Face to BMI Web API

- Pathik Rupwate

Body Mass Index

The BMI is defined as the body mass divided by the square of the body height

- BMI is an estimate of body fat and a good gauge of your risk for diseases that can occur with more body fat.
- The higher your BMI, the higher your risk for certain diseases such as heart disease, high blood pressure, type 2 diabetes, gallstones, breathing problems, and certain cancers.
- Being over normal weight is becoming more and more common in America.

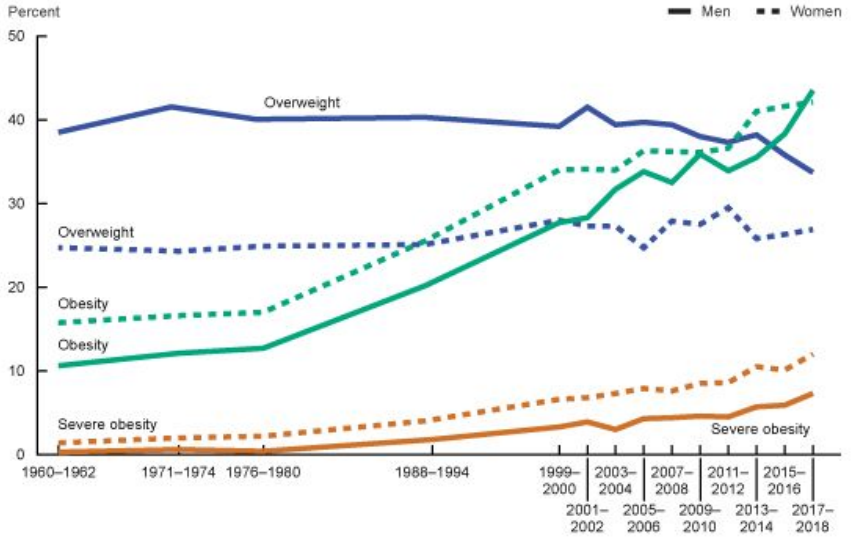


Fig: % of above-normal weight groups in America from 1980-2018

BMI Data

Total Faces = 4206 (2438 Males & 1768 Females)

- Underweight (16 < BMI ≤ 18.5): 7
- Normal (18.5 < BMI ≤ 25): 680
- Moderately Obese (30 < BMI ≤ 35): 681

	Unnamed: 0	bmi	gender	is_training	name
0	0	34.207396	Male	1	img_0.bmp
1	1	26.453720	Male	1	img_1.bmp
2	2	34.967561	Female	1	img_2.bmp
3	3	22.044766	Female	1	img_3.bmp
4	4	37.758789	Female	1	img_4.bmp

img_0.bmp

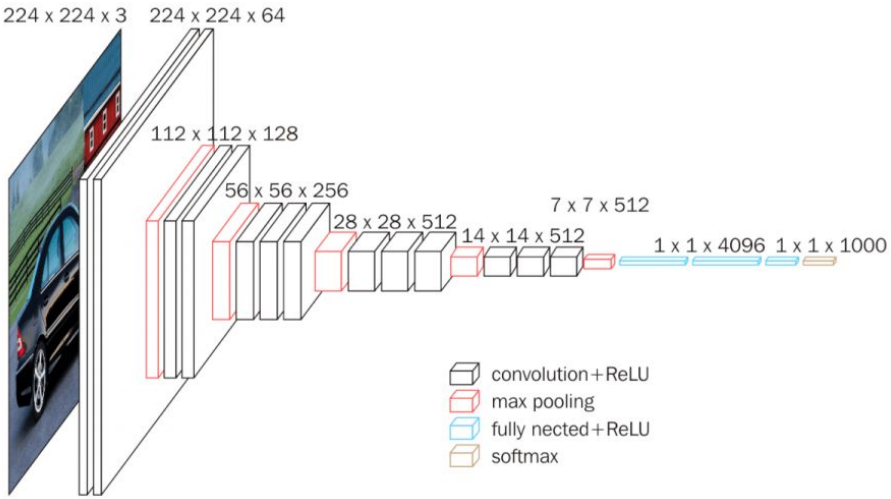
img_1.bmp

img_7.bmp

img_8.bmp

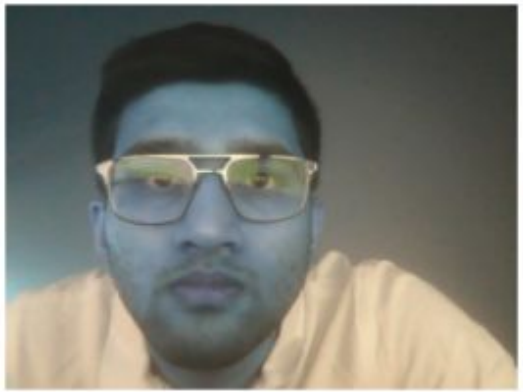
Pre-trained Model: VGG-16

- Convolutional neural network that is 16 layers deep
- The pretrained network can classify images into 1000 object categories, such as keyboard, mouse, pencil, and many animals. As a result, the network has learned rich feature representations for a wide range of images.
- The network has an image input size of 224-by-224



