ISSN 2320 - 2602
Volume 9 No.7, July 2020
International Journal of Advances in Computer Science and Technology
Available Online at http://www.warse.org/IJACST/static/pdf/file/ijacst08972020.pdf
https://doi.org/10.30534/ijacst/2020/08972020

An Enhanced Application for Nutrition Intake Detection using Deep Learning and IoT

Akshatha Prabhakaran[1], Amrutha Surendran[2], Anjali K Rejive[3], Anjana Babu[4],Neethu Maria John[5]
[1]B.Tech student,India,akshathap09@gmail.com, [2]B.Tech student,India,amruthasure12@gmail.com,
[3]B.Tech student,India,anjalirejive98@gmail.com, [4]B.Tech student,India,anjana.babu9cse@gmail.com,
[5]Assistant Professor,India,neethu.john01@mangalam.in

ABSTRACT

Now-a-days our world relays more or less on junk food. Due to the practice, many health issues have been reported in the recent past. This occurs mainly due to poor nutrition. Hence ensuring proper nutritional intake is the dire need of the hour. Maintaining a perfect diet, helps in improving the overall well being, also aids in fighting malnutrition and reduces the risk of chronic illness and diseases. This paper presents an IoT based application for sensing nutritional intake using deep learning techniques which is fully automated. For this, a deep learning is used. It is a convolution neural network. It contains 2 or more layers performing data transformation. YOLO and clarifia algorithms are used here. This electronic product comprises of Wi-fi enabled sensors to quantify the nutrients contained in the diet wherein a camera is used to capture the food items, which serves as the input to the sensors. The user can also input details regarding his /her ailments so as to receive suggestions about the captured food items; that is, whether the meal is appropriate to the user. A smart phone application to retrieve all the nutritional data about the food ingredients. Here, an IoT platform is used to analyse and store the sensed information.

Key words : Internet of Things (IoT), Consumer Electronics, Smart Healthcare, Smart Home, Food Monitoring, Nutrition Monitoring.

1.PROPOSING SYSTEM

This paper deals with an IoT system incoperated with deep learning algorithms so as to monitor the nutrient intake as per the given input item..This system can be deployed either using software or along the support of hardware components. Here, we use pi-cam, load sensor and the microcontroller named Raspberry pi as hardware component. For montoring the value of a food item say, an apple, the image captured by the pi-cam is served as one of the input. This image is processed by the Raspberry pi and is sent as the mail of the intended user. The second input is the value of the weight of the item as calculated by the load sensor. Now the dimension or character recognition is done by a library called load encoder which gives an integer value which is characterised as the weightage of the particular food. Hence, the weightage and weight indicated as (x1and x2) given as data set is checked against the values of weight and weightage of the given food. For this, we use decision tree regression which is one type of predictive problem solving method under machine learning. The regression tree allows output as integer values out of continuous input variables. Thus, the y value corresponding to the x1 and x2 values is obtained which gives the final output, that is, the particular nutritional value contained in the food item.

