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ClassEmoAnalytix: Sentiment and Emotion Identification for Real-time Student Facial Expression

Shivanand C Hiremath, Keerti M. Shahapur, Nikita R. More, Nikita A. Gunagi, Shravana H. Hucharaddi

Visvesvaraya Technological University, Belagavi
SG Balekundri Institute of Technology, Engineering school in Belgaum, Karnataka
Shivanandch@sgbit.edu.in

ABSTRACT.

"ClassEmoAnalytix" pioneers real-time facial expression examination in classrooms utilizing cutting-edge innovation. It points to precisely de tect and categorize students' feelings, giving teachers with quick bits of knowledge into their enthusiastic states. Conventional strategies regularly ignore unobtrusive prompts, but "ClassE-moAnalytix" captures a wide extend of feelings like bliss, perplexity, and disappointment, empowering teachers to adjust instructing strategies accordingly.The system's centrality lies in its potential to make a more candidly cleverly instructive environment. Teachers can tailor their approaches in real-time, interceding instantly to back understudies encountering challenges. "ClassEmoA-nalytix" accomplishes this through progressed calculations prepared on broad facial expression datasets, guaranteeing precise acknowledgment of differing emotions. Further-more, the framework advances ceaselessly through machine learning, refining its ana-lyses over time. Past classroom applications, "ClassEmoAnalytix" offers in-sights instructive inquire about, advising the improvement of more compelling educating procedures and mediations. In outline, "ClassEmoAnalytix" speaks to a sig-nificant headway in instruction innovation, giving teachers with invalua-ble instruments to upgrade learning encounters and back students' passionate well-being.

Keywords: Video Processing, OpenCV, Machine Learning, Emotion Analysis

1. Introduction

ClassEmoAnalytix" addresses the restrictions of conventional evaluation strategies in capturing nuanced understudy criticism by coordination Django, SQLite, and OpenCV. This mix of advances empowers real-time video information handling and investigation, em-powering teachers with proactive experiences into understudy comprehension levels amid addresses. By presenting assumption investigation, the extend fills a basic hole in conven-tional instruction frameworks, assessing understudy engagement and fulfillment amid live addresses. In the advanced time of virtual and mixed learning, understanding students' real-time comprehension levels gets to be significant. The system's engineering, counting video capture and opinion investigation models, coupled with a user-friendly Django-based interface, encourages effective information visualization and educated decision-making for educators.

Beyond its innovative components, "ClassEmoAnalytix" guarantees to change conventional appraisal hones, allowing teachers uncommon flexibility based on prompt criticism. By wedding innovation with instructional method, the venture makes a energetic and responsive instructive environment, adjusting with the advancing needs of present day learners and teachers. Through machine learning and real-time examination, the framework offers personalized educating techniques custom-made to person enthusiastic needs, contributing to made strides student-teacher communication and optimized instructive experiences.

The venture points to bridge the crevice between conventional appraisals and passionate angles of learning, leveraging facial expression examination to give real-time bits of knowledge into understudy assumptions. By joining passionate insights into instructive hones, "ClassEmoAnalytix" aims to make comprehensive and locks in learning environments, where understudies feel caught on, bolstered, and propelled to take part effectively. This input not as it were yields valuable experiences. A Opinion Anal-ysis Framework to Make strides Educating and Learning for college directors and educates but moreover plays a key part in impacting understudy choices on which univer-sities to go to or courses. A framework that naturally parses client comments to distinguish specific feelings and their particular seriousness would permit suppliers to rapidly distinguish clients in emergency, permitting them to prioritize reactions, and in this way, po-tentially deflect undesirable results. Such a framework may moreover offer assistance give a large scale see of the relative predominance of different passionate and mental issues among benefit clients

