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FRIDGE IMAGES TO RECIPE GENERATION

[1]Hamsalekha NC, [2]Harshitha K, [3]Prerana vinayak Deshpande, [4]Raksha K, [5]Dr.Shilpa Biradar

[1234]Ug Students, Dept. Of ISE , Dr. Ambedkar Institute Of Technology Bangalore

[5]Asst. Professor, Dept. Of ISE, Dr. Ambedkar Institute Of Technology, Bangalore

Abstract

Food waste is a worldwide problem that has a significant influence on both the economy and the environment. It is a problem that affects both consumers and producers. This article introduces FridgeSnap, a technology that is based on picture categorization and has the potential to assist in reducing the amount of food that is wasted throughout the world. Following the identification of the component food item by an underlying deep learning model, the tool then suggests various recipes that may be produced with the food item. The tool gets as input photographs of individual food items that are obtained from the electronic device of the user, such as a mobile phone or tablet. Because it was developed using the Android Studio integrated development environment (IDE) utilizing Java programming languages and XML, the application is compatible with Android devices. There is a version of FridgeSnap that is publicly accessible on Github. This version includes the source code as well as the android application package (APK) file. It has the potential to be shipped.

Keywords: Image classification Food waste Android application.

1-Introduction

Food waste is a significant issue that requires creative solutions. Notwithstanding attempts to tackle the problem at both consumer and producer levels, current strategies have shown ineffectiveness. Consequently, an innovative and accessible strategy is required to captivate customers. Current solutions mostly emphasize incentivizing the recycling of food waste, shown as the 'Nanjing Green Account system,' which awards customers electronic points for the proper recycling of their food waste [1]. Nonetheless, these incentives mostly promote recycling instead than the consumption of the food products themselves. This article introduces FridgeSnap, a smartphone application intended to use leftover or mispurchased food products that customers own, with the objective of offering a pragmatic solution to mitigate food waste. The program employs sophisticated picture identification with a multiclass deep learning classification model to provide personalized recommendations for utilizing surplus food products.

FridgeSnap mainly serves customers who often buy 'multipacks' or substantial amounts of certain food items, such as potatoes or carrots, however use barely a fraction of their purchases. FridgeSnap operates by using image classification methods on food items photographed with users' mobile device cameras. The taken picture undergoes a classification process using a pre-trained deep learning model to identify the food item, which is then appended to a list that may include one or several food items. Subsequently, FridgeSnap produces recipes that use the food products from the list, per user request. This indicates that customers are no longer required to dispose of products they have either inadvertently acquired or do not plan to use fully. They may use FridgeSnap for cooking ideas that optimize the utilization of such products.

This unique technology enables customers to prevent excessive waste and optimize their food purchases, therefore boosting sustainability and minimizing total food waste.

The latest iteration of FridgeSnap employs a multi-class classification algorithm designed to identify 20 food products, which include bacon, bananas, bread, broccoli, butter, carrots, ceese, chicken, cucumber, eggs, fish, lettuce, milk, onions, peppers, potatoes, sausages, spinach, tomatoes, and yogurt. Conversely, the majority of current methodologies in this domain depend on the human input of food products in textual format, which may be labor-intensive, such as SuperCook, BigOven, and Epicurious.Three FridgeSnap is both efficient and inventive in reducing user effort and minimizing food waste.

Food is fundamental to human existence. Not only does it provide us with energy—it also defines our identity and culture. As the old saying goes, we are what we eat, and food related activities such as cooking, eating and talking about it take a significant portion of our daily life. Food culture has been spreading more than ever in the current digital era, with many people sharing pictures of food they are eating across social media. Querying Instagram for #food leads to at least 300M posts; similarly, searching for #foodie results in at least 100M posts, highlighting the unquestionable value that food has in our society. Moreover, eating patterns and cooking culture have been evolving over time. In the past, food was mostly prepared at home, but nowadays we frequently consume food prepared by third parties (e.g. takeaways, catering and restaurants). Thus, the access to detailed information about prepared food is limited and, as a consequence, it is hard to know precisely what we eat. Therefore, we argue that there is a need for inverse cooking systems, which are able to infer ingredients and cooking instructions from a prepared meal.

