Solitary Identification and Analysis of Considerate Nutritional Consumption and Identifying Malnutrition

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Abstract

The food supply chain is in danger from various factors, including climate threats, such as heat waves, floods, droughts, and other extreme occurrences such as intensive livestock farming, demand for animal protein, practices for antimicrobial resistance and various other factors leading to serious food shortages and an increase in food prices. Malnutrition is a major issue, with an estimated 663 million individuals affected. Poor nutrition is a serious problem that affects a vast number of people globally. Recurring infections, which make the issue worse, add to this dilemma. The fact that 22% of children under the age of five are considered "stunted," meaning they are much shorter than the usual child of their age, is one of the most alarming effects of this problem. Additionally, a sizeable portion of people— over 697 million—who account for 9% of the global population—experience extreme food insecurity. The majority of fatalities occur in mostly high and medium poverty nations. One of major factors that helps us identify the quality of nutritional consumption is the body's main defense against external aggressions is its skin, which is affected by chronological ageing and photo-ageing. Poor eating habits and nutritional imbalances are major contributors to undernutrition and overnutrition among individuals, and also obesity, so it is important to build a machine learning model to regulate the flow of nutritional consumption and depict malnutrition among individuals. This model can be used to anticipate malnutrition on an individual basis, making it a more precise and effective method of recognizing the need to avoid incorrect food intake.

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INTRODUCTION

Proper nutrition is crucial for the life, growth, and development of children. Unfortunately, malnutrition has become widespread, with young children being its primary victims. Half of the mortality rate among children under the age of five is caused by undernutrition [1].

A 2018 report found that 40 million children worldwide were overweight, while 49 million children under the age of five were wasted. Asia was home to almost 50% of all stunted children under

the age of five, accounting for 55% of all affected children worldwide, with 39% of them living in Africa. Additionally, 68% of the world's wasted children come from Asia [2].

Malnutrition can result from either inadequate or excessive nutrition. Undernutrition is prevalent in many young children and is the lack of essential proteins and nutrients necessary for healthy growth. It includes measurements such as wasted, underweight, and stunted, which are connected and caused by a lack of critical vitamins and minerals [3, 4].

Wasted refers to acute malnutrition that occurs when a child lacks recent meals, stunted is a composite indicator for both acute and chronic malnutrition, and underweight is the outcome of both acute and chronic malnutrition [5, 6].

Undernutrition is associated with various diseases, such as digestion and nutrient absorption problems, which affect different age groups, including young children, adolescents, pregnant and breastfeeding women, and the elderly [3, 4].

Malnutrition of all types includes undernutrition (wasting, stunting and underweight), vitamin and mineral deficiencies, overweight, obesity and related diet-related non communicable diseases. With an estimated 663 million individuals affected, poor nutrition is a serious problem that affects a vast number of people globally. Recurring infections, which make the issue worse, add to this dilemma. The fact that 22% of children under the age of five are considered "stunted," meaning they are much shorter than the usual child of their age, is one of the most alarming effects of this problem. Additionally, a sizeable portion of people—over 697 million—who account for 9% of the global population—experience extreme food insecurity. Malnutrition is the main reason for about 45% of deaths of children under five. Most of them occur in low- and middle-income countries. The prevalence of overweight and obesity among children is increasing in these countries also.

The body's main defence against external aggressions is its skin. Chronological ageing and photo-ageing are two different types of skin ageing that are both influenced by internal and environmental influences. People have progressively come to understand the significance of diet, which serves as the body's primary source of energy and nutrients, for the skin. Poor eating habits and nutritional imbalances are significant contributors to skin ageing, according to modern science [7].

We use these major factors as our base towards building a machine learning model to regulate the flow of nutritional consumption and depicting malnutrition among individuals and how important it is the regulate consumption levels.

The paper is organized as follows. The next section briefly describes the unpredictability of valid reasons impacting global food supply and why there is a need to build a model. In the third section, related work is discussed, and the process methodology and results are described in the fourth section. The last section presents the conclusions and future scope.

LITERATURE REVIEW

The climatic impacts and effects of change on public health and farm production in recent years. One of the largest threats to agricultural and human health in recent years is climate change [3]. The greenhouse effect is to blame for the rising average world temperature. Carbon dioxide is a major greenhouse gas that has been rising at an alarming rate, which increases plant production due to photosynthesis. However, rising temperatures can have the opposite effect by increasing crop respiration and evaporation rates, increasing pest infestation rates, changing the flora and fauna of weeds, and shortening crop duration [4].

Due to greenhouse gases and current global warming, climate change is also having a major impact on human health. The influence of the climatic change made people who lived in all islands, coastal areas, mountainous areas, and polar regions more susceptible [8].

Due to recent climatic change, this example has implications for human health as well as agriculture and calls for preventative measures. In the present, climate change is the world's biggest and most pervasive challenge. Climate change is defined as variations in average estimates of meteorological components like temperature and precipitation that have been computed over a long period of time.

Throughout the past many decades, it was suggested that particular changes in the climate on the global scale were a result of improvements in human activities that altered the overall composition of the entire global atmosphere. Climate change has an impact on human health and agriculture in the 21st century is critical and significant [8].

To prevent effects on human health, such as malaria or dengue, etc., which are genuinely brought on by climatic changes, we require rigid and confident adaptation. To resolve these situations, it is necessary to put into practice a few procedures, including:
- High-quality energy mechanisms that support the safe use of these public transportation systems as well as physical mobility, such cycling and walking, as alternatives to private automobiles are needed [4].
- They could minimize harmful carbon and ease the burden of residential air and gas pollution, which accounts for around 4.3 million deaths per year, as well as ambient air pollution, which accounts for about 3 million annual fatalities [4].

Weather variations have an impact on many food system practices directly and indirectly, but crop production shows the biggest changes. Since the early 1980s, agricultural output projections under a changing environment have been investigated. From the 1990s onward, investigations have projected the effects of climatic alterations on crop results under numerous instances using projected crop simulation and data based on climatic conditions. Since then, simulations of crop models have been employed in hundreds of research cases to predict the performance of different crops under a variety of climatic situations [9].

Results are systematically monitored and evaluated by national and international organizations. In particular, Group II of the Intergovernmental Panel on Climate Change (IPCC) is putting in work to provide evidence-based policy recommendations for coping with and adapting to climate change. Examine examples from the past 5 IPCC assessment cycles that show that as whole consequences are negative in numbers but vary greatly by region [9].

Simply put, malnutrition is a condition in which children between the ages of 0 and 5 experience difficulties from the moment of their birth. There could be various causes. It might be a genetic condition. The other factor could be that the mother did not eat enough nourishing foods while the kid was still in the womb. It impedes the body's typical or normal growth. These kids grow in an extraordinarily different way from other kids. That could be a physical disorder, a mental disorder, or occasionally even both [10].