Most of these datasets have been utilized as preparing and test sets, and these feeling classification approaches have been utilized to create machine learning calculations to classify feelings in content, in spite of a few rule-based approaches. In specific, a few work includes development of feeling assets.
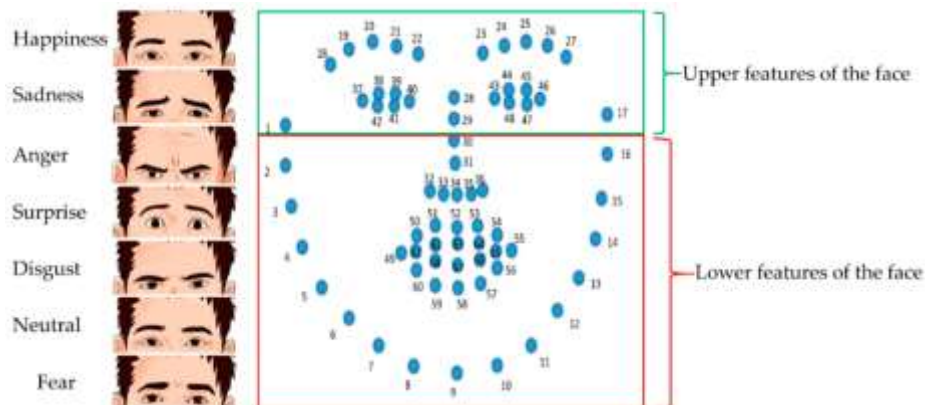

Figure 1: Facial investigation focuses utilized for facial expression.

With the improvement of fake insights and profound learning, numerous FER calculations have been proposed to bargain with the expression data in facial representations, which has made strides the exactness of acknowledgment slowly and accomplished way better execution than conventional strategies.The errands of FER can be primarily isolated into two categories: inactive pictures (spoken to by photos) and energetic grouping (spoken to by recordings) that take the energetic relationship between the ceaselessly changing pictures into account and subsequently posture extra challenges than the previous. In expansion to the vision-based strategies, other biometric strategies can moreover be embraced to help the acknowledgment of expression. Adequate labeled preparing databases that incorporate as numerous varieties of the populaces and situations as conceivable are critical for analysts to plan and test a FER show or framework; the existing databases are primarily isolated into controlled and uncontrolled. On one hand, the controlled databases, spoken to by CK+ Jaffe, and MM, are collected from research facility situations with adequate light and basic foundations. These days, since most genuine scenes are complex and changeable due to components such as lighting, FER in inquire about office or controlled circumstances is by and huge con-sidered to be of little reasonable significance and utilized essentially for the confirmation of concept of highlights extraction and classification methodologies. On the other hand, the uncontrolled databases, such as FER2013 and AFEW , are collected from complex circumstances with perpetually different establishments, occlusions, and enlightenments; these scenes are more comparable to the genuine circumstances and have been dynamically utilized in more and more asks almost.

2. Literature Review

Sujata Rani et al.[1], deliberates about Investigation Framework in instruction can enhance teaching and learning by analyzing students' estimations towards course materials, teaches, and by and large learning encounter. By capturing input in real-time, teachers can adjust their educating strategies to address students' needs and inclinations, eventually cultivating a more locks in and compelling learning environment**.** F.-L. Jang et al. [2], deliberates about psychiatric archive recovery utilizing a discourse-aware demonstrate includes creating progressed calculations able of understanding the nuanced dialect and setting inside psychiatric reports. By consolidating discourse-awareness, this show can recover important archives more precisely, moving forward data get to for mental wellbeing experts. This approach improves the proficiency and adequacy of psychiatric inquire about, conclusion, and treatment arranging by giving custom fitted and comprehensive data recovery.

L.-H. Xu. et al. [3], discuss about the development and investigation of an enthusiastic corpus include making a database of content containing different feelings communicated by people. This corpus serves as a important asset for opinion investigation, feeling acknowledgment, and common dialect preparing inquire about. Through point by point investigation, analysts can reveal designs, patterns, and etymological markers related with diverse feelings, encouraging the improvement of more exact feeling location calculations and applications over different spaces such as brain research, promoting, and human-computer interaction.

C. Ying, et al. [4], proposes a cognitive-based explanation framework for feeling computing upgrades feeling investigation by considering cognitive perspectives like discernment and elucidation nearby emotional states. This approach gives more profound bits of knowledge into enthusiastic encounters and makes strides the exactness of feeling acknowledgment models, profiting different spaces counting healthcare and human-computer interaction. H. Wang, et al.[5] deliberates about making Chinese feeling dictionaries utilizing a graph-based calculation and different assets includes creating comprehensive databases of Chinese words explained with passionate implications. By leveraging a graph-based approach and combining different phonetic assets, such as word references and corpora, this strategy upgrades the exactness and scope of emotion-related terms in Chinese. These vocabularies serve as important instruments for assumption investigation, feeling acknowledgment, and characteristic dialect handling assignments in Chinese content, profiting applications extending from social media checking to mental investigate.

