ASHESI UNIVERSITY

AI Final Project Report: BiteCheck Food Classification

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CS254_B: Introduction to Artificial Intelligence

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I. Project Introduction (Organisation & Problem)

Access to nutritious food is essential for student well-being, academic success, and long-term health. However, we noticed that students often struggle to make informed dietary choices, especially when campus food options lack clear nutritional labeling. At Ashesi University, while vendors offer a variety of meals, students still lack the information needed to differentiate between healthy and unhealthy options. To address this issue we developed BiteCheck, a machine learning-powered solution designed to analyse food images and classify them as either healthy or unhealthy.

The goal is to enable students to make better food decisions by providing immediate and accessible feedback on their food choices through the use of visual recognition.

II. Our Machine Learning (ML) Approach & How it Solves the Problem

Our problem statement is to develop a system that can automatically classify food images as healthy or unhealthy based solely on visual characteristics, without requiring manual nutritional analysis or database lookups. This addresses the challenge that manual nutritional assessment is time-consuming and requires expertise most consumers lack.

ML can thus help solve this problem through a supervised learning approach using Convolutional Neural Networks (CNNs), specifically by leveraging a pre-trained ResNet50 model. CNNs excel at image feature extraction through their hierarchical pattern detection capabilities, while ResNet50's deep architecture (50 layers) overcomes the vanishing gradient problem through residual connections. This approach enables the system to extract complex visual features from food images—including texture, color patterns, and compositional elements—and transform them into accurate health classifications. The ML solution converts

what would be an impractical manual analysis task into an automated system providing immediate feedback, making healthy eating decisions more accessible.

III. Challenges Faced during Data collection & Preprocessing

Our food image project faced several data challenges. The Food-101 dataset lacked organization and needed restructuring to work with our pipeline. The images varied a lot in quality - different lighting, angles, resolution, and cluttered backgrounds - which made classification harder. Steps like resizing, normalization, and augmentation occasionally produced distortions or diminished the clarity of key food features that were essential for accurate classification. Perhaps most frustrating was our initial training performance - despite employing a robust pre-trained model, our accuracy remained stubbornly low at approximately 30%. Overcoming this required multiple iterations of adjustments to our data augmentation strategies, learning rates, and the strategic freezing and unfreezing of model layers.

IV. Ethical Considerations Surrounding our Project

The ethical considerations for our project were minimized by our use of a publicly available food dataset (on Kaggle). However, we recognize that real-world food recognition applications require careful attention to bias and fairness, as models trained predominantly on Western cuisines may perform poorly with diverse cultural food items. A truly effective system demands representation across global food cultures to ensure inclusivity. We've maintained proper attribution to the original Food-101 dataset creators, respecting intellectual property rights throughout our work. Despite initial challenges in dataset preparation and model fine-tuning, our system successfully demonstrates the practical application of machine learning for food recognition, providing valuable insights into developing effective computer vision systems in this domain.