Proposal to Integrate Our Mobile Application to Improve the Health of Stony Brook University Students

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EXECUTIVE SUMMARY

NutrAllFit is a company created by four Stony Brook students in order to combat and reduce allergic reaction accidents in the world. According to the Food Allergy Research & Education organization, about 200,000 of the 32 million people who have food allergies in the United States require emergency medical care for allergic reactions to food every year. However, not much is done in this world to prevent this common and fatal disease that stays with victims throughout their lifetime.

NutrAllFit wishes to take the first step forward to solving this worldwide crisis. Our mobile application ensures direct communication between the consumers and the producers about the nutrients and allergens in the foods that the consumers buy. This significantly increases the safety of the food that customers with food allergies are about to buy. In addition, we also provide food suggestions based on the users' health conditions and daily nutrition intakes in order to provide all users with a healthy life.

We are what we eat, and our application suggests and manages people's meal intakes. NutrAllFit will become a world-changing app that everyone will need in order to improve the general wellness of everyone on Earth. We really wish that you can take us into consideration as we are about to alter the world into a better and healthier place.

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INTRODUCTION

Background

There is a victim of food allergies within a group of four college students that created this project. In the hopes of helping our groupmate and anyone else with this disease, we decided that a mobile application could help us solve this problem. However, none of the health mobile applications that currently exist on the market are related to food allergies. Nonetheless, we did not give up on our hopes and decided that we should create our own mobile application to do this job.

Scope

Our application's major focus was on allergy prevention. However, that would narrow our application down to only users with food allergies. Taking that into consideration, we've decided that we should create an application that would help everyone become healthy by managing the users' meal intakes. Not too many apps in today's market merge these two aspects together which will make us stand apart from others.

To make us a truly unique application that consumers will gravitate towards is incorporating design elements to tackle many of the issues that plague modern fitness apps. The biggest flaw we will cover is the slow manual input in these apps. Although many of them implement an auto search style that remembers the logs of previously inputted food, this whole process is very tedious and deters users from actively using the mobile application. Also, many apps do not have accurate data when it comes to calculating nutritional values.

Solution

One of our specialties is that we utilize computer vision technology to quicken the users' experiences so that they do not have to deal with the old fashioned manual input styled nutrition application. Our software is capable of detecting the specific meal and calculates your nutritional intake with the press of one button by using the camera functionality built into every smartphone. Also, we plan to expand our database to include a variety of options that would not be otherwise offered on other platforms. With all of these upgrades, we hope to make a mark in the fitness app industry and provide a quick and convenient user experience.

DESIGN

User Interface

Upon the first time use of NutrAllFit, we will ask the users to fill out a form about their health history. This will be used to help us calculate what meals to suggest to the users to eat and what foods they need to look out for. The biggest flaws of most health applications on the current market are that they are bothersome to use while they give minimal information to their users. Having to manually put in every food just for the sake of calculating their calories is simply not worth anyone's time. To avoid that situation, we decided that we should implement a computer vision to help quicken and enhance user experience. By scanning with the camera on the phone, users will not have to waste any of their meaningful time to manually input their food. Moreover, they will get an immediate response to their calorie consumption as well as allergen and other food warnings. We carefully choose our fonts and colors and every aspect of the user interface to make our application easily accessible and user friendly.

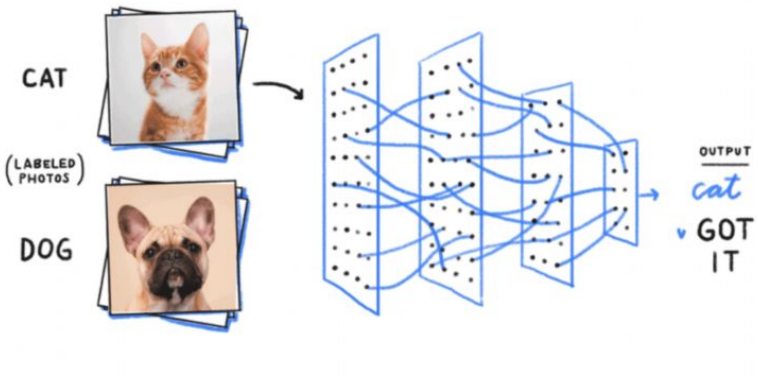
Usage of Computer Vision

The most important part of the image recognition process is to teach computers how to identify something in an image by gathering and organizing data to build a predictive model and use it to recognize images. To begin, there are two ways a computer sees an image, either as a raster or a vector image. Raster images are created with thousands of pixels. It's similar to blending colors

to soften the transition from one color to another. On the other hand, a vector image is similar to creating a bunch of tiles of different shapes and putting them together. In order to organize the images, we have to extract important information from the images and classify them. We can extract important information by cropping out information that we don't need. For example, say you have an image of a cat in a room, we can run an edge detector on the image to crop the image to contain the cat and not the room.

