“HEARTILENS”

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Abstract:

In today's busy world, everyone is busy with their own stuff, like working late nights in offices and having mental stress and health issues. For continuing with their work, they need to be healthy. People are so busy in their lives that, whatever they are given, they eat it without knowing whether it will affect their body, unhealthy or healthy. So to help that audience, we have made a project where a user can capture the image of a food item and get the calories and cholesterol level so that they get to know the cholesterol level as well as the calorie level of the food. We focused on the heart of the human body, as the title suggests heartilens. In order to calculate the calorie we used thumb as a calibration and to detect the object we used YOLO v4 algorithm that is You Look Only Once, in which we achieved 98.61 % mean average precision.

Introduction:

As we all know "Health is Wealth", despite knowing this quote majority people don't know weather they are taking a healthy food intake or a non healthy food intake. Non-healthy food intake lead to obesity, which is not good for all the organs like heart to proper work ,like people face many problems of heart like high blood pressure, high cholesterol etc. When a person eat junk food , they think that it is much tastier than vegetable and keep on continuing eating that, which lead them to gain body weight and cross the normal BMI range and become obese. A new study released by Lancet shows that in 2022 ,more than 1 billion people are living in world with obesity. All over the world, obesity among adults has more than doubled since 1990, and has quadrupled among children and adolescents(5 to 19 years).The data also shows that 43% of adults were overweight in 2022.

Convolutional Neural Network can be used in this direction to detect the food items. We used YOLO a convolutional neual network, a type of neural network , which are very good at detecting object pattern. YOLO was proposed by Joseph Redmond in 2015 .It was proposed to deal with problems faced in food recognition at that time .We used dataset available on roboflow and used thumb calibration in order to calculate the calorie.

Literature Review:

S.No.	Paper	Published	Writters	Abstract
1	Deep neural network for food image classification and nutrient identification: A systematic review	28/03/2023 Volume 24, pages 633–653, (2023)	Rajdeep Kaur,	using FIC and object detection techniques to estimate nutrition with food image analysis.
2	Vision-based food nutrition estimation via RGB-D fusion network	17 May 2023. https://doi.org/10.1016/j.foodchem.2023.136309	Wenjing Shao a, Weiqing Min b c, Sujuan Hou a, Mengjiang Luo b c, Tianhao Li b c, Yuanjie Zheng a, Shuqiang Jiang b c	based on the RGB-D fusion achieved better performance,combined multimodal feature fusion and multi-scale fusion modules.
3	Smart Diet Diary: Real-Time Mobile Application for Food Recognition	Applied System Innovation in 2023	Muhammad Nadeem, Henry Shen, Lincoln Choy, and Julien Moussa H. Barakat	uses deep learning for food recognition, calculating calorie counts based on a dataset of 16,000 food images. With an overall accuracy of around 80%
4	Assessment of sensory and nutritional attributes of foxtail millet-based food products	published in Frontiers in Nutrition in 2023	Laghima Arora, Renuka Aggarwal, Inderpreet Dhaliwal, Om Prakash Gupta, and Prashant Kaushik	explores the development and evaluation of eight foxtail millet-based food products. The study highlights the high nutritional value of these products, including protein, fiber, and resistant starch, along with a low predicted glycemic index, suggesting their suitability for diabetics and contributions to nutritional security.
5	A systematic literature review of indicators measuring food security	published in Agriculture & Food Security in 2023	Ioannis Manikas, Beshir M. Ali, and Balan Sundarakani	analyzes 78 articles to understand common indicators, their effectiveness, and data requirements, identifying dietary diversity and experience-based indicators as widely used. It provides insights for policymakers on improving food security metrics to support more effective monitoring and interventions
6	Health to Eat: A Smart Plate with Food Recognition, Classification, and Weight Measurement for Type-2 Diabetic Mellitus Patients' Nutrition Control	puiblished in mdpi in 2023	Salaki Reynaldo Joshua, Seungheon Shin, Je-Hoon Lee, Seong Kun Kim	Using a YOLOv5s algorithm and a load cell sensor, the system accurately identifies food types, measures weight, and calculates nutritional content. This technology aims to support diabetic patients in monitoring their diet and offers potential integration with mobile diabetes management applications
7	Evaluation of adherence to the Mediterranean diet with sustainable nutrition knowledge and environmentally responsible food choices	published in Frontiers in Nutrition in 2023	Emine Yassıbaş and Hatice Bölükbaşı	The cross-sectional survey of 1,732 adults reveals moderate MD adherence levels, with age, nutrition knowledge, and eco-friendly choices positively impacting adherence scores. Findings suggest the need for strategies to increase MD adherence and promote eco-friendly eating behaviors to achieve health and environmental goals
8	Evaluation of Growth Conditions, Antioxidant Potential, and Sensory Attributes of Six Diverse Microgreens Species	puiblished in mdpi in 2023	Ajeet Singh Dhaka, Harsh Kumar Dikshit, Gyan P. Mishra, and others	This study explores the growth optimization, antioxidant potential, and sensory properties of six microgreen species (mungbean, lentil, red radish, pearl millet, mustard, and red cabbage). With a focus on maximizing nutritional benefits, the study found that red cabbage microgreens had the highest antioxidant activity (87% DPPH radical scavenging), while pearl millet showed a strong yield and high phenolic content. These insights aim to enhance microgreen production for health and sensory appeal
9	Food Calorie Estimation Using Convolutional Neural Network	Published in 2023	Mrs. Srilatha Puli, Mrs. S. Sunitha Surarapu,K. Prajitha,A. Shreshta,G. Nikhil Reddy,K. Vijay simha Reddy	The paper brought forward a CNN-based model for automated calorie estimation from food images, with accuracy surpassing traditional manual methods. Built on TensorFlow, the implemented food items detection and calorie computation yield a 20% reduction in volume error. It definitely heralds massive benefits in healthcare for diet monitoring.
10	Hybrid Deep Learning Algorithm-Based Food Recognition and Calorie Estimation	Published on 24 November 2023	Ritu Agarwal, Tanupriya Choudhury, Neelu J. Ahuja,and Tanmay Sarkar.	This paper presents a deep learning-based hybrid architecture for estimating the calorie in food that integrates segmentation, classification, and volume calculation. Using Mask RCNN for image segmentation and YOLO V5 for feature extraction, the model is able to identify accurately the food items and calculate dimensions toward the estimation of calorie content with an accuracy of 97.12%. This in turn will help individuals monitor their portion sizes as well as their calories, potentially bringing about further guidance regarding volume intake.