Data Processing

- First we map Male to 1 and Female to 0 in the bmi dataset
- We then read in the images and split into train and test datasets
- Preprocess the images for VGG16



Fine-tuning the Model

Model Architecture:

- Load VGG16 model without the top layer
- Add a new fully connected layer for classification
- Add Global Average Pooling layer
- Add a dropout layer of 50%
- Add a dense layer with gelu activation
- Add a final Dense layer with gelu activation

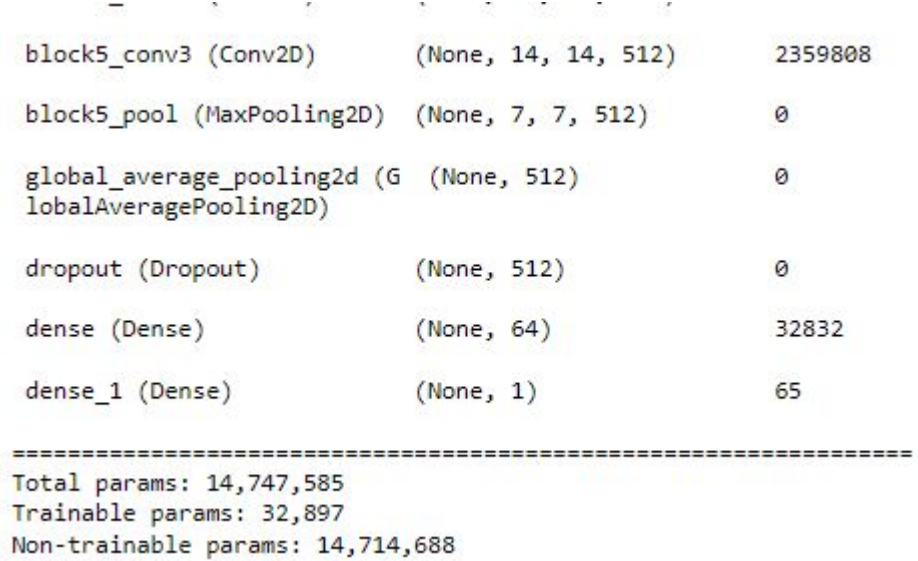


Fig: Last 6 layers of the model

Evaluation

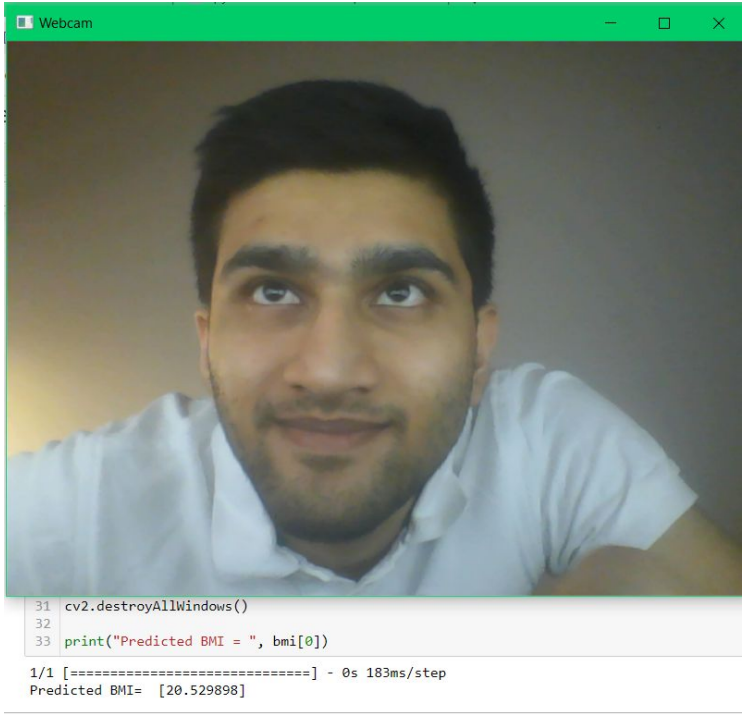
Mean Absolute Error of the fully trained fine-tuned model: 7.88

Predicted BMI: 31.68258
Actual BMI: 28.940978786
Absolute Error: 2.741602161875978

Predicted BMI: 25.25292
Actual BMI: 24.6588951901
Absolute Error: 0.5940249606568351

BMI in Real Time with Camera Input

- Use CV2 in Jupyter notebooks
- Read in frames from webcam input
- Predict BMI of faces using trained model in live time and display it
- Click to save final frame as final image as get the final predicted BMI



Future Work:

- Deploy flask on Google Cloud platform to make it the web API available on the internet.
- Train with a larger dataset of faces
- Get more facial data from different regions around the world.
- Apply more layers and fine-tune model further
- Use VGGFace3 pre-trained model which was trained on 4.2 million images.

Thank you!