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Artificial Intelligence Based Calorie Estimator

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***Abstract*: Artificial Intelligence based calorie estimator is a deep learning methodology which has been initiated to determine the calories a food image contains. The mass records of food and volume specifics are not included in the current system. Additionally, the current system is not capable of recognizing any type of Indian Foods, which leads to partial calorie estimation of foods. In this proposal, we put forward Indian food image as dataset which includes the detailed information rate of calories. Object detection is one of the significant techniques used for estimating calories to the fullest. This is the initially released artificial intelligence based calorie estimator where dataset is Indian Foods. The food intake is being tracked and the calorie count is monitored by the intended system. The results show that the degree of precision is acceptable for the model and it will greatly ameliorate and facilitate the present manual calorie valuation approaches**

Keywords: dataset, calorie estimation, object detection, food recognition.

I. INTRODUCTION

Obesity and overweight are two inter related terms describing a state of possessing too much of body fat. Simply, obesity is defined as the weight that is excessive than what is considered to be as a healthy weight considering the height factor also in to account. The body is made up of various vitamins and minerals, protein, fats, water, and carbohydrates. Factors contributing to weight gain are many like eating habits, untimely food, genes, physical inactivity, sleeping time and habits, medical conditions, type of food consuming etc. obesity is a risk factor which leads to many diseases such as diabetes, heart attack, enlargement of lungs, increase in rate of blood pressure, raise blood cholesterol, which is in short a life threatening situation. As well as adults, Obesity is also being affected by children too. Since the growth rate of children differ from each other, that is each child grow at different rate, obesity is hard to spot in children.

BMI is an abbreviation of Body Mass Index which is a measure of weight calculation. The calculation depends upon the ratio of the person's weight and height. BMI produces a good approximate of "fatness" with the help of which the person will get an alert of how obese he is. The increase in rate of Body mass index corresponds to high risk of diseases. To reduce weight for obese people is a tedious task. Proper medication is to be followed consuming healthy food and lessening the calorie intake. Doctors advice of a personal assistant to assist them, so that they can be more alert. In order to avoid the need of an assistant, an assisting model is developed. The model is a proper monitoring system tracking each time food intake and amount of consumed food is to be properly kept in track. Computer vision based calorie estimator where introduced to calculate calories from images exactly based on the food information.

Fig.1 . Risks of obesity

Opencv is used as an object detection API in the model detecting the objects which is termed as computer vision. The output of opencv is given to tensorflow to detect what the image contains. Simply, Tensorflow is used for the identification of food images in the model where tensorflow is defined as an open source deep learning library designed for performing complex computations to build machine learning systems from scratch. It consists of an already pretrained

model called inception which is classified with 1000 class images by Google's imagenet. Here we take the final layer of the inception model and retrain the system to make it to identify Indian dishes with more accuracy and precision.

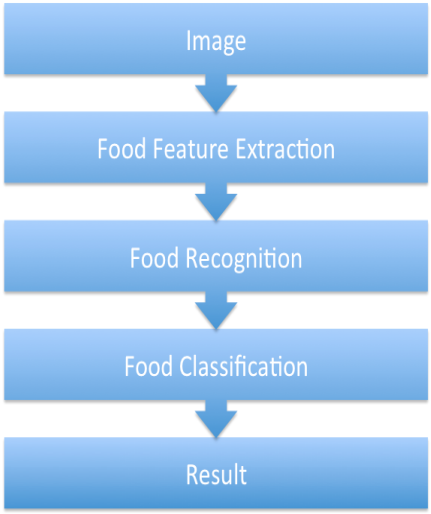

Fig. 2. Flow control for food recognition using tensorflow

An image is provided as the input to the tensorflow directory. The tensorflow calculates the probability value of the image subjected . The feature map extracts the features of the provided image and the type of food is recognized. Followed by the recognition, food type is classified. Finally, result is obtained.

The obtained result is given to the calorie estimation table to calculate the corresponding calories, so that the amount of calories consumed could be analyzed in an effective manner and we will be able to control obesity and overweight problems in future.

II. BACKGROUND STUDY

This section will primarily look into some of the research already carried out in order to improve calorie Estimation.

A. *Pooled Analysis:*

The Pooled analysis is a method frequently acclimated in epidemiology when individual studies are too small to allow any definite conclusion. Several guidelines have been appeared on pooling of classical epidemiological studies[2], but no advice is accessible on pooling of studies. (I.e.)Performing analysis on analysis is called pooled analysis

B. *Seed Displacement:*

It is a displacement tracking algorithm. It is a key venture in the evaluation of food portion size, all of the grid points are utilized similary as seeds. And by displacing them in water the volume of the food might be distinguished successfully[8].