Y. Changhua et al.[6], deliberates on "Building feeling vocabulary from weblog corpora" involves extricating enthusiastic terms and estimations from weblogs to make a comprehensive database. This dictionary helps assumption investigation and feeling discovery in online substance, giving profitable experiences into open opinion and conclusion patterns. By leveraging the tremendous sum of information accessible in weblogs, this approach upgrades our understanding of enthusiastic expressions in advanced communication. TulikaSaha, et al.[7], implements a Multitask Multimodal Outfit Demonstrate coordinating estimation and feeling investigation to classify tweet acts. By leveraging numerous modalities, such as content and pictures, this show makes strides classification exactness and captures nuanced expressions in social media substance. This approach upgrades understanding of client eagerly and opinions in tweets, profiting applications like social media checking and supposition investigation.

Jacob Whitehill, et al.[8] deliberates on "The Faces of Engagement" centers on naturally recognizing understudy engagement levels through facial expressions investigation. By leveraging facial acknowledgment innovation, this inquire about points to improve educating adequacy and understudy learning encounters. This approach offers bits of knowledge into real-time engagement elements, helping teachers in adjusting their educating procedures appropriately. Hangyu Li, et al.[9] implements using "Adaptively Learning Facial Expression Representation" includes refining facial expression understanding utilizing C-F names and refining strategies. By consolidating relevant and fine-grained names, this strategy makes strides the exactness and flexibility of facial feeling acknowledgment models. The approach upgrades the capacity to decipher unobtrusive facial prompts, profiting applications like full of feeling computing and human-computer interaction.

N. Altrabsheh, et al.[10] deliberates on "SA-E: Opinion Examination for Instruction" centers on applying opinion investigation strategies to instructive settings. By analyzing understudy estimations, this approach points to make strides instructing methodologies, improve learning encounters, and distinguish regions for instructive mediation. It empowers teachers to tailor their strategies to superior meet understudy needs and cultivate a steady learning environment.

3. Proposed Methodology

A. Capture Video During Lectures using OpenCV:

OpenCV Integration: Consolidate OpenCV to get to and associated with the webcam for video capture.Webcam Setup: Design OpenCV to capture video streams in real-time amid lectures.Frame Handling: Prepare each outline to extricate significant data, guaranteeing productive video capture.Continuous Capture: Actualize a circle for nonstop video capture, making a video stream for advance examination.

B. Perform Sentiment Analysis on Video Content:

Facial Expression Examination: Create calculations to analyze facial expressions in each outline. Assumption Scoring: Actualize machine learning models prepared on sentiment-labeled datasets to relegate assumption scores based on facial expressions.Real-time Examination: Empower real-time opinion investigation on the captured video substance, generat-ing opinion scores for each frame.Integration with Django: Interface the assumption investigation module with the Django web application for consistent interaction.Develop a Django Web Application for Information Visualization:

C. Django Project Initialization:

Begin a unused Django venture and design the essential settings.User Verification: Execute client confirmation components for secure access.Web Pages Develop-ment: Make web pages for video gushing, opinion examination comes about, and the information visualization dashboard.Django Channels for Real-time Overhauls: Coordinated Django channels to set up WebSocket communication, permitting real-time upgrades from the estimation examination module.

D. Implement a Prediction Model for Student Understanding:

Information Integration:Combine assumption scores with relevant information such as facial ex-pressions' term and mindfulness patterns.Feature Building: Distinguish key fea-tures characteristic of understudy understanding, considering assumption patterns over time and intelligently behaviors.Machine Learning Demonstrate Improvement: Prepare a forecast demonstrate, conceivably a relapse or classification demonstrate, to figure understudy understanding levels based on the distinguished features.

Training and Approval: Prepare the demonstrate utilizing a labeled dataset and approve its exactness and execution utilizing partitioned data.Integration with Django: Join the forecast demonstrate into the Django web application for real-time upgrades on understudy understanding levels.

This point by point breakdown outlines the step-by-step usage of video capture, assumption investigation, Django web application improvement, and the integration of a expectation show for understudy understanding. The cohesive integration of these components gives teachers with a comprehensive apparatus for evaluating and adjusting to real-time understudy engagement and comprehension amid addresses.

