AR Measurement Technology Applied to Nutritional Management

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Nutritional Management

- **Definition**: Assist with or provide a balance dietary intake of foods and drinks.

- **Health management**: In Health Japan 21(健康日本２１), it is divided into meal, sleep and movement.

- With population aging problem, average life expectancy is increasing, but about 10 years gap exist between average and health life expectancy. For some patients, such as pancreatitis or gastrointestinal disease, effective nutritional management should be a high priority.

Source: https://medical-dictionary.thefreedictionary.com/nutrition+management; http://www.kenkounippon21.gr.jp/; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2798168/

Problem in Health Management

- In health management, human body can be considered as system.

- Pedometer, this common health management method is recording output data from human body. And applications to monitor sleeping are also familiar.

- Nutrition management is recording input data to human body, which is not easy to obtain. So this genus of application is not prominent.

Purpose of This Study

- To improve health literacy, meal, sleep and movement should be managed.

- To solve the problems of nutrition management, Machine learning and AR measure technology could be applied to record nutrition and calories of daily foods and drinks.

Related Work

- Food Log, Aizawa Yamasaki Lab, The University of Tokyo.

- Recording user's daily food via photos to do health management via food photos, meanwhile sharing the pleasure of dining.
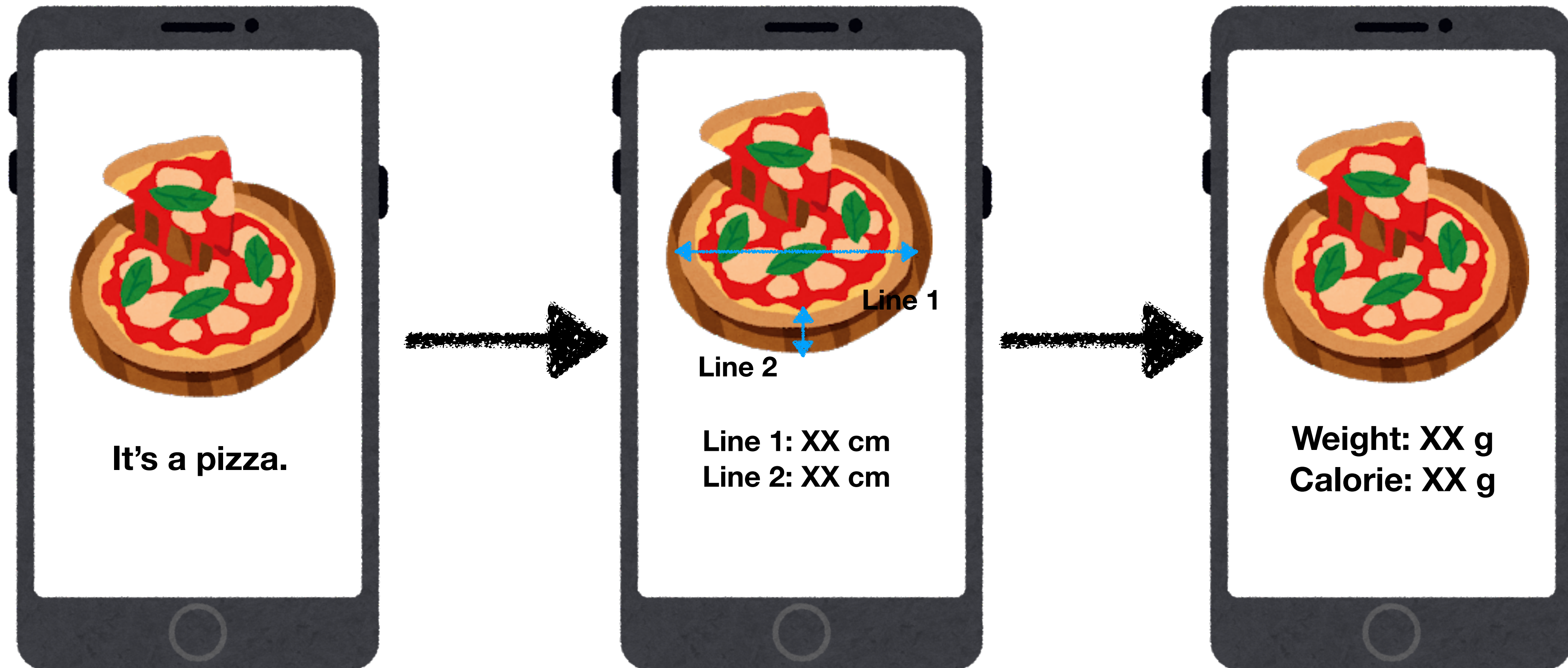

