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CO Attainment: Assessment of Course Outcomes for Engineering Colleges Affiliated to Anna University

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Abstract

The CO Attainment project addresses the challenges associated with the manual assessment of student answer scripts in colleges, which is often labor-intensive, prone to errors, and inefficient. The project leverages a deep learning approach to automate the recognition of marks from scanned answer scripts and facilitates the systematic tracking of curriculum outcomes (COs). The core of the project is a Convolutional Neural Network (CNN) trained on the MNIST dataset, which is adept at recognizing handwritten digits with high accuracy. This model is integrated into a user-friendly Tkinter-based GUI, allowing college staff to input subject details and curriculum outcome question numbers, and upload scanned answer scripts for automatic mark extraction.

The project follows a multi-step methodology: it begins with the collection and preprocessing of scanned answer scripts to enhance image quality and standardize formatting. The CNN model, trained on the MNIST dataset, is fine-tuned to accurately recognize marks on these scripts. A Tkinter GUI facilitates interaction with the system, enabling staff to seamlessly upload scripts and input necessary metadata. The extracted marks are processed using Pandas to compute aggregated scores for each curriculum outcome and are then stored in a structured CSV format.

The CSV data is subsequently integrated into a database management system (DBMS) with robust access control mechanisms to ensure data security and integrity. The database allows for efficient storage, retrieval, and analysis of the assessment data, which is accessible to authorized personnel across the college campus. Comprehensive testing and validation are conducted to ensure the accuracy and reliability of the system. Furthermore, college staff are provided with thorough training to effectively use the GUI and interpret the results.

Through the automation of mark recognition and the systematic tracking of curriculum outcomes, the CO Attainment project aims to enhance the efficiency, accuracy, and transparency of the academic evaluation process. This project not only reduces the workload of college staff but also facilitates timely feedback and data-driven decision-making in educational institutions.

KEYWORDS: Deep Learning, Database Management System, Graphical User Interface, Comma Separated Values, Toolkit Interface, Course Outcome, Artificial Intelligence, Convolutional Neural Network, Machine Learning, Database, Sum of Points, College Staff, Subject Assessment, Data Management System

Introduction

The ever-evolving landscape of higher education demands continuous innovation to ensure curricula effectively equip students with the knowledge and skills they need for success. A critical component of this mission is assessing how well courses achieve their intended learning outcomes (COs). Traditionally, this process relies on meticulous, time-consuming manual review of answer scripts

by faculty. This approach, while well-intentioned, presents several limitations.

Firstly, manual grading is inherently labor-intensive. Faculty burdened with grading large volumes of scripts face a significant time crunch, diverting valuable resources away from core activities like teaching, research, and student interaction. Secondly, the human element introduces subjectivity. Despite best efforts, inconsistencies in scoring can arise due to factors like fatigue, varying interpretations of rubrics, or unconscious bias. Finally, traditional assessment often focuses solely on overall grades, providing limited insights into student mastery of specific learning objectives within a course.

The CO Attainment project emerges as a groundbreaking solution, harnessing the transformative power of deep learning and data analysis to streamline and revolutionize curriculum outcome assessment. This innovative approach promises to address the shortcomings of manual grading and empower institutions with a more efficient, data-driven approach to measuring learning outcomes.

Literature survey

[1] People have never been extra reliant on machines than they're nowadays. As an instance, neural network and machine learning algorithms may be used to do everything to classify objects in films for adding some sound to silent films. Similarly, one of the many regions of studies and development is handwritten textual content reputation, which has a plethora of ability programs. Handwritten Recognition (HWR), many times also called as Transcribed textual content acknowledgment Handwritten Text Recognition (HTR), is the capability of a system to benefit and decipher comprehensible manually written input collected from various sources. On this paper, here used Convolution Neural network (CNN), support Vector Machines (SVM), and Multi-Layer Perceptron (MLP) models to perform handwritten digit reputation on MNIST datasets. The main objective is to determine the quality possible model for digit recognition with the aid of evaluating the accuracy and execution instances of the aforementioned models. The CNN model was able to give 99.53% accuracy on testing data.