III. a) Architecture Overview
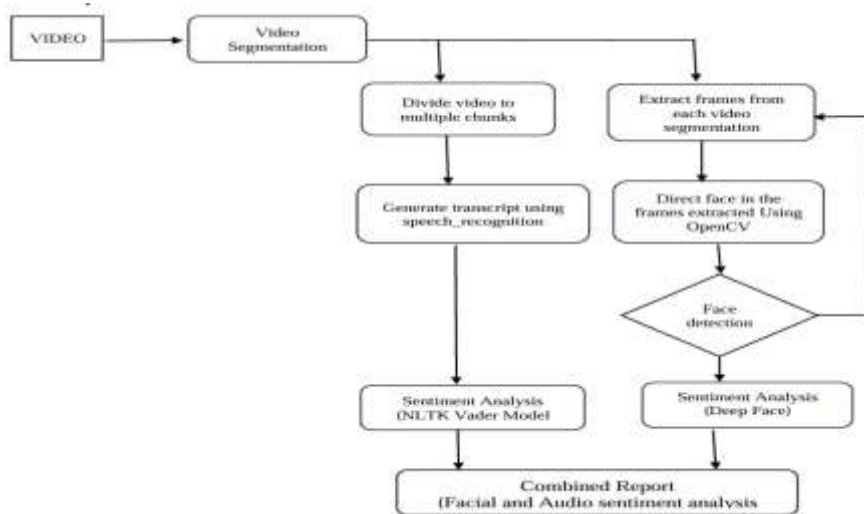
1. Video Chunking: Partition the input video into different chunks to encourage handling. This step makes a difference in overseeing theanalysis of expansive recordings proficiently.

2. Transcript Generation: Utilize discourse acknowledgment techniquesto change over sound substance from each video chunk into a literary transcript. This may include utilizing instruments like Google's Speech-to-Text or other appropriate APIs.

3. Sentiment Analysis: Apply wistful investigation to the produced transcript. For this extend, you've specified utilizing the NLTK Vader demonstrate. NLTK's Vader (Valence Mindful Word reference and sEntimentReasoner) is a apparatus planned for estimation examination that considers both the extremity and concentrated of assumptions in content. This engineering permits real-time investigation of facial expressions by breaking down the prepare into reasonable steps, empowering proficient estimation and feeling distinguishing proof from understudy facial expressions.

 4.Frame Extraction: Extricate outlines from each video section to get person pictures. This is ordinarily done at normal interims to capture a arrangement of outlines speaking to the substance of the video.

5. Face Detection with OpenCV: Utilize OpenCV (Open Source Computer Vision) for confront location in the extricated outlines. OpenCV gives pre-trained models for confront discovery, such as Haarcascades, which can distinguish faces inside pictures.

 6. Sentiment Analysis with Deep Face: Apply conclusion examination utilizing Significant Go up against, which is a significant learning-based go up against examination library. Significant Go up against can be utilized to analyze facial expressions and remove supposition information from the distinguished faces. It frequently incorporates neural frameworks arranged on facial feeling datasets.

III. b) Data flow:

Opinion examination at that point categorizes input into positive, impartial, or negative senti-ments. Visualizing patterns helps teachers in recognizing ranges for improvement.An alarm framework informs of pressing issues, cultivating a nonstop enhancement circle.

1. Data Collection: Assemble facial expression information from real-time understudy intuitive utilizing cameras or sensors. Guarantee different tests to capture a wide run of feelings and opinions. Explain information with comparing names showing the feeling or estimation communicated.

2. Data Preprocessing: Clean and standardize the collected information, tending to clamor and exceptions. Normalize pictures for reliable lighting conditions.Crop or resize pictures to center on facial expressions.Split the dataset into preparing and testing sets.

3. Feature Extraction: Consider progressed methods like profound learning for programmed highlight extraction. Change and speak to facial highlights in a organize reasonable for machine learning calculations

4.Sentiment Identification: Utilize strategies like Characteristic Dialect Handling (NLP) to analyze printed information related to the understudy interactions.Use opinion dictionaries or pre-trained models to distinguish the in general assumption communicated.

