**Project “Education MindA.I.lytics”**

Team members:

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Github project repository link:

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We certify that this submission is the original work of members of the group and the Faculty’s Expectations of Originality.

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**ABSTRACT**

# Welcome to Education MindA.I.lytics, a groundbreaking initiative propelling the evolution of AI-driven academic feedback. In this pivotal first stage of our project, we delve into the intricacies of data collection, cleaning, labeling, and preliminary analysis to pave the way for a robust and innovative system.

# Our goal is to develop a cutting-edge solution that harnesses the power of real-time facial expression analysis to discern the nuanced responses of students during academic interactions. Through meticulous data collection, we accumulate a diverse set of facial expressions, capturing the essence of curiosity, engagement, neutrality, and cognitive overload. This rich dataset forms the cornerstone for training our AI model.

# The data cleaning process is a crucial step, ensuring the removal of noise and irrelevant information, thereby enhancing the accuracy and reliability of our model. Concurrently, meticulous labeling adds depth to our dataset, enabling the model to distinguish subtle variations in facial expressions with precision

# As we embark on preliminary analysis, we aim to uncover patterns and trends within the data, laying the foundation for the subsequent stages of our project. The ultimate vision is to present educators with a sleek dashboard, offering instantaneous insights into student engagement levels - 30% engaged, 20% neutral, 10% nearing cognitive overload. This dashboard empowers instructors to tailor their teaching strategies based on real-time feedback, fostering an enriched and adaptive learning environment.

# Education MindA.I.lytics represents a bold leap towards a future where AI transforms the educational landscape, providing educators with invaluable tools for responsive and personalized teaching methodologies.

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# Dataset

## Dataset overview.

The dataset encompasses a variety of images reflecting diverse emotions, including happiness and neutrality. Primarily, the images showcase frontal shots of faces set against varied backgrounds. An interesting aspect of this dataset is its broad demographic representation, spanning ages from babies to the elderly, encompassing distinct races, and encompassing various genders. Additionally, the dataset exhibits specific characteristics, such as:

* Side-view images, where the complete facial structure may not be visible.
* Artistic renderings, featuring drawings and sketches among the images.
* Instances where individuals in the images are wearing sunglasses, adding a unique element to the dataset.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Type of dataset | Emotion Categories | Number of images | Total images / dataset | Total images |
| Training dataset | angry | 3995 | 28709 | 35887 |
| disgusted | 436 |
| fearful | 4097 |
| happy | 7215 |
| neutral | 4965 |
| sad | 4830 |
| surprised | 3171 |
| Testing dataset | angry | 958 | 7178 |
| disgusted | 111 |
| fearful | 1024 |
| happy | 1774 |
| neutral | 1233 |
| sad | 1247 |
| Surprised | 831 |

## Dataset justification.

The motivation for selecting these datasets for the project lies in their unique characteristics and direct relevance to the objectives of facial emotion recognition. The datasets were specifically chosen for the following reasons:

* *Emotional Diversity*: The datasets comprehensively cover a spectrum of emotions, prominently featuring happiness, neutrality, surprise, sadness and even Anxiety. This aligns seamlessly with the project's overarching goal of crafting a robust emotion recognition system.
* *Demographic Representation*: The inclusion of diverse age groups, races, and genders within the datasets contributes to the creation of a comprehensive dataset. This diversity enhances the model's capacity to generalize effectively across a wide range of demographic categories.

However, these datasets present specific disadvantages:

* *Side-View Complexity*: The inclusion of side-view images, where facial structures may be partially obscured, introduces complexity to the recognition task. This challenge requires the model to navigate instances where the facial expression might be misinterpreted as anger, despite the person actually expressing a neutral emotion.
* *Watermarked Images*: A further challenge is presented by certain images within the dataset bearing watermarks.
* *Artistic Variations*: The dataset's incorporation of artistic renderings and instances featuring individuals wearing sunglasses adds variations that necessitate the model's adept handling for accurate recognition.

In addition, there are number of challenges for the AI model to learn:

* *Subtle Facial Expressions*: Teaching the model to accurately recognize subtle changes in facial expressions, especially those indicative of nuanced emotions like mild surprise or slight discomfort.
* *Diverse Demographics*: Ensuring the model can generalize well across diverse demographic groups, including different age ranges, ethnicities, and genders, to avoid bias and improve inclusivity.
* *Dynamic Environments*: Adapting to variations in lighting conditions, background settings, and dynamic environments to maintain accurate recognition in real-world scenarios.
* *Subject-Specific Challenges*: Handling cases where individuals have unique facial features or characteristics, such as beards, glasses, or distinctive hairstyles, which might impact facial expression analysis.
* *Ambiguous Expressions*: Addressing situations where facial expressions are ambiguous or mixed, making it challenging to categorize them into a single emotion category accurately.

These challenges contribute to the model's overall learning experience, fostering adaptability and accuracy in recognizing facial emotions across a wide array of situations and individuals.

## Provenance Information.

* Source of images:

“https://drive.google.com/file/d/1X60B-uR3NtqPd4oosdotpbDgy8KOfUdr/view”

* Collection methodology: Download.
* License: CC0: Public Domain (CC0 1.0 DEED – CC0 1.0 Universal)

# Data Cleaning

## Cleaning techniques and methods.

* Manual visual inspection: checking for clarity, any artifacts that might affect the interpretability of the visual content such as watermarked, presence of sunglasses, drawing or sketching.

## Data standardization

* Converting png grayscale images to numpy array (every pixel has value ranging from 0 - 255) for model training purposes.