[2] proposes a new type of handwritten digit recognition system based on convolutional neural network (CNN). In order to improve the recognition performance, the network was trained with a large number of standardized pictures to automatically learn the spatial characteristics of handwritten digits. For model training, according to the loss function, the convolutional neural network continuously updates the network parameters with the data set in MNIST, which contains 60,000 examples. For model test, the system uses the camera to capture the pictures composed of the images generated by the test data set of MNIST and the samples written by different people, then continuously processes the captured graphics and refreshes the output every 0.5 seconds.

[3] Deep learning has witnessed a significant evolution recently with growth in high-performance devices and research in the neural network. The central aspect of this paper is to discuss the deep learning concept ideas and problems faced during training the model and come with a solution for better accuracy, illustrated by digit recognition and prediction using a convolution neural network. The first part of the research focused on the techniques used for training models in neural networks and enlightened the previous study in digit recognition. The second half of the paper detailed the concept of the proposed model for digit recognition with

increased accuracy by preprocessing samples and ensemble of two or more models with different architectures and preprocessing. Preprocessing of samples and implementation of the model architecture is done using python.

[4] compares the performance of several classifier algorithms on a standard database of handwritten digits. We consider not only raw accuracy, but also training time, recognition time, and memory requirements. When available, we report measurements of the fraction of patterns that must be rejected so that the remaining patterns have misclassification rates less than a given threshold.

[5] discusses the Course Outcomes and its importance in the assessment of Program Outcomes and Program Education Objectives. The authors have presented a case study of Course Outcome assessment and attainment method implemented in their own institute. The course outcome assessment method along with direct assessment and indirect assessment tools, with the detail mathematical calculations is explained with the example values. The results of Course Outcome attainment are used by the staff members for the attainment of POs, PEOs and for improving the overall teaching learning process.

[6] Deep learning architectures use a set of layers to learn hierarchical features from the input. The learnt features are discriminative, and thus can be used for classification tasks. Convolutional neural networks (CNNs) are one of the widely used deep learning architectures. CNN extracts prominent features from the input by passing it through the layers of convolution and nonlinear activation. These features are invariant to scaling and small amount of distortions in the input image, but they offer rotation invariance only for smaller degrees of rotation. We propose an idea of using multiple instance of CNN to enhance the overall rotation invariant capabilities of the architecture even for higher degrees of rotation in the input image. The architecture is then applied to handwritten digit classification and captcha recognition. The proposed method requires less number of images for training, and therefore reduces the training time. Moreover, our method offers an additional advantage of finding the approximate orientation of the object in an image, without any additional computational complexity.

[7] Quality assurance and improvement process is about determining whether the set educational objectives meet a general standard of quality. Emphasis of outcome based education (OBE) system is on quantifying what the students are capable of doing and learning outcomes of the students is one of the key components. Course Outcomes are the statements indicating knowledge and skills the student is expected to acquire at the end of a course. Program outcomes represent the knowledge, skills and attitudes the students should have at the end of program. Program outcomes can be directly measured through course outcomes. The outcome based education model is based on defining various parameters called as Graduates Attributes. In this paper, an approach for measuring program outcomes attainment through course outcomes is presented. Course outcomes are attained based on assigning two step weights depending upon the nature of course and mapping of various exam heads with respect to course outcomes. The proposed method provides the result of course outcome attainment and program outcome attainment. The results are obtained through a program in MS Excel.

[8] Deep Convolutional Neural Networks - also known as DCNN - are powerful models for different visual pattern classification problems. Many works in this field use image augmentation at the training phase to achieve better accuracy. This paper presents blocky artifact as an

augmentation technique to increase the accuracy of DCNN for handwritten digit recognition, both English and Bangla digits, i.e., 0-9. This paper conducts a number of experiments on three different datasets: MNIST Dataset, CMATERDB 3.1.1 Dataset and Indian Statistical Institute (ISI) Dataset. For each dataset, DCNNs with the proposed augmentation technique give better results than those without such augmentation. Unsupervised pre-training with the blocky artifact achieves 99.56%, 99.83% and 99.35% accuracy respectively on MNIST, CMATERDDB and ISI datasets producing, in the process, so far the best accuracy rate for CMATERDB and ISI datasets.

