Face Image BMI Prediction

Detailed Project Report

INTRODUCTION

In recent years, the intersection of healthcare and artificial intelligence has led to remarkable advancements in predictive analytics and personalized health monitoring.

One such application is the prediction of Body Mass Index (BMI) from facial images, which combines computer vision and machine learning techniques to offer a non-invasive method for assessing an individual's health status.

The objective of this project is to develop a system that can accurately predict BMI from a facial image. This system comprises a client-side interface built with HTML, CSS, JavaScript, and Bootstrap, which allows users to upload their images.

The backend is powered by a Flask API that processes these images using a Convolutional Neural Network (CNN) model trained on a dataset of face images and their corresponding BMI values.

The CNN model, implemented using Keras/TensorFlow, is designed to extract relevant features from the facial images and predict BMI with high accuracy.

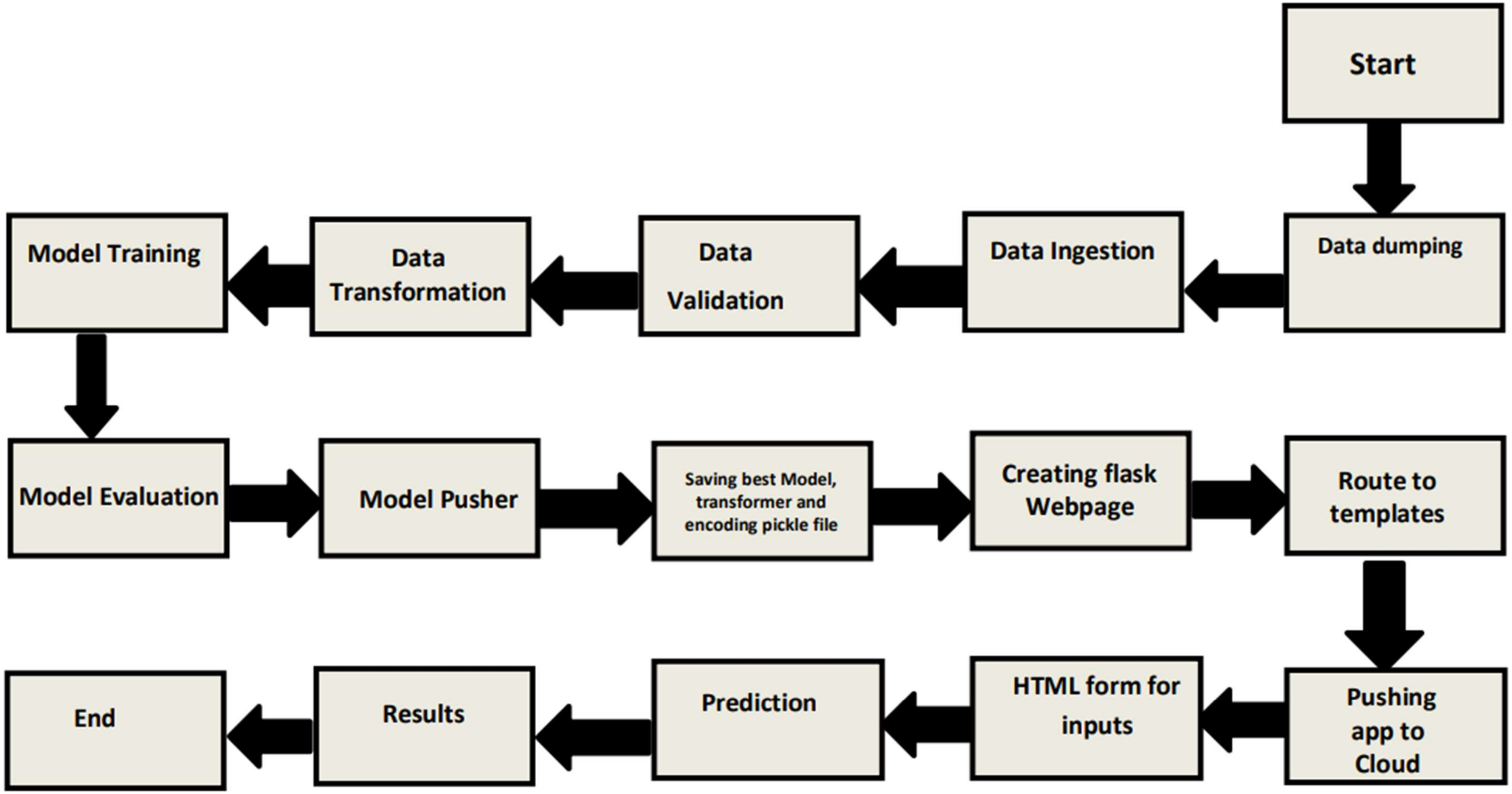
The entire solution is deployed on a cloud platform to ensure scalability and accessibility. This innovative approach not only simplifies the BMI measurement process but also demonstrates the potential of AI in enhancing health monitoring and diagnostics.