11	Calorie Estimation of Food and Beverages Using Deep Learning	Publication Year: 2024	Vasantha M, Nanditha P R, Keerthana D R, Sushmitha K C	SmartBite" is a deep learning system for real-time food recognition and calorie estimation. Based on the MobileNet architecture and Food 101 dataset, the method efficiently identifies and classifies food items and provides users with estimates of calories in order to help them track their diets and maintain healthy eating.
12	Using distance estimation and deep learning to simplify calibration in food calorie measurement	Published by IEEE in 2015	Pallavi Kuhad; Abdulsalam Yassine; Shervin Shimohammadi	This paper presents a completely automatic and user-friendly approach to calibrating food portion sizes using image processing, deep learning, and mobile cloud computing. Based on the dimension and weight estimation of food portions, the approach enhances accuracy in measuring the calorie count. Experimental results show an average increase of 95% compared to those achieved with prior methods.
13	Computer vision and deep learning-based approaches for detection of food nutrients/nutrition: New insights and advances	Published in April 2024	Sushant Kaushala, Dushyanth Kumar Tamminenib, Priya Rana, Minaxi Sharma, Kandi Sridhar, Ho-Hsien Chen	50 wordsclear Humanize AI This review sums up computer vision in food processing, focusing on meat, grains, fruits, vegetables, and seafood. Recent advances in deep learning algorithms allow for accurate, non-destructive food recognition and estimation of nutrients. These vision-based technologies promise a future of rapid, cost-effective, and precise nutritional analysis to support health and nutrition research.
14	Analysis of Convolutional Neural Networks on Indian food detection and estimation of calories	Published in 2022	Suriyakrishnan Sathi sh,S. Ashwin,Md. Abdul Quadir,L.K. Pavithra	This study developed a deep learning model using OpenCV to identify Indian cuisine and estimate calorie content accurately. A custom dataset of Indian cuisine images was created, and a Convolutional Neural Network was applied for classification. The model achieved 99.19% accuracy on training data and 95.30% on testing data, with calorie estimates showing an error variation of ±10 calories from actual values.
15	Deep Learning-Based Food Calorie Estimation Method in Dietary Assessment	18/02/18	Yanchao Lianga, Jianhua Lia	Obesity treatment demands tracking daily food intake; computer vision also supports estimation of caloric consumption from food images. This article employs Faster R-CNN for the detection of food, and GrabCut for extracting contour information from food images, using volume estimation formulas to compute calories. Experimental results demonstrated the accuracy of this method in enhancing the precision of volume estimation.
16	Food Image Detection System and Calorie Content Estimation Using Yolo to Control Calorie Intake in the Body	ICIMECE 2023	Fitroh Romadhon, Faisal Rahutomo , Joko Hariyono1, Sutrisno, Meiyanto Eko Sulistyo, Muhammad Hamka Ibrahim, Subuh Pramono	Overconsumption of calories leads to obesity and degenerative diseases, such as diabetes and heart disease. This study constructs a system utilizing the YOLO algorithm in Python and uses FatSecret Indonesia data to detect food types and estimate their calorie content. The food detection got high performance with a 0.94, 0.90, and 0.91 precision, recall, and F1-score respectively. However, performance was low on Hugging Face, with suboptimal CPU usage and lower-quality images, at the scores of 0.84, 0.32, and 0.41.
17	Food Calorie and Nutrition Analysis System based on Mask R-CNN	Published by IEEE	Meng-Lin Chiang,Chia-An Wu,Jian-Kai Feng,Chiung-Yao Fang,Sei-Wang Chen	Obesity is a critical health issue linked to chronic diseases like diabetes and heart disease. This study introduces a food calorie and nutrition analysis system using images, leveraging the Ville Cafe dataset with 35,842 images across 16 food categories. A Mask R-CNN with union postprocessing improves analytics and visualization, achieving 99.86% accuracy and 97.17% IoU. Food weight estimation experiments with linear regression showed an average absolute error of 8.22 and a relative error of 0.13.
18	FOOD CALORIE ESTIMATION USING MACHINE LEARNING	Published May 2024	Prof. Sarika Bodake, Yash Makesar, Ayush Patil, Rahul Singh, Akash Sarulkar.	With an ever-increasing concern for health, technology has started to contribute to healthier lifestyles. A health and fitness application with calorie estimation based on the YOLO algorithm and a BMI calculator providing overall health information is proposed in this paper. The system is trained on a diverse food dataset and is designed to be seamlessly integrated into a user-friendly mobile platform. Experiments validate the effectiveness of calorie tracking and BMI computation, thereby demonstrating its potential as a practical tool for health management. One such innovation shines light on how computer vision and machine learning empower people to achieve fitness goals.

