Status Report

For

Towards a Healthier Life:Food Library and Recommendations

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1. Executive Summary

A well-balanced recipe is critical to a healthy lifestyle. As the rapid improvement of living standards in the past decades, healthy diet gains more attentions. In order to meet people's needs for healthy living management, a variety of apps raised, which are made to record what users eat every day. However, there still are some differences between people’s expectations and facts. Users tend to use more convenient software. For instance, users still need to manually type the name of food instead of just taking a picture and waiting for the system to analyze it automatically.

2. Project description

In this project, we are going to develop an application to help people record their food consumed every day, calculate the nutrition, as well as the energy (in Calorie) has been taken and provide a simple analysis result and recommendation for future recipes. The novel point of this project is that we allow the user by only taking a picture to upload what they eat every day, instead of manually inserting the food according to catalogue.

As people pay more and more attention to dietary health, a convenient and scientific dietary guide is particularly important, while diet monitoring software plays such a role.There are several existing means and algorithms used for image recognition. Machine learning procedures, especially for deep learning, like CNN with TensorFlow and SVM, will be used to achieve the project.

3. Scope and objectives

Objective:

The project objective is to develop an Android app to recognize food by only just

taking a picture; and as a result, to help people record their food consumed every day, calculate the nutrition, as well as the energy (in Calorie) has been taken and provide a simple analysis result and recommendation for future food recipes.

Scope:

The estimated duration of this process is six months, and we will investigate the recording performance of food types using CNN (Convolutional Neural Network) with TensorFlow, SVM(Support Vector Machine) and ML (Machine learning) techniques. The available methods include Android apps development, i.e., UI design. We also will build a large food image library for training purposes using technology of Database management. At the same time, we need to have AI computing power and floating-point computing ability, after identifying the food volume, calculate the weight according to the density, calculate the calorie content according to the weight. This makes it possible to read the picture to identify the magical function of food calories.

Approach

We choose Scrum, which is an agile development, a human-centered, iterative, step-by-step development method. This approach provides us with a framework for thinking. It is beneficial for us to prevent missing places and managing whole processes when we complete this project according to its phases.

Major Milestones

（1） By 2018.21.23, our entire team completed the basic concept of Machine Learning.

（2） By 2018.12.5, we have found all the pictures of the materials we need to use.

（3） By 2019.1.10, in the APP development, we completed the UI design and made several modifications according to the user's needs to achieve the most

comfortable and convenient level. Also completed the "login / registration" function, recipe recommendation function, beverage library and life cycle function.

Deliverables

(1)Research report detailing:

I) Collect massive data about various kinds of food mainly from the following 3 websites:

58PIC: http://www.58pic.com/tupian/shiwu.html

BOOHEE: http://www.boohee.com/food/

FITNES: http://www.fitnes.cn/food/

II) Prepare data: Find pictures and related data (such as calorie, quality and so on) of various foods, then screen out foods to ensure the diversity and commonness of data.

III) Analyze the data sets: Associate food images with related data and store them in groups according to different criteria.

VI) Test algorithm:

Test whether the food picture and data match each other, and evaluate the richness of the food types in the database.

 Use the CNN algorithm.

There are four main steps in CNN: convolution, subsampling, activation and full connectedness. (Hhchin87, 2015)

 Use the SVM algorithm.

Given labeled training data, the algorithm outputs an optimal hyperplane which categorizes new examples. (Intro, 2014)

(2)Concrete realization of picture recognition function

In daily life, the environment where people live in a day changes a lot. For example: breakfast at home, lunch at companies. Therefore, the pictures taken during the day differ greatly, and there are many kinds of food. In order to be able to identify food more accurately, our team divides the identification of food images into two steps: the first step is to use the food scene recognition algorithm. The food scene recognition algorithm identifies whether food is present in the image, and if no food is present, the recognition ends. If there is food, it is necessary to further determine where the food is located, and then segment the food image to determine which images belong to the food. The second step is to use a food image classification algorithm. The food image classification algorithm identifies the images segmented in the first step to determine the type of food. Although there are very many kinds of foods in daily life, in nutrition, food can be divided into five categories: staple food, meat, vegetables, fruits and soup. Then, the kind of food can be confirmed.