C. *Hough Transformation Algorithm:*

The Hough transform is a extraction strategy utilized within image analysis, computer vision, and digital image processing. The purpose of the technique is to find blemished instances of objects within a certain class of shapes by a voting technique. This adopting methodology is carried out in an parameter scope, from which object applicants are obtained as local maxima in a so-called accumulator scope that is explicitly constructed by the algorithm for determining the Hough transform[6].

D. *Implementation:*

We define L1 as the loss function of the food calorie estimation task and L2 as that of the food categorization task, and denote N as the total number of learning data. The overall loss function L is as follows:

$$L = -\frac{1}{N}\sum_{i=0}^{n}(L1 + \lambda_1 L2) \quad (1)$$

The food calorie estimation task is treated as a regression problem. Generally, in the regression problem, a mean square error is used as the loss function, but in this paper we use loss function as shown below. We denote L1ab as an absolute error and L1re as an relative error, L1 is defined as following:

$$L1 = L1_{re} + \lambda_2 L1_{ab} \quad (2)$$

This loss function improves learning speed and performance. Let yi as the estimated value of an image xi and gi as the ground-truth, L1ab and L1re are defined as following:

$$L1_{ab} = |y_i - g_i| \quad (3)$$

$$L1_{re} = \frac{|y_i - g_i|}{g_i} \quad (4)$$

Because the food categorization task is a multi-class classification problem, a soft-max function is used for the output layer of the food categorization task, and L2 is calculated by the standard soft-max cross entropy.

Table 1:

	Calorie regression		Categorization	
	abs. err.(kcal)	rel. err.(%)	Top-1(%)	Top-5(%)
Single-task	105.73	30.15	80.43	96.93
Multi-task	94.14	27.93	82.48	97.54

III. PROPOSED RESEARCH

It is clear that a number of algorithms are there to identify images and provide a calorie based calculation for the requested image.
It is also clear that there is no dataset for Indian food items and no corresponding calorie database present for these food items. And there is no system present to identify Indian food items in real world. A model is designed to overcome the issues of the existing system by identifying Indian food and estimating corresponding calories.

A. *Proposed system design:*

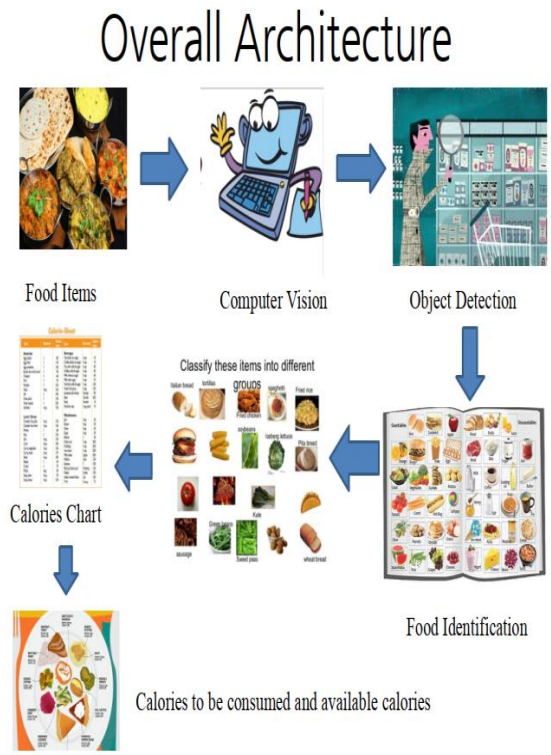

Fig.3.System Architecture

B. *Proposed Project Flow Diagram*

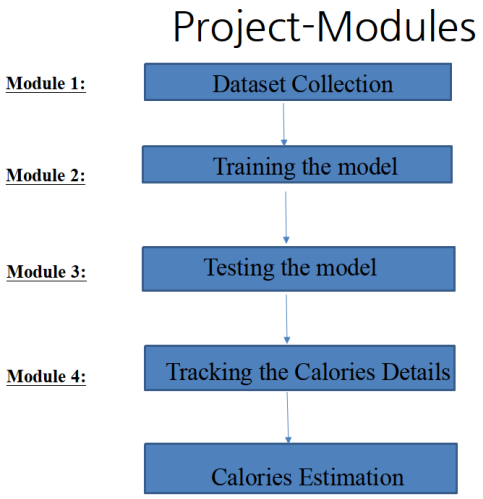

Fig.4. Flowchart of working modules

Table 2:
Food Recognition Accuracy for Single Food Items

NO	Sample Food items	Recognition Rate (%)
1	Dosa	100
2	Idly	99.5
3	Idiyappam	89
4	Seer fish	91
5	Cutlet	87
6	Bonda	93
7	Poori	100
8	Pongal	88
9	Chicken lollipop	94
10	Bull's eye egg	100
11	samosa	100
12	Boiled egg	100
13	vada	97
14	parota	98
15	Briyani	83

IV. Envisaged Research

The proposed research work entitled "**Artificial Intelligence based Calorie Counter**" would envisage the following:

- System to detect Indian food items in real world environment
- Identify corresponding calories to the food items
- Keep track of person's diet by estimating appropriate calories based on their height and weight i.e. based on Corresponding BMI values.