OBJECTIVE

The primary objective of this project is to develop an end-to-end system for predicting Body Mass Index (BMI) from facial images using advanced deep learning techniques. The system will feature a user-friendly web interface, enabling users to upload face images effortlessly.

The backend will utilize a Flask API to handle image processing and interact with a pre-trained Convolutional Neural Network (CNN) model. This CNN model, designed for feature extraction and regression, will provide accurate BMI predictions. The project aims to demonstrate the feasibility of non-invasive health monitoring through computer vision.

ARCHITECTURE

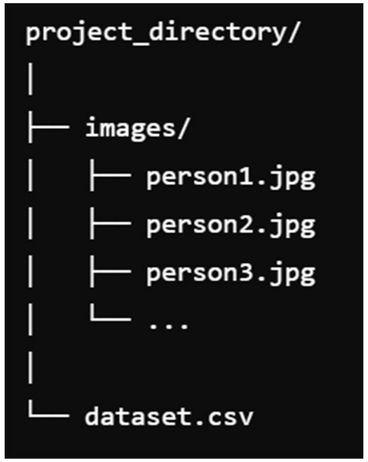


DATASET

The CSV file serves as the mapping between images and their BMI values. It should have at least two columns:

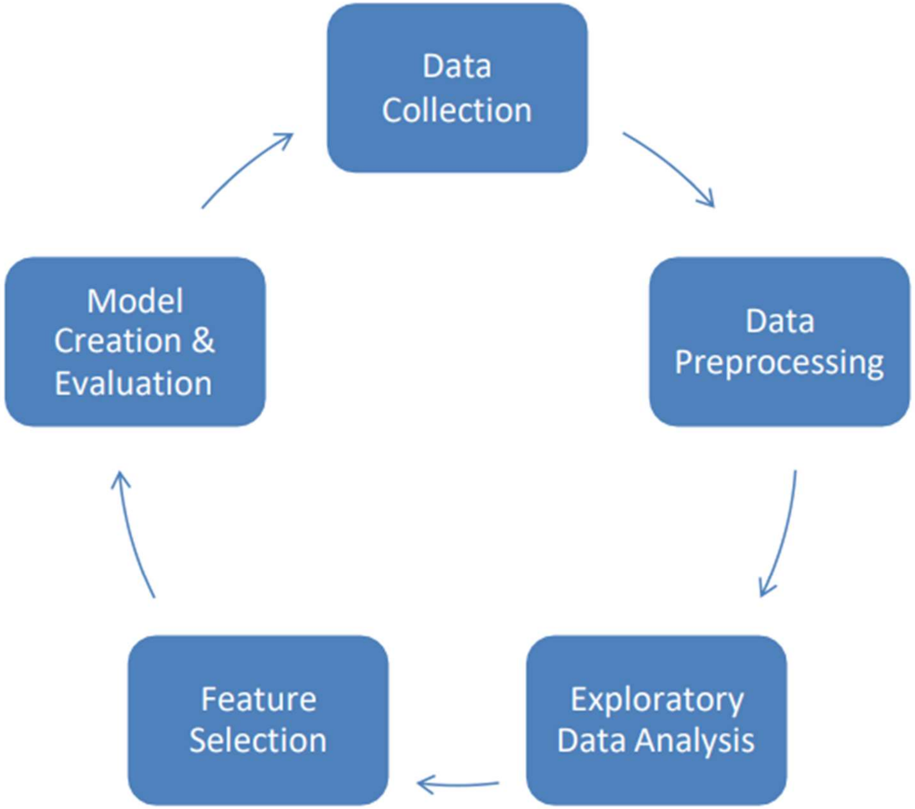
- **filename**: The name of the image file (e.g., person1.jpg).
- **BMI**: The corresponding BMI value for the person in the image (e.g., 22.5).