Source: http://www.foodlog.jp/en

Related Work

- NICT(National Institute of Information and Communication Technology) project by Keio University and Tanita Health Link, analyze health information feedback based on biological log data for improvement of health literacy.
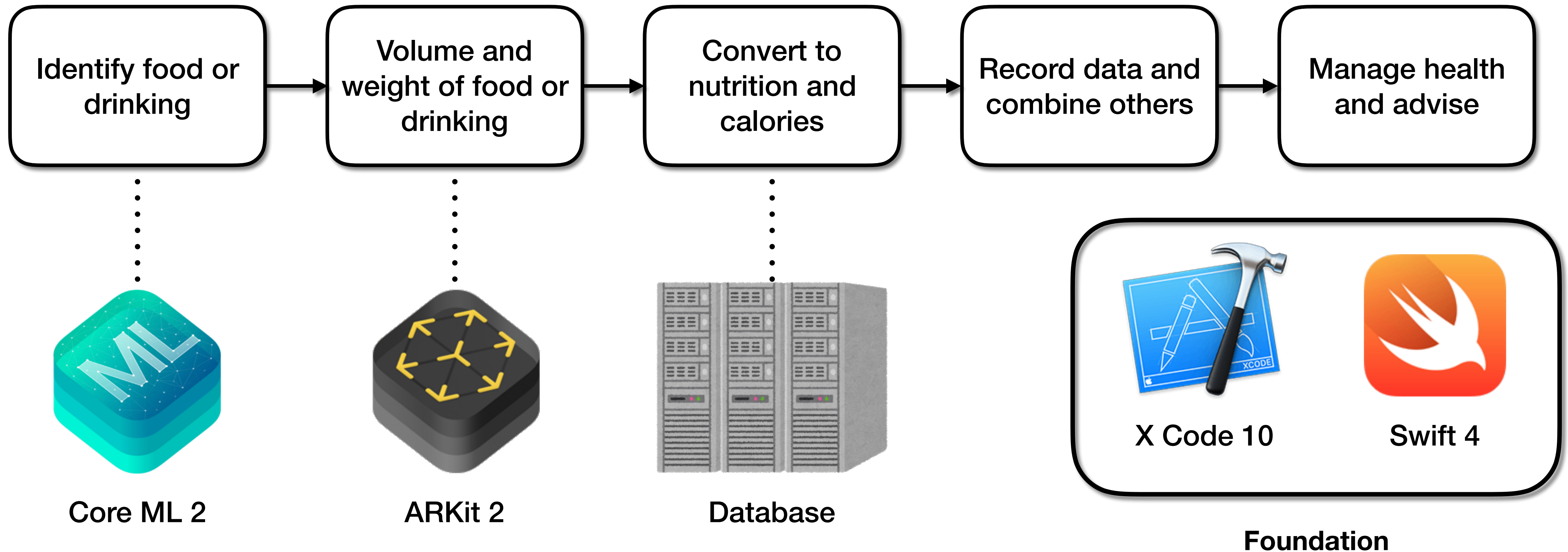

