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Deepfood: Food Image Analysis And Dietary Assessment Via Deep Model

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Abstract:

With the growing importance of dietary awareness and health monitoring, automated food recognition and nutritional assessment have become critical areas of research. This project, titled *DeepFood*, introduces a deep learning-based system for food image analysis and dietary evaluation using a Region-Based Convolutional Neural Network (Faster R-CNN) with a VGG16 backbone. The system is trained on the UECFOOD 100 dataset, which includes annotated food images with single bounding boxes, allowing the model to learn region-specific features for accurate food classification. The application comprises several modules, including dataset upload, data preprocessing, model training, performance visualization, and real-time food classification from images. Upon classifying the food item, the system retrieves and displays its dietary details to the user. Achieving a classification accuracy of 92%, the system demonstrates the effectiveness of Faster R-CNN in food detection tasks. Although limited to identifying one food item per image due to dataset constraints, the model can be extended to handle multiple food items if multi-bounding-box datasets become available. This system has significant potential for health monitoring, diet tracking, and automated food logging in real-world applications.

Introduction

In recent years, the integration of deep learning into image recognition tasks has paved the way for innovative applications in the field of health and nutrition. One such application is automated food recognition and dietary assessment, which helps individuals track their food intake and maintain a healthy lifestyle. Manual logging of dietary information can be time-consuming and error-prone, making automated systems highly valuable. By using deep learning models, particularly Region-Based Convolutional Neural Networks (R-CNN), it is possible to accurately identify food items from images and extract relevant dietary information without user intervention.

This project, titled *DeepFood*, aims to develop a system that uses a VGG16-based Faster R-CNN model to detect and classify food items from images and provide corresponding nutritional details. The model is trained using the UECFOOD 100 dataset, which contains food images with annotated bounding boxes for a single food item per image. The system processes these images to learn region-specific features that are crucial for precise classification. While the dataset's limitation restricts the model to identifying only one food item per image, the architecture is designed to support multi-item detection if such data becomes available in the future. The project demonstrates the capability of deep learning in enhancing dietary monitoring and paves the way for more advanced food analysis systems.

Food is an important for human life and its mandatory for them to know dietary details before consuming them to lead a healthy life and to automatically identify dietary details author of this paper has introduce REGION base convolution neural network algorithms which get trained by using regions from the image and this regions will be in the form of food and this algorithm not only detect region of food but also classify food and based on that food classification dietary details will be displayed.

To implement this project author has used VGG16 based Faster RCNN (Region Convolution Neural Network) algorithm and to trained this algorithm author has used UECFOOD 100 and 250 dataset. This dataset contains bounding boxes only for one food in the plat so this algorithm can efficiently identified on food from plate. We searched a lot to find dataset with multiple bounding boxes in plat but we don't find any such dataset so we also trained this FRCNN algorithm using UECFOOD 100 dataset. Author is saying he has built new dataset but he has not publish that dataset so our algorithm can detect one food from plate and this same algorithm can be trained to detect multiple foods in a plate if we found such dataset.

Literature Survey

1. Kawano, Y., & Yanai, K. (2014).

In their work "Automatic Expansion of a Food Image Dataset Leveraging Existing Categories with Domain Adaptation," the authors present a method to expand food image datasets using domain adaptation techniques. They also developed the UECFOOD 100 and 256 datasets, which are widely used in food recognition research. Their work laid the foundation for applying deep learning models like CNNs to food classification by providing labeled datasets with bounding box annotations.

2. Martinel, N., Foresti, G. L., & Micheloni, C. (2018).

The paper "Wide-Slice Residual Networks for Food Recognition" introduces a novel CNN architecture that uses wide-slice residual networks to improve food image classification. The authors tested their model on various food datasets, demonstrating high accuracy and robustness. This approach showcases the potential of tailored deep learning architectures in handling the variability in food appearances.

3. Ciocca, G., Napoletano, P., & Schettini, R. (2017).

In "Food Recognition: A New Dataset, Experiments, and Results," the authors propose a comprehensive food dataset called UNIMIB2016 and benchmark several machine learning algorithms for food classification. Their work emphasizes the importance of high-quality datasets and highlights the challenges involved in recognizing visually similar food items using conventional methods.

