A Mobile Phone User Interface for Image-Based Dietary Assessment

Ziad Ahmad, Nitin Khanna, Deborah A. Kerr, Carol J. Boushey, and Edward J. Delp

Video and Image Processing (VIPER) Lab
School of Electrical and Computer Engineering
Purdue University
West Lafayette, Indiana USA
ace@ecn.purdue.edu
Traditional Dietary Assessment Methods

• 24-Hour Dietary Recall – consists a listing of foods and beverages consumed 24 hours prior to interview

• Food Record (FR) – preferred method for clinical studies; minimum number of records is at least two days

• Food Frequency Questionnaire (FFQ) - identifies foods most commonly eaten and indicate on average how much and how often different foods are consumed
Pen/Pencil and Paper Food Record
Disadvantages of Traditional Methods

- Vulnerable to underreporting
- Difficult to remember food types and quantity consumed
- Can be boring and tedious, especially to adolescents
Using Technology

• Mobile device features:
  – built-in camera
  – network access
  – location information retrieval
  – accelerometer
Existing Mobile Applications

- Most existing dietary assessment mobile phone applications rely on entering dietary intake manually

- Existing dietary mobile phone application that rely on images are not designed for automated image analysis

- Our mobile application is one of the first image-based dietary assessment mobile phone application designed for automated image analysis
TADA System Overview

1. Client
   - Labeled Images With Food Type (e.g. Milk, Toast, Eggs)

2. Image + Metadata
   - Food Type (Label)
   - Labeled Segmented Images (Area Estimates)

3. Server
   - Volume Estimation

4. Server
   - FNDDS Indexing
   - Nutrient Information

5. Output
   - Labeled Images With Food Type (e.g. Milk, Toast, Eggs)

6. User Confirmation and Adjustment

7. Research Community

8. February 3, 2014
User Interface Development Process

• The user interface was developed in paper prototyping sessions with dietitian experts from the Nutrition Science Department at Purdue University

• The user interface was used in several research studies and enhanced from study to study
  – We had over 200 users
  – We collected over 30,000 food images
Mobile Phone Application

- TADA application developed for iPhone
Main Views of the App

1. Record
   - Before Eating
   - After Eating

2. Review
   - Fri, Mar 2 at 03:48 PM

3. More
   - User Settings
   - Researcher Settings
   - About

February 3, 2014
Recording

- For each eating occasion the user takes a pair of images, before eating and after eating

Tips for taking an image

1. Arrange food and beverages on a flat surface.
2. Place fiducial marker to the lower left of the food and beverages.
3. Hold the phone in landscape mode with the
Image Acquisition

- Angle information is extracted from the phone
- Colors along with words assist the user in taking an image at preferred angle
Image Acquisition: Preview

- A preview of the image captured by the user

Scan Barcode
Barcode Scanning

• User can scan barcodes of food items present in the image
• We are developing a barcode database with accurate nutritional data
• Most barcode databases are used for inventory management and generally don’t have accurate nutritional data
Image Quality Checking

• Check for:
  – Presence of fiducial marker (checkerboard)
  – Blurriness in the image
Communications

• Images are sent after the after eating image is taken
Review

• The user can tap on the **Refresh** button to check and download results from server.
Review

- The user can select an eating occasion from the list to review
- The **before eating image** is then displayed in landscape view with food labels on it
Review: Colors and Zoom-in Capability

• Different colors help the user in identifying bubble-pin correspondence

• The green color is reserved for confirmed labels

• Zoom-in by pinching the screen to have a better view
Review: Labeling

- To confirm, remove, or correct a food label, the user taps on the bubble.
Review: Incremental Search

• Incremental search capability can be used to quickly search the complete list

• Searching is performed on the label and on the description
Review: Food Not Listed

- User can type-in a new food name if not present in the list
Review: Adding Food Label

Step 1: Tap on Add button

Step 2: Zoom, tap on pencil button

Step 3: Circle food item

Step 4: Tap on Use button

Step 5: Search for food

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Settings

Version: 3.3.1
Release date: 01/08/2012

User Settings

Researcher Settings

About

Tips
Camera Assistant
Delete History in Review
Theme

Cyan
Green
Orange
Magenta
White

User ID
Server IP

Reminder 1: 8:00
Reminder 2: 12:00
Reminder 3: 18:00

TADA
technology assisted dietary assessment

February 3, 2014