5. Sentiment Classification: Prepare a machine learning show (e.g., Back Vector Machines, Neural Systems) on labeled information to classify opinions. Fine-tune the show utilizing the preparing set to im-prove classification accuracy.Evaluate the demonstrate on the testing set to guarantee generali-zation to unused information.

6. Subjective Identification: Create calculations to recognize subjective expressions, capturing subtleties past fundamental sentiments.Leverage relevant data and multi-modal information (e.g., facial expressions combined with voice tone) for improved subjective investigation.

7. Application of Machine Learning Calculation for Preparing & Testing: Select fitting machine learning calculations based on the nature of the issue (classification, regression).Train the chosen calculations on the planning set, modifying hyperparame-ters for perfect performance.Evaluate the models on the testing set to overview their pre-cision, exactness, audit, and F1- score.

8. Output Presentation: Visualize comes about utilizing charts, charts, or disarray frameworks to exhibit the perfor-mance of the model.Implement a user-friendly interface to show real-time estimation and feeling analysis.Provide noteworthy experiences and suggestions based on the distinguished assumptions for teachers or pertinent partners.

4. RELATED THEORIES

A Convolutional Neural Organize (CNN) is a profound learning demonstrate particularly de-signed for preparing and analyzing visual information, such as pictures. It comprises mul-tiple layers, counting convolutional layers for include extraction, pooling layers for dimensionality lessening, and completely associated layers for classification. CNNs have revolutionized errands like picture classification, question discovery, and picture segmenta-tion, accomplishing state-of-the-art execution in different computer vision applications.

VGG and ResNet are particular models inside the domain of Convolutional Neural Systems (CNNs), with VGG known for its uniform structure and ResNet for its presentation of leftover associations, both contributing altogether to the advance-ment of picture acknowledgment errands inside the broader field of CNNs.

The ordinary convolutional neural organize more direct than the profound convolutional neural organize. The profound convolutional neural systems prepared with a huge number of information to extricate more highlight maps to prepare organize impeccably. The concept of the profound convolutional neural arrange we utilized in our explore. Weused the VGG organize as our base arrange. To prepare VGG arrange require a part of time, and it has a few localization issue. To recoup the issue, we included a few additional layer in VGG organize that progresses the exactness. The proposed design appears in Fig 3. To extricating include maps, the primary commitment comes from conv4 and con5. To make all include maps the same measure from these two layers we evacuated 4th maxpooling from unique VGG organize. Additionally, collect more little data we passed the yield of conv4 and con5 to 3×3 convolutional layer(conv6). The yield of conv6 passes through to made strides ResNet arrange. The adjusted ResNet arrange gathers sets of 1×1 and 3×3 convolutional layers. To minimize the computation taken a toll we utilized 1×1 convolutional layer to compress the information by the bottleneck strategy. At that point the yield passes to the 3×3 convolutional neural arrange to extend the information once more and recoup the mistake information. The ResNet arrange utilized as a aide organize in this test. That too works as a bank of data. This data utilized as actuation of completely associated layers.The completely associated layers protect this data that makes a difference to minimize the preparing misfortune and increment location exactness.
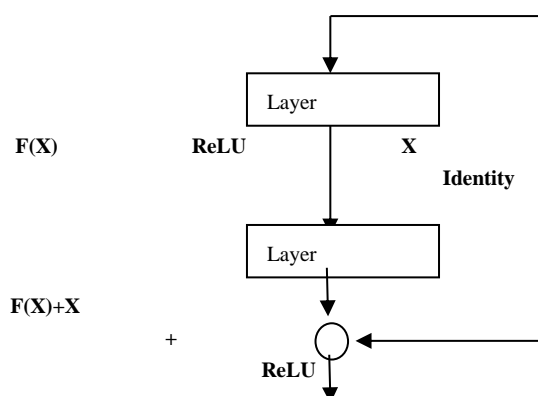
$$F(X) := H(X) - X \text{ which gives } H(X) := F(X) + X$$

1. Residual Block Concept: In a ResNet, (F(x)) represents a residual function to be learned by network, and (H(x)) is the wanted basic mapping (or character mapping) that we need to learn. The objective is to surmised (H(x)) straightforwardly through (F(x)) such that (H(x) approx F(x) + x).