Software Applications

1. Identify the food in the picture
2. And give the detailed data of the food
3. Give relevant advice on this food

(3)UI Design:

UI design refers to the overall design of the human-computer interaction, operation logic and interface aesthetics of the software. A good UI design is not only to make the software personal and tasteful, but also to make the operation of the software comfortable, simple, free, and fully reflect the positioning and characteristics of the software. Therefore, as a life-like application software, we should make the UI design from the user's point of view, which best meets the user's needs.

Expected Interface

In the top half part of the main interface, there is a calendar used to make it more convenient for people to mark the date. Every day, people can record food names and food photos of their breakfast, lunch, dinner and snacks. These data are recorded in

the lower part of the main interface, which is more regular and beautiful. When clicking the photos of food, another interface which shows the calories of food would appear. When clicking the button of loving heart, people can see their preferred food and the food they can't eat.

Required Software

Photoshop、AI、AE、Fireworks、CorelDraw、Flash

4. Response to the proposal recommendations

(1) For the problem that the project took too long, we made changes to the Gantt chart. Our project originally expected to be completed at 4th June 2019. After the revision, our project is about to end at 4th May 2019. Under this revision, we have grasped the concept of "Machine Learning" and completed the process ahead of time.

(2) For the problem of too much project material, we have limited the range of foods that the APP can recognize. Originally, our APP recognized any type of food. After discussion, our APP only recognizes 24 common dishes. In order to improve the accuracy of recognition, we collected 20 pictures for each variety. In this way, 480 pictures were quickly found in cooperation with our team members.

(3) For the unreasonable division of project of the team members, we have once again arranged the division of project. Originally, each of us was responsible for writing reports, finding materials, UI design, and writing code respectively. This kind of sub-union has caused some team members to work too much. So we will conduct a group meeting to assign tasks before each task, so that each team member can participate and learn more.

5. New variations and reason

In terms of functionality, we have simplified the image recognition function in the app. In the original proposal, we want our app to recognize all the food and get the calorie content. But in the process of doing it, we found that in order to achieve this function, we may have to spend several months in collecting pictures of various foods, which was very time-consuming. Therefore, we finally decided to confine the types of identifiable dishes to 24 common Chinese dishes such as tomato scrambled eggs, dumplings, etc., which greatly reduced the workload of collecting image resources, and we can devote more time and energy to UI design and machine learning.

In terms of task assignment, we changed the strategy and let each team member involve in each task. In the original proposal, we divided the task into four parts: programming, UI design, writing reports and collecting materials, and each member was responsible for one of them. For the students responsible for programming and UI design, their tasks are too heavy to keep up with the original work plan. For students who are responsible for writing reports and collecting materials, their contribution is too small. The most important thing is that they can't learn any useful knowledge and skills from the graduation design. After changing the strategy, everyone can participate in the task and make a contribute, which can ensure the efficiency and quality of the project.

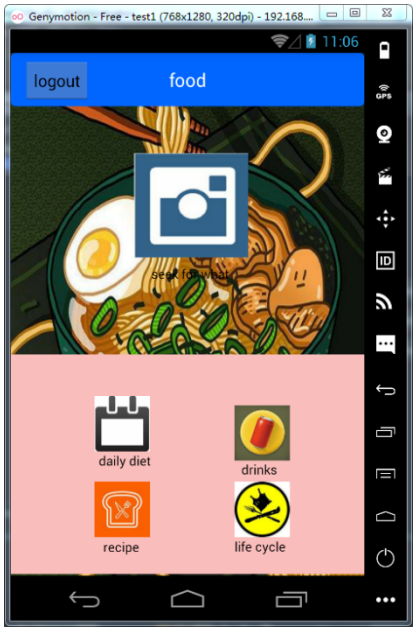
We have made a change to the Gantt chart of the work plan.We have delayed the time of literature reading. Because we have been confused about the algorithm of image recognition, we spent more time on literature reading which helped us to have a deeper understanding of the difficult algorithm.