2-LITERATURE SURVEY

The article "Recipe Generation from Food Images using Deep Learning" written by Srinivasamoorthy and colleagues (2022) offers a complete review of the use of deep learning methods in the process of evaluating food photos. In this study, the obstacles that are unique to food image analysis are discussed. These issues include changes in appearance as well as distinctions within the same class. The authors of the second study are Salvador, Amaia, Michal Drozdzal, Xavier Giró-i-Nieto, and Adriana Romero. "Inverse cooking: Recipe generation from food images." For the purpose of generating recipes from food photos, a unique method is presented in the Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. This approach combines deep learning with natural language processing (NLP) techniques. In this study, a technique is proposed in which convolutional neural networks (CNNs) are used to extract features from photographs. These characteristics are subsequently processed by recurrent neural networks (RNNs) or other natural language processing models in order to create textual recipes that correlate to the extracted features.

A comprehensive investigation of the relationship between food image analysis and recipe production is presented in the article "Food Image Analysis and Recipe Generation: A Review" (2020), which was written by L. Gao and his colleagues. In it, the methodologies, datasets, difficulties, and possibilities that are associated with these topics are investigated. Among the many subjects that are discussed in this study are food recognition, the identification of ingredients, the suggestion of recipes, and the development of recipes automatically via the use of techniques such as deep learning.

The article "Recipe Generation from Food Images: A Deep Learning Approach" written by M. Han and colleagues (2020) provides an innovative approach that makes use of deep learning techniques in order to successfully produce recipes from food photographs automatically. In this study, the topic of recipe creation from photos is presented, previous work is discussed, the suggested deep learning architecture is described, the dataset that was used for training is described in detail, the training technique is explained, the performance of the model is evaluated using suitable metrics, and the results are discussed. "Recipe Generation from Food Images using Attention-based Neural Networks" is a paper that was published in 2020 by D. Chaudhary and his colleagues. This study investigates the use of attention-based neural networks for the purpose of generating recipes from photos of food. It is anticipated that the article would provide the challenge of generating recipes from their respective photos.

In the article "Cooking with AI: A Survey on Recipe Generation using Deep Learning" by S. Sankar and colleagues (2021), the authors address the uses of recipe generation in a variety of fields, including culinary inventiveness, meal planning, and customized cooking help. The article "Inverse Cooking Recipe Generation from Food Images" was written by B. Ujwala and his colleagues in 2023. The Convolutional Neural Network (CNN) is being used in the development of an inverse cooking system that is capable of generating cooking recipes taken from photographs of food. Utilizing a one-of-a-kind design, the system is able to forecast the components and the relationships between them without prescribing any particular sequence. After that, it provides cooking directions by concurrently taking into consideration the picture and the components that should be inferred.

3- METHODOLOGY

AI CHEF:

The AI community has embraced multi-sensory or multi-modal approaches to advance this generation of AI models to resemble expected intelligent understanding. Combining language and imagery

represents a familiar method for specific tasks like image captioning or generation from descriptions. This paper compares these monolithic approaches to a lightweight and specialized method based on employing image models to label objects, then serially submitting this resulting object list to a large language model (LLM). This use of multiple Application Programming Interfaces (APIs) enables better than 95% mean average precision for correct object lists, which serve as input to the latest Open AI text generator (GPT-4). To demonstrate the API as a modular alternative, we solve the problem of a user taking a picture of ingredients available in a refrigerator, then generating novel recipe cards tailored to complex constraints on cost, preparation time, dietary restrictions, portion sizes, and multiple meal plans. The research concludes that monolithic ultimodal models currently lack the coherent memory to maintain context and format for this task, and that until recently, the language models like GPT-2/3 struggled to format similar problems without degenerating into repetitive or non-sensical combinations of ingredients. For the first time, an AI chef or cook seems not only possible but offers some enhanced capabilities to augment human recipe libraries in pragmatic ways. The work generates a 100-page recipe book featuring the thirty top ingredients using over 2000 refrigerator images as initializing lists