Proposed methodology

The CO Attainment system leverages a three-tier architecture to automate mark reading, analyze curriculum achievement, and store the results securely. This breakdown details the functionalities of each tier:

The CO Attainment system operates on a three-tier architecture, consisting of:

Presentation Layer (Frontend): This user-facing layer provides a user interface for staff interaction.

Business Logic Layer (Backend): This layer handles core functionalities like deep learning model execution, data processing, and database interaction.

Data Layer: This layer manages data storage and retrieval, including answer script images, extracted marks, and curriculum outcome attainment data.

The frontend utilizes Python's Tkinter library to create a user-friendly graphical interface. Key functionalities include:

Course and Exam Selection: Staff can choose the specific course and exam for which they want to analyze curriculum outcomes.

Curriculum Outcome Input: A user-friendly interface allows staff to input question numbers associated with each curriculum outcome.

Data Visualization (Optional): The system can potentially display visualizations of curriculum outcome attainment data for better understanding.

The backend is the engine of the system, responsible for core functionalities:

Deep Learning Model: A pre-trained deep learning model, likely a Convolutional Neural Network (CNN), will be integrated to process uploaded answer script images. The model will be responsible for accurately extracting marks from the scripts.

Data Processing: The extracted marks data will be processed using the Pandas library. This involves filtering marks based on the input curriculum outcome question numbers and calculating the sum of marks achieved for each outcome.

Database Integration: The system will connect to a secure database (e.g., MySQL, PostgreSQL) to store the calculated curriculum outcome attainment data. This data will be accessible to authorized staff for further analysis and reporting.

API Integration (Optional): For scalability, the backend can be designed with an API (Application Programming Interface) to facilitate communication with external systems, if needed in the future.

This three-tier architecture ensures a modular and scalable design for the CO Attainment system. The clear separation of concerns allows for independent development and maintenance of each layer, making it adaptable to future enhancements and integrations.

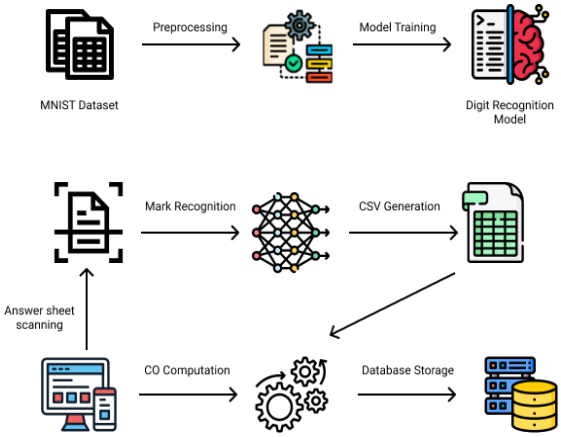

Fig 1: General System Architecture

Figure 1 shows the working and data flow of the entire system.

Implementation

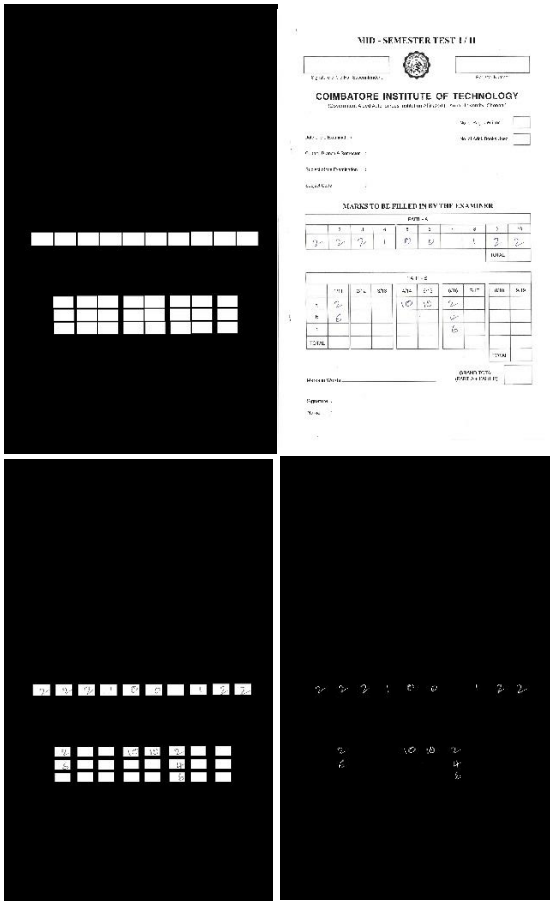

Fig 2: Extraction of mark regions

Figure 2 describes the extraction of regions where the marks would be entered by the staff. This is done by applying the mask image on the scanned answer script image. After extracting the regions of entered marks, the numbers in that regions are extracted.

