iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** IV **Month of publication:** April 2026

DOI: https://doi.org/10.22214/ijraset.2026.81092

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue IV Apr 2026- Available at www.ijraset.com

Automated Food Calorie Estimation System Using Image Processing

Prof. Mrs. R.K.Suryawanshi, Parth Dhane , Akash Chavan, Rohit Chavan , Rahaul Jadhav
Computer Science and Engineering SVERI's College of Engineering, Pandharpur, India

Abstract: Automated Food Calorie Estimation SystemUsing Image Processing is a digital solution designed to assist individuals in monitoring their nutritional intake through computer vision. Traditional dietary tracking relies on manual logging, which is ofteninaccurateduetohumanestimationerrorsandinconsistentportionsizing.This project utilizes deep learning and image processing to identify food items and estimate their volume and caloric content from a single photograph. By integrating Convolutional Neural Networks (CNN) for classification and geometric modeling for volume estimation, the platform provides a non-invasive, real-time approach to weight management. This solution demonstrates an efficient method for nutritional monitoring, ensuring better health outcomes while addressing the limitations of manual dietary recording.
Keywords: Image Processing, Deep Learning, Calorie Estimation, Computer Vision, CNN, Food Recognition, Volume Estimation, Nutritional Monitoring, Healthcare Technology.

I. INTRODUCTION

Theglobalriseinlifestyle-relatedhealthissues,suchas obesityanddiabetes, hashighlighted the importance of precisecaloric monitoring. However, most individuals struggle to accurately estimate food portions and nutritional values, leading to ineffective diet management. Traditional methods, such as handwritten food diaries or manual mobile app entries, are time-consuming and prone to significant under-reporting.

This project, Automated Food Calorie Estimation System Using Image Processing, leverages modern computer vision to automate this process. By analyzing food images captured via a smartphone, the system identifies the type of food and calculates its approximate volume. Through the integration of nutritional databases, the system converts these visual dimensions into precise caloric data. This platform aims to provide a more reliable and user- friendly ecosystem for health-conscious individuals and medical patients alike.

II. RELATED WORK

Inrecentyears,theuseofArtificialIntelligence(AI)indietaryassessmenthas gained traction. Researchers have explored various decentralized and centralized models to automate food recognition.

- Recognition Frameworks: Early systems utilized Support Vector Machines (SVM) and hand-crafted features like color histograms and texture. However, these methods struggled with complex meals.
- Deep Learning Approaches: Recent studies have shifted toward Convolutional Neural Networks (CNNs), such as ResNet and Inception, which offer higher accuracy in multi-class food classification.
- VolumeEstimation:Someframeworksutilizea"top-viewandside-view" approach to estimate food volume. Others have proposed using reference objects (like a coin or credit card) to provide a scale for 2D images to calculate 3D volume.
- Limitations: Despite advancements, existing systems often face challengesregarding "hidden"calories(likeoilsorsauces)andoverlapping fooditemsonasingleplate.Theproposedsystembuildsupontheseworks by combining optimized CNNs with improved geometric shape approximation.

III. PROPOSED METHODOLOGY

The system is designed to provide a seamless pipeline fromimage capture to caloric output. The workflow focuses on accuracy, speed, and ease of use.