Methodology:

For detecting the food item and classifying it, we used YOLO v4 algorithm which is a very fast object detection and classification on which it has been trained on. During segmentation phase we will separate the object area from the picture which is been detected in previous phase. Currently we have two types of shape of food that is sphere and cylinder. Then their volume is being calculated .In order to calculate weight we used density(g/cm^3) and get calculate by:

W=density*volume

And calorie is calculated using C(Calorie)=W*Calorie per 100gm/100

Experimental Results:

Or state of the art food classification model performed exceptionally well as evident from the following table

Criteria	Score
Mean Average Precision	98.61%
Precision	0.97
Recall	0.99
F1-Score	0.98

Following is table for estimated calories which we got in out best-case .The accuracy column values show the % of Accuracy calculating as Accuracy=(Estimated Calories by system/Actual Calories) *100.

Items	Actual calories	Estimated calories	Accuracy(%)
Tomato	22	18	81.81
Qiwi	44	50	88
Onion	63	71	88.73
Carrot	30	26	86.66
Banana	110	121	90.90
Apple	95	83	87.36
Orange	60	48	80

System Architecture:

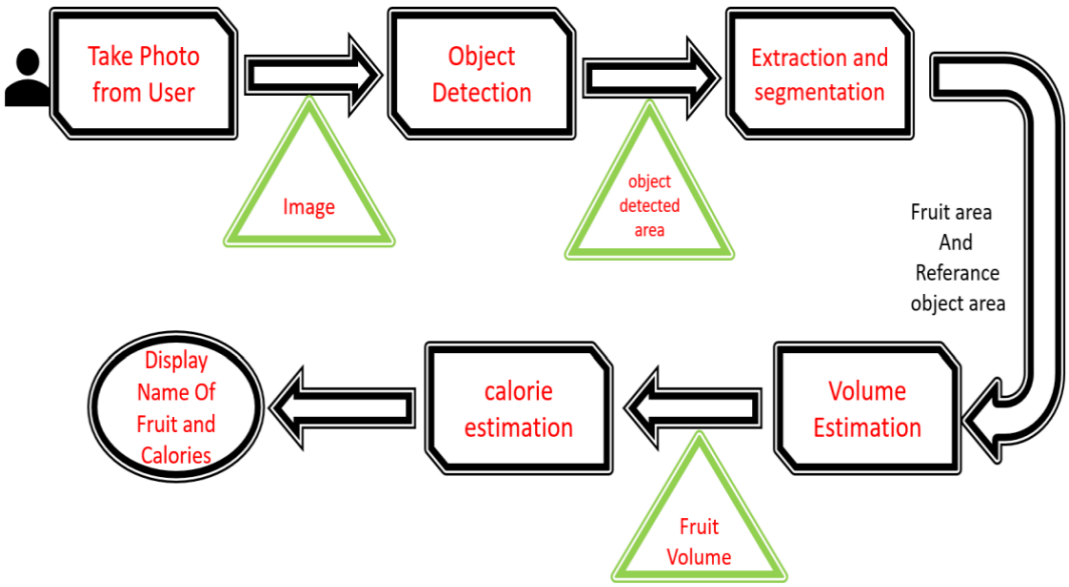
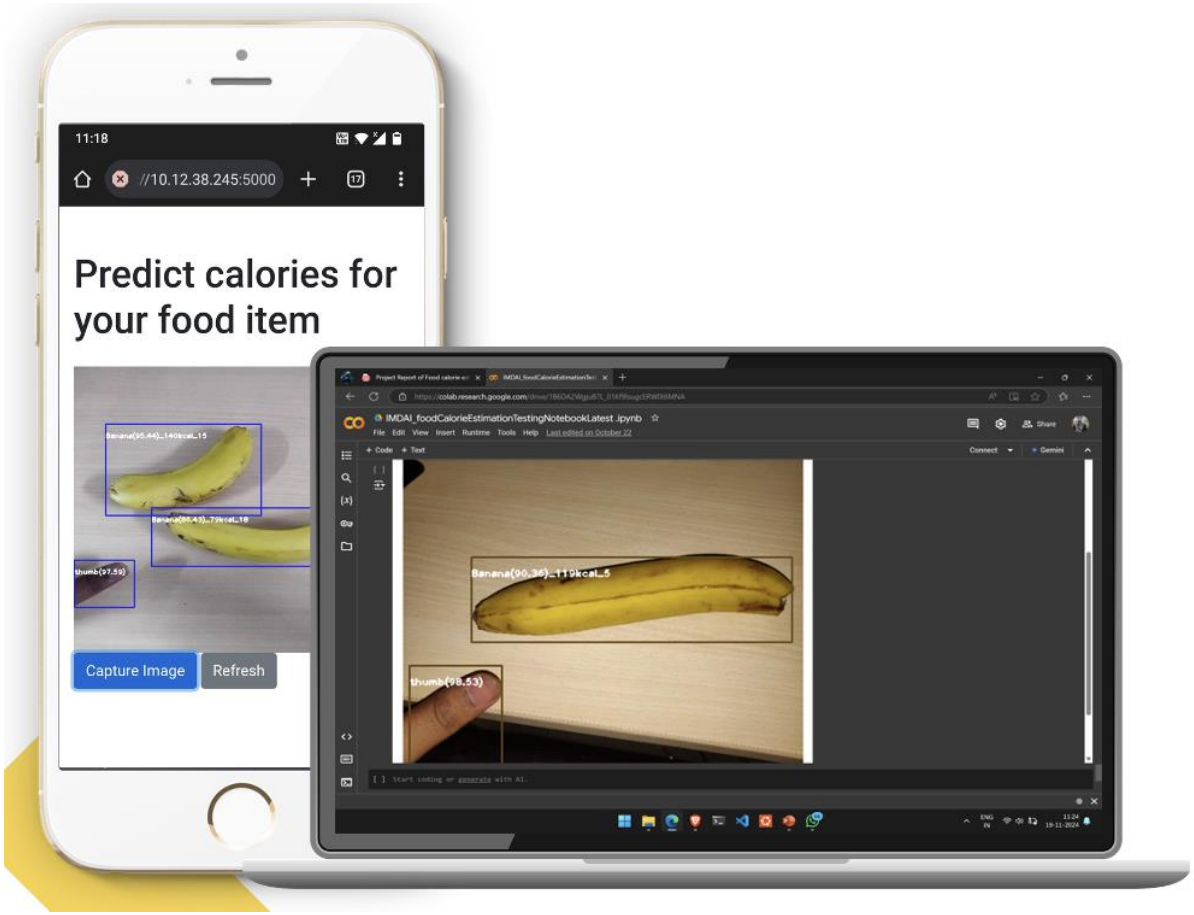


Fig 1: Diagram of system



Conclusion:

Food calorie estimation by convolutional neural network gives significant results as seen from result section above. Given picture to our system, quickly recognizes the food item , gives the calorie content of food item and get cholesterol level of food item. By doing this work, we get to know that food calorie estimation , food best for your heart and other body parts is a vast research area. By accurately detecting and classifying food items and estimating their calorie content the system provides valuable insights into dietary habits. This project is helpful in detecting the food items and also getting the calorie content of it.