



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 accidental allergic reaction accidents. 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 to prevent this common and sometimes fatal health issue that can last a lifetime.

NutrAllFit wishes to take the first step to solve this worldwide phenomenon, and we want to start within our community at Stony Brook University. Our mobile application ensures direct communication between food consumers and food producers. It will alert consumers — students and staff — about the nutrients and allergens in the foods they buy on campus. This significantly increases the safety of the food they consume. 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 makes suggestions for and manages people's meal intakes. We hope that Stony Brook University will consider partnering with us as we take our first step in making the world a safer and healthier place.

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INTRODUCTION

Background

According to the International Food Information Council Foundation, “The U.S. Department of Education projects that nearly 3 million incoming college freshmen will begin school across the country this fall. Given that around four percent of the adult population suffers from food allergies, there may be more than 100,000 incoming freshmen students with food allergies to manage” (cite). In fact, one of the creators of this product suffers from food allergies. In the hope of helping people like our groupmate, we decided that a mobile application could help us combat this problem that so many others face, especially since none of the current mobile health applications on the market address the problem of food allergies.

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 for many reasons, but the 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 mentions 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. Turner, author of paper “Food-induced fatal anaphylaxis: From epidemiological data to general prevention strategies”, performed a systematic review of fatal anaphylaxis found that peanut and tree nuts are the most common (about 87%) food triggers for people around ages 20-22 in the US (page 3, 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 allergy attacks are still increasing. And this is what our app is trying to address — the unintended ingestion of allergens.

How Do We Prevent allergic reactions?

The best way to deal with an allergic reaction is to prevent it. According to a *Healthline* article, to prevent an allergic reaction, patients should read food labels and ask the food provider for the ingredients (Schaefer). Today most people depend on their smartphones 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. The other apps similar to this are MyFoodFacts and AllergyEats. The apps differ in how to make a personal profile and whether the app is free.

Our application, on the other hand, promotes collaboration between the food provider and the app maker, which builds a level of trust for the consumer. This is inherently different from the apps in the market.

What can we accomplish?:

As we have mentioned earlier, the prevalence of food allergies, the situation is dire than it looks. According to the study made by Mimi L. K. Tang, the author of “Food Allergy: Is Prevalence Increasing?”, the age groups that have the highest rates of mortality from anaphylactic shock caused by food allergies are older children and teenagers ([5]- pg. 5). People of these age groups are more interested in eating outside and exploring their food choices. Also, teenagers and young adults, in particular, go to high school or college where they have more freedom in selecting their foods. Therefore, it is very important to raise awareness about allergies. Among the student group, college students have a higher risk of suffering allergy attacks because of their eating habits and their choices of where to eat. For this reason, raising allergy awareness in SBU’s campus dining system is an important step. According to studies, this age group uses smartphones the most. By using our app to bridge the gap between campus dining and its student, staff and faculty consumers we can help create a more allergy-friendly place to eat and decrease the mortality rate from allergy attacks.

Solution

Here is where you want to quickly explain what you do in a brief overview that puts all of the pieces together. Something like this: We have created an app that will allow users to

refer to a database of SBU dining service foods to check for allergens before purchase or ingestion. By working directly with the chefs and having direct access to all of the ingredients in the foods, we can ensure that our database includes an accurate list of what foods are safe for which consumers. At the same time, we want to help everyone become healthy by managing users' meal intake. Not too many apps in today's market merge these two aspects and make us stand apart from others.

Design

We incorporate design elements to tackle many of the issues that plague modern fitness apps. Our design makes us unique and attracts customers. We cover the biggest flaw in these apps, which are slow manual inputs. Although many apps implement an auto search that remembers the logs of previously input food, this whole process is very tedious and deters users from actively using the mobile application. Another concern is that many apps do not have accurate data when it comes to calculating nutritional values. However, our app developers communicate with business owners to ensure that the application produces the most accurate calculation.

We utilize computer vision technology to speed the users' experiences so that they do not have to deal with the old-fashioned manual input 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. With the partnership between NutrAllFit and SBU, we will target the dining halls to improve the health of many of your students. We will be able to ensure the accuracy of our ingredients and catalog your menu items

into our database. Also, we will be able to suggest many of the food options on your campus that fits every student's personalized profiles.

DESIGN

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 to be placed on the food packaging or next to the food on the menu, so that users can scan the codes 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.

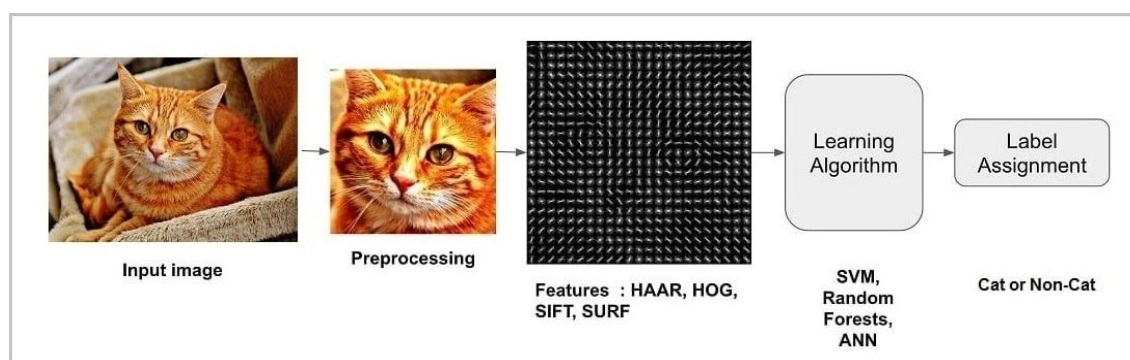


How to use Computer Vision

In addition to the QR codes, users will be able to use computer vision to scan their foods for nutrition and ingredients. The most important part of the image recognition process is to teach computers how to identify something in an image. We need to gather and organize the images to feed into the computer algorithm so that we can 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.