6. Current project status

6.1. Work completed

1. UI design

We have roughly completed the UI design of the app, including the welcome interface and most of functional interfaces.The software used in UI design is android studio, and the language is java.



2. Collection of food pictures

We have collected all the image data needed for image recognition technology. We took 24 Chinese dishes on the phone as required. There are 20 photos of each dish. Each photo has an unified background.

3. Function realization

Our app has implemented 4 features.

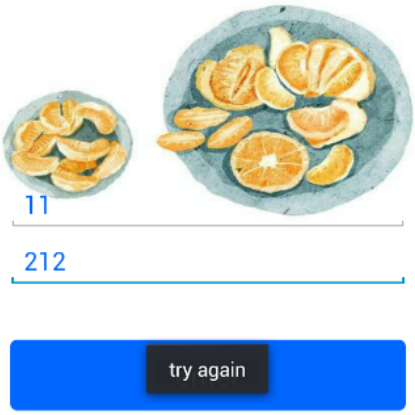
Login and registration

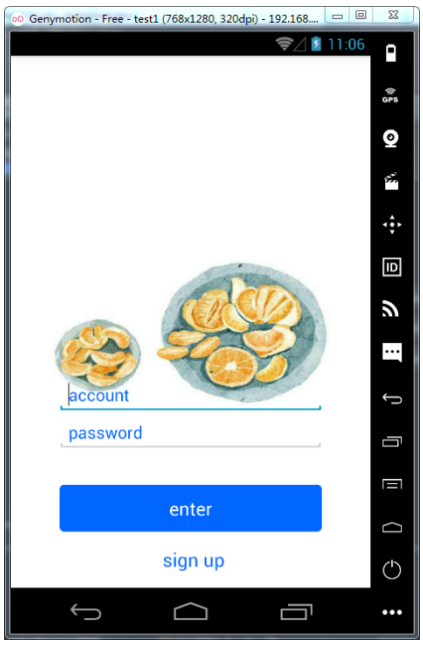
Using the database that comes with android studio, the function is associated with the

database through related SQL statements. The database includes two attributes: account number and password.

When logging in, the input account is checked to see if there is the account in the database. If it exists, it detects whether the password corresponds; if it does not exist, it displays "try again".

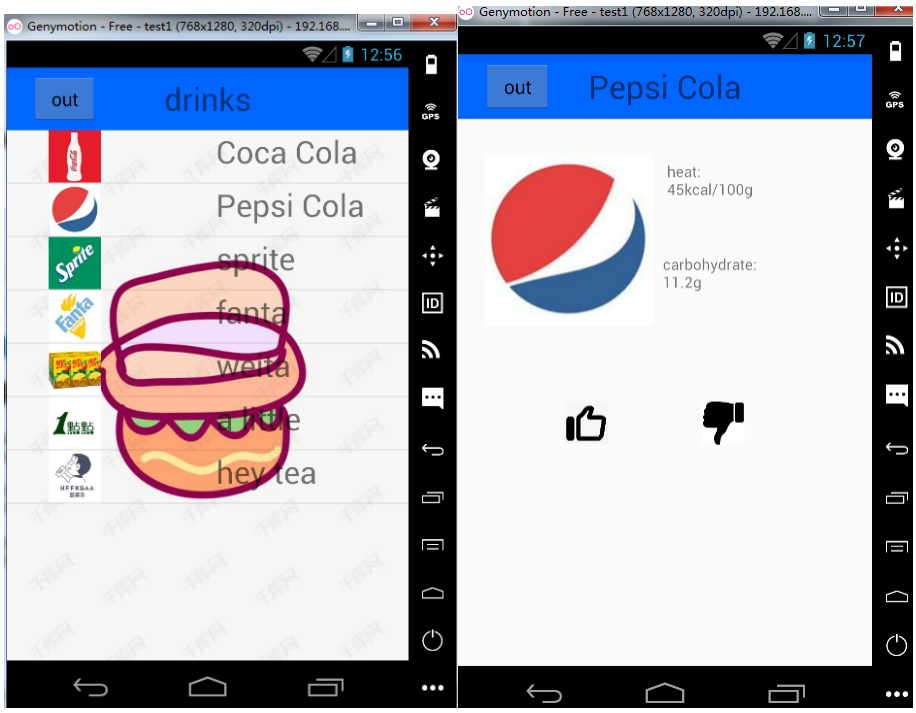
When registering, the entered account is searched in the database. If it already exists, "the account has been signed" is displayed, otherwise "success" is displayed and enters the main interface.