2. Residual Learning: Instead of directly learning the mapping (H(x)) (as in traditional networks), ResNets learn residuals (F(x)) with respect to the input (x). By doing so, the network learns to predict the difference or residual between the current input (x) and the desired mapping (H(x)).

3. Identity Mapping: The identity mapping (x) is used to propagate the input directly through the network without any change (when (F(x) = 0)). This approach is crucial because it helps in alleviating the vanishing gradient problem and makes it easier for the network to learn.

4. Mathematical Interpretation: Given (F(x) := H(x) - x), rearranging the equation gives (H(x) = F(x) + x). This means that the network aims to predict (H(x)) by adding the residual (F(x)) to the input (x).

5. Discussion

Real-timeSentimentAnalysisDuringLectures:Enable real-time sentiment analysis during lectures by integrating OpenCV for video stream capture from the webcam. Analyze facial expressions using algorithms within each frame. Utilize machine learning models to assign sentiment scores based on recognized expressions. Implement continuous analysis for instantaneous feedback throughout the lecture. Integrate Django channels for WebSocket communication, enabling immediate updates on sentiment scores in the web application.

Coordinated assumption scores with relevant information, like length of positive expressions and engagement designs. Recognize prescient highlights and create a machine learning demonstrate (e.g., relapse, classification) to estimate understudy understanding levels. Implant the show into the Django web app for real-time overhauls on anticipated understanding. Plan an instinctive dashboard utilizing HTML/CSS/JavaScript for information visualization. Incorporate a devoted page for real-time opinion examination comes about and visualizations of understanding levels. Guarantee responsiveness over gadgets. Secure get to with client confirmation. Utilize Django channels for WebSocket communication, empowering consistent overhauls on opinion scores and understanding levels.

In this try, the VGG arrange served as the establishment for our strategy. The results portrayed in Fig. 4 illustrate its viability in recognizing multi-scale objects with surprising exactness. Moreover, it successfully minimizes computation costs and decreases layer measurements, upgrading the network's execution in precisely identifying human feelings.
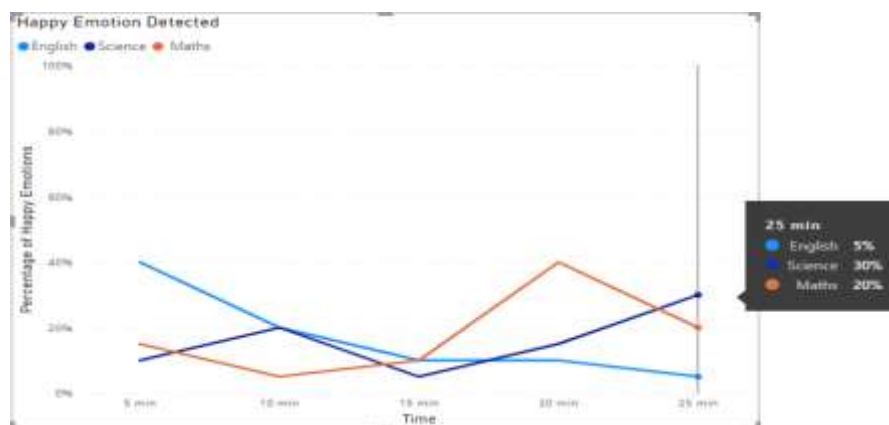
6. Results Analysis

Fig. 1a Happy Emotion Detection Report

Recognizing Happy feelings in a line chart includes taking note upward patterns or reliable high execution over subjects like maths, science, and English. An generally increment or reliably high scores over time might demonstrate fulfillment or happywith scholarly advance. Steady or making strides designs over all subjects might moreover propose positive feelings.
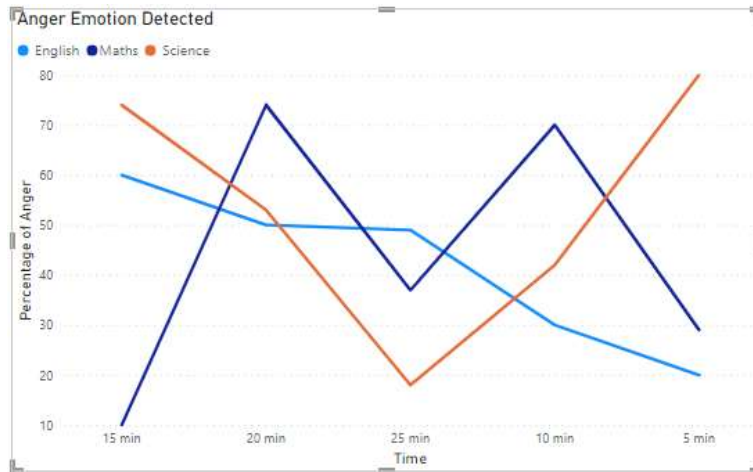
Fig.1b Angry Emotion Detection Report