Action runtime testing,

Accountable for assessing the duration required to execute a certain activity inside the program. A total of 51 tests were conducted on various aspects of the application, including text validation on the landing page and the functionality of deleting items from the food item list. The identified feature deficiencies have been rectified in the latest version of FridgeSnap, including alterations from the original design to guarantee optimal user experience.

Potential impact of application

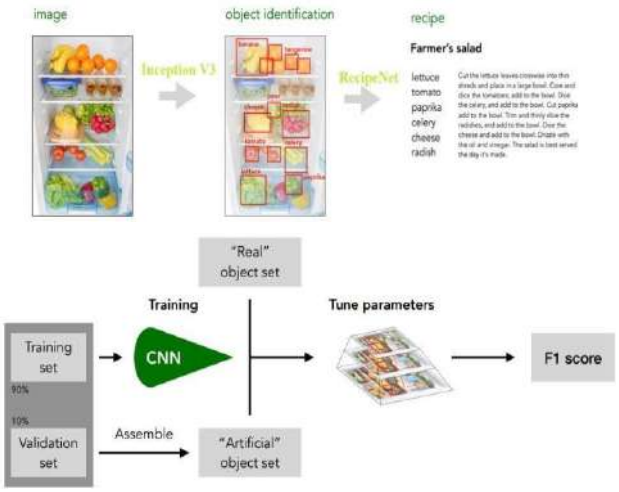
FridgeSnap has the potential to make a significant contribution to research, particularly in the fields of image recognition and food-related fields. Additionally, it has the potential to address a pressing societal issue by reducing food waste, promoting sustainable practices, and improving the economic well-being of individuals and households. Following is a list of the possible impacts that might be made on research, the economy, and the environment:

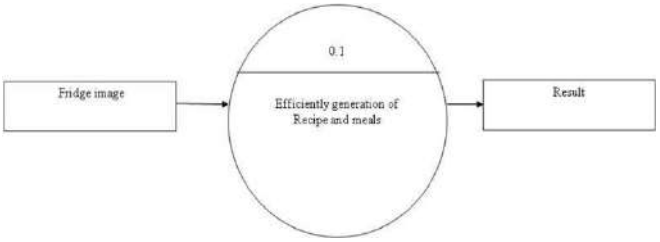
Investigate: To the best of our knowledge, the dataset that was produced for this study is the first one to contain a collection of specific food items that can be utilized for multi-class food picture classification tasks. This means that the dataset is quite unique. This dataset concentrates on individual food items, such as potatoes and carrots, in contrast to other datasets that are already available, such as Food-101 [5] and Food-5K [6], which predominantly show photographs of whole meals and categorize food items into broad classes, respectively. Due to the fact that it is both unique and specialized, the dataset has become a new baseline for assessing and developing food identification algorithms. This may possibly lead to major advances in multi-class picture classification methods, which might have uses that go beyond FridgeSnap's objective to reduce food waste. In addition to fostering cooperation and creativity within the scientific community, the availability of this dataset [3] and the open-source code of FridgeSnap both contribute to the promotion of accessibility.