©IJRASET: All Rights are Reserved

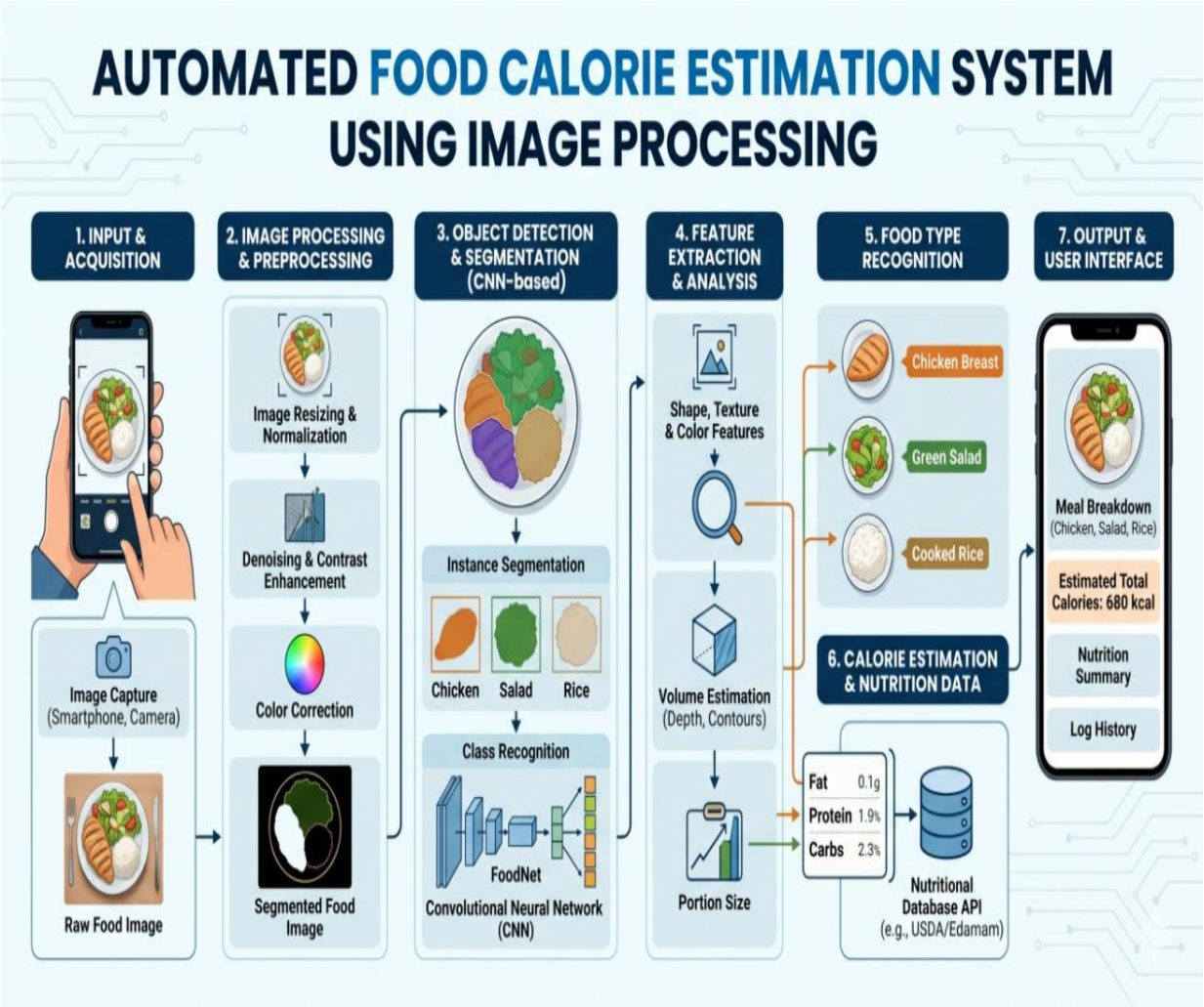


Fig.1.WorkflowofAutomatedFoodCalorieEstimationSystemUsingImage Processing

1) ImageAcquisition:Theusercapturesahigh-resolutionimageofthefood plate, ideally including a standard reference object for scale.
2) Pre-processing: Images undergo noise reduction and resizing. Contrast enhancement is applied to distinguish food items from the background (plate or table).
3) Food Recognition: A CNN model, trained on datasets like Food-101, identifies the specific food categories present in the image.
4) Segmentation:Thesystemperformsinstancesegmentationtoisolateeach food item and determine its surface area in pixels.
5) Volume & Calorie Calculation: Using the reference object, pixel area is convertedtoreal-worlddimensions.Caloricdensityisthenretrievedfrom a nutritional database (e.g., USDA FoodData Central) to provide the final estimation.