For a child to obtain all the nutrients necessary for optimal growth, they typically need to consume foods like fish, meat, eggs, green vegetables, citrus fruits, fresh nutritious fruits, and milk that are rich and self-sufficient in proteins and nutrients. Pulses and cereals must both be ingested. Yet, given India's large population, more of these cereals, pulses, and other foods are being consumed or used, and the

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nation's production and economic development have lagged since the 1990s. This is something that deserves our attention. The contribution of these nutrients in children is also considered when looking at the fertility of dirt, chemicals used to cultivate those crops, rain, and other natural resources [11].

When cut, some fruits and vegetables may appear ripe and healthy on the outside but be unripe or rotten on the inside. These are business strategies to sell fruits and vegetables in large quantities outside of the growing season. This has an impact on the nutritional worth of people who eat those foods. Only a small percentage of children are affected by some chronic diseases from birth. Typhoid, jaundice, and other conditions are among the known causes of malnutrition. Even in India, there are areas where people regularly go without enough food and experience severe hunger. And there are regions on the periphery of Africa where crops with nutrition are not grown because of their unfavorable climate, muck, and other factors [12].

Malnutrition has an impact on ageing as well. It affects a person's lifespan as well. When compared to the average human lifespan today, our ancestors had lifespans that were greater than 100 years. Blood pressure and sugar problems affect modern beings from an early age. The age may be between 30 and 40 years. Additionally, children these days are born with blood pressure and sugar levels that may be genetically altered, inherited, or are the result of malnutrition [13].

The nutritional state of patients and their present health hazards can be tracked by people and clinicians with the aid of programmes like m-health and e-health. These programmes support a wide range of technologies, including neural networks, machine learning techniques, and various other analytical tools. Students now have the chance to investigate many booming applications that can benefit the country. In order to categorize the features and qualities of the meals or diets, we also employed feature engineering in this sector. This is the location where significant nutritional deficits are found. Finding the holes and voids in the diet so we can fill them could be useful [14].

The government just began providing nutritional meals for children to expectant mothers in Telangana, which has the potential to reduce malnutrition and other dietary deficits in children by 70% while they are still in the womb. When free nutrition kits are offered to the underprivileged, this may also aid them. And those who are not sufficiently informed about the type of diet that women should follow while pregnant will also become self-aware about this diet plan and the types of precautions and diet that should be given to newborn children on a regular basis [13].

If not, it could result in a persistent illness or problem. The current study shows that many adults were hospitalized or bedridden as a result of these factors. It may also cause cognitive deficits in elderly people who are older than 60 to 70 years. One of them could be arthritis, a prevalent chronic condition affecting elderly people that makes them completely bed-ridden for the rest of their lives. Adults may also be affected by it. The three main classes of Smart Information and Communications Technology (ICT) solutions for human nutrition are typically food recognition monitoring, malnutrition assessment, and food intake. These problems might be remedied early on [15].

One of the most popular measurements for determining a person's health is body mass index (BMI). If someone is underweight, healthy weight, overweight, or obese, this test can tell us about it. BMI is also associated with body fat and is a significant predictor of all potential sicknesses and diseases that may worsen with higher body fat ranges. Nowadays, excess calorie consumption and a sedentary lifestyle leads to a higher body fat percentage. On the other hand, malnutrition among adults is more common and ubiquitous than we are currently aware of. Adults' nutritional status can be evaluated using the BMI both on an individual and a collective basis [5].

Because individuals are busy and frequently do not have a weighing scale or measuring tape at home, authors have recommended an easy and affordable method of establishing a person's weight, height and BMI from their faces [5].

Weight-related issues are directly linked to all chronic diseases. If this continues, the next generation may not survive this generation. The typical diet of an overweight person, which includes a variety of high-calorie fast foods, contributes to this. Although the consumption of these foods increases the energy of a person, this energy only lasts for a short time until the feeling of hunger comes back again. The second factor is the lack of physical activity [6].

The increasing use of modern technologies such as televisions, cell phones, video games, etc. has resulted in a significant decrease in the time the average person spends exercising. The third reason is stress. Due to the high stress and lack of sleep that comes with our busy lives, we are less likely to exercise. Additionally, hormonal and metabolic changes can promote weight gain. Another reason can be our environment and our transport system, which is too dependent on cars. Sometimes there are not enough sidewalks, community parks, playgrounds or bike paths for recreation [6].

ANALYSIS AND REASONING
Reference Paper Results (Climatic Impacts on Food Production) [9]
We consider the primary reference paper used to depict the impact of climate on crop production across countries [9]. In this paper, the authors analyse the climatic trends and the agricultural production across countries based upon their primary crops and yield percentage. They emphasized on the climatic changes impacting the production of crops over the years due to changes in atmosphere. Similarly, many scientists are working on different factors influencing the food production, making it a diversified topic and making it difficult to draw conclusions.

Work
Climate changes have an impact on agriculture, which in turn affects food production. Several people have examined the circumstances of this issue and drawn conclusions suggesting that it is imperative to address the climatic conditions as they are significantly influencing world food production. Yet this is only one side of the story; the real twist is that even agriculture has a significant impact on climatic conditions. Using data analytics, we have exploited carbon emissions, which both support agriculture and are a key cause of climatic change.

Agricultural Practices Affecting Climatic Conditions
Dataset used – Our dataset was obtained from AgroSphere (a project under NASA) as shown in Figure 1(a)–(c).
- *Countries.csv:* contains distinctive country codes used in data on emissions and food production.
- *Emissionall.csv:* data from emissions from various sources (just from agriculture) are contained in the file.
- *FAOcrops.csv:* Includes information on global food production (crop weight in tonnes).
- *Yield.csv:* This file contains information about global food production (measured in hectares).

Identifying trends in emission for a limited set of products across various countries as shown in Figure 2(a) and (b).

