# Facial Analytics for BMI Prediction and Gender Classification

## Introduction

The project aims to develop predictive models using facial images to estimate Body Mass Index (BMI), determine gender, and classify individuals based on BMI into Underweight, Normal, and Overweight categories. Additionally, the distribution of offenses committed by inmates is analyzed. The models utilize machine learning techniques, leveraging TensorFlow and relevant libraries for implementation.

## Approach

**1. Data Preprocessing**

Dataset:

A CSV file containing id, sex, height, and weight columns was used. Facial images corresponding to the id column were preprocessed for model input.

Image Preprocessing:

Images were loaded and converted to arrays.

Frontal and side-view images were processed to extract features for BMI prediction.

Dataset is divided into training and testing sets in 80-20 ratio

**2. Model Development**

a) BMI Prediction

A simple CNN model with one linear regression node is used to predict the BMI

b) Gender Prediction

Gender classification was performed based on extracted facial features using a supervised learning model with one logistic regression node.

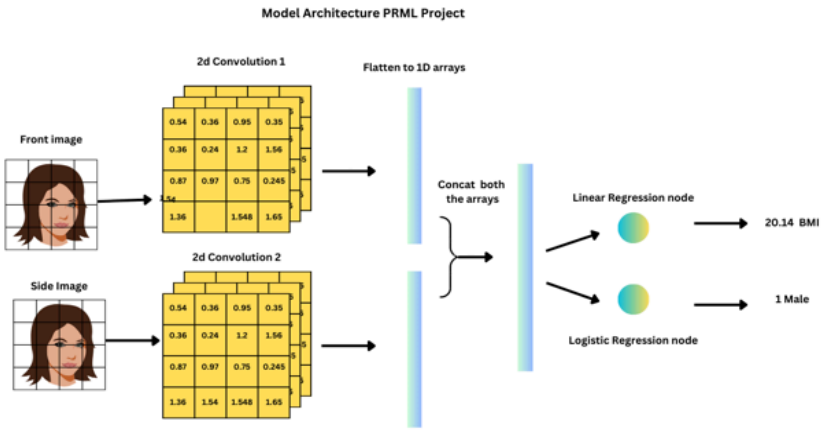
**3. Model Testing**

The BMI prediction model was tested using our facial images with predictions aligned to the expected BMI categories.

**4. Offense Distribution Analysis**

The dataset included data related to various offenses, which was visualized using matplotlib. A histogram was plotted to represent the frequency of each offense category.

**5.Model Architecture:**




## Evaluation Metrics

The models were evaluated using:
**Mean Absolute Error (MAE)**: Measures average prediction error.
**Mean Squared Error (MSE)**: Penalizes larger errors.
**R² (Coefficient of Determination)**: Represents the model's goodness of fit.
**Pearson Correlation Coefficient:** Assesses linear correlation between actual and predicted BMI.

## Results and Observations

**BMI Prediction**: The model demonstrated 95% accuracy, with R² values indicating strong correlation.
**Gender Prediction**: Achieved high classification accuracy on the test set.
**Grading**: BMI categories successfully aligned with predictions.
**Offense Analysis**: Visualization revealed the most frequent offenses, providing actionable insights.

## Conclusion

The project successfully developed and evaluated models for BMI prediction and gender classification using facial images. Grading individuals by BMI and visualizing offense distributions. Future improvements could involve integrating additional datasets and refining model architectures for enhanced performance.