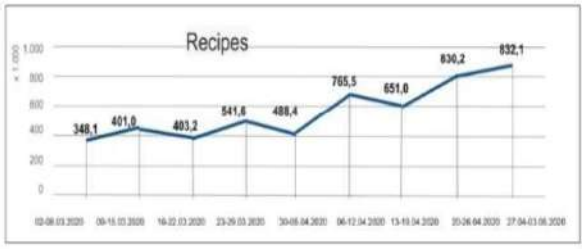
In terms of the environment and sustainability, food waste is a substantial contribution to environmental concerns such as soil contamination, water pollution, greenhouse gas emissions, and decreased agricultural yields. It is estimated that around 7.2 million tons of food waste is produced year [7]. In

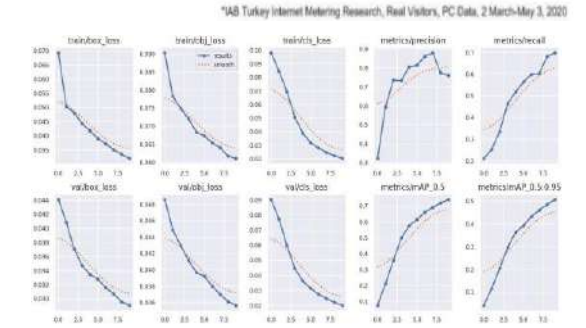
order to save money and reduce one's impact on climate change, one of the most straightforward and effective advice is to reduce the amount of food that is wasted [8, 9]. Therefore, FridgeSnap indirectly helps to a decrease in the quantity of food that is abandoned by customers, which in turn reduces the environmental footprint that is connected with food waste. This is accomplished by assisting individuals in recognizing and making effective use of food products. This fits with the aims of sustainable development, which are connected to the protection of the environment and the assurance of food security. Both the economy and education: [10] It is estimated that the annual economic effect of food waste at the household level is around 680 pounds. With the aid of FridgeSnap, individuals are able to make more efficient use of the food that they currently own, which may result in lower shopping expenses. The result is that individuals and families will see economic savings and an improvement in their overall financial well-being. Furthermore, the function of FridgeSnap that suggests recipes based on the food products that are available may teach users about cooking and meal planning, which can encourage culinary innovation and perhaps lead to healthy eating habits from the user.

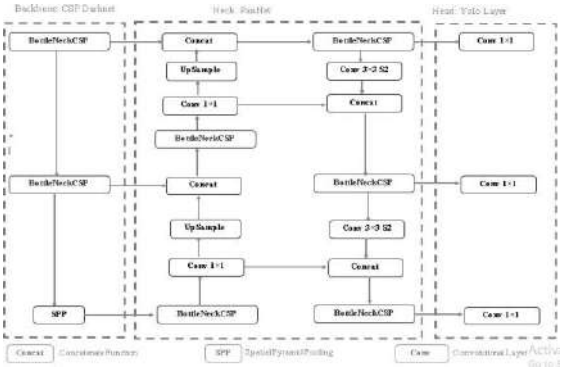
4-Results











5- Future work

It is a noticeable drawback of the present version of FridgeSnap because it is unable to calculate the amount of the food items that have been recognized, despite the fact that it provides helpful aid in recognizing food items from photographs. By enhancing the tool to estimate food amounts, its usability might be significantly improved, particularly in terms of filtering recipe recommendations based on the food items that are

accessible, therefore providing a cooking experience that is more thorough and suited to the individual. Through the implementation of this prospective improvement, not only would food waste be reduced even more, but meal planning would also become more accurate and time-efficient.

6-Conclusion

It is possible for home chefs to keep track of their food supply with the use of a web-based application called FridgeChamp. Users are able to maintain a record of their recipes and have the option of either keeping them

secure or making them available to the public. Additionally, the system gives customers the ability to establish expiry dates for their food products and to get warnings when goods are close to reach their expiration date. In addition, customers have the ability to establish "alert" levels for each item, which will cause them to get a notification when the supply drops below a certain threshold. The planner function lets users to plan their meals up to a year in advance, making it a great tool for grocery shopping and organizing home cooking. Each user has their own account and refrigerator, and the planner feature allows users to prepare their meals in advance. In addition, FridgeChamp provides its customers with a recipe database that allows them to keep all of their recipes in a single, easily accessible spot, without any unnecessary information being included.

7-References

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