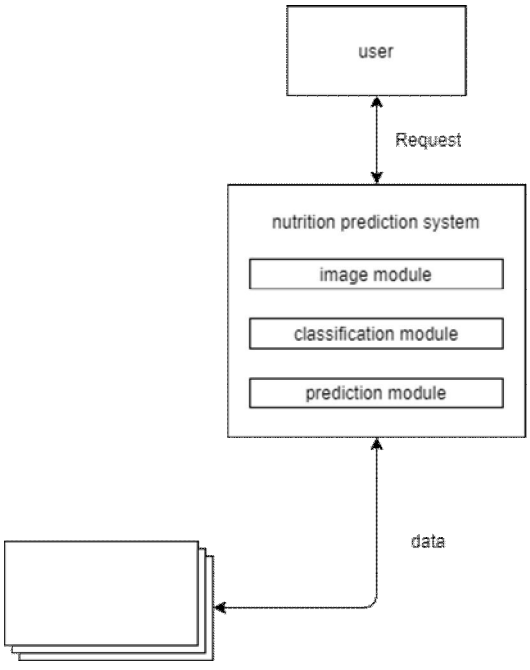

Figure 1: System architecture

2. RELATED WORKS

Research on existing calorie intake using the concept of proportionality of food bite count to the calorie intake. A micro electro mechanical gyroscope was used to track wrist motion (equal to bite count) which turned out to be inaccurate and insensitive during uncontrolled meal sittings. it was affordable and convenient. However, it was more prone to error while an individual tries to examine calorie intake due to varying serving sizes [1].Research on food image classification using multiple kernel learning was used to estimate weight of food items by combining image features to determine the type. However, practically it failed to show high performance [2]. Research on smart log addresses the low performance of the existing systems, which uses deep learning mechanisms to predict nutritional data of future meals. This system involved a weighing sensor to sense the weight of the input. However, it does not give any information whether the meal can be consumed by the user or individual using it which makes the system less persuasive [3].Research on personalised nutrition by prediction of glycemic response, it analysis the blood sugar level and obesity of the food intake by the person. connected to device which takes blood sugar level in each 5 minutes for an entire week and they uses a mobile app which records all the action of the person. Using all data an algorithm is generated to predict the blood sugar level according to the intake of the food by the disciplines. Using this prediction a good diet plan is given to the disciplines. This makes life to become healthier and changes the lifestyle[4]. This paper deals with a fully automated IoT system to determine the nutrition intake of a diet using a 5 layer perceptron layer neural network and Baysian network which comes under deep learning techniques .The system uses a cellular phone camera to capture the images of the input diet which is then sensed using different Wi-fi enabled sensors to sense the nutrient content which is then analysed and stored for future predictions with the aid of deep learning. This system also suggests if the food item is appropriate for the user as per his health conditions. The information is stored in cloud for analysis and storage for references. The system is highly convenient and affordable.

3. EXPERIMENTAL ANALYSIS

A) Data acquisition of nutrition detector

Data acquisition for the nutrition detector consists of some hardware and software designs. Raspberry pi, Raspberry pi cam, load cell, HX711 are some of the hardware components.

Raspberry pi is a latest model with 64 bit quad- core processor, dual band with 2.4 GHz and 5 GHz of wireless LAN, faster ethernet etc. it is small and powerful. ie, it act as a small computer all the nutrition value of the food item are stored in the Raspberry pi. In our proposed system the Raspberry pi is connected to the load cell and camera module. Load cell is used to measure the weight of the food item. Raspberry pi cam which is known as camera module is used to capture the image of the food item. Here the nutrition value is predicted on the basis of image captured by the pi cam. the nutrition value of 50+ items are stored in the Raspberry pi.

Figure 2: Raspberry Pi

Load cell is the one of the most basic and important component in the proposed system. It is a type of transducer. It converts a force into electrical signal which can be measured and standardized. The signal changes depends up on the force applied on the load cell. Here we use load to measure the weight of the food

Figure 3: Load cell

item. It is made up of aluminium alloy and it is capable of to take the reading upto 1 Kg. there are many types load cell. For eg: strain gauge, pneumatic etc.

Raspberry pi camera module V2 is a high definition image capturing device with 8 megapixel sony IMX219 image sensor. It uses CSI interface designed specially for cameras. This can be used for various other applications. Raspberry pi camera supported with raspberry pi and jetson nano.

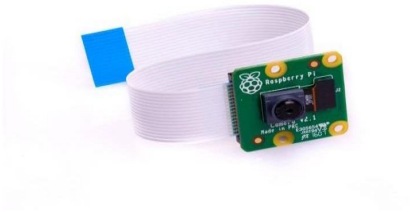

Figure 4: Camera module

HX711 is a dual channel 24 bit precision and A/D pressure sensor load cell amplifier. This is connects the load cell and raspberry pi. It act as a amplifier. When the load cell measures the weight of the food item, it is converted in the electrical signal. This may not be accurate, sometimes it varies also. To get an accurate value we use HX711, this retrieves the output from the load cell the it performs amplification and produce accurate weight measurement of the food item. The produced output is given to the Raspberry pi module and obtains the nutrition value of the corresponding food item.