Source: http://lab.sdm.keio.ac.jp/health/
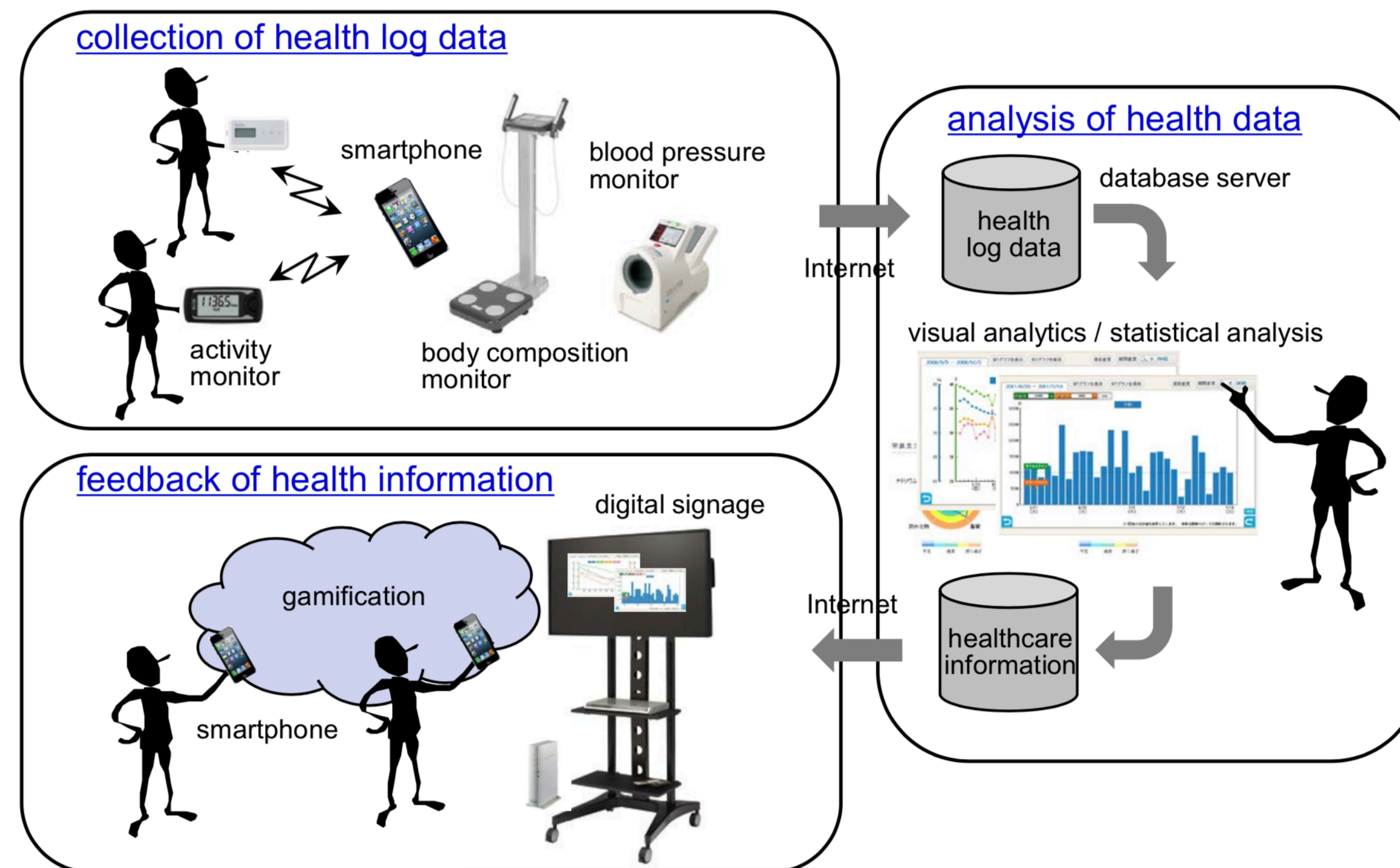
Nutrition Management System

- **Goal:** Identify foods or drinks and measure volume of them, and then convert volume to nutrition and calories.

It's a pizza.

Line 1

Line 2

Line 1: XX cm
Line 2: XX cm

Weight: XX g
Calorie: XX g

SDM
System Design and Management

Proposed System

```
┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ Identify food│   │ Volume and   │   │ Convert to   │   │ Record data  │   │ Manage health│
│ or drinking  │──▶│ weight of    │──▶│ nutrition and│──▶│ and combine  │──▶│ and advise   │
│              │   │ food or      │   │ calories     │   │ others       │   │              │
│              │   │ drinking     │   │              │   │              │   │              │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘
```

Core ML 2   ARKit 2   Database

X Code 10   Swift 4

Foundation

Identification of Food

- **Core ML**: Integrate machine learning models into your app.