Next, we convert the cat image to feature vectors. Feature vectors are used to represent images in a mathematical way that help machines analyze easily. There are many different techniques that convert images to feature vectors such as Histogram of Oriented Gradients (HOG), Scale-Invariant Feature Transform (SIFT), and Speed Up Robust Feature (SURF). Feature vectors are important in machine learning since many machine learning algorithms require numerical representations of objects. After converting the cat image to the feature vector, we will feed it to a classification algorithm that will categorize it into the cat category. However, before we can do that, we have to "teach" the algorithm by showing tens of thousands of cat and

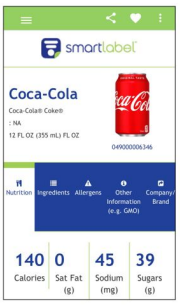
non-cat images to create neural networks which will help us build a predictive model. Neural networks can contain thousands of interconnected nodes and each node has its own data which includes the things it has seen or interacted with along with their original rules. Together, the nodes create a neural network, the basis of machine learning.



Our Implementation

We have developed two ways in which to produce quick and efficient scanning by implementing computer vision:

- ***QR Code Scan:*** The affiliate company that we partner with will have every meal with a QR code attached. The QR code will be linked with the types of ingredients used as well as portion sizes and will be highly accurate because the company itself is providing the data.

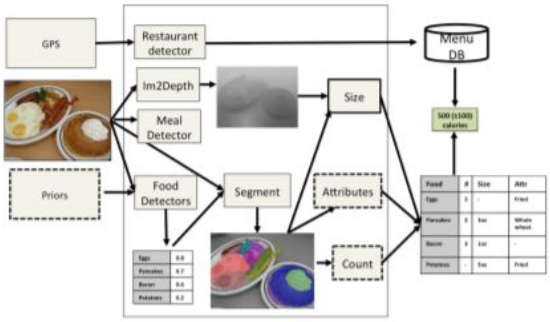


- ***Food Scanning:*** This second option could be used when there are no QR codes provided. It will be able to scan the entire meal with a single picture and evaluate its nutritional value. Although less accurate than the choice of using QR codes, it is a quicker process than using manual input while maintaining a fairly accurate analysis.

The incorporation of QR codes will be a simple process. The companies we collaborate with will either attach the codes onto the food packaging or if it's not something that can be packaged, it will be posted on the menu selections. These respective companies will also provide the nutritional information needed and we will add it to our databases. The supplied data will be closely monitored and inspected to ensure a small margin of error.

However, food scanning will be significantly more difficult. Our application will work in tandem with the concepts of computer vision, but because machine learning rarely produces perfect results, accuracy will be inevitably compromised. Regardless, it is still a powerful and reliable tool with virtually no noticeable lag. The system called Im2Calories is our model for food scanning which is able to distinguish each content of a meal and predict nutritional values. This technology performs several steps in order to calculate its results.

- *Phase One: Segmentation*
    - The software separates each food in the meal from the input image
    - This process needs to be able to localize and find detailed features
- *Phase Two: Volume Calculation*
    - Estimates the amount of volume taken up by each segment three-dimensionally
    - Uses a depth map to create an average height for each individual grid point



- *Phase Three: Calorie Calculation*
    - The system searches for the food within the database to determine each segment's caloric density
    - By using the volume, a simple calculation is done to compute the total calories

Allergen Prevention

One of the most important aspects of the NutrAllFit app is its allergy prevention feature. To understand better we will separate this section into three parts.

- Why Allergen Prevention? :

    An allergy is a normal reaction of the body to keep its homeostasis and defense stronger. However, a severe allergic reaction is called anaphylaxis. Symptoms include itching, swelling in the mouth, vomiting, or diarrhea. Not all of these symptoms are life-threatening. But in severe cases, the situation can become worse and can lead to death. Anaphylactic shock can occur because of many reasons. But most prevalent cases occur because of food-induced allergies. This is called food anaphylaxis. In the article, " Food-Induced Anaphylaxis: Role of Hidden Allergens and Cofactors", the author mentioned that the outcome and the severity of the anaphylaxis differ significantly between young children and adults. The anaphylaxis depends on the dose of the allergens that have entered the body, as well as the kind of food allergens getting into the body. From another study made by Guillaume Pouessel and Paul J. Turne, we know that a systematic review of fatal anaphylaxis found that peanut and tree nuts are the most

common (about 87%) food triggers for people around age 20-22 in the US (table 2). Even though people are concerned and always look out for these ingredients in the food, sometimes it doesn't become so obvious. That is one of the reasons that the allergy attacks are still increasing. That leads us to ask the next question.