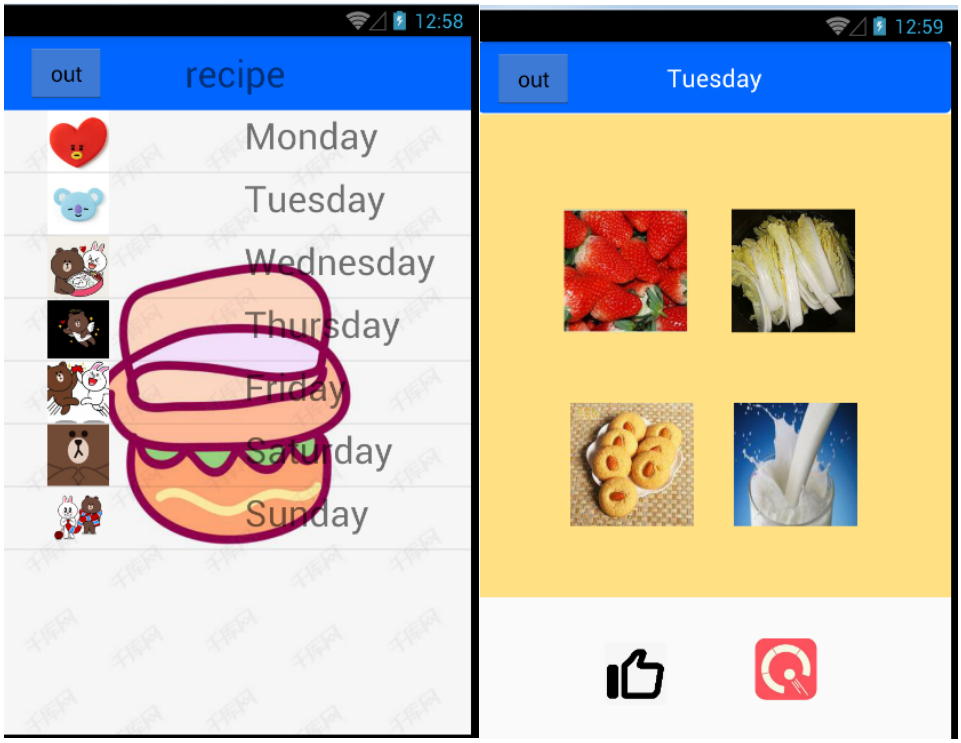
□Drinks

This feature is used to check the calories contained in each beverage. After clicking into the interface, the user can search for the different types of drinks in the listview to view the related data. There are also like and dislike buttons below, and the user can evaluate different beverages according to their own preferences.