We will be using raster images since photographs are classified as raster images. In order to organize the images, we have to extract important information 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 to help machines analyze easily. We will be using the Speed Up Robust Feature (SURF) technique since it's the most efficient algorithm. 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. We then “teach” the algorithm by showing tens of thousands of cat and non-cat images to create neural networks that 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, thus accomplishing our task of developing our image recognition technology.

Our Implementation

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

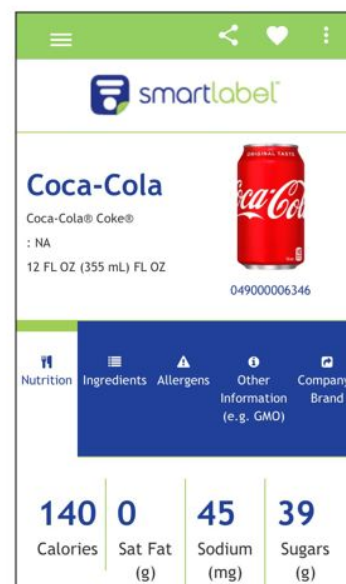
- **QR Code Scan:** We will attach every meal with a scannable QR code that many can use.

The QR code will be linked with the types of ingredients used as well as portion sizes and will be highly accurate because SBU will be providing the data.

- **Food Scanning:** This second option could be used when there are no QR codes provided.

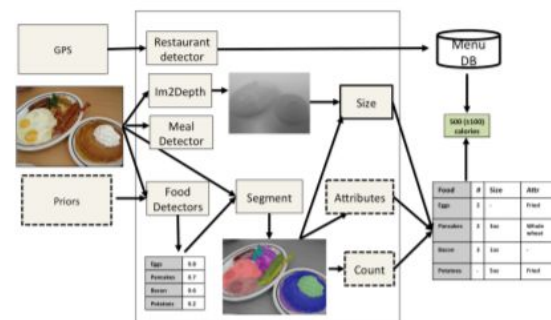
It will be able to scan the entire meal with a single picture and evaluate its nutritional value. Any food from

Stony Brook University's dining hall will be easily recognized in our system since our algorithm has perfected distinguishing features from outside food to SBU food.



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 for foods that are not made by SBU. Regardless, it is still a powerful and reliable tool with virtually no noticeable lag. Combined with its knowledge of the products produced by Stony Brook University, the accuracy will be near perfect with even better processing times. 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

User Interface

The first time a user logs in to NutrAllFit, we will ask them to fill out a form about their health history. This will help us to calculate what meals to suggest and what foods they need to look out for. The biggest flaws of most health applications is that they are bothersome to use and give minimal information to their users. Manually adding 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 computer vision to help enhance user experience. By scanning foods with a phone's camera, users will not have to waste any of their meaningful time manually inputting 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.

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 providing us feedback on ways

to improve the app so that we can give them the best possible experience. Since we plan to keep the app free in order for it to be easily accessible for potential users, our main source of revenue will come from hosting advertisements. We will integrate these ads in a way to prevent any hindrance to the user experience. If the user wants to be able to remove all ads or support the app, they can make an in app purchase of \$0.99 to do so.

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 an allergy can eat everything safely. We will keep on improving our application based on our user feedback to eliminate any kind of competition.

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. To combat these challenges, we will post job listings that are looking for experienced developers only and seek financial aid from government or private sources to lift the burden on our budget. Also, the scanning aspect of the app will be fairly limited. It will not be able to detect every detail in the picture taken. For instance, it will more than likely not be able to pick up the dressings put in a sandwich or anything that may be obscured in the photo. In these cases, if the user chooses, they can resort to manual input that will still be integrated. 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 a budget of \$410,500 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 make the application easier to use. 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.

Budget Breakdown – One Year Timescale

- App Development – \$350,000
 - *Developer Pay* – \$250,000

- *Information Security* – \$100,000
- Office Expenses – \$40,000
 - *Equipment (Computer Hardware, Office Items, etc.)* – \$12,500
 - *Rent/Utilities* – \$27,500
- Financial Services – \$20,500
 - Financial Advisors – \$10,000
 - Advertisements – \$10,500

Total Cost: \$410,500

CONCLUSION

Based on past actions where the university has expanded menu options and hired a nutritionist to provide nutritional counseling to students, it is clear that Stony Brook wants to ensure the health and safety of its student base.. 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 healthier campus to your students, faculty, staff and visitors.

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