- How Do We Prevent allergy? :

The best way to deal with an allergy is to prevent it. According to one Healthline article, to prevent an allergic reaction, the patient with allergy should read the label of the food and ask the food provider for the ingredients (Anna Schaefer). Today most people depend on their smartphone for getting information. People use different smart apps to maintain anything from their daily schedule to lifestyle. However, there are still not enough smart apps that contain an adequate amount of information about allergens. From the hyper-clinical health site *Verywell Health*, we found that there are six apps that work with people's allergy risks. One of the apps among them is ContentChecked. This app scans the product barcode to tell the user if the product has any of the big eight allergens. This is a paid app. There are other apps similar to this are MyFoodFacts and AllergyEats. Some of the key factors that differ in all the apps are the making of personal profile and free service. Another important aspect of those apps lacked is the connection between the food provider and the consumers. However, our NutrAllFit app will be free of service for consumers. It will also have the liberty to create personalized profiles and can create a bridge between food producers and consumers.

- What can we accomplish? :

  As we have mentioned earlier the prevalence of food allergies, the situation is more dire than it looks. According to the study made by Mimi L. K. Tang, the age groups that have the highest rates of mortality by anaphylaxis shock from food allergies are older people and teenagers (cite page number). People of these age groups are more interested in eating outside and exploring their food choices. Also, people from these age groups go to high school or college.Therefore, it is very important to raise awareness against allergies. Among the student group, college students have a higher risk of getting allergy attacks because of their eating habits and the choices of where they eat. Campus dining is one of the important places where the awareness of allergies is most needed. A good connection between the food provider and the consumer is very important to raise allergy awareness. If we go back and review the largest age group for allergy attacks, we can find that most of them actually use the smartphone the most. Therefore, we need some sort of smart app that can resolve the bridge between the food producer and the food consumers. Then we can have more allergy-friendly places and the mortality because of the allergy attack will decrease.

MARKET

Stakeholders

Our stakeholders consist of health-conscious people, affiliated companies, and advertising partners. Those who are willing to make eating decisions affecting their health will be our target demographic. Our consumer base will be the ones that are providing us feedback on ways to

constantly improve the app while giving them the best possible experience. Each company we work with incorporates NutrAllFit into their system and provides users with highly accurate databases. In return, their vested interests in our company will increase their sales due to our personalized recommendations to our consumers based on each user's profile and receive a portion of our profits. Advertising partners will be able to showcase our application and convince viewers to install NutrAllFit on their platform of choice. These stakeholders will be the core of our business model for us to progress to broader horizons.

Competitors

There will barely be any competitors that can go against us when our application becomes a reality. There is currently no health application on the market that provides allergy prevention and food suggestions. Not to mention that we've also gotten rid of the bothersome manual input aspect that every health application has. We are also the middle man of every food purchase so we can ensure that everyone with allergy can eat everything safely. Our existence will become so important in this world that no one would be able to compete with us. We will keep on improving our application based on our user feedback to eliminate any kind of competition.

Management

To manage this project, we need you to provide all the ingredients and the portions to every food you serve on the campus. We will put these pieces of information into our database and transform them into QR codes in front of their corresponding food for the users to scan with their cameras. Once this is set and we are able to receive enough feedback, we will make adjustments

to our application. After the beta test, we will visit other restaurants and factories to expand our database.

Challenges

Given the complexity of this project, a notable challenge is a price to develop such an application. NutrAllFit is combining two sectors of the market, fitness and allergy prevention, as well as using machine learning to develop the scanning aspect. Finding developers to work on such an intricate design will be difficult since machine learning is a recently booming field. The time also needed to dedicate towards working on a massive project will be substantial. However, we believe that this is an important application that needs to be developed and our team is willing to overcome these challenges to make a life-altering app.

BUDGET

As Stony Brook students, we wish to implement our product on the campus where our dreams have started. We're seeking for a budget of $215,000 to start our research and further develop this project. Our project will include a huge database of food menus and nutritional values, as well as a computer vision scanner to increase the ease of use of our application. If you're willing to provide us with this budget, we can launch the beta test in 3 months. We'll receive feedback from the students to gradually improve and update our application.

CONCLUSION

In the past, there have been attempts where you tried to provide healthier choices to the students by expanding the menu options of dining areas. One such example was in 2013, where Kristina

(Tina) Tiernan, a nutritionist, was hired to provide nutritional counseling for the students of Stony Brook. In addition, many more attempts were made to diversify the meals on campus. Based on your past actions, we believe that Stony Brook would like to ensure the health and safety of its student base so that they can strive and create a better future. As a matter of fact, we believe that we share the same goals. We would like to accompany you through your journey to create a better place for everyone in the world to live in. It is in your best interest to consider this opportunity to implement our application on your campus to protect and enrich the lives of all Stony Brook students and staff.

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