Figure 5: HX711

Software technologies

In our proposed system we use some software technologies:

- Machine learning
- Deep learning
- Programming language: python
- IoT

Machine learning is one of the application of artificial intelligence. It introduces the ability to learn automatically about the system.

Machine learning is a specified algorithm which builds a mathematical model based on training data. Machine learning is used to make prediction or decision by studying the previous data or a system. Machines are of 3types:

Supervised learning is used to built a mathematical model from set of data which contains both input and output. Supervised learning means learning is done by the training a data set which as an input and desired output. Simple example is teacher teaches he student. There are 2 types of supervised learning algorithms ie, classification algorithm and regression algorithm. Classification algorithm is used to predict a set of value. Regression algorithm is used to predict multiple values for a set of data. In unsupervised learning also mathematical model is built from data set which contains only input. Clustering and association are the methods used for unsupervised learning. The goal of the unsupervised learning is to predict the model by learning more about the given data input.

There is no correct answer and no supervisor. In reinforcement learning the prediction of a model is done by predicting the output of a data, which has no environment or a state. It uses dynamic programming technique. It does not assume the exact mathematical model.

Deep learning is another subset of artificial intelligence. Artificial neural networks are used in modern deep learning. Deep learning means the data transformed into number of layers. It can be constructed using greedy layered method. Unsupervised learning tasks use more deep learning methods. There are many applications such as image recognition, visual art processing, natural language processing.

Python is a high level programming language, open source, objects oriented, interactive language. It contains classes, data types, modules and interfaces to many system calls and libraries. Python is used widely in machine learning.

It is very easy to learn but it is slower than other languages. The capacity of data handling is large. In our proposed system pandas and MatPlotlib libraries are used. MatPlotlib is a python library with numerical mathematic expression NumPy. Pyplot is a module that has a MATLAB like interfaces. NumPy means numerical python. It has N-dimensional array objects and sophisticated function. Eg: linear algebra, matrices. Pandas is a open source data, fastest, manipulation tool. it is another kind of library.

B) Analysis of data in nutrition detector

In nutrition detector, to provide a efficient nutrition value prediction we use YOLO algorithm (you only look once). It is an object recognition algorithm and its main function is image classification. There are many images or objects, it should be classified using object recognition. To perform object recognition few steps are should be followed:

1. Classify the image: the first important step is to classify the object. When the object image is displayed it should be identified and perform classification method.

2. Location of object: when the object is classified the next step is to identify the location of the object that were it is placed. Sometimes there will be multiple

objects in the image by this information appropriate action should be taken.

3. Detection of object: when the object location is identified next is to detect the object. For detection here we use a tool known as bounding boxes. It use to select only the particular image and by this image the object is detected.

C) *Model testing*

In our proposed system we have imported some python libraries. It also an API interface Pandas, Seaborn and MatPlotlib. Which is easy to perform. Here we import label encoder from the library SkLearn. It is used to convert the catogarical values ie, the object name intoin integers. Run the label encoder and stores the labels. Input the data ie, attributes it will be stored. We can check information of the stored data. This is known as data preprocessing. Now the categorical values are converted into integer. The integer values are stored in array.

