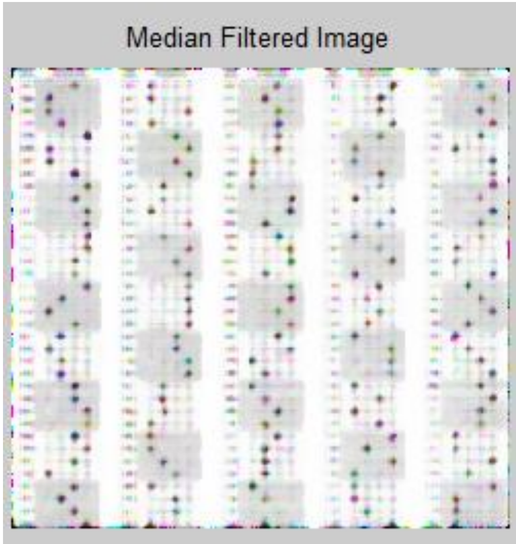

Figure (v) – Median Filtering

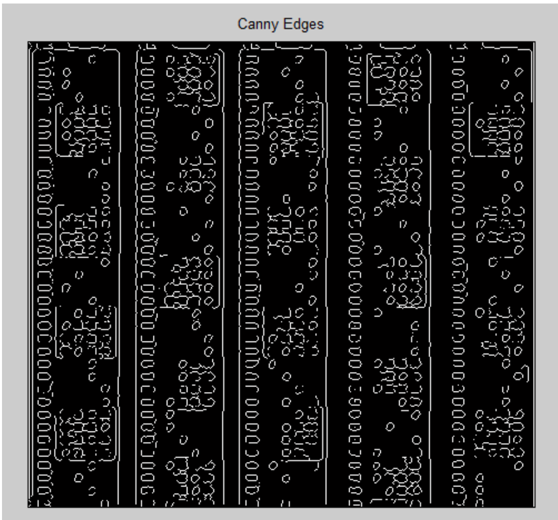

Figure (vi) – Edge Detection

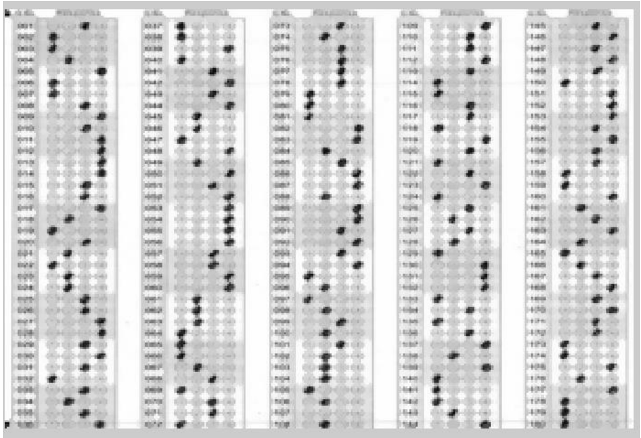

Figure (vii) – Image Finalization

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Accuracy of Linear kernel is: 66.6667%
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Figure (viii) – Predicting accuracy of the system

This system can easily replace an initial assessment tool for educational reasons and many other things because it has a 66.67% accuracy rate and can detect marked circles or bubbles in OMR (Optical Mark Recognition). The proposed approach may be implemented in as little as 60 seconds, saving us both time and the expense of purchasing large OMR sheet scanning equipment. The system's only flaw might be the slant of the sheet as it is being placed on the conveyor belt, though this can be fixed afterward.

Conclusion

The proposed system presents a highly efficient and cost-effective approach for evaluating answer sheets from exams conducted worldwide. It offers a viable alternative for users who seek to avoid substantial investments in heavy machinery. Recognizing the significance of time in human lives, this system significantly reduces the evaluation process duration. Extensive testing has proven that the system can evaluate a paper within a maximum time frame of 60 seconds. The algorithm meticulously checks for errors and provides an accurate assessment of the candidate's marks.

The implementation involves a series of straightforward procedures, including image acquisition, conversion to grayscale, intensity analysis of each bubble, and subsequent mark calculation. These steps are carefully designed and seamlessly integrated to ensure optimal performance. Moreover, the system exhibits considerable potential for future advancements and diverse applications. It can be harnessed effectively for surveys, attendance tracking, and various other purposes. With the integration of machine learning techniques, the system's prediction capabilities become increasingly robust, paving the way for the development of a comprehensive hardware unit dedicated to prediction and evaluation. This opens up vast possibilities for enhancing the overall efficiency and accuracy of grading processes. By harnessing the power of machine learning, this proposed system not only addresses current evaluation needs but also sets the stage for future advancements in the field of automated assessment.

References

[1] Mr Hui Deng, Feng Wang, Bo Liang "A Low-Cost OMR Solution for Educational Applications" International Symposium on Parallel and Distributed Processing with Applications 2008.

[2] Parinya Sanguansat, “Robust and Low-cost Optical Mark Recognition for Automated Data Entry,” IEEE Transactions on, vol. 9, no. 1, pp. 62-66, 2015.

[3] Tien Dzung Nguyen, Quyet Hoang Manh, Phuong Bui Minh, Long Nguyen Thanh, Thang Manh Hoang, “Efficient and Reliable Camera based Multiple-Choice Test Grading System,” IEEE International Conference on Advanced Technologies for Communications (ATC), 2011

[4] Ms.Sumitra B. Gaikwad, “Image Processing based OMR Sheet Scanning,” International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 3, March 2015.

[5] John D. "OMR." A Dictionary of Computing 2004. Retrieved March 17, 2011 from Encyclopedia.comhttp://www.encyclopedia.com/doc/IOII-OMR.html

[6] Rusul Hussein Hasan, Emad I Abdul Kareem “An Image Processing Oriented Optical Mark Reader Based on Modify MultiConnect Architecture MMCA” International Journal of Modern Trends in Engineering and Research (IJMTER) Volume 02, Issue 07, [July– 2015].

[7] Nutchanat Sattayakawee "Test Scoring for Non-Optical Grid Answer Sheet Based on Projection Profile Method", International Journal of Information and Education Technology, Vol. 3, No. 2, April 2013.

[8] A. AL-Marakeby "Multi-Core Processors for Camera based OMR", International Journal of Computer Applications (0975 – 8887) Volume 68– No.13, April 2013.

[9] Rakesh S, Kailash Atal, Ashish Arora "Cost Effective Optical Mark Reader", International Journal of Computer Science and Artificial Intelligence Jun 2013.

[10] Sumit Tiwari, Sandeep Sahu "A Novel Approach for the Detection of OMR Sheet Tampering Using Encrypted QR Code" , 2014 IEEE International Conference on Computational Intelligence and Computing Research.

[11] K. Toida, "An Overview of the OMR technology: based on the experiences in Japan", Workshop on Application of new information technology to population: Paper based data collection and capture, Thailand, 1999. [12] Soumitra Patole, Aniket Pawar, Avanish Patel, Akshay Panchal ,Prof. Ravindra Joshi, " AUTOMATIC SYSTEM FOR GRADING MULTIPLE CHOICE QUESTIONS AND FEEDBACK ANALYSIS", International Journal of Technical Research and Applications e-ISSN: 2320-8163.