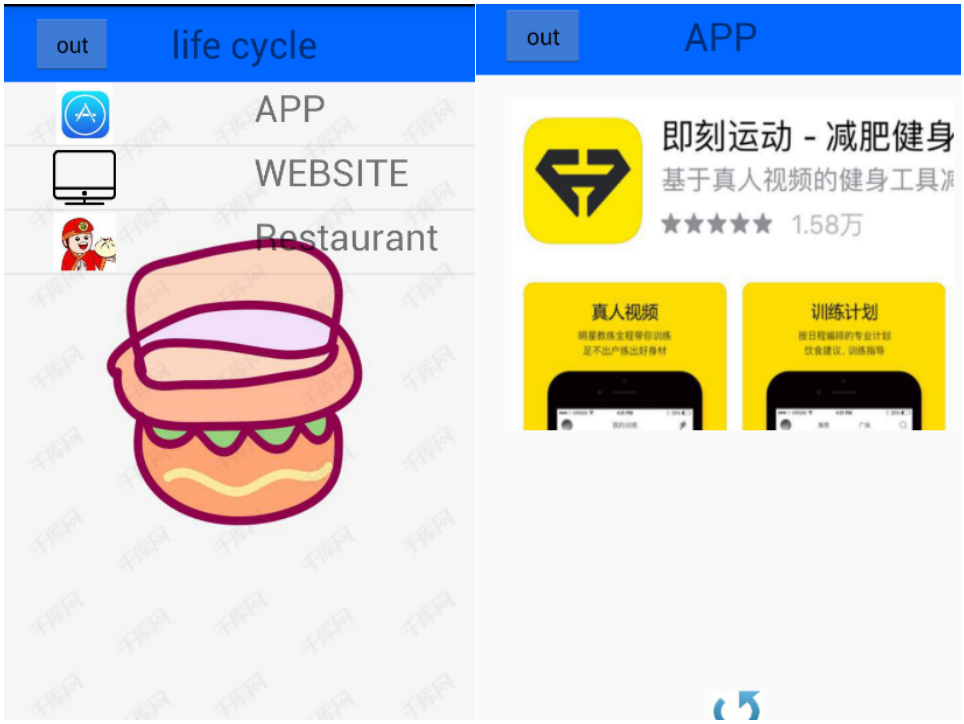
□Recipe

This feature will recommend recipes based on the needs of each user. In the recipe recommendation interface, users can view recipe recommendations for seven days a week. When the user is dissatisfied with the recipe recommendation, he can click on the button below and the app will recommend a new recipe. Also, there is the like button.



□Life cycle

In this interface, users can browse the recommended three types of food media (restaurants, web pages, apps). After clicking to view the recommendations, you can view the new recommendations by pressing the button below.



6.2. Work yet to be done

Our app has two unfinished features.

1. Picture recognition function

This feature comes in handy when the user has no time or difficulty in manually entering the name of the food to get the calories. Through the image recognition technology, the user can get the name of the food and the specific calories by taking a photo, which saves the user's typing time and improves the user's service experience. We are still researching and learning picture recognition algorithms, which is the difficulty we will overcome in the next stage.

2. Daily diet record function

This feature is mainly used to record the user's daily diet and calories. The UI design of this feature is more complicated, including the choice of date and so on. We will implement the function as soon as possible.

6.3. Issues that exist in our project/team

- Slow progress of the project:

Because everyone is the first to contact Android software project development, all aspects are very strange. In addition, the time spent in learning is longer than expected. Unexpected errors also occurred during practice.

- Original UI design does not meet requirements:

The first UI design is not neat and succinct enough, which does not meet the client’s requirements. Icons and backgrounds are easy to mix, making it difficult for users to operate smoothly. Also, some button settings are not ergonomic. Therefore, users cannot receive good experience.

- Lack of reasonable time planning and scheduling notice:

Sometimes we will forget to have a meeting, so we will temporarily inform that there will be a meeting the next day, while often conflict with the schedule of the team members.

- The initial work arrangement is not perfect:

In the initial assignment, some members underestimated the difficulty of being assigned work taking charge of the aspects they do not familiar, slowing down the progress.

- Lack of skills of using the machine learning:

As for our team, the biggest problem is the lack of skills of using the machine learning. Although we are CS students, we are not familiar with the machine learning. When coding of the machine learning, we need to spend much time in referring materials. So, there is often a delay in the progress of the project.

7. Recommendation for the team

- Quality First:

We will complete the project with quality assurance first, ensuring that each team member understands all aspects of the project.

- Communicate more frequently with the client:

We will increase the number of times we meet with our customers and listen to all aspects of feedback. Ensure that the customer is satisfied with the final project.

- More reasonable work distribution:

We selected a more capable member as the team leader. Performed a redistribution of

work and helped team members who encountered difficulties or lags.

