Face BMI Prediction Using Deep Neural Networks

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MSCA 31009 IP04 Machine Learning & Predictive Analytics

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Introduction

Body Mass Index (BMI) is a widely used health indicator for assessing weight status and associated health risks. It plays a crucial role in determining the overall well-being of individuals and populations. Traditionally, BMI is calculated based on height and weight measurements.

However, advancements in computer vision and deep learning techniques have opened new possibilities for BMI detection using facial images. Analyzing BMI from facial images can provide a non-invasive and convenient approach for assessing weight status.

Problem Statement

The primary objective of this research is to surpass the current metrics published in research journals by employing a combination of tuned deep-learning models.

By leveraging the strengths of state-of-the-art architectures, such as VGGFace, VGG16, ResNet50, DenseNet121, and others, we aim to improve the accuracy of BMI detection from facial images. Multiple iterations of tuning these models will be performed to optimize their performance specifically for BMI prediction. The proposed approach will utilize a diverse dataset of facial images, encompassing a wide range of ages and gender, to ensure robustness and generalization.

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Feature Engineering and Tuning:

Image Data Augmentation:
Rescaling, rotation, shifting, shearing, zooming, and flipping

Early Stopping:
Early Stopping prevents overfitting by monitoring a chosen metric, like validation loss. Training stops if the metric doesn't improve for a specified number of epochs.

Regularization, Batch Normalization, Freeze and Unfreeze Layers

Modeling Frameworks:

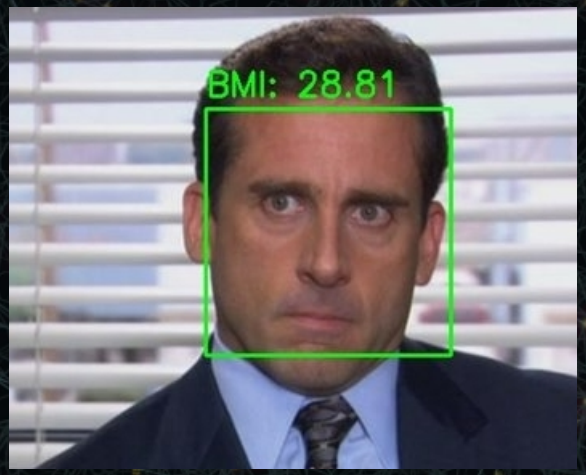
VGG16 with Dropout and L2 Regularization
ResNet50V2 with Custom Dense Layers
DenseNet121 with Dropout
VGG16 for Feature Extraction with Fine-tuning

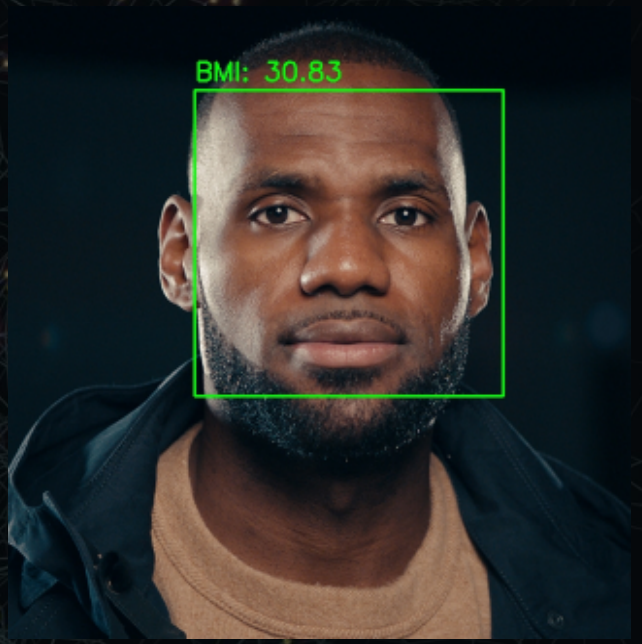
Multiple variations in each with different set of dense layers and other combinations