Yield versus Emission Across Countries
The climate is a never-ending cycle that can have different effects on food production. But this is only one aspect; there are many others that will also have an impact on how food will be produced in
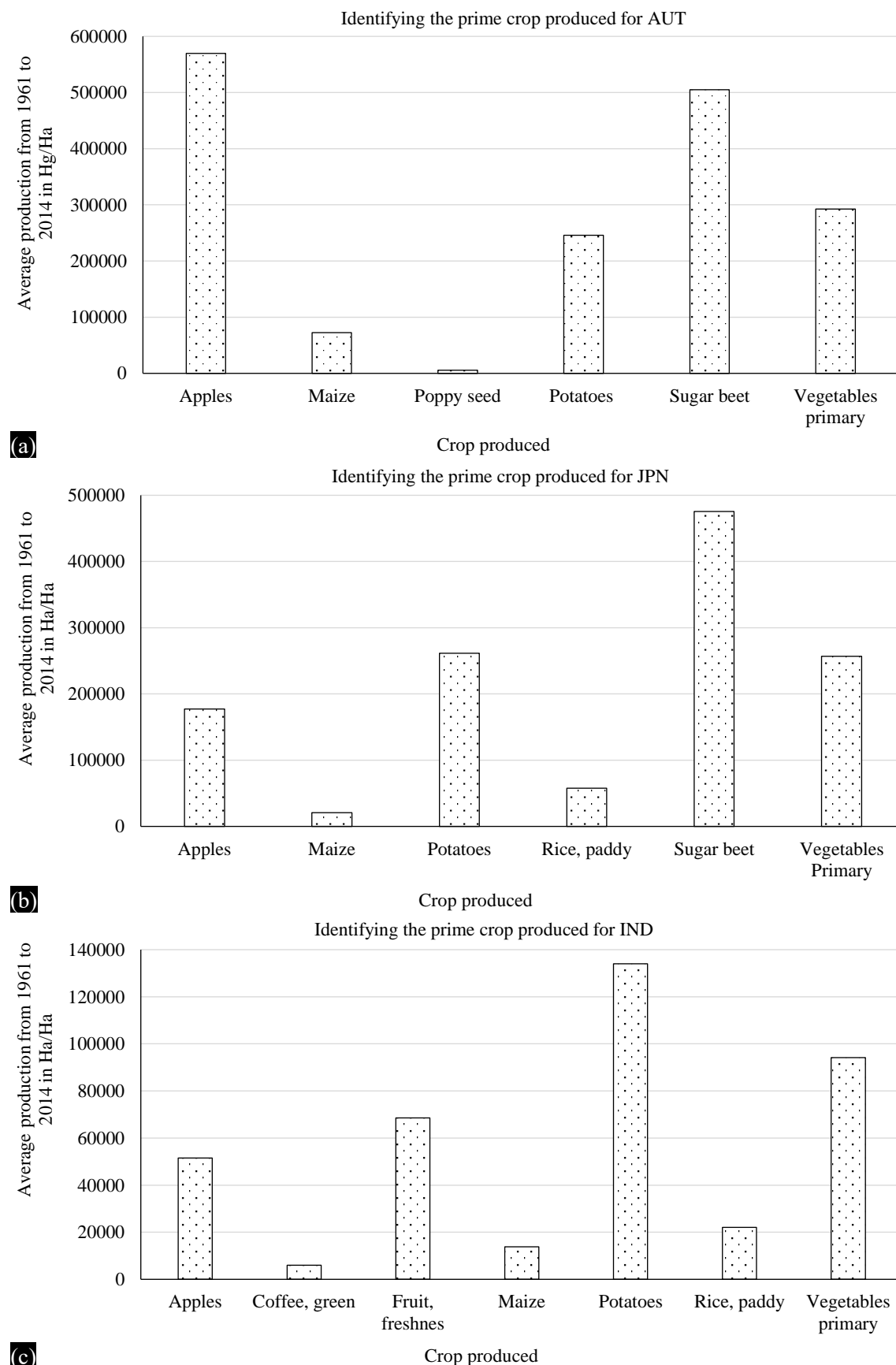
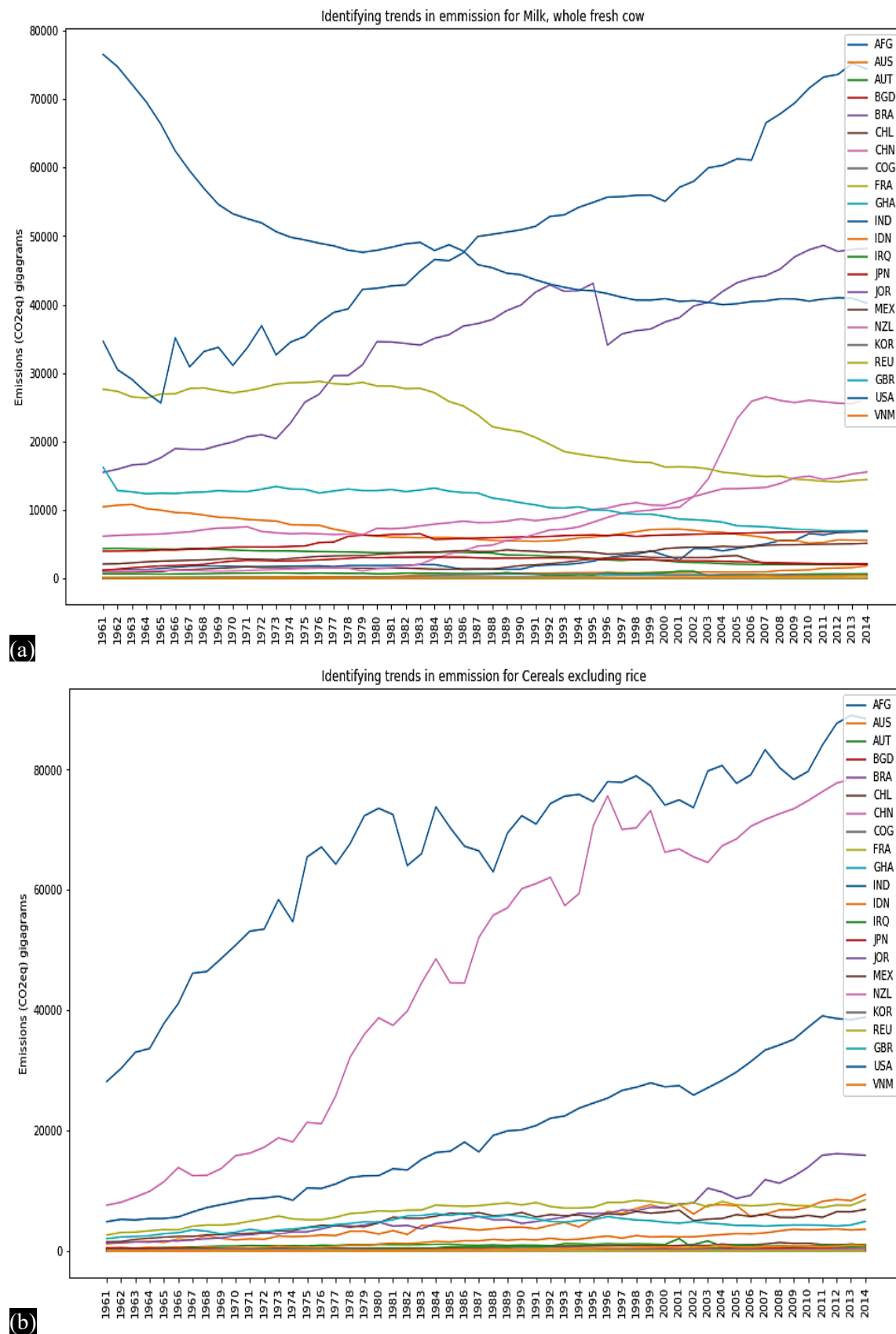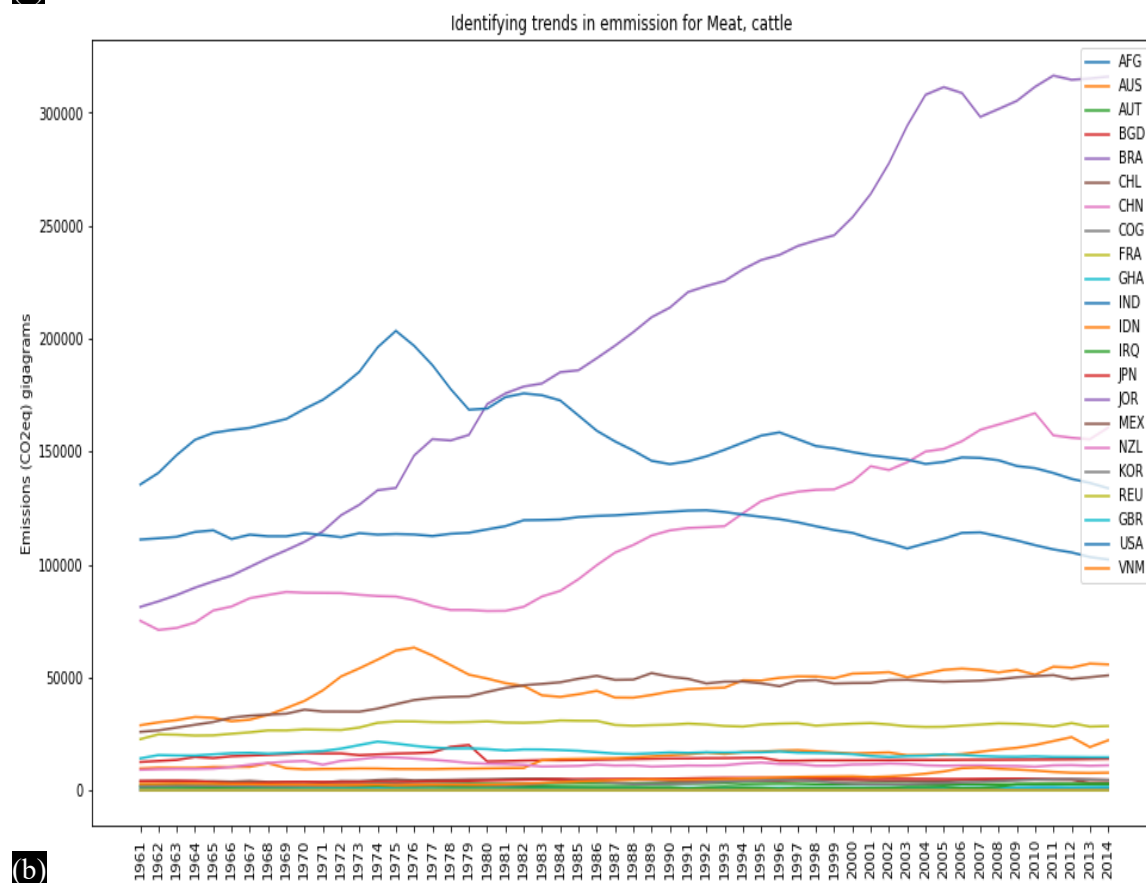**Figure 1.** (a)–(c) identifying primary crops produced in selected countries.

