

KSCST Synopsis

- a) Title of the project: **ENCEPHALON – Solve and Learn**
- b) Name of the College & Department: **NEW HORIZON COLLEGE OF ENGINEERING.**
- c) Name of the Students & Guide(s) (with email id and cell no. if any):

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d) Keywords:

Handwritten equation solver

Convolutional Neural Networks (CNN)

Image processing

Mathematical equations and matrices

Graphing solutions

Coding platform

Quiz

Discussion forum

Collaborative learning

Accessibility

Efficiency

Engagement

Modern education

Computer vision

Character recognition

Polynomial equations

Logical operations

Trigonometric equations

Accuracy

Segmentation

Binarization

Connected component analysis

Mathematical Equation Solver

Deep Learning

Neural Network

AI & ML

Integrated Quiz Test on platform

All in One Platform

ENCEPHALON

e) Introduction / background (with specific reference to the project, work done earlier, etc) -

The intricacies involved in Human-Computer Interaction (HCI) are decreasing rapidly, allowing for more natural and easier interaction between humans and computers. This is due to advances in technology, such as handwriting recognition, natural language processing, and face detection. In this paper, we discuss a specific use case of handwritten mathematical equation recognition and solving. Currently, researchers rely on existing math engines and algebraic computer systems, which can be complex and time-consuming for simple equations. To simplify this process, we have developed a user-friendly tool that can capture the image of a mathematical equation, recognize the equation within it, and present the user with the solution. This tool can be integrated with any available mathematical device, and can also be used for other applications, such as automating the verification of mathematical claims in technical documents or exam paper evaluations.

Recognizing handwriting has been a focus in recent years, with numerous methods explored to enable computers to identify and classify handwritten symbols. Our application uses a custom-designed Convolutional neural network (CNN) to classify symbols with high accuracy. The application can solve simultaneous equations, plot graphs for expressions of any given degree, and act as a simple calculator for handwritten arithmetic expressions. Tutorials and editing capabilities are also included in the application.

Furthermore, the project provides a platform for testing mathematical and coding skills, allowing users to compete with others and receive grades. Links to learn coding and compilers

are also provided. This development is a major advancement in education and can greatly benefit those who want to learn, grow, and succeed.

f) Objectives

The project ENCEPHALON is to develop a reliable and accurate handwritten equation solver using Convolutional Neural Networks (CNN) with image processing techniques. The project aims to achieve high accuracy in solving various types of handwritten equations, including arithmetic, quadratic, and trigonometric equations, as well as logical operations (AND, OR, NOT, NAND, XOR, NOR). The application will also have the capability to extract text from images and provide a platform for users to learn and share educational content, take tests on various topics, and improve their coding skills in languages such as C, Python, and Java. The project aims to make learning an enjoyable experience for students in today's digital age by providing updated content, instant feedback, and performance monitoring. Additionally, the project will conduct user studies and surveys to gather feedback on usability, effectiveness, and user satisfaction, and explore the impact of the application on student learning outcomes. Its unique approach used in this project involves horizontal compact projection analysis and a survey for segmentation and binarization of handwritten equations. Connected component analysis and integrated connected component analysis methodologies are utilized for character classification using CNN. Character string operation is used for detecting characters in the polynomial. The project will also explore the integration of the application with other educational technologies such as virtual reality or augmented reality tools to enhance the visualization of mathematical concepts and make learning more interactive and exciting. Social learning features will be considered to allow students to collaborate and learn from each other in real-time. Furthermore, the project will conduct research to evaluate the effectiveness of mobile educational math apps in enhancing student performance and engagement and identify the most effective instructional strategies for using these apps in various educational contexts to improve the overall quality of math education.

g) Methodology (about 30 lines) (materials, methods, details of work carried out, including drawings, diagrams etc).