Outrage may be reflected in a line chart by sharp decreases or whimsical vacillations in execution over subjects such as maths, science, and English. These sudden changes may show dissatisfaction or disappointment with scholastic results
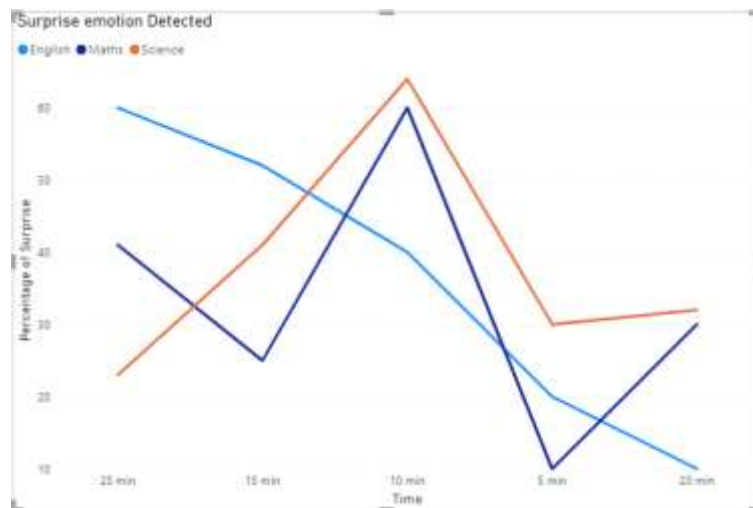

Fig.1c Surprise Emotion Detection Report

Surprise emotion may be watched in a line chart through sudden spikes or startling deviations in execution over subjects like maths, science, and English. These unexpected changes might demonstrate unanticipated components affecting scholastic advance.
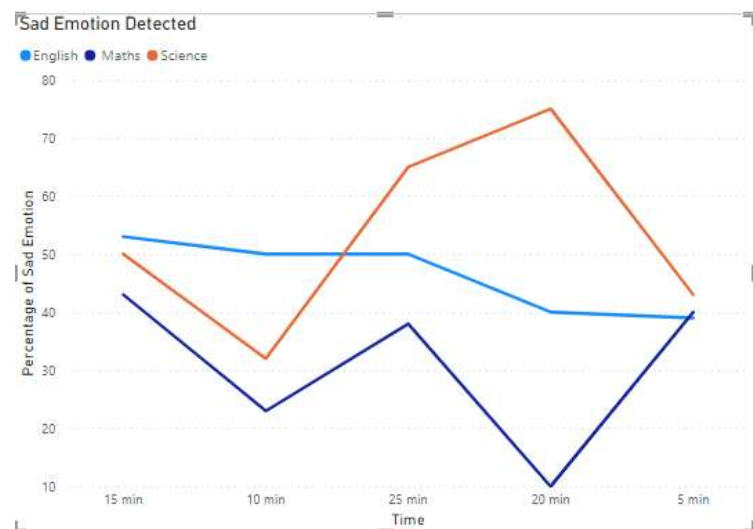

Fig. 1d Sad Emotion Detection Report

Identifying sad feelings in a line chart includes watching pattern over time for subjects like maths, science, and English. A reliable decay or lower execution over different subjects might demonstrate sad. Sudden drops or fluctuating designs might too propose passionate trouble or disappointment with scholastic advance.
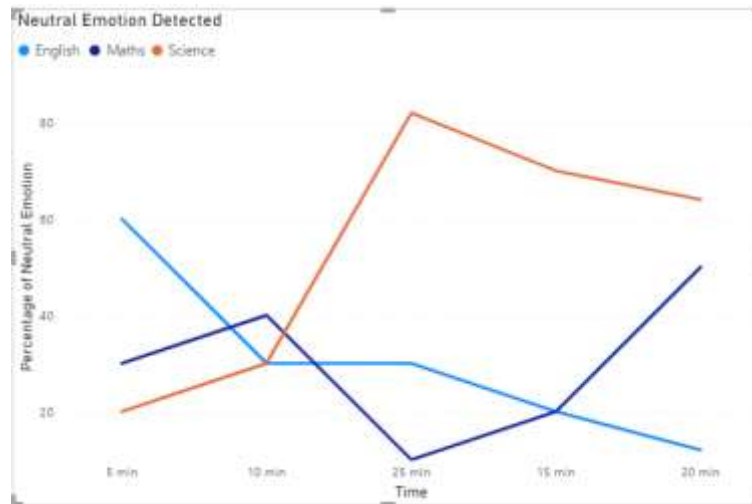