(a)

(b)

Figure 2. (a) and (b) identifying trends in emission for a limited set of products for respective countries – PART 1.

(a)

(b)
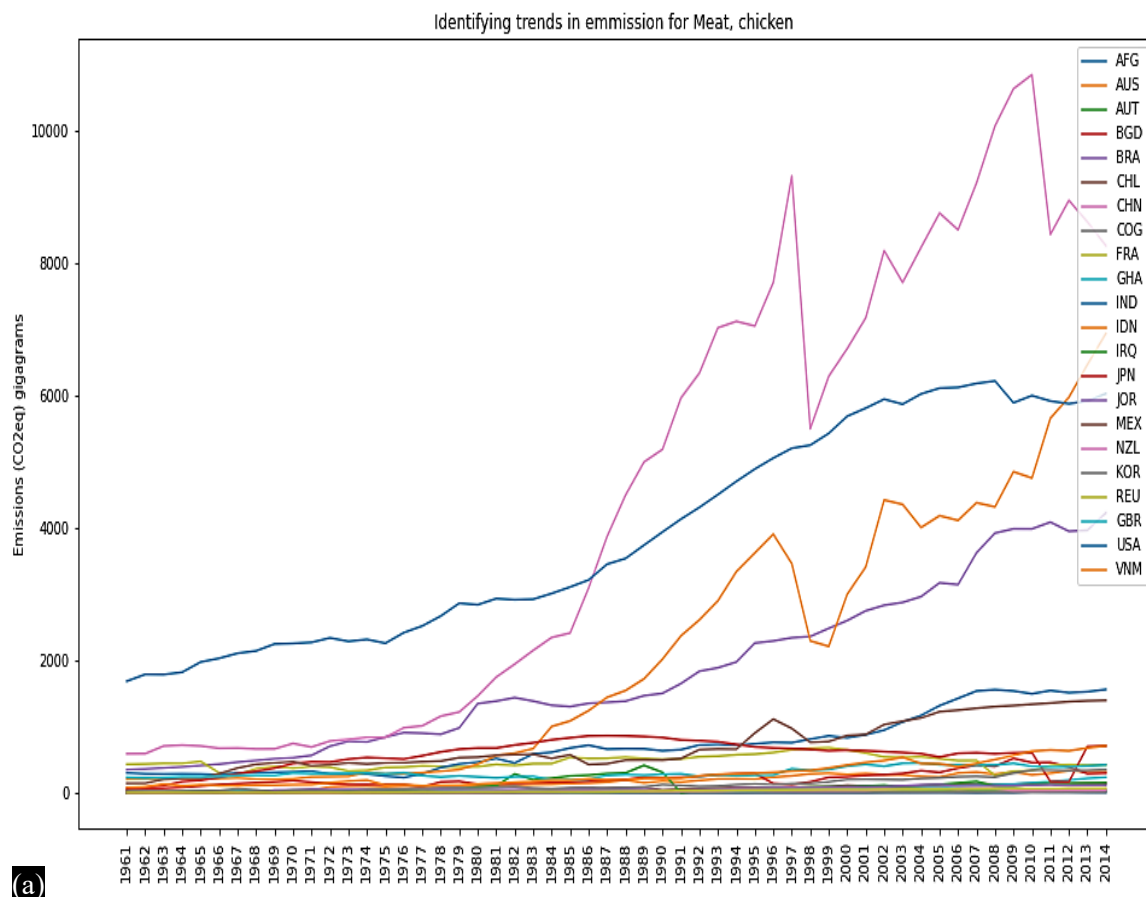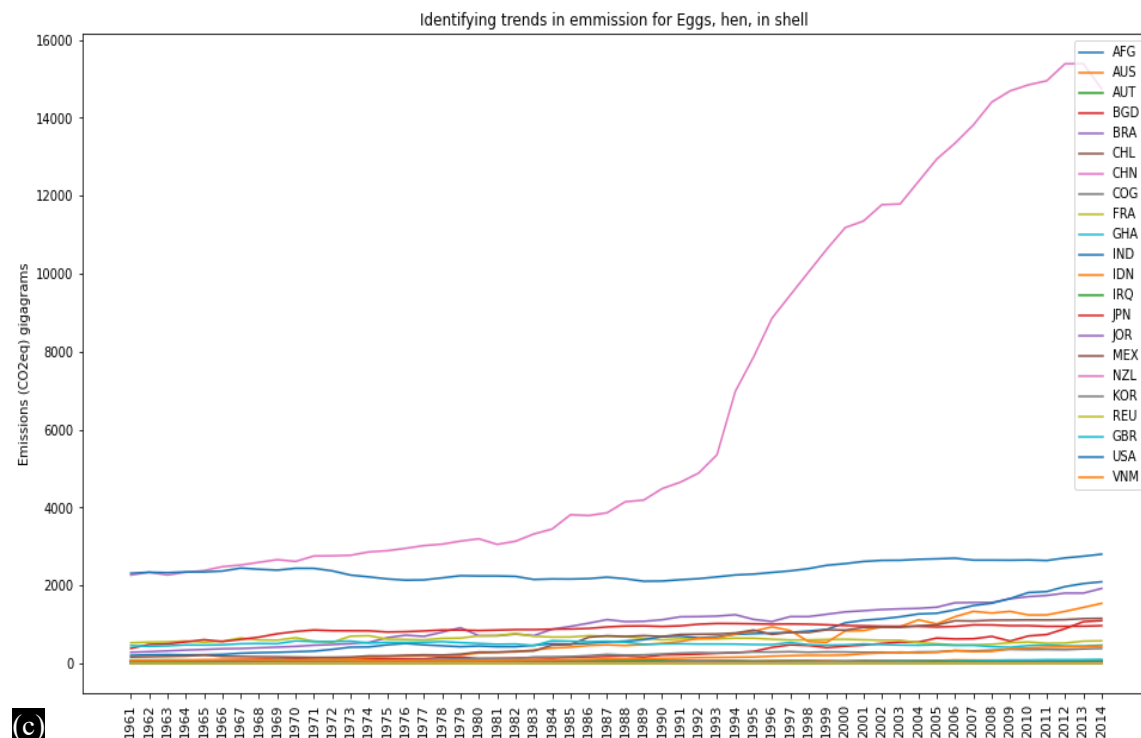
Figure 3. (a)–(c) identifying trends in emission for a limited set of products for respective countries PART 2.
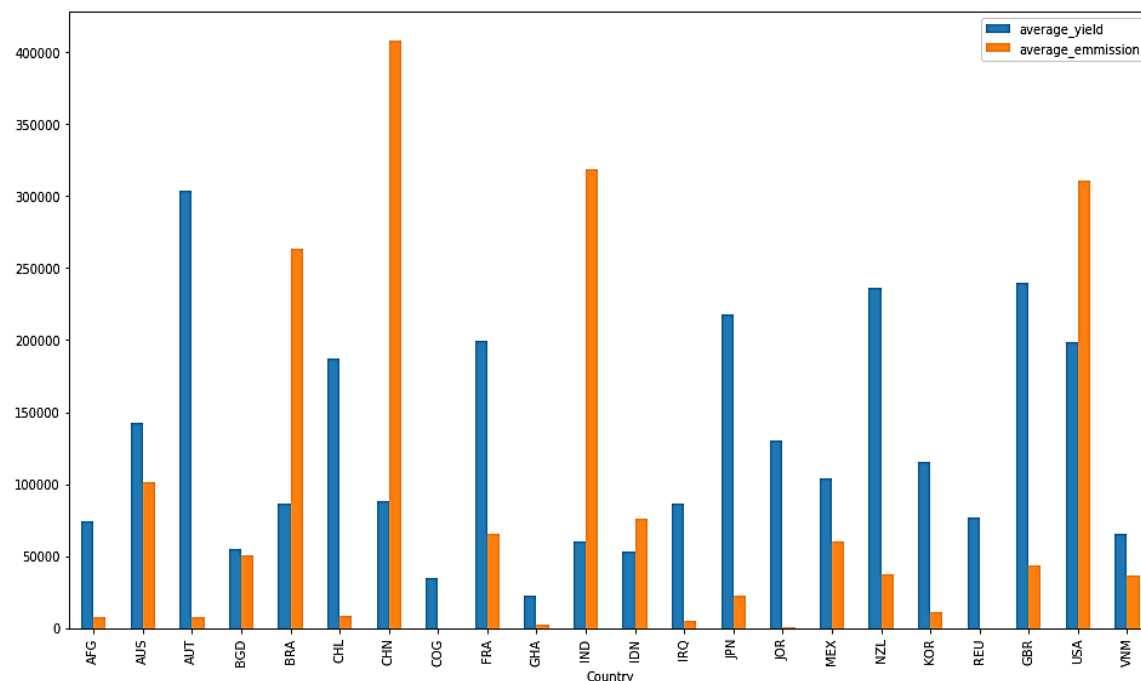
Figure 4. Average yield versus emission for respective countries.

the future. We conclude that while we cannot forbid it, we can govern it. Hence, we now have a need for a model that both helps us control our food intake and, unavoidably, aids each individual in determining the kinds of items to be ingested. If this model were to be expanded, it may aid in the identification of data regarding global food requirements and assist in the regulation of agricultural methods and food production to meet demands rather than mass-produce as shown in Figures 3(a)–(c) and 4.

PROCESS METHODOLOGY AND RESULTS

It may be a good idea to some extent to analyse numerous records, spot patterns and trends, and draw conclusions regarding malnutrition across the nation. However, because the reports were analysed as a whole, there may still be many individuals whose data has not been recovered and these analyses were done solely using the poverty score. We will be able to assess food and nutritional consumption through the model we created in order to anticipate malnutrition on an individual basis, making it a more precise and effective method of recognising incorrect food intake. Additionally, these findings may be helpful in a wide range of industries and areas as shown in Figure 5.

- World Health Organization Nutritional Analysis in India Reports [1]
- Food and Nutritional Security in India [2]
- Food Safety and Standards Authority of India (FSSAI) National Food Survey 2022 [3]

