

Project Proposal

Project Title

Calorie Estimation from Images: A Deep Learning and Computer Vision-Based Approach

Student Name: Atheer Mohammed Al-Shahrani

Master's Student, Department of [Artificial Intelligence]
[MIDOCEAN UNIVERSITY]

1. Project Overview

One of the most difficult things for people who want to control their weight or enhance their general health is keeping up a healthy diet. The majority of calorie-tracking apps currently on the market rely on manual data entry, which is laborious, prone to human error, and deters regular use.

By putting forth an AI-based method that uses image analysis to automatically calculate the caloric content of a meal, this project seeks to overcome this constraint. The system will recognize food items from photos using computer vision and deep learning techniques, then use learned visual features to estimate their caloric values.

This research is important because it has the potential to improve the accuracy, effectiveness, and accessibility of nutrition tracking. The suggested system can help people make better dietary decisions and support upcoming smart-health applications by automating calorie estimation.

2. Project Goal

Clearly describe the goal of your project. For example:

- Create a model that can recognize foods in pictures.
- Increase tracking and calorie estimation efficiency.
- Use artificial intelligence to develop a tool that assists users in tracking their food intake..

3. Approach

Explain how you plan to achieve your project goal. This might include:

- **Data Collection:**

- The project will use publicly available food image datasets such as *Food-101* and *UECFOOD-256*, which include a large variety of labeled food images. Additional image samples may be collected manually to increase diversity and accuracy. Nutritional data and calorie values will be obtained from trusted online nutrition sources like *Verywell Fit* and verified food databases used in applications such as *MyNetDiary* and *MyFitnessPal*

- **Data Processing:**

- Prior to training, all gathered images will undergo pre-processing. To improve model generalization, the procedures include resizing, normalization, and data augmentation (rotation, flipping, brightness adjustment, and noise addition), as covered in ResearchGate (2017). Preprocessing guarantees that every image has a uniform pixel distribution and dimension that are appropriate for CNN training.

- **Model/Method Selection:**

- To identify foods and estimate calories, a Convolutional Neural Network (CNN) architecture will be used. Transfer learning can be used to increase accuracy and decrease training time with pre-trained models like ResNet or MobileNet. In order to separate food items and increase the accuracy of calorie estimation, image segmentation techniques will also be investigated, drawing inspiration from the SegFood Deep Learning project (IEEE Dataport, 2023).

- **Testing and Evaluation:**

- The model's performance will be assessed through the use of metrics like F1-score, recall, accuracy, and precision. To evaluate the system's capacity for generalization, unseen food photos will be used for testing. To assess error rates and confirm the model's dependability, the estimated calorie values will be contrasted with actual nutritional data.

4. Project Steps and Timeline

- **Data Collection and Preparation**(Weeks 1–3)
- To guarantee consistent and high-quality input for model training, clean, resize, normalize, and boost the data.

- **Model Building and Training**(Weeks 4–8)
- In order to increase accuracy, create and train a Convolutional Neural Network (CNN) model using transfer learning with pre-trained architectures like ResNet or MobileNet.
- **Testing and Evaluation**(Weeks 9–10)
- Use metrics like accuracy, precision, and F1-score to assess the performance of the model. Test unseen data to determine reliability and generalization.
- **Final Adjustments and Reporting**(Weeks 11–12)
- Implement the last model modifications and write the project report that details the approach, findings, and analysis.

5. Expected Results

- Increased precision in identifying and categorizing food items from photos: By utilizing data augmentation and transfer learning techniques, the CNN-based model is anticipated to improve recognition accuracy in comparison to manual calorie tracking methods.
- New perspectives on using deep learning for calorie estimation: By showing how computer vision and deep learning can be used to efficiently estimate caloric values directly from images, the project will advance the field of research and increase the effectiveness of nutrition tracking systems.
- A working prototype that could be developed into a mobile application for health: The created model will be the basis for an intelligent, artificial intelligence (AI)-driven health app that can help users automatically track and control their daily caloric intake.

6. Resources Needed

- **Software and Tools:** Jupyter Notebook and Google Colab as development environments, the Python programming language, the TensorFlow/Keras frameworks for CNN implementation, and image processing libraries like OpenCV and NumPy.
- **Datasets:** Research datasets such as SegFood (IEEE Dataport) for food segmentation and calorie estimation experiments, as well as publicly accessible food image datasets.

- Computing Resources and Support: Enough cloud storage for image datasets, access to a Google Colab GPU for deep learning model training, and academic supervision from computer vision and artificial intelligence specialists.

7. References

Artificial Intelligence & Computer Vision, Nutrition & Energy Metabolism, and Project-Specific Databases & Applications are the three primary fields that underpin the project "Application-Based Fitness Plan with A Diet Recommendation System (DRS)" and are covered by the following references.

A. Academic References in Artificial Intelligence and Computer Vision (AI & Computer Vision)

1. He, K., Zhang, X., Ren, S., & Sun, J. (2016). *Deep Residual Learning for Image Recognition (ResNet)*. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)* (pp. 770–778).
<https://arxiv.org/abs/1512.03385>
2. Graikos, A., & Charisis, V. (2018). *Single Image-Based Food Volume Estimation Using Monocular Depth-Prediction Networks*. *Nutrients*, 10(12), 2005.
<https://www.mdpi.com/2072-6643/10/12/2005>
3. Zhang, S., Yao, L., Sun, A., & Tay, Y. (2019). *Deep Learning for Recommender Systems: A Survey and New Perspectives*. *ACM Computing Surveys (CSUR)*, 52(1), 1–38.
<https://arxiv.org/abs/1707.07435>

B. Specialized References in Nutrition and Energy Metabolism (Nutrition & Energy Metabolism)

5. Mifflin, M. D., St Jeor, S. T., Hill, L. A., Scott, B. J., Daugherty, S. A., & Koh, Y. O. (1990). *A New Predictive Equation for Resting Energy Expenditure in Healthy Individuals*. *The American Journal of Clinical Nutrition*, 51(2), 241–247.
<https://doi.org/10.1093/ajcn/51.2.241>

C. Project-Specific Databases and Applications (Project Specific Databases & Applications)

8. Verywell Fit. (2023). *How Many Calories Do I Need Each Day?*
<https://www.verywellfit.com/how-many-calories-do-i-need-each-day-2506873>
9. MyNetDiary. (2023). *Calorie Counter*.
<https://www.mynetdiary.com/>

10. MyFitnessPal. (2023). *Calorie Counter and Diet Tracker*.
<https://www.myfitnesspal.com/>
11. Lose It! (2023). *Calorie Counter, Food and Exercise Tracker App*.
<https://www.loseit.com/>
12. Noom. (2023). *The Last Weight Loss Program You'll Ever Need*.
<https://ieee-dataport.org/open-access/seg-food-semantic-food-segmentation-through-deep-learning>