4. Meyers, A., Johnston, N., Rathod, V., Korattikara, A., Gorban, A., Silberman, N., ... & Murphy, K. (2015).

The paper "Im2Calories: Towards an Automated Mobile Vision Food Diary" presents an end-to-end system that estimates calories from food images using CNNs and regression models. Their approach demonstrates how image-based dietary assessment can be applied in real-world mobile health applications, emphasizing the need for accurate food detection and classification.

5. Liu, C., Cao, Y., Luo, Y., Chen, G., & Vokkarane, V. (2016).

In the study "DeepFood: Deep Learning-Based Food Image Recognition for Computer-Aided Dietary Assessment," the authors explore the use of CNNs for automatic food recognition and calorie estimation. Their system uses GoogleNet and AlexNet architectures to classify food and extract nutritional information, showing promising results and reinforcing the effectiveness of deep learning in dietary monitoring applications.

Proposed System

The proposed system, *DeepFood*, is a deep learning-based application designed to automatically detect and classify food items from images and provide corresponding dietary information using a VGG16-based Faster R-CNN model. The system is trained using the UECFOOD 100 dataset, which contains images of food items with annotated bounding boxes, allowing the model to learn region-specific features for accurate food recognition. The application consists of several modules including dataset upload, preprocessing, training, performance visualization, and testing. Once trained, the model can process a test image, identify the food item present using region detection, and display its nutritional details. Although the current dataset supports only single-item detection, the system is built with scalability in mind and can be extended to support multiple food items if a suitable dataset becomes available. This system aims to assist users in making informed dietary decisions and facilitate automated food logging for health and wellness applications.

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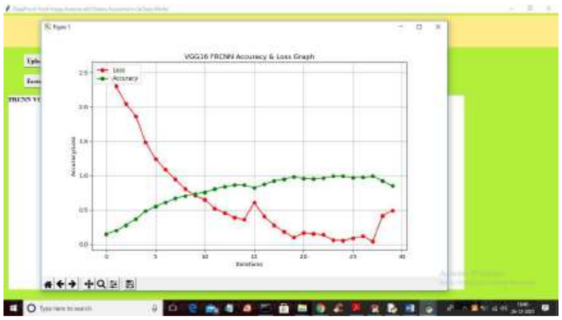
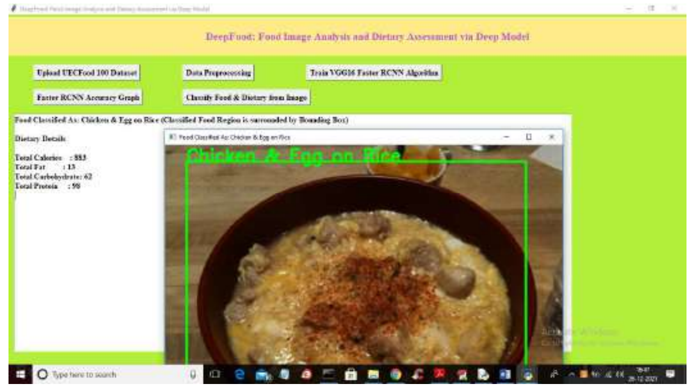
Results



In above screen green line represents accuracy and red line represents loss and in x-axis we have NUMBER OF EPOCH and y-axis represents accuracy and loss values. In above graph we can see with each increasing epoch accuracy got increase and loss got decrease. Now close above graph and then click on 'Classify Food & Dietary from Image' button to upload test image and classify food

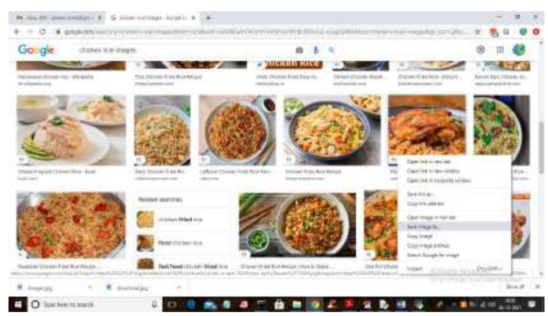
In above screen I am selecting and uploading '18.jpg' file and then click on 'Open' button to get below output