IV. IMPLEMENTATION DETAILS

The system is implemented using Python and deep learning frameworks toensure robust performance:

1) ModelTraining: Theclassificationengineuses YOLO(YouOnlyLook Once) or Mask R-CNN for simultaneous detection and segmentation.
2) FrontendInterface:Amobile-responsivewebapplicationdevelopedwith React or Flutter allows users to upload images and view results instantly.
3) Backend: A Flask or FastAPI server handles the image processing logic and communicates with the nutritional API.

4) Database:Alocalorcloud-baseddatabasestoresuserhistoryand nutritional mapping for common regional dishes.

V. EXPERIMENTAL RESULTS AND ANALYSIS

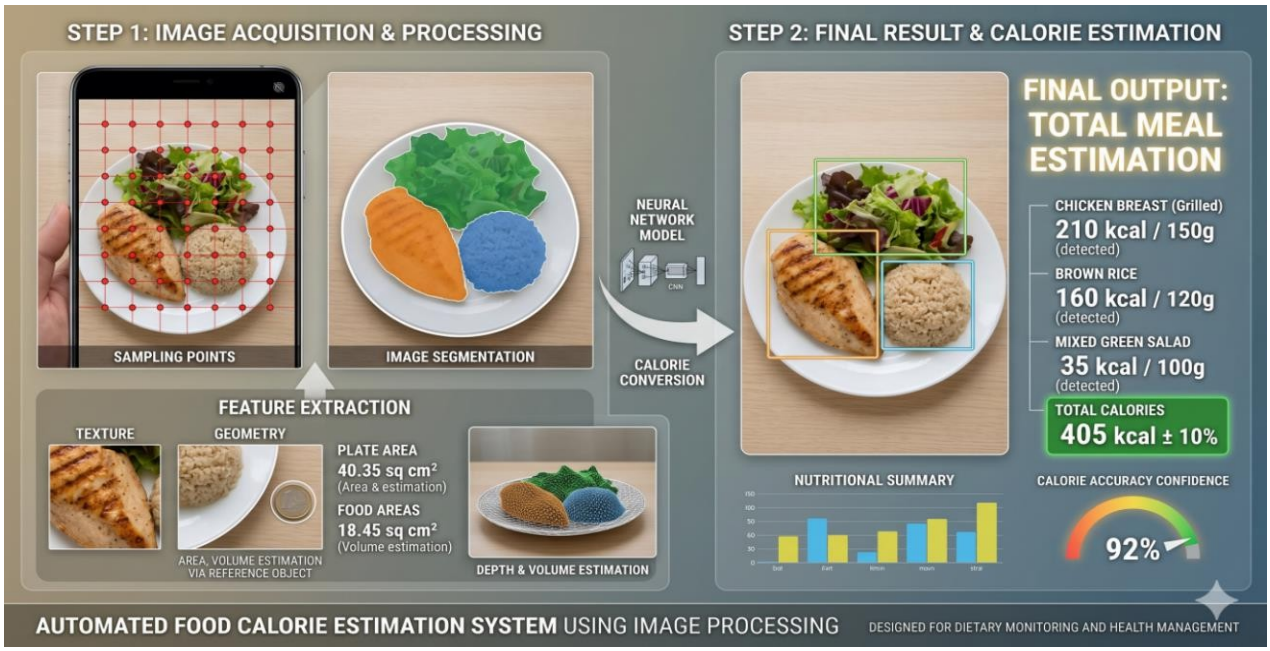


Fig.2.Final output of Calorie Estimation

The system was evaluated based on classification accuracy and the precision of calorie estimation. Tests involved diverse food groups, including liquids, solids, and mixed meals.

- Accuracy:Thesystemachievedaclassificationaccuracyofapproximately 89-93%acrosscommonfoodcategories.
- Volume Error: By using a reference object, the volume estimation error was restricted to within ±12%, which is significantly more accurate than average human visual estimation.
- Performance: Image processing and result generation were completed within 2-4 seconds, making it viable for real-time daily use.