- More systematic scheduling:

We forgot to use the scheduling software to help and remind us. We started using Trello to remind the team members of the schedule and work.

8. Individual contributions and learning achieved

Ye Fuying:

As a member of the group, although we have encountered many difficulties in the process, we have solved most of them under our efforts, and there are still some problems that we need to solve. In this project, I am mainly responsible for the development of APP sub-functions, including login and registration, food recommendation, life cycle and so on. I was not familiar with the operation of these functions at first, which was a bit complicated for me. But through the gradual understanding of the function, these functions are finally realized. Some features may differ from expectations, but they are basically fulfilled. I hope that I can continue to work hard and improve my completion.

Liu Yibin:

I take charge of the development of APP functions, including camera and daily date recording. Although these functions haven't been done, I think I will finish the project soon. Because we are freshmen as to Android development, we encountered lots of difficulties and unexpectable errors, we tried our best to solve them. In addition, I am responsible for writing parts of document. I have learned the layout of the Android project and its related writing of logic code.

I will continue to learn more about the Android program database, because I haven't learnt how to use database store images.

Chen jialing:

At the beginning of the graduation design, I did research work on the machine learning procedures, especially for deep learning, like CNN with TensorFlow and SVM, which would be used to achieve our project.In order to better reflect the framework and functions of our app, I collected the appropriate image resources and used a software called “Knife”to made a mock up which would be shown in the mid term review. In order to make a database of food, another member and I took 24 Chinese dishes on the phone as required. There are 20 photos of each dish. Also, I participated in the UI design and made comments on the design. The core code of the image recognition is still under improvement and modification. In addition, In order to track and adjust the progress of the completion, each time we finished the meeting, another member and I would record the conversation and confirm the completion of the tasks arranged at the last meeting.

This graduation design has made me more aware of the importance of teamwork. In the process, disagreements and arguments can't be avoided. How to deal with these arguments at this time is the key to determining whether a team is harmonious. By actively communicating with each other, we adopted opinions that satisfied everyone, which avoided conflicts and maintained the team's peace. UI design lets me know how to design the interface according to the user's needs and how to make the user have a better service experience. Among them, Swing played an important role in UI design. As a very useful component in Java, Swing can make a lot of wonderful UI foundations. However, image recognition technology is still a problem that I have been unable to overcome. This technique involves many algorithms for image recognition, which is very time consuming and difficult for me to understand and use. I will spend more time and experience to solve this difficulty in the next stage.

Pan Jiayao:

So far in the R&D project, I have participated in every meeting on time and have never been absent. During the meeting, I will report to the instructor and other team members on my weekly tasks, promptly present my difficulties in the project

development process, and discuss solutions with teachers and team members. At the same time, I will also listen carefully to the reports of others and do a good job of recording the group meetings.

First of all, I have a deep understanding of the introduction, requirements and goals of this project. Based on these contents, I learned "Machine Learning" in my spare time and read books on Android development to prepare for the next development work.

Next, I collected 240 photos of food, including a total of 12 dishes and 20 pictures per dish. In order to more accurately identify the picture of the photo, in the process of looking for the picture material, I will try to select pictures with obvious differences in food and background. In order to have a more satisfactory picture, I will even cook at home, take pictures, and use these photos as material.

In addition, I also participated in the design of the app page. According to the user's habits and comfort, I adjusted the position of the buttons, font color and font size in the interface several times to try to make our app interface look more reasonable.

All in all, I learned how to discuss with the group members, how to record the meeting content, understand the "Machine Learning" and "Android development", learned to collect the materials used in the project development process, and also learned the UI design.

9. Appendix

Hhchin87. (2015). Convolutional Neural Networks(CNN) Introduction. Retrieved on November 2, 2018 from: https://www.google.com.hk/amp/s/algobeans.com/2016/01/26/introduction-to-convolutional-neural-network/amp/

Introduction to Support Vector Machine. (2014). Retrieved on November 2, 2018, from: https://docs.opencv.org/2.4/doc/tutorials/ml/introduction_to_svm/introduction_to_svm.html