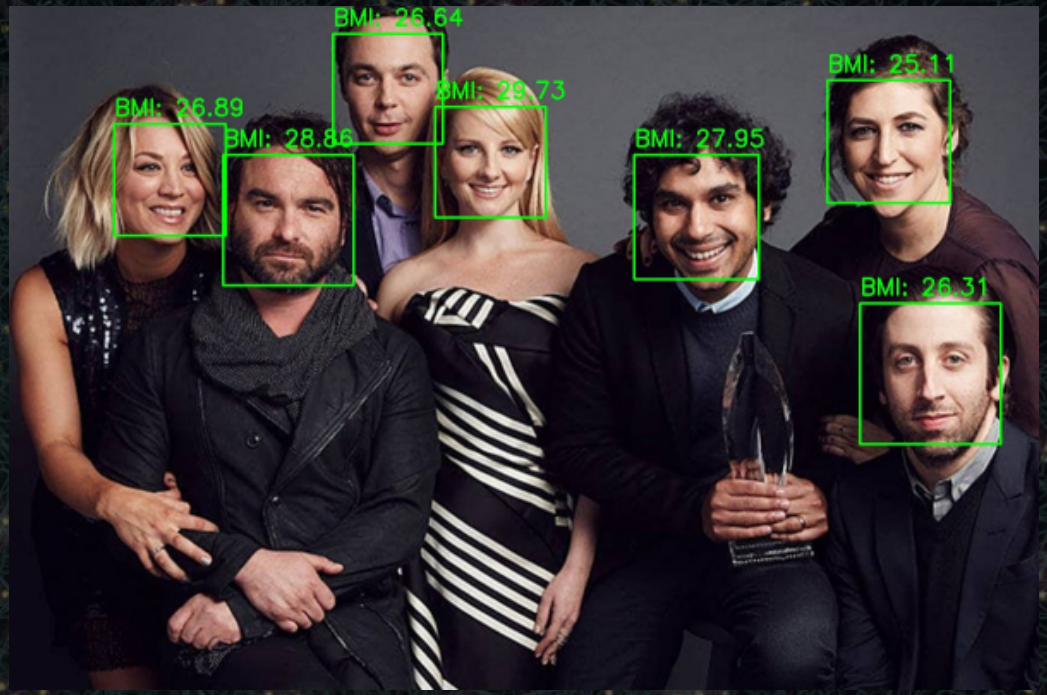
Findings

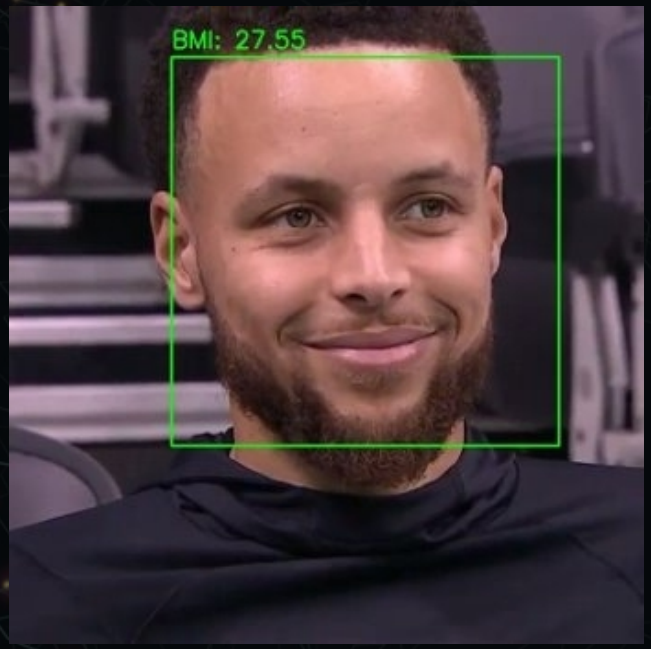
Model Configuration	RMSE	MAE
VGG16 (2 Dense Layers followed by Dropouts, Regularization	10.18	7.66
VGG16 (2 Dense Layers followed by Dropouts, Regularization, Data Augmentation	10.61	7.79
VGG16 (2 Dense Layers followed by Dropouts, Learning Rate Tuned)	10.65	8.11
ResNet50	11.31	8.35
DenseNet121	12.51	9.31