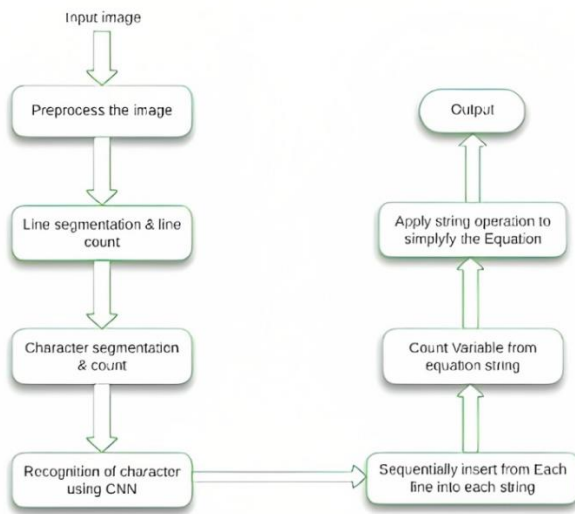


Diagram 1

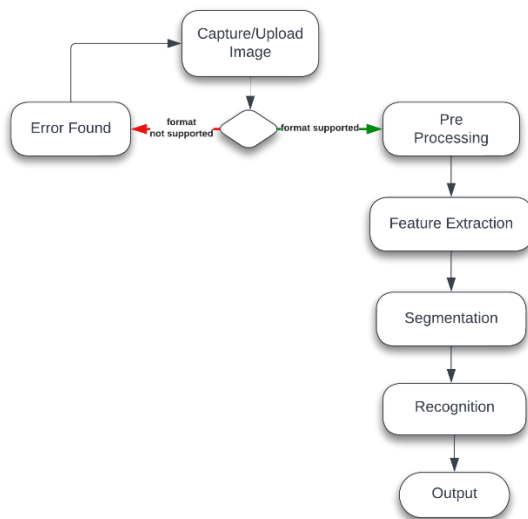


Diagram 2

1. Input Module:

The project begins by receiving handwritten image inputs in various formats such as jpg, jpeg, or png. The input module handles images of any size or resolution.

2.Pre-processing Module:

The pre-processing module is responsible for enhancing the quality of the input image and preparing it for further processing.

Image processing techniques, such as noise reduction and binarization, are applied to reduce noise and segment the input image into smaller sub-images. Binarization converts the image into a binary format.

3. Machine Learning Module:

utilizes a Convolutional Neural Network (CNN) that has been trained using image processing techniques, responsible for identifying and classifying the handwritten characters and symbols present in the input image.

The deep learning neural network accurately classifies the characters and converts them into ASCII values.

The trained CNN ensures accurate identification of the input .

4. Output Module:

The output module converts the identified handwritten input into a digital text format and presents it to the user.

The converted text is designed to be easily readable and understandable.

The output module may display the recognized equation or expression and provide a textual representation of the solution.

Additional Features of Encephalon:

Code Editor and Compiler:

Encephalon provides a code editor and compiler where users can write and execute code in languages such as C, Python, and Java.

Testing and Instant Feedback:

The platform provides tests on various topics, allowing users to assess their knowledge.

Architecture:

Encephalon adopts a client-server architecture.

The client-side comprises a web application that allows users to upload handwritten images and displays the results obtained from the server-side.

The server-side performs image processing, segmentation, classification, and solution generation.

Cloud computing services are utilized to ensure scalability and handle multiple users simultaneously.

User-Friendly Interface:

By incorporating these features and following the described working process, Encephalon aims to create an all-in-one platform that provides an enjoyable and engaging learning experience for students in the field of mathematics and coding.

h) Results and Conclusions (about 20 lines with specific reference to work carried out):

Regarding the ENCEPHALON project, its primary goal is to solve handwritten equations using machine learning concepts like deep learning and neural networks to achieve high accuracy. The app will also extract text from images and facilitate sharing and learning of educational content. Online learning has advantages like providing access to updated content, enabling immediate testing, and allowing coding in various languages such as C, Python, and Java. ENCEPHALON aims to assist modern students in focusing on practical knowledge and making homework and coding easier. The project involves a literature survey, code development, and testing to achieve its objectives.

i) What is the innovation in the project?

