COSE474-2024F: Final Project Proposal
"Food Ingredient Detection and Recipe Recommendation Model"

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1. Introduction

AI influences various areas related to food, such as predicting the quality and safety of agricultural products and crops. While there appear to be numerous AI applications related to improving food productivity, there seems to be a lack of AI systems focused on promoting proper food consumption. In 2022, the total amount of food waste generated by households amounted to 631 million tons (United Nations Environment Programme, 2024). This project aims to develop an AI model that provides food recipes based on visible ingredients by analyzing photos of the ingredients. By using this model, individuals will be able to easily receive recipes based on the ingredients they currently have, enabling them to start cooking. As a result, this will contribute to reducing food waste generated in households.

2. Problem definition & chanllenges

Large-scale food waste poses a threat to environmental pollution and undermines food security, the state in which all individuals have sufficient access to high-quality food (Corrado & Sala, 2018). Although food waste occurs in various sectors, preventing food waste at the household level is the most effective approach to addressing the issue (Woolley et al., 2022). The model developed in this project will naturally encourage a reduction in food waste by providing recipes, which is likely to have a greater impact than merely raising awareness about the need to reduce food waste due to its excessive levels.

3. Related Works

This project will utilize a Faster R-CNN model with a ResNet-50 backbone as the pretrained model. The Faster R-CNN model improves upon the previous Fast R-CNN model by introducing anchor boxes in the Regional Proposal Network (RPN) to generate object detection proposals more efficiently, thereby enhancing its speed (Ren et al., 2016). The Faster R-CNN model demonstrates high accuracy in detecting overlapping or small objects. Although it

has the disadvantage of being slower, this will not pose an issue for this project, as real-time processing is not required. ResNet demonstrates high performance and efficiency in deep networks due to its use of residual connections. For the same reasons, ResNet-50 will be used as the backbone in this model.

4. Datasets

If further performance improvement is deemed necessary, transfer learning will be applied using an additional dataset. The dataset consists of approximately 4,000 food ingredient images and 120 classes. By training the model on this supplementary dataset, the goal is to enhance the model's ability to accurately recognize various food ingredients.

5. State-of-the-art methods and baselines

Samsung Food provides recipes based on available ingredients and offers the advantage of tailoring recipes to individual preferences, such as vegan diets or nutritional needs. Additionally, it integrates with appliances like refrigerators, allowing for convenient recipe suggestions. However, the requirement to purchase appliances with these integrated features presents a significant barrier to entry. In contrast, our model has the advantage of enabling users to receive recipes simply by taking photos with a smartphone, eliminating the need for specialized appliances.

References

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