

Project Brief (12th October 2020)

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Food Detection and Classification for nutrients estimation

- Problem:

There are several global problems that the topic of Automatic Food Classification addresses. With growing problems in obesity, and a lack of nutrition and balanced diets amongst millions of people nowadays, this is an area that demands more research. According to WHO, more than 1.9 billion adults in 2016 were overweight, and over 650 million were obese.⁽⁶⁾ The major cause identified for this global problem is the accumulation of excessive fat over time.⁽⁶⁾ This research would particularly be useful and a great dive into food image classification to identify the nutritional content of different foods. Moreover, many applications nowadays are in fact highly based on images, rather than text; major examples are Pinterest, and Flickr. Such a feature can also be pivotal in the development of these applications as well. Furthermore, with growing use of manual food-diary applications, this research would be fundamental to shifting these applications to automated versions. There are a significant number of research papers on object detection and recognition but very few on food detection and classification. As a result, this project will explore existing work in this field and related fields to propose a feasible solution to these problems.

- Goals:

The research project aims to investigate existing papers on Object detection and classification as well as Food detection and classification, and existing food datasets (for example: food images in ImageNet⁽⁴⁾, food-11⁽⁷⁾, food-101⁽³⁾, UEC-food 256⁽²⁾, ECUSTFD⁽⁵⁾ datasets etc.) both with and without potential to estimate nutrients from food images. By the end of this paper, I would like to have a solid understanding of the different methods that can be used to identify food from images including a combination of supervised algorithms such as Random Forest, Support Vector Machine, and Feature Extraction approaches like RGB Histograms, edges, as well as Deep Learning approaches. Moreover, I would like to get a strong grasp of the process of Transfer Learning, training and retraining the images on different datasets, as well as comparing the performance of each model on different food image datasets. In terms of object classification models, this project will aim to fittingly use models like Inception and Resnet as these are latest in the Object detection and classification industry. However, the project will briefly go through several other models that have been taken into consideration. The current final goal of this research is to develop a web application based on the best-found model for food classification, potentially even with the ability to identify key nutrients in the food. All the models will be compared based on their performance in existing chosen food datasets.

- Scope:

The focus of this project will be to compare pre-existing advanced Computer Vision and Machine Learning techniques to solve recognition problems for a variety of different food images. This project will not delve deeper than that. Only pre-existing models will be used in this paper, as creating a Deep Learning model from scratch, specifically to detect and classify food images is a very complex task, requires a lot of computing power, and is therefore beyond the scope of this paper, especially given the time constraints⁽¹⁾. If there is additional time available and a possibility for extending the project, this research will also attempt to produce a new dataset consisting of a limited number of images, belonging to a small number of distinct, pre-defined classes. There will also be a set quantity of food in each image; for example: one banana, one slice of bread etc. The purpose of the dataset would be to provide a more accurate way of measuring nutrients by including an extra element such as a ruler next to the food in each image. This dataset could particularly be used as a starting point to further research that may be conducted in this field.

References

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- (4) *ImageNet*, www.image-net.org/.
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- (7) Verma, Avi. "Food-11." *Kaggle*, 5 June 2019, www.kaggle.com/vermaavi/food11.