VI. SECURITY AND PRIVACY

Since the platform may store personal dietary habits and health data, privacy is a fundamental aspect.

- Data Protection: User images and nutritional logs are encrypted both in transit and at rest.
- Anonymization: Personal identifiers are separated from the dietary data used for system improvement to ensure user anonymity.
- User Authority: Users have full control over their history and can delete their records at any time.

VII. CONCLUSION AND FUTURE WORK

The Automated Food Calorie Estimation System demonstrates the feasibility of using image processing to replace manual dietary logging. By leveraging deep learning,thesystemprovidesahighlevelofaccuracyandconvenience.Futurework will focus on:

- LiDARIntegration:Usingdepth-sensingtechnologyinmodernsmartphones to eliminate the need for reference objects.
- AI-BasedAnalytics:Providingpersonalizedhealthrecommendationsbased on long-term caloric trends.
- ExpandedDatasets:Trainingthemodelonawidervarietyofglobalcuisines to improve recognition in different cultural contexts.

REFERENCES

CoreDeepLearningandComputerVision
[1] He,K.,Zhang,X.,Ren,S.,&Sun,J."DeepResidualLearningforImage Recognition," Proc. IEEE Conf. on Computer Vision and Pattern Recognition (CVPR), 2016.
[2] Simonyan,K.,&Zisserman,A."VeryDeepConvolutionalNetworksfor Large-Scale Image Recognition," International Conference on Learning Representations (ICLR), 2015.