Age Prediction Model

The two primary motivations for developing an age prediction model are as follows: That is, by significantly influencing the BMI calculation, it will aid in identifying the age component that will precise the prognosis of malnutrition. By addressing skin ageing, it will also assist in forming conclusions. Food consumption and skin ageing go hand in hand since healthy nutritional intake reduces skin ageing [14]. We will be able to determine the best diet to prevent premature ageing of the skin thanks to the aforementioned study.
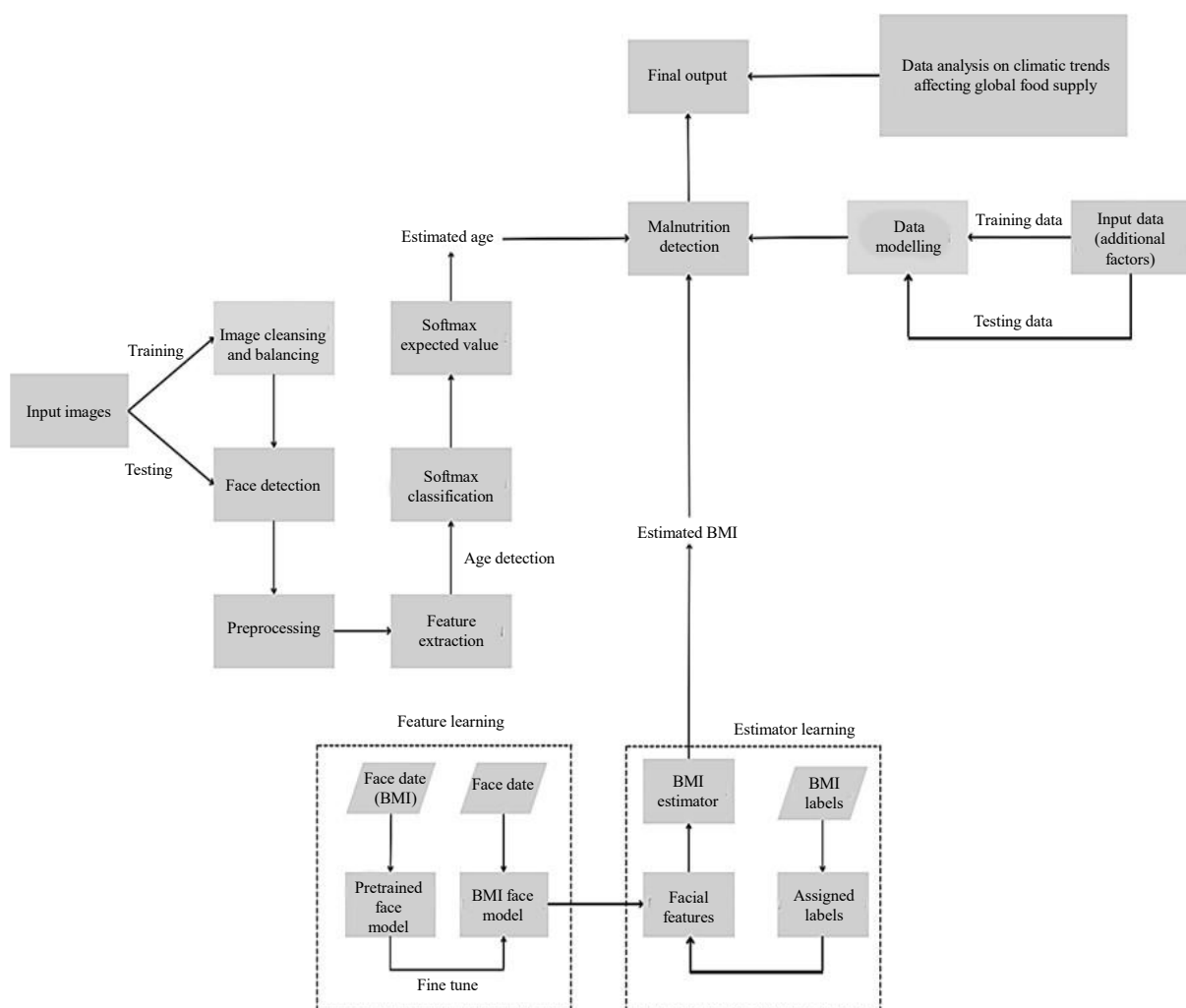

Figure 5. Model prototype.

The link contains these snapshot and further information as shown in Figure 6.

We regularly face primary challenges in deciding what to eat to maintain young and healthy skin, defining a healthy diet and the role of diet in aging. The topic that currently attracts maximum attention is ways to maintain healthy skin and delay skin aging. Skin is the primary barrier that protects the body from external aggressions. Skin aging is a complex biological process, categorized as chronological aging and photo-aging, and is affected by internal factors and external factors. With the rapid breakthrough of medicine in prolonging human life and the rapid deterioration of environmental conditions, it has become urgent to find safe and effective methods to treat skin aging. For diet, as the main way for the body to obtain energy and nutrients, people have gradually realized its importance to the skin. Therefore, in this review, we discuss the skin structure, aging manifestations, and possible mechanisms, summarize the research progress, challenges, possible directions of diet management, and effects of foodborne antioxidants on skin aging from the perspective of food and nutrition.

Nutrition is closely associated with skin health and is required for all biological processes of skin from youth to aging or disease. Nutrition levels and eating habits can repair damaged skin and can also cause damage to the skin. In recent years, a number of people have closely linked health-nutrition-eating habits and skin health, besides, clinical research and epidemiology have successfully combined nutrition with tissues and organ health and have confirmed that nutritional levels and eating habits have a certain degree of impact on skin health and aging.

Figure 6. Facts from reference paper on nutritional intake impacting skin ageing [14].

Results

This output will help us to identify malnutrition among individuals with playing a major role in implying as an input to predict BMI and also through tentative age difference will bring it as an inference to skin aging and nutritional consumption methods as shown in Figure 7.

Figure 7. Age prediction shows male ageing between 15 and 20 years.

Height Prediction Model

For predicting malnutrition, we need to consider all the factors influencing an individual's BMI. The Haar Cascade algorithm is used for object detection in computer vision. To train the classifier, positive and negative samples of the object are used. Positive samples contain the object while negative samples do not. Haar-like features are extracted from these samples, which are rectangular regions with different intensity values. The extracted features are then used to train the classifier, which can be used to detect the object in new images or video frames. Haar Cascade classifiers are widely used for face detection in images and videos. However, they can also be used to detect other objects, such as animals, pedestrians, and cars. OpenCV, a popular computer vision library, provides pre-trained Haar Cascade classifiers for various objects and also includes tools for training new classifiers.
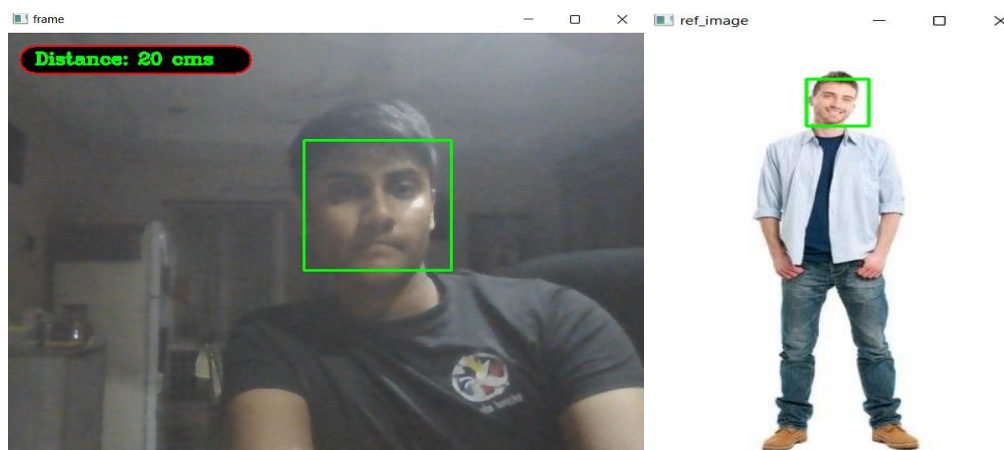
Figure 8. Facial identification and assessing distance **Figure 9.** Reference image.
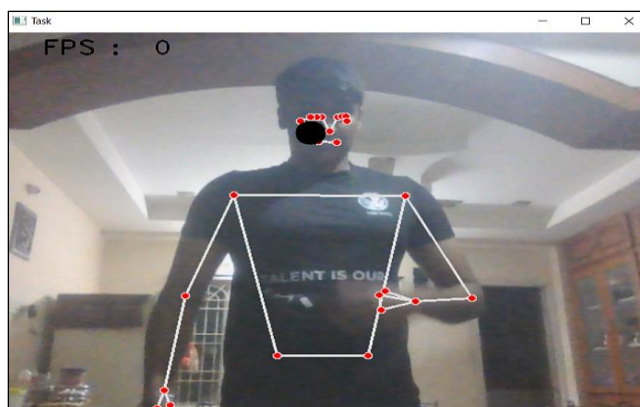from the camera to produce further results.