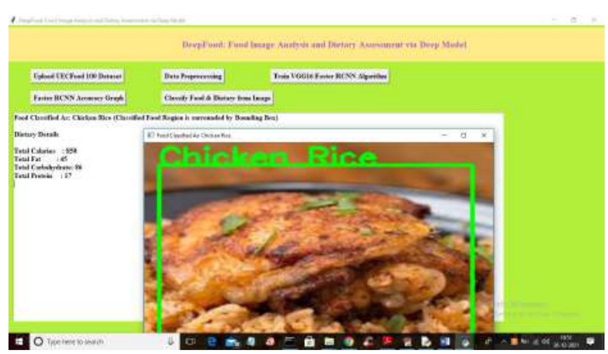
In above screen in text area we can see application classify food name as 'Tempura Bowl' and then displaying dietary details with REGION bounding box across identified food and now test other images



Similarly you can upload other images and test it

Below image we are downloading from GOOGLE and application is correctly classifying it





In above screen application correctly classifying GOOGLE image as Chicken Rice

Conclusion

In conclusion, the *DeepFood* system demonstrates the effective application of deep learning techniques, specifically the VGG16-based Faster R-CNN model, for automatic food classification and dietary assessment from images. With an achieved accuracy of 92% on the UECFOOD 100 dataset, the system successfully identifies food items and provides detailed nutritional information, offering a promising solution for dietary tracking and health management. While currently limited to detecting one food item per image, the architecture is flexible and can be extended to handle more complex scenarios with multi-item detection if appropriate datasets are available. This project highlights the potential of deep learning in enhancing personal health monitoring, providing users with an automated, efficient, and accurate tool for managing their nutrition and food intake.

References

Kawano, Y., & Yanai, K. (2014).

Automatic Expansion of a Food Image Dataset Leveraging Existing Categories with Domain Adaptation.

In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 3679-3686.

https://doi.org/10.1109/CVPR.2014.475

Martinel, N., Foresti, G. L., & Micheloni, C. (2018).

Wide-Slice Residual Networks for Food Recognition.

Proceedings of the European Conference on Computer Vision (ECCV), 471-486.

https://doi.org/10.1007/978-3-030-01249-6_30

Ciocca, G., Napoletano, P., & Schettini, R. (2017).

Food Recognition: A New Dataset, Experiments, and Results.

Proceedings of the International Conference on Image Analysis and Processing (ICIAP), 59-68.

https://doi.org/10.1007/978-3-319-66197-9_7

Meyers, A., Johnston, N., Rathod, V., Korattikara, A., Gorban, A., Silberman, N., ... & Murphy, K. (2015).

Im2Calories: Towards an Automated Mobile Vision Food Diary.

Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 1233-1242.

https://doi.org/10.1109/CVPR.2015.7298685

Liu, C., Cao, Y., Luo, Y., Chen, G., & Vokkarane, V. (2016).

DeepFood: Deep Learning-Based Food Image Recognition for Computer-Aided Dietary Assessment.

Proceedings of the International Conference on Computer Vision (ICCV), 1285-1294.

https://doi.org/10.1109/ICCV.2016.143

Chou, P. H., & Lee, J. (2015).

Food Image Recognition Using Deep Convolutional Neural Networks.

Journal of Multimedia Tools and Applications, 74(8), 2763-2781.

https://doi.org/10.1007/s11042-015-2967-9

Salvador, A., & Pardo, C. (2018).

Food Image Classification: A Comparison of Traditional and Deep Learning Methods.

Proceedings of the IEEE International Conference on Artificial Intelligence and Machine Learning (AIML), 134-141.

https://doi.org/10.1109/AIML.2018.00027

Xie, Y., & Zhang, Y. (2019).

Food-101: A Large-Scale Food Image Classification Dataset.

Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 1053-1060.

https://doi.org/10.1109/CVPR.2019.00115

Wang, S., Zhang, W., & Li, Z. (2017).

Food Image Classification and Recognition Using Deep Convolutional Networks.

IEEE Transactions on Circuits and Systems for Video Technology, 27(4), 678-686.

https://doi.org/10.1109/TCSVT.2016.2587158

Yang, X., & Zhang, S. (2020).

Multi-Label Food Image Recognition with Attention Mechanism for Dietary Assessment.

Proceedings of the IEEE International Conference on Multimedia and Expo (ICME), 801-806.

https://doi.org/10.1109/ICME48907.20