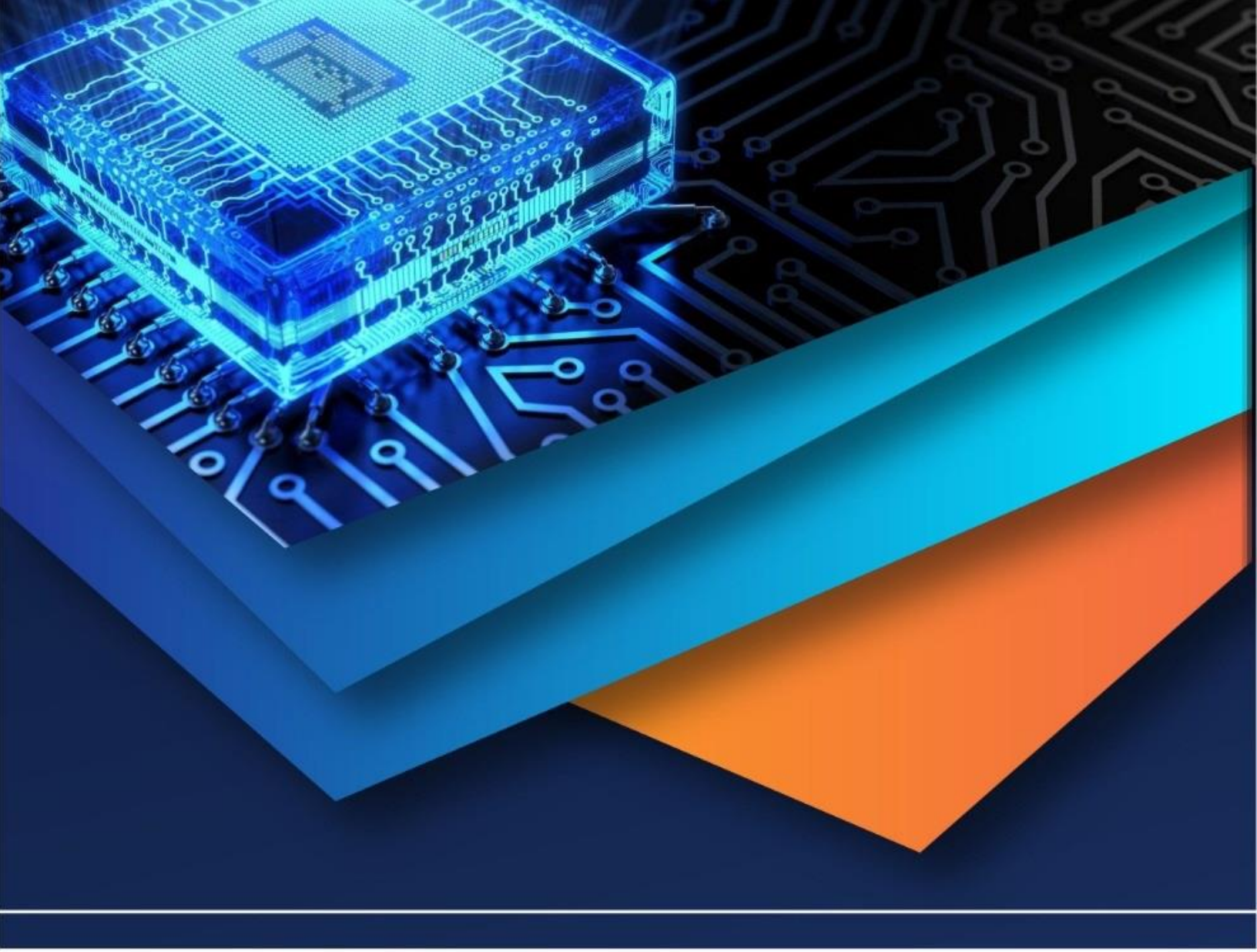
[3] Haque,R.U.,etal."LightweightandParameter-OptimizedReal-Time Food Calorie Estimation from Images Using CNN-Based Approach," Applied Sciences, MDPI.
[4] Reddy, J., et al. "Food Recognition and Calorie Estimation Using MachineLearning,"InternationalJournalofEngineering&Extended Technologies Research (IJEETR), 8(1), 2026. RecentResearch (2025–2026)
[5] "Calories EstimationofFood and BeverageUsing Deep Learning-Based Image Analysis" International Journal of Leading Research Publication (IJLRP),7(4),April2026.Thispaperdetailsadeeplearningarchitecture using CNNs for classification and regression models to compute calorie values from hierarchical visual features like texture and shape.
[6] "Food Recognition and Calorie Estimation Using Machine Learning" InternationalJournalofScientific&AcademicResearch(IJSAT),2025. This project utilizes the YOLOv8 model specifically trained on Indian food items for accurate recognition and real-time nutritional tracking.
[7] "Food Calorie Estimation Using Deep Learning and Computer Vision" International Journal of Engineering Technology and Research Management (IJETRM), April 2025. This article presents a system using YOLOv5forfooddetectionandvolumeestimationtechniquestoprovide approximate calorie counts.
[8] "Image-BasedFoodCalorieEstimation"MiniProjectReport,April2026. This report describes a CNN-based classifier achieved a recognition accuracyof97.11%whileestimatingvolumebasedonfoodweightin grams.

VolumeandCalorieEstimationTechniques

[9] "FoodPortionEstimation:FromPixelstoCalories"arXiv:2602.05078v1, February 2026. A comprehensive review discussing the transition from explicitgeometric recoveryusing fiducialmarkers (like coins) to modern monocular inference for 3D volume prediction.
[10] GrabCutAlgorithmandFasterR-CNNarecombinedinadvancedsystems to detect food and calibration objects while refining contours for precise volume estimation.
[11] "Food Calories Estimation Using Image Processing Techniques" ResearchGate,2026.Thispaperproposesmultiple-hypothesesimage segmentation and Bayesian Fuzzy Clustering to identify regions for salient region detection.

NutritionalStandardsandDatasets

[12] Bossard, L., Guillaumin, M., & Van Gool, L. "Food-101 – Mining DiscriminativeComponentswithRandomForests," Proc.EuropeanConf. on Computer Vision (ECCV), 2014.
[13] USDA FoodData Central Database. A standard predefined nutritional databaseutilizedtocalculatefinalcaloriecontentonceafooditemandits portion size are identified.
[14] UNIMIB2016.Akeydatasetusedfortheeffectiveanalysisofproposed methods in terms of Mean Square Error (MSE) and Standard Accuracy (SA).



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)