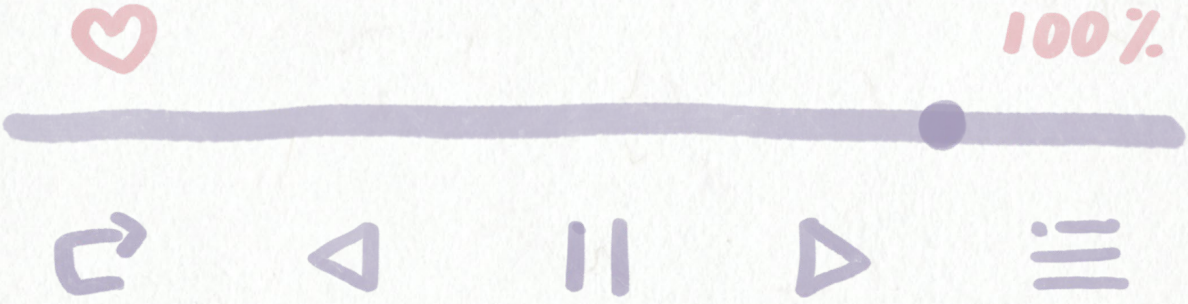
Process book

COM-480 Data visualization

Food Nutrition and Sustainability



Author: Chenyu Han, Haoying Lyu,Yuxin Wang

Contents

1. Introduction and motivation

1.1 Motivaiton

More and more people are now paying attention to the nutritional information of food, including the nutritional content, additives and preservatives in food, and are also paying more attention to the ingredients and production process of food, in pursuit of healthier and more sustainable choices.

Having enough food to support their healthy and active lives is a basic need for people around the world. However, the prevalence of various forms of food insecurity and malnutrition around the world is an obstacle to achieving the Sustainable Development Goal of Zero Hunger and Good Health and Well-Being. We hope to demonstrate in this project that nutritional information about food can not only help people make better and healthier food choices, but perhaps we can also gain more inspiration.

1.2 Introduction

In our project, we first present the main nutritional information of the different food categories in our database in a novel and unique way, so that users can explore and get a general idea of the nutritional information on our webpage. We then combine information on food production, food nutrition, and population data for different countries in the world to explore whether the production of food in different countries meets the nutritional needs of their people. The visualization allows us to clearly observe how the needs of different nutrients are being met in each country. In response to the unmet situation, countries can consider increasing the production of foods rich in these nutrients.

2. Exploratory Dataset Analysis

2.1 Datasets

In order to visualize the nutritional data of the food, two datasets were found for processing. The first one, from kaggle, is called Food Ingredients, and it contains very rich food data, with detailed information on various food categories as well as macronutrients and micronutrients. However, when we needed nutrition data for individual foods, we got the data we needed from the data tables provided on the official

websites of the Australian and New Zealand Food Standards Agency.

For the analysis of national nutrient satisfaction, the database was derived from the supporting material provided by Chen, Canxi et al. in 2021.

2.2 Exploratory Data Analysis

For food nutrients:

- **Foods in the same category have broadly similar nutritional characteristics.** For example, carbohydrate-rich grains outperform protein-rich foods in terms of energy value; vegetables and fruits provide relatively little energy or protein because 70% or more of their weight is water, but many contain vitamin C and carotenoids.
- **Carbohydrates, fats and proteins** are generally the three most abundant nutrients in foods, also known as macronutrients. They are also the items that people most often mention and pay attention to when managing their dietary habits.
- **Food production varies greatly from country to country.** This may be influenced by geographical location, climatic conditions, economic level, etc. But in general, as the world's population continues to increase, the production of food in each country is also basically increasing.
- **Nutrient adequacy rates vary between countries.** Corresponding to the total nutrient requirements of the total population in each country, there are significant differences in how well each country produces food to meet the needs of its people each year. In general, dietary nutrients produced in high-income countries are generally adequate, while low-income countries often lack important micronutrient supplies.

3. Design and Implementation

3.1 Initial Design

- **Overall design**: The first part will work as the homepage. Cartoon food images were added to the homepage to fit the project theme. A navigator was designed at the top of the page so that users can click on different headings to move to our corresponding visualization area. The colors of the web page wanted to be

consistent with the style of the homepage image, so a low saturation color scheme was used. This decision is intended to give the user a gentle and comfortable browsing experience. The overall font size is large, also in consideration of reducing the user's visual fatigue level.

- **Food nutrition information:** Based on the conclusions drawn from our preliminary analysis of the data, we wanted to create several visual charts in terms of food groups. Through our search research, we found that the more common methods of visualizing food nutrition are bar charts and pie charts.

To explore a more novel approach, we noticed ternary charts. A ternary plot (Ternary plot) is a prime graph describing the sum of three variables as a constant, with each component scaled to 100% at the vertex of the corresponding equilateral triangle and 0% at the line opposite it, dividing the zero line and the vertex proportionally for estimating the content of each component. First we explored the ternary diagram applied to the visualization of the three main macronutrients being carbohydrates, proteins and fats.