This project introduces an innovative approach to enhance mathematical learning by integrating various components into a comprehensive platform. Our augmented mathematical learning system combines a coding platform, quiz-taking platform, discussion forum, and mathematical equation solver, all designed to provide an immersive and collaborative learning experience. Furthermore, the system incorporates a graphing feature, enabling students to visualize mathematical concepts with ease. This integration not only streamlines the learning process but also fosters an interactive environment for students and educators alike.

Traditional methods of learning mathematics often lack interactivity and fail to address the diverse needs of learners. To overcome these limitations, our innovative platform integrates several key components to create a comprehensive solution. By incorporating a coding platform, quiz-taking platform, discussion forum, mathematical equation solver, and graphing feature, we aim to revolutionize the way mathematics is taught and learned.

Coding Platform: The addition of a coding platform empowers students to apply their mathematical knowledge in practical coding exercises. This feature allows learners to explore the real-world applications of mathematical concepts, fostering critical thinking and problem-solving skills.

Quiz-Taking Platform: To assess understanding and reinforce learning, our platform includes a quiz-taking platform. Students can access a wide range of quizzes tailored to various mathematical topics, providing instant feedback and opportunities for self-assessment.

Discussion Forum: Promoting collaborative learning, our system integrates a discussion forum where students can engage in meaningful discussions, seek assistance, and share insights. This fosters a sense of community and encourages active participation among learners.

Mathematical Equation Solver: The core functionality of our platform lies in the inclusion of a handwritten equation solver. This advanced feature utilizes machine learning algorithms to interpret and solve handwritten equations, eliminating the need for manual calculations and providing immediate solutions.

Graphing Feature: Understanding mathematical concepts often requires visual representation. Our platform offers a graphing feature that generates accurate graphs based on input equations. This visual aid enhances comprehension and enables students to explore the relationship between equations and graphs effortlessly.

Conclusion: By integrating coding, quizzes, discussions, equation solving, and graphing capabilities into a single platform, our augmented mathematical learning system transforms the way mathematics is taught and learned. The comprehensive nature of this platform fosters a holistic understanding of mathematical concepts, encourages collaboration, and provides an immersive learning experience for students. This innovation holds great potential to revolutionize mathematical education and empower learners to excel in their mathematical journey.

j) Scope for future work (about 20 lines).

Learning problem-solving skills is essential for everyone, and advancements in information technology and scientific innovations in teaching methods have led to modern teaching methods. These methods, starting with the scientific calculator and progressing to video teaching tapes, electronic equipment, multimedia, and computer programs, have shown improved results in the teaching of mathematics compared to classical methods that relied on the blackboard and other traditional instruments. However, it is crucial to select the most suitable modern teaching methods for the subject, place, and educational environment.

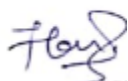
The project's aim is to develop an app that can solve mathematical problems with just a picture. The app provides clear visualization of problems in 3D planes, not only solving the problem but also giving a clear visual understanding along with proper explanations in just a few seconds. The project also includes other features such as code compilation and 3D modeling of mathematical equations.

So overall, In the future, this project can be extended by enhancing the app's functionality to include more complex mathematical concepts and problem-solving techniques. The use of advanced machine learning algorithms can be incorporated to recognize and solve a more extensive range of mathematical problems. Furthermore, the app can be optimized for different learning contexts, including online courses or personalized tutoring sessions. In addition, future work can explore the integration of the app with other educational technologies like virtual reality or augmented reality tools to enhance the visualization of mathematical concepts and make learning more interactive and exciting. Additionally, the app can include social learning features, allowing students to collaborate and learn from each other in real-time.

Lastly, further research can be conducted to evaluate the effectiveness of mobile educational math apps in enhancing student performance and engagement. The research can also identify the most effective instructional strategies for using these apps in various educational contexts. By addressing these areas, the effectiveness and accessibility of mobile educational math apps can be improved, enhancing the overall quality of math education.

After completing with the approval of guide pls upload .

Name & signature of Guide:



Ms. Florance G