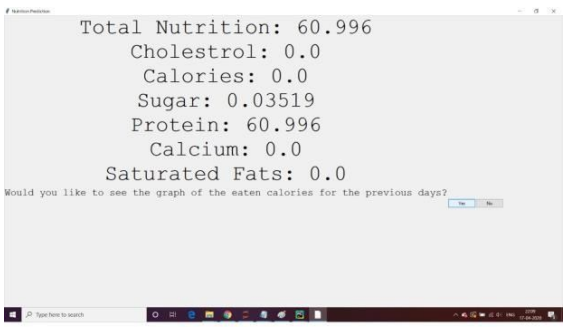

Figure 6: Output

Next we perform data classification. From library SkLearn.Tree we import decisiontreeRegressor to predict the object.

It is use predict more Y value by imputing 2 X values. The predicted output is stored as Y value and object name is stored as X value. In machine learning to train a data set, it should be splitted as 80% to training and 20% for testing. This is known as train test split method.

4.RESULT

This diet monitoring system helps fitness freaks or patients in determining tha calorie intake of the diet by providing all the nutrient content information or about the calories contained in the particular diet. Rather it also provides an entire sophisticated graph structure containing all the statistical information so as to check whether the entire diet plan was an ideal one or not. This system makes greats use of the machine learning and IoT techniques the process of classification of the food consumed with the aid of decision tree regression methods etc.

5.CONCLUSION

Here we presented a healthified nutrition prediction design. The design is highly efficient with diet monitoring. The algorithms used to implement the nutrition detector is decision tree regression algorithm and clarify algorithm. Using the image nutrition value is detected .the picture is passed through raspberry pi and to the loader sensor .the loader sensor defines the wait of the corresponding input. The weight and weightage value is compared with the value that stored in the dataset using decision tree regression algorithm. It provides the accurate nutrition value. This design becomes essential to our improves lifestyle. It provides to maintain a good diet in our day to day life.

REFERENCES

1. Y.Dong, A.Hoover, J.Scisco, and E.Muth, "A New Method for Measuring Meal Intake in Human via Automated Wrist Motion Tracking," Applied Psycho. and Biofeedback,vol.37, no.3, pp.205-215, 2012.

2. T.Joutou and K.Yanai, " A Food image recognition system with multiple kernel Learning," in Proc. IEEE Int. Conf. Image Proc., 2009, pp.285-288.

3.P.Sundaravadivel,K.Kesavan,L.Kesavan,S.P.Mohanty, E.Kougianos and M.K.Ganapathiraju, "Smart-Log: An Automated Predictive Nutrition Monitoring System For Infants Through IoT" in Proc.IEEE Int. Conf. Consum. Election., 2018.

4.Prof.Eran Segal and Dr.Eran Elinav, " personalized nutrition by prediction of glycemic response", http://doi.org/10.1016/j.cell.2015.11.0001.

5. Ajeet Ram Pathak, Manjusha Pandey, Siddarth Rautaray, " Application of Deep Learning for Object Detection", http://doi.org/10.1016/j.procs.2018.05.144.

6.T.Vu, F.Lin, N.Alahurafa and W.Xu," Wearable Food Intake Monitoring Technologies: A Comprehensive Review,"Computer, vol.6, no.4, 2017.

7. J.Wang, Z.Zhang, B.Li, S.Lee and R.Sherrat, "An Enhanced Fall Detection System for Elderly Person Monitoring using Consumer Home Networks," IEEE Trans. Consum. Electron., vol.60, no.1, pp.22-29, Feb 2014.

8. H.Kalantarian, N.Alshurafa and M.Sarrafzadeh, "A Survey of Diet Monitoring Technology," IEEE Pervasive Comput., vol.16, no.1, pp.57-65, Jan 2017.

9.P.Sundaravadiel, E.Kougianos, S.P.Mohanty and M.Ganapathiraju, "Everything You Wanted to Know about Smart Healthcare," IEEE Consum. Electron. Mag., vol 8, no.1, pp.18-28, Jan 2018.

10. O.Beijborn, N.Joshi, D.Morris, S.Saponas and S.Khullar, "Menu-Match:Restaurant-Specific Food Logging from Images," in Proc. IEEE Winter Conf. Appl. Of Comput. Vis., 2015.