Filename	BMI
person1.jpg	22.5
person2.jpg	27.3
person3.jpg	19.8

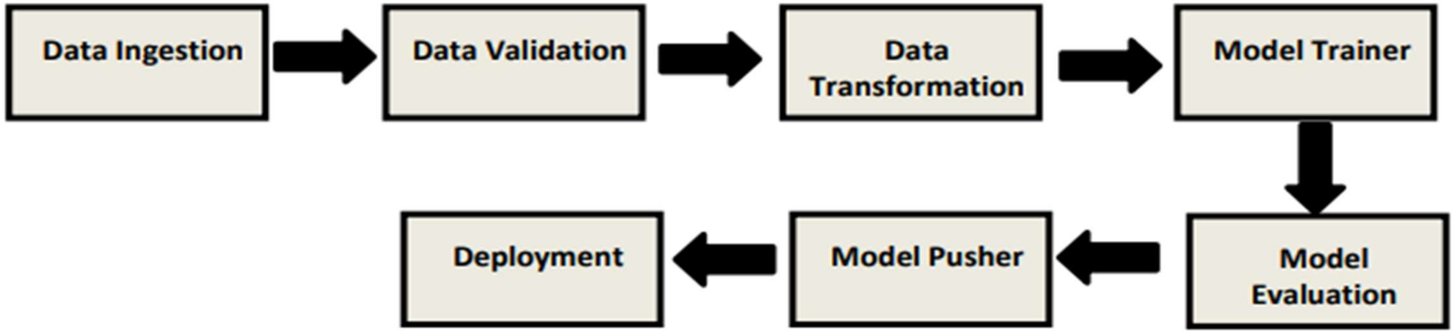


```
project_directory/
|
├── images/
|   ├── person1.jpg
|   ├── person2.jpg
|   ├── person3.jpg
|   └── ...
|
└── dataset.csv
```

DATA ANALYSIS STEP



MODEL TRAINING AND EVALUATION



CONVOLUTIONAL NEURAL NETWORK

Convolutional Neural Networks (CNNs) are a powerful type of neural network designed specifically for processing and analyzing visual data. They are particularly effective in tasks such as image classification, object detection, and facial recognition due to their ability to automatically learn spatial hierarchies of features.

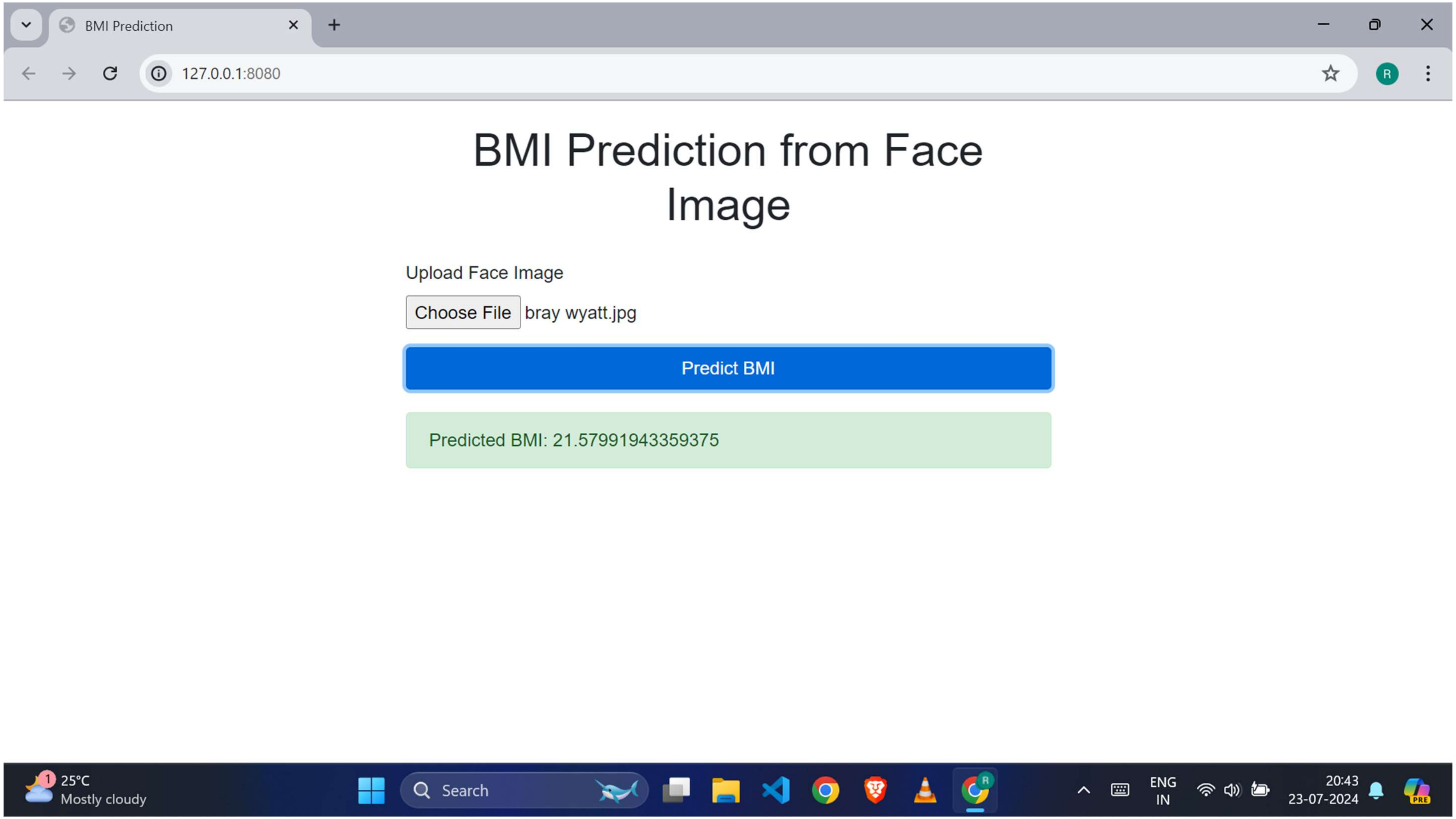
A CNN consists of several key components: convolutional layers, pooling layers, and fully connected layers. The convolutional layers apply a series of filters to the input image, which helps in detecting various features such as edges, textures, and patterns. These filters are learned during the training process, allowing the network to adapt and identify important features relevant to the task at hand.