- **Core ML Models**: MobileNet, SqueezeNet, Places205-GoogLeNEt, ResNet50, Inception v3, VGG16…
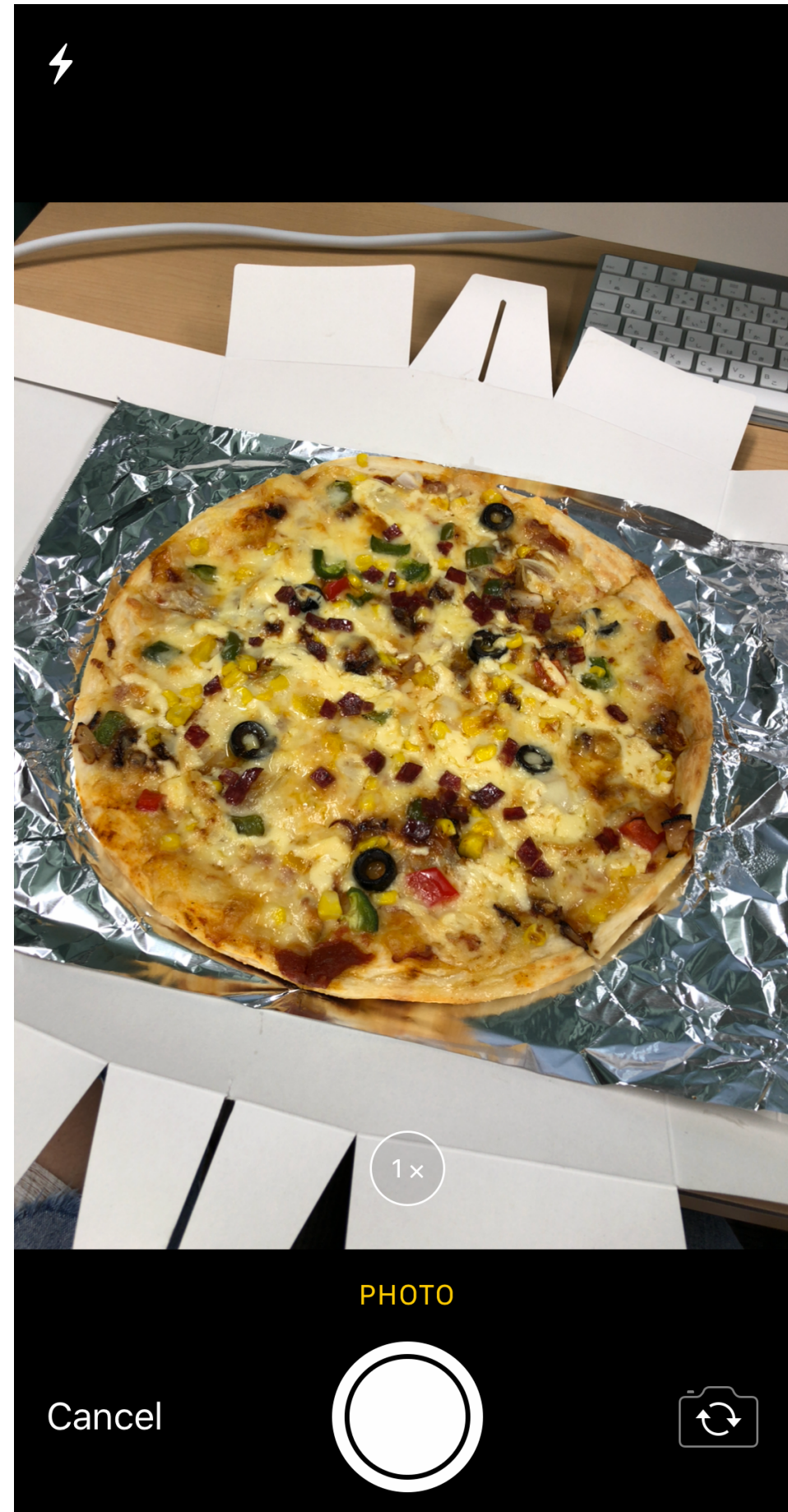