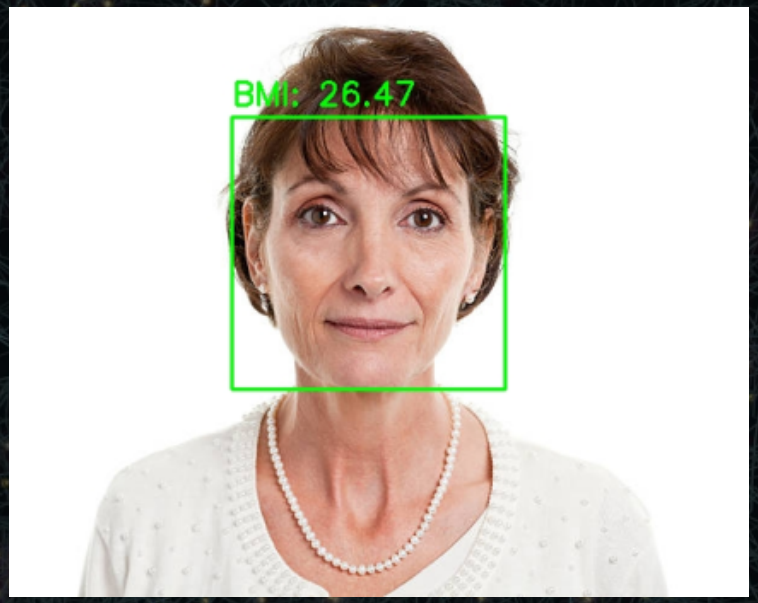
Prediction Screenshots

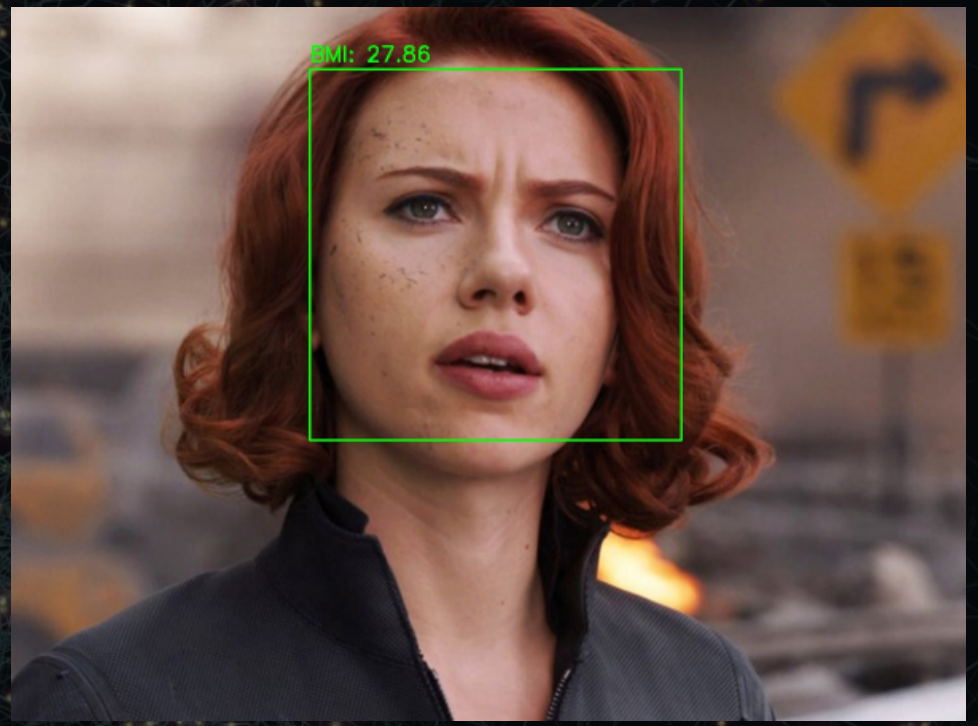

BMI: 28.81

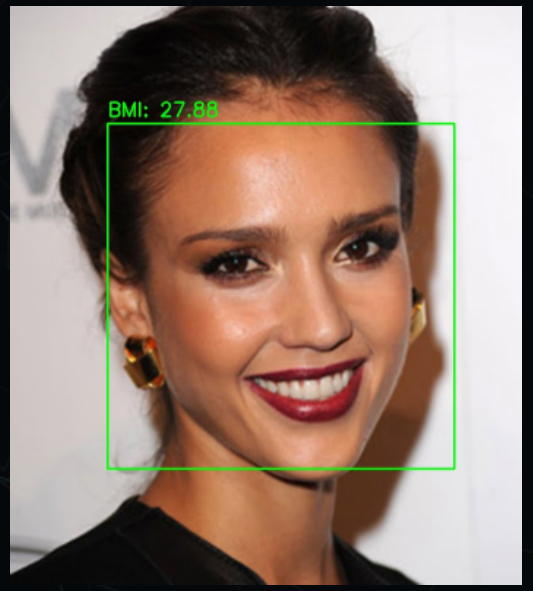

BMI: 30.83


BMI: 26.64
BMI: 25.11
BMI: 29.73
BMI: 26.89
BMI: 28.86
BMI: 27.95
BMI: 26.31

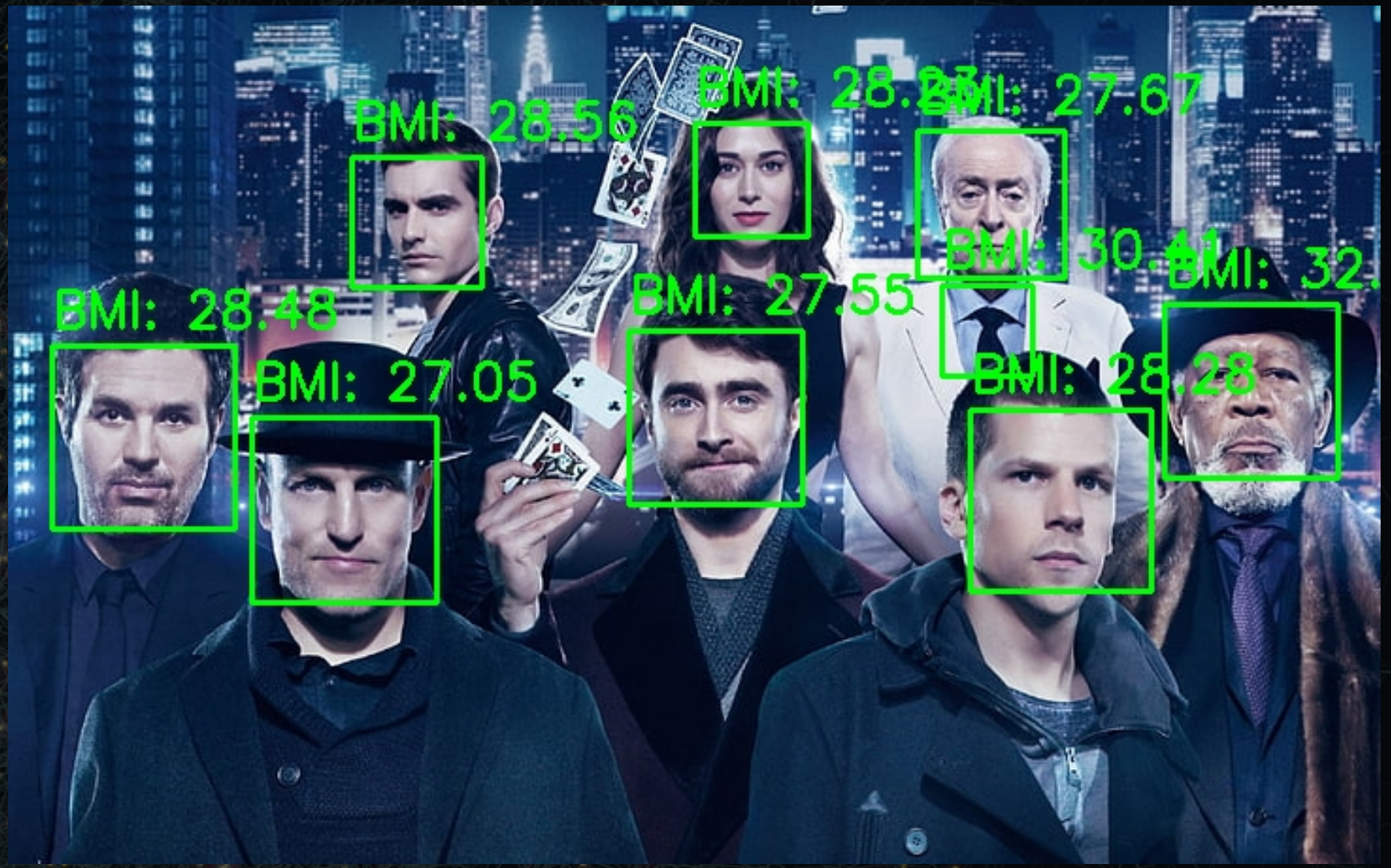

BMI: 27.55


BMI: 26.47


BMI: 27.86


BMI: 27.88


BMI: 28.94
BMI: 29.91
BMI: 29.64
BMI: 29.92
BMI: 30.73
BMI: 29.34
BMI: 33.97
BMI: 28.16
BMI: 27.52
BMI: 28.09
BMI: 28.03
BMI: 27.62


BMI: 28.56
BMI: 28.48
BMI: 27.05
BMI: 27.55
BMI: 27.67
BMI: 28.28

Thank You!