- **Worldwide food production:** In milestone2 we originally planned to visualize the differences in food production over time in different countries based on a world map with differences in circle radius size. However, in subsequent studies, we shifted the theme of the project from individual food nutrition pairings to a more rarely studied national perspective. So, we finally settled on a combination of four types of maps, bar graphs, pie charts, and line graphs.
- **Word cloud for recipes**: Based on the database we selected in milestone1,3 we generated a word cloud of recipes from different regions. This provides a visual representation of the dietary preferences of different regions, including the differences in ingredients, tastes, and cooking styles. This section is mainly intended to briefly represent the regional differences behind the food choices.

3.2 Chanllenges and changes

The database of nutritional information about food contains complex and numerous information. We need to select some of the most representative foods and common nutritional data for visualization to avoid overly complicated charts after visualization of

complicated data, which affects users' reading.

Issue also emerged when implementing the drop down menu and integrating the pie chart into the corresponding drop down value.

The bar charts are too messy. And too much information makes users get less information from the visualization instead. Solutions: (1) combine some food groups into one so that there are less different colors in one stack bar (like "chicken", "pork", and "ruminant meat" into a new group named "Meat"). (2) remove the number inside the bar to clean the graph but the user could still view the detailed number of each food group by hovering over the color stack. similar issue with the pie chart: too messy, too many groups. Moreover, the food groups in pie chart and stack bar chart are different, so it is not easy to connect the two graphs together. so did more cleaning and regroup of the raw data so that we could get more meaningful information by looking at the two visualizations together. For example, check the production trend of cereals in different countries in the pie chart as we see that cereals contribute the most to energy and protein for most regions from the stack bar chart.

Figure 1

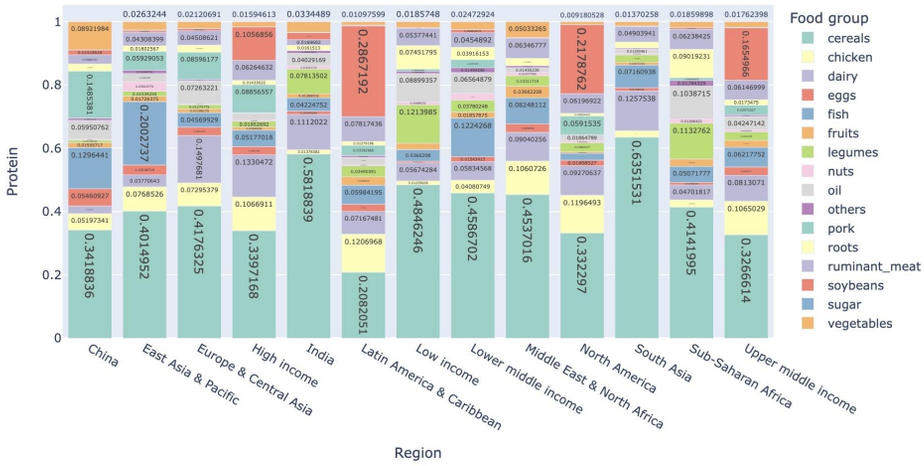


Figure 2

3.3 Final Implementation

- **Food Group Nutrients：**

For the ternary graph, we added interaction methods and data richness. Users can select the nutrients represented by the three coordinates of the ternary chart below, and the corresponding nutritional information of different food groups is displayed accordingly. In addition, we added a radar chart of the nutrient content of twelve typical foods based on the amount of different nutrients required daily by adult males. The coordinate axes are in percentages and the values are the percentage of the nutrients contained in the food to the daily requirement of adult males.

- **Worldwide food production：**

We have also studied the nutritional sustainability of food worldwide.

To figure out how domestic food production fulfills the nutrient needs of a national population, we calculated the adequacy ratio. The adequacy ratio for the nutrient in country for the year was calculated through Equation:

Is there any place on Earth that produces enough nutrients for the people who live there? We plotted the ratio of production to demand for each nutrient on a map of the world. Then, if we want to know which crops we can add to ensure that enough nutrients are produced, we need to know which exact food groups provide common nutrients for people? We visualized these food groups as stacked bar graphs for each nutrient for different places on the planet.

In addition, we were curious about the trends in the production of the above food groups over the years. This time, we investigated each country in more detail.

Agriculture and food systems need explicitly consider nutrients, rather than just focusing on increasing yields or considering caloric adequacy. The transition from calorie-oriented food systems to a nutritionsensitive system for achieving multiple Sustainable Development Goals.

4. Peer assessment

Chenyu Han: Ternary diagram and map drawing

Haoying Lyu: Database organization and preliminary processing, report writing

Yuxin Wang: Bar and pie charts, web frame building

The parts that were not mentioned were done in collaboration with us。