- **Inception v3**: Detects the dominant objects present in an image from a set of 1000 categories such as trees, animals, food, vehicles, people, and more.
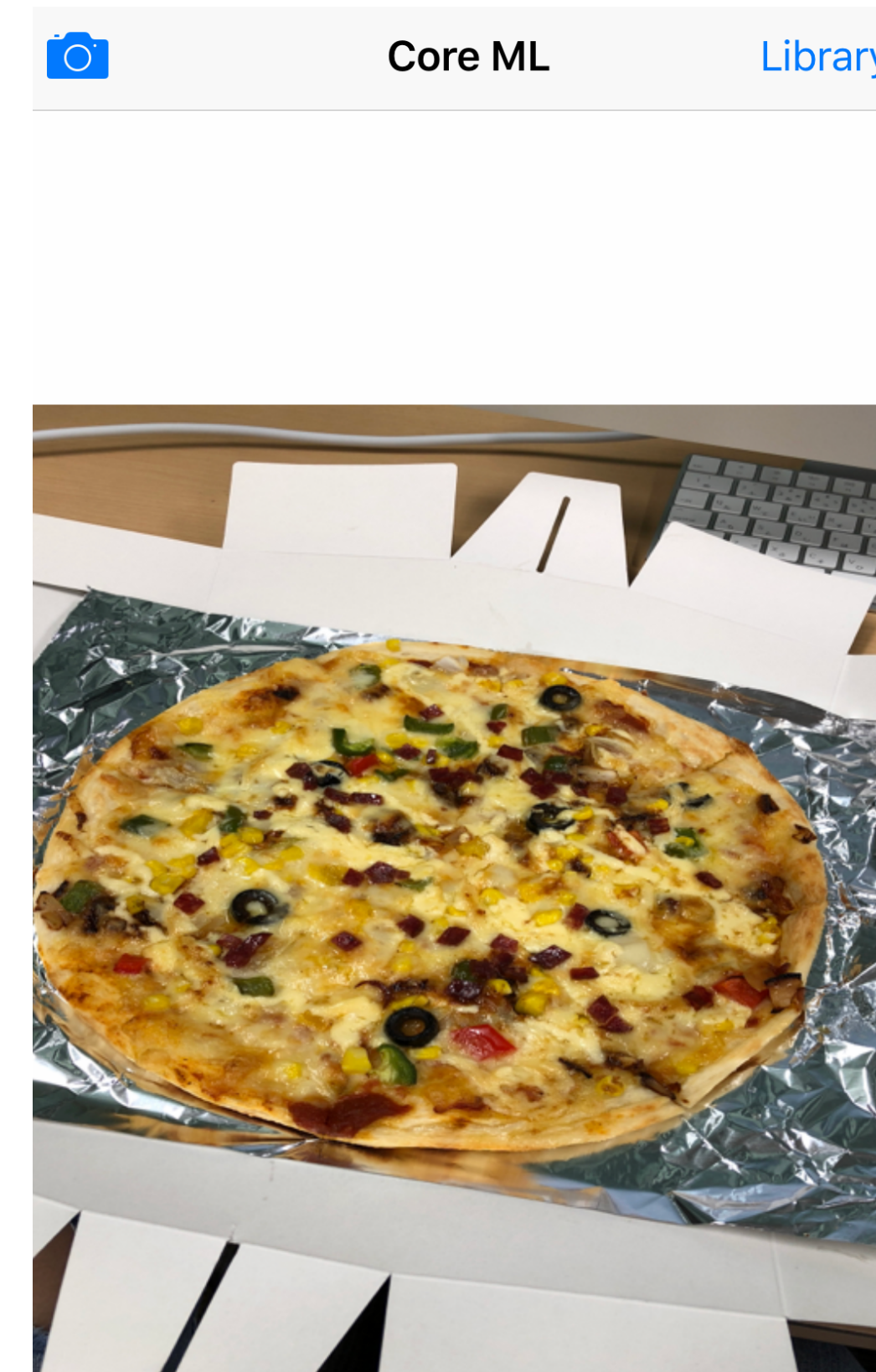
Demonstration of Identifying Food

Step 1:

Take photo
or choose
from library

Step 2:

Identify food

It is a pizza, pizza pie.

Measurement of Food

- **<u>AR</u>**: Augmented reality, is the integration of digital information with the user's environment in real time.

- **<u>ARKit</u>**: Apple's augmented reality (AR) development platform for iOS mobile devices.

- **<u>AR Measurement</u>**: Using AR to quickly gauge the size of real-world objects.

Source: https://whatis.techtarget.com/definition/augmented-reality-AR; https://whatis.techtarget.com/definition/ARKit;

Demonstration of Measuring Food

Future Work

- **Identifying more kinds of foods.** Such as pizza, it has many toppings so their nutrition facts would be different.

Margherita   **Tomato and Salami Pizza**

- **More accurate.** According to demo, the three measurement results were different. The measurement result should be more stable.

Conclusion

- Health management could be performed from three aspects, meal, sleep and movement. So these aspects should be paid attention in daily life, especially nutrition management is significant for human body.

- This research would focus on building an application with Core ML and ARKit to identify foods and calculate nutrition facts. It could help user calculate everyday nutrition intake to manage health.

Thank you for listening.