Fig.1e Neutral Emotion Detection Report

Neutral feelings in a line chart may show as steady or reliable execution over subjects like maths, science, and English without noteworthy changes or patterns. The non attendance of eminent increments or diminishes recommends a adjusted and sincerely unbiased reaction to scholastic advance.
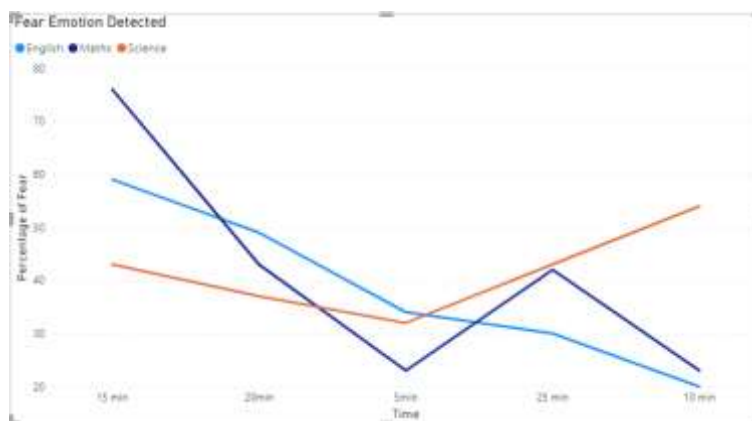

Fig.1f Fear Emotion Detection Report

Fear might be apparent in a line chart if there are sudden drops changes in execution over subjects like maths, science, and English. These startling changes may demonstrate uneasiness or trepidation almost scholarly execution.

The assignment includes making a line chart portraying feeling discovery over time, with feelings such as Happy, Fear, Surprise, Angry ,Sad, Neutral to on the y-axis as rates. The x-axis would speak to time interims of 5 to 25 minutes, with partitioned line charts for distinctive subjects like maths, science, and English, exhibiting how feelings change over these classes over time.

7. Conclusion

"ClassEmoAnalytix" stands at the cutting edge of instruction innovation, advertising a groundbreaking arrangement for real-time opinion and feeling recognizable proof in classrooms. Its inventive approach empowers exact discovery and categorization of students' feelings, giving instructors with quick bits of knowledge into their passionate states. By capturing a wide extend of feelings such as bliss, perplexity, and disappointment, "ClassEmoAnalytix" enables teachers to tailor their educating methodologies appropriately, cultivating a more candidly shrewdly instructive environment.

Traditional strategies regularly neglect unpretentious signals, but "ClassEmoAnalytix" bridges this crevice by leveraging progressed calculations prepared on broad facial expression datasets. This guarantees exact acknowledgment of different feelings, permitting instructors to mediate instantly and bolster understudies confronting challenges. The system's ceaseless change through machine learning encourage upgrades its expository capabilities over time.

Beyond its quick classroom applications, "ClassEmoAnalytix" contributes profitable experiences to instructive inquire about, educating the advancement of more successful educating strategies and mediations. By giving instructors with priceless devices to improve learning encounters and bolster students' enthusiastic well-being, "ClassEmoAnalytix" envoys a noteworthy progression in instruction technology.

In conclusion, "ClassEmoAnalytix" envoys a critical headway in instruction innovation. Its capacity to give instructors with important apparatuses for upgrading learning encounters and supporting students' enthusiastic well-being marks a significant step forward. As it proceeds to advance through machine learning and educates instructive inquire about, "ClassEmoAnalytix" guarantees to contribute significantly to making a more sincerely brilliantly and compelling instructive scene.

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