Figure 10. Body detection algorithm results along with a
reference image of what results are to be obtained.

A Python module called Pyttsx3 can be used to turn text into speech. To carry out this conversion, it makes use of many Python packages as well as the Microsoft Speech API (application programming interface). You may quickly add speech output to your program by incorporating pyttsx3 into your Python programs. You can customize the speech rate, loudness, and voice utilized for the speech output with Pyttsx3, which supports a number of text-to-speech engines and languages. The library offers simple, user-friendly techniques for turning text into speech, and you can even save the produced speech as an audio file. In general, pyttsx3 is a versatile and potent library that may be used to convert text to speech in a range of applications, including educational software, automation scripts, and accessibility solutions as shown in Figures 8 and 9.

The result for height detection is based upon the positioning of the camera parallelly and distance in such a way that your whole body from face to legs is detected using the body detection algorithm, this result is obtained through the video as shown in Figure 10.

Weight Prediction Using Heights
An algorithm in the field of machine learning is based on learning that is influenced upon training the model beforehand with précised data, this learning mechanism of the model is supervised learning and one of the main methods of predictions linear regression. It performs regression operations. The use of independent variables is done by regression to model target predictors. It determines the relationship between variables and predictions as shown in Figure 11.

	Gender	Height	Weight
0	Male	73.847017	241.893563
1	Male	68.781904	162.310473
2	Male	74.110105	212.740856
3	Male	71.730978	220.042470
4	Male	69.881796	206.349801

Figure 11. Dataset information.

Dataset

Split dataset into training set and test set. We will use 80% of the data for training and 20% of the data for testing. Then we fit regression model using LinearRegression() to train our model. On evaluating, we obtain these results as shown in Figure 12.

```
Step 7: Model Evaluation

    from sklearn import metrics
    print('R square = ',metrics.r2_score(y_test, lrpred))
    print('Mean squared Error = ',metrics.mean_squared_error(y_test, lrpred))
    print('Mean absolute Error = ',metrics.mean_absolute_error(y_test, lrpred))

R square =  0.9052889824534557
Mean squared Error =  97.87152220196164
Mean absolute Error =  7.955916525326745

    my_weight_pred = lr.predict([[1,70]])
    print('My predicted weight = ',my_weight_pred)

My predicted weight =  [192.82156966]
```

Figure 12. Results obtained for weight prediction model.

This model will help us predict weight in order to use it for BMI prediction model. The model built for predicting weight has its own arguments, as the dataset is limited. But more precision can be attained across individuals by training the model by implying more scenarios and more diverse datasets. Keeping in mind the need for more availability of data in order to attain more precision, we can state inferences that the model produced achieves higher precision for the limited dataset used.

R-squared is a standardized version of mean squared error (MSE) used in regression analysis. R-squared represents the percentage of variance in the actual value of the response variable actually explained by the regression model, whereas MSE measures the residual error. A regression model is considered to be well-fitting when the R-squared value is high, near to 1, meaning that a sizable percentage of the variance in the response variable is explained by the model. It is difficult to assess the validity of the regression model with certainty because MSE is influenced by the response variable's range of values.

While analysing real-time data and performing regression analysis in East West University [16], the author attained an R-squared value 0.482491 which is very much lower and tends to give wrong predictions, whereas this model has an R-squared value of 0.9052, which indicates high precision.

BMI Prediction Model

To divide the dataset, we used Sklearn. The training dataset and testing dataset labels were placed on the split dataset. In order to evaluate which regression would produce the best results for the dataset, this project tried a number of different regressions. R-squared is termed as the coefficient of determination. For every process of regression, the R-squared was considered to attain the accuracy and relevance of the model. The more significant the number, which is often between 0 and 1, the better, the more effective a model learns the data. The regression with the highest R-squared among them is chosen as the winner.

Typical types of regression are lasso regression and linear regression. These interactions in this experiment obviously include price transfers, pricing patterns, and price miles. The model is created by separately calculating each relationship and equation before integrating them all. When there is a linear relationship between two variables, they perform well. Yet regression has a number of problems.

For instance, outliers may have an impact because extreme samples alter the regression. This project deleted 1% of the margin data during data pre-processing in order to prevent extreme samples, but it still persists. Also, if two variables have complex associations with several arrivals on the relationship curve, linear regression may become perplexing and malfunction as shown in Figure 13.

Dataset

A person's mass (weight) and height are used to calculate the BMI. Because weight is given in kilogrammes and height is measured in metres, the BMI is computed by dividing weight by the square of height and is reported in kilogrammes per square metre (kg/m^2) [15].

A table or graph that displays BMI by height and mass using contour lines or colours for different BMI categories and other units of measurement can be used to determine BMI (convert to metric units for calculation) [15].

BMI is a helpful tool for determining a person's general classification as overweight, normal weight, underweight, or obese based on the mass of tissue (muscle, fat, and bone) and height. Overweight (more than 24.9 kg/m^2), underweight (less than 18.5 kg/m^2), and normal weight (25–29 kg/m^2). Obesity is one

	Sex	Age	Height	Weight	BMI
0	Female	21	65.78331	112.9925	18.357646
1	Female	35	71.51521	136.4873	18.762652
2	Female	27	69.39874	153.0269	22.338985
3	Male	24	68.21660	142.3354	21.504612
4	Female	18	67.78781	144.2971	22.077669

	Age	Height	Weight	BMI
count	24950.000000	24950.000000	24950.000000	24950.000000
mean	26.497836	67.992821	127.077390	19.321368
std	5.190667	1.901551	11.663509	1.552091
min	18.000000	60.278360	78.014760	13.070879
25%	22.000000	66.704955	119.307525	18.278339
50%	27.000000	67.995700	127.152500	19.302160
75%	31.000000	69.271823	134.893550	20.357547
max	35.000000	75.152800	170.924000	26.023756