V. Conclusion And Futurework

From this proposal, we came across several features of deep learning algorithms such as convolution neural networks, inception model, object detection and various features. In the future we can provide these features to a robot to track our dietary plans in an automated way.

VI. References

[1] Wei Zheng, Dale F. Mclerran, Betsy Rolland, Xi- anglan Zhang, Manami Inoue, Keitaro Matsuo, Jiang He, Prakash Chandra Gupta, Kunnambath Ramadas, and Shoichiro Tsugane, "Association between body- mass index and risk of death in more than 1 million asians," New England Journal of Medicine, vol. 364, no. 8, pp. 719–29, 2011

[2] Mariachiara Di Cesare, James Bentham, Gretchen A. Stevens, Bin Zhou, Goodarz Danaei, Yuan Lu, Honor Bixby, Melanie J. Cowan, Leanne M. Riley, and Kaveh Hajifathalian, "Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 192 million participants," *Lancet*, vol. 387, no. 10026, pp. 1377– 1396, 2016

[3] W. Jia, H. C. Chen, Y. Yue, Z. Li, J Fernstrom, Y. Bai, C. Li, and M. Sun, "Accuracy of food portion size es- timation from digital pictures acquired by a chest-worn camera.," *Public Health Nutrition*, vol. 17, no. 8, pp. 1671–81, 2014

[4] Zhou Guodong, Qian Longhua, and Zhu Qiaoming, "Determination of food portion size by image process

[5] Y. Bai, C. Li, Y. Yue, W. Jia, J. Li, Z. H. Mao, and M. Sun, "Designing a wearable computer for lifestyle evaluation.," in *Bioengineering Conference*, 2012, pp. 93–94

[6] Parisa Pouladzadeh, Pallavi Kuhad, Sri Vijay Bharat Peddi, Abdulsalam Yassine, and Shervin Shirmoham- madi, "Mobile cloud based food calorie measurement," pp. 1–6, 2014.

[7] JohanAKSuykensandJoosVandewalle,"Leastsquares support vector machine classifiers," *Neural processing letters*, vol. 9, no. 3, pp. 293–300, 1999

[8] Gregorio Villalobos, Rana Almaghrabi, Parisa Pouladzadeh, and Shervin Shirmohammadi, "An image procesing approach for calorie intake measure- ment," in *IEEE International Symposium on Medical Measurements and Applications Proceedings*, 2012, pp. 1–5.

[9] FAO/INFOODS, U. Ruth Charrondire, David Hay- towitz, and B. Stadlmayr, "Fao/infoods density database version 1.0," 2012

[10] Lukas Bossard, Matthieu Guillaumin, and Luc Van Gool, "Food-101–mining discriminative components with random forests," in *European Conference on Computer Vision*. Springer, 2014, pp. 446–461.

[11] Mei Chen, Kapil Dhingra, Wen Wu, Lei Yang, Rahul Sukthankar, and Jie Yang, "Pfid: Pittsburgh fast-food image dataset," in *IEEE International Conference on Image Processing*, 2009, pp. 289–292.

[12] Parisa Pouladzadeh, Abdulsalam Yassine, and Shervin Shirmohammadi, "Foodd: An image-based food de- tection dataset for calorie measurement," in *Interna- tional Conference on Multimedia Assisted Dietary Man- agement*, 2015.

[13] Dimitrios Ioannou, Walter Huda, and Andrew F Laine, "Circle recognition through a 2d hough transform and radius histogramming," *Image and vision computing*, vol. 17, no. 1, pp. 15–26, 1999.

[14] Ren, Kaiming He, Ross Girshick, and Jian Sun, "Faster r-cnn: Towards real-time object detection with region proposal networks," in Advances in neural information processing systems, 2015, pp. 91–99.

[15] Carsten Rother, Vladimir Kolmogorov, and Andrew Blake, "Grabcut: Interactive foreground extraction using iterated graph cuts," in *ACM transactions on graph- ics (TOG)*. ACM, 2004, vol. 23, pp. 309–314.

[16] J. Wenyan, Z. Ruizhen, Y. Ning, J. D. Fernstrom, M. H. Fernstrom, R. J. Sclabassi, et al., "A food portion size measurement system for image-based dietary assessment," in Proc. IEEE 35th Bioeng. Conf., Apr. 2009, pp. 3–5.

[17] W. Wu and J. Yang, "Fast food recognition from videos of eating for calorie estimation," in Proc. Int. Conf. Multimedia Expo, Jul. 2009, pp. 1210–1213