Fig 3: Recognized Digits (28x28)

Figure 3 shows the images recognized digits from the answer script image

Fig 4: User Interface (Main Window)

Figure 4 depicts the user interface where the staff will be entering the data required for computing course outcome.

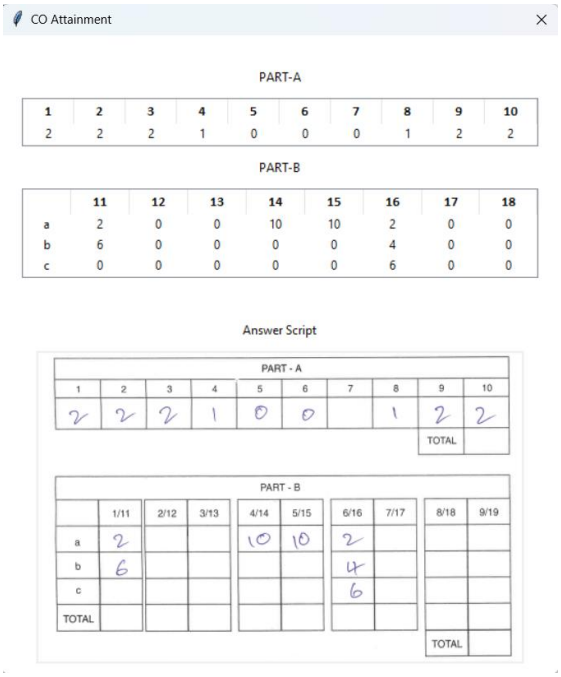

Fig 5: User Interface (Edit Window)

Figure 5 shows the interface for the staff to correct the discrepancies caused by the deep learning model.

Conclusion

The CO Attainment project revolutionizes curriculum outcome assessment by leveraging deep learning and data analysis. Automating mark reading with deep learning models frees up faculty time and enhances accuracy. Staff input on curriculum outcomes, coupled with extracted marks data, allows for data-driven analysis of student performance against learning objectives. Secure data storage and easy access empower informed decision-making for continuous program improvement. This scalable solution signifies a paradigm shift in assessment, paving the way for a more efficient and effective learning environment.

Reference

[1] Sachin Chauhan; Samar Mahmood; T. Poongodi. (2023). Handwritten Digit Recognition using Deep Neural Networks.

[2] Chao Zhang; Zhiyao Zhou; Lan Lin. (2020). Handwritten Digit Recognition Based on Convolutional Neural Network.

[3] Shailesh S Rajput; Yoonsuk Choi. (2022). Handwritten Digit Recognition using Convolution Neural Networks.

[4] L. Bottou; C. Cortes; J.S. Denker; H. Drucker; I. Guyon; L.D. Jackel; Y. LeCun; U.A. Muller; E. Sackinger. (2002). Comparison of classifier methods: a case study in handwritten digit recognition.

[5] Mousami Vanjale; Sachin Shelar; P. B. Mane. (2015). Assessment of Course Outcomes (COs) in University affiliated engineering programs - case study of Course Outcome attainment.

[6] Ayushi Jain; Gorthi R. K. Sai Subramanyam; Deepak Mishra. (2018). Rotation Invariant Digit Recognition Using Convolutional Neural Network.

[7] Pravin G. Kulkarni; Ami R. Barot. (2022). Attainment of Course Outcomes and Program Outcomes: A Case Study in an Engineering Course.

[8] Md Shopon; Nabeel Mohammed; Md Anowarul Abedin. (2017). Image augmentation by blocky artifact in Deep Convolutional Neural Network for handwritten digit recognition.