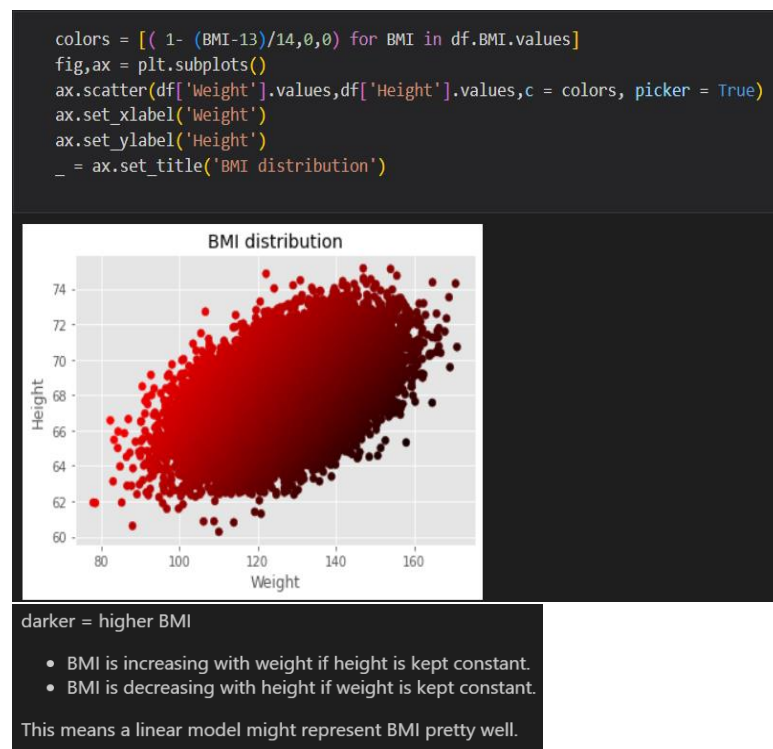**Figure 13.** Descriptive statistics for body mass index (BMI) prediction model dataset.

```
colors = [( 1- (BMI-13)/14,0,0) for BMI in df.BMI.values]
fig,ax = plt.subplots()
ax.scatter(df['Weight'].values,df['Height'].values,c = colors, picker = True)
ax.set_xlabel('Weight')
ax.set_ylabel('Height')
_ = ax.set_title('BMI distribution')
```

darker = higher BMI

- BMI is increasing with weight if height is kept constant.
- BMI is decreasing with height if weight is kept constant.

This means a linear model might represent BMI pretty well.

Figure 14. Body mass index (BMI) distribution graph.

Loss function

Mean squared error - squared difference between predictionBMI and actual BMI

```
def calculate_loss(df):
    return np.square(df['predictionBMI'] - df['BMI'])

preddf = predict_BMI(train_data)
print('loss = ', calculate_loss(preddf).mean())
```

```
loss =  2.3449897213832664
```

```
print('\nPrediction on validation set before training')
de_normalize(predict_BMI(validation_data),means,stds).head(10)
```

Prediction on validation set before training

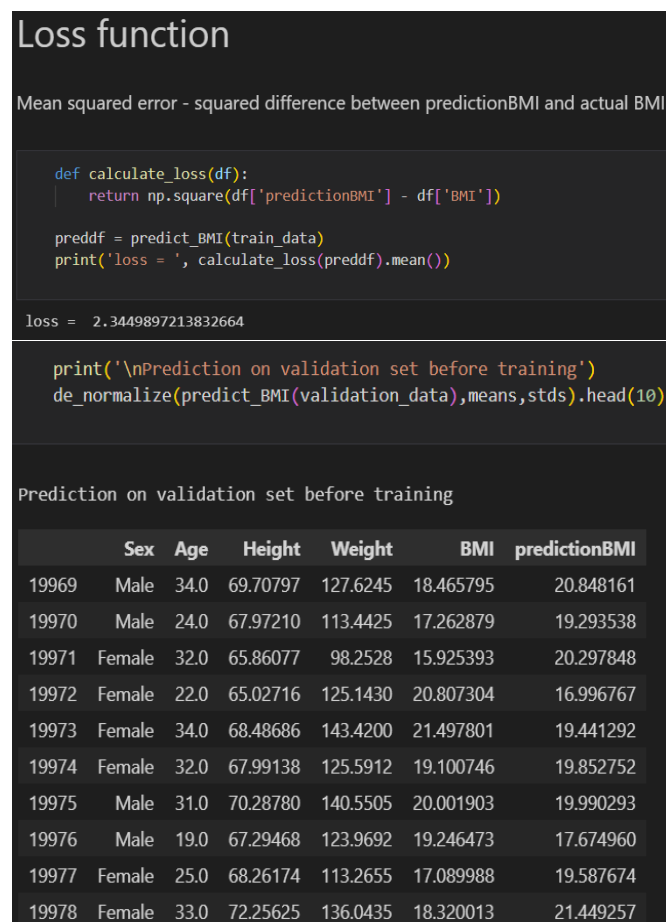|	Sex	Age	Height	Weight	BMI	predictionBMI
19969	Male	34.0	69.70797	127.6245	18.465795	20.848161
19970	Male	24.0	67.97210	113.4425	17.262879	19.293538
19971	Female	32.0	65.86077	98.2528	15.925393	20.297848
19972	Female	22.0	65.02716	125.1430	20.807304	16.996767
19973	Female	34.0	68.48686	143.4200	21.497801	19.441292
19974	Female	32.0	67.99138	125.5912	19.100746	19.852752
19975	Male	31.0	70.28780	140.5505	20.001903	19.990293
19976	Male	19.0	67.29468	123.9692	19.246473	17.674960
19977	Female	25.0	68.26174	113.2655	17.089988	19.587674
19978	Female	33.0	72.25625	136.0435	18.320013	21.449257

Figure 15. Evaluation of Loss function and prediction of validating set.

```
# Weight in Pounds and Height in inches
new_data = [{'name' :'Aryan', 'Age': 21, 'Height': 72, 'Weight': 167.51}]
predictBMI_real(new_data)
```

	name	Age	Height	Weight	predictionBMI
0	Aryan	21.0	72.0	167.51	23.061719

```
# Bmi Scale
a = float(input("Enter BMI: "))
if a<18.5:
  print("The candidate is underweight")
elif 18.5<=a<25:
  print("Normal")
elif 25<=a<30:
  print("Overweight")
elif 30<=a<35:
  print("Obese")
else:
  print("Extremely Obese")
```

```
Enter BMI: 23.06179
Normal
```

Figure 16. Results of body mass index (BMI) prediction model.

of the four major adult BMI categories (30 years or older). When used for people with abdominal obesity, short stature, or extremely muscular mass, BMI limits may render it less useful than certain options for forecasting a person's health rather than as a statistical assessment of groups [15].

BMIs less than 20 and larger than 25 kg/m^2 were linked to higher all-cause mortality, with risk rising as BMI departed from the 20 to 25 range as shown in Figures 14–16 [15].

CONCLUSION AND FUTURE SCOPE

From the above results, that is, by significantly influencing the BMI calculation, it will aid in identifying the age component that will give a precise prognosis of malnutrition. By addressing skin ageing, it will also assist in forming conclusions. Food consumption and skin ageing go hand in hand since healthy nutritional intake reduces skin ageing.

We will be able to determine the best diet to prevent premature ageing of the skin. BMI will help us in identifying the need of regulating the nutritional consumption and food intake in such a manner that we have a normal BMI.

This model helps us work on ourselves individually. With more data and more practices, we will be able to attain highest precision. BMI segregates individuals into undernutrition, normal weight overweight, and obese individuals.

Keeping in mind the food supply, this model will help us identify every individual's nutritional requirement. Based upon these inferences, the government can act to produce products in a regulated manner rather than producing in bulk. This will ensure a reliable supply of food for years to come.

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