Pooling layers are then used to reduce the spatial dimensions of the feature maps, effectively summarizing the information and reducing the computational load. This process of convolution and pooling is repeated several times, allowing the network to learn increasingly abstract and complex representations of the input image.

Finally, the fully connected layers, which are typical neural network layers, take the high-level features extracted by the convolutional and pooling layers and use them to make the final prediction. In the context of BMI prediction from facial images, the CNN model is trained on a dataset of face images and their corresponding BMI values, learning to associate certain facial features with specific BMI ranges. This hierarchical approach enables CNNs to achieve high accuracy and robustness in image-based prediction tasks.

Prediction Result

- The model gave the training accuracy of 90.44% and test accuracy of 87.30%



BMI Prediction from Face Image

Upload Face Image

bray wyatt.jpg

Predicted BMI: 21.57991943359375

MODEL DEPLOYMENT

- The final model is deployed on Azure using Flask framework.
- Implemented AWS EC2 instance for this and created pipeline.
- Used GitHub Actions for CI/CD implementation.

FREQUENTLY ASKED QUESTIONS

Q1) What is the source of data?

The data for training is obtained from famous machine learning repository.

UCI Machine Learning Repository: https://archive.ics.uci.edu/ml/datasets/faceimage+bmi

Q2) What was the type of data?

The data was the combination of numerical and Categorical values.

Q3) What's the complete flow you followed in this Project?

Refer slide 3rd, 4th and 5th page for better understanding.

Q4) After the File validation what do you do with incompatible file or files which didn't passthe validation?

Files like these are moved to the Achieve Folder and a list of these files has been shared with the client and we removed the bad data folder.

Q5) How logs are managed?

We are using different logs as per the steps and each logs are printed in the logs folder.
Anyone can refer to check the flow of the code.

Q 6) What techniques were you using for data pre-processing?

- Removing unwanted attributes
- Visualizing relation of independent variables with each other and output variables
- Cleaning data and imputing if null values are present.
- Converting categorical data into numeric values.

Q 7) How training was done or what models were used?

- Used that data for model transformation with the help of Column Transformer and image scaling.
- Did model training with the help of CNN Model.

Q 8) How Prediction was done?

- Flask webpage was created for user interface to provide details to the given form.
- Prediction page will show the predicted result on the basis of user inputs.

THANK YOU