Globally Food and Nutrition Level Detection Using Smartphone Camera Image

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Introduction:

- There is an urgent need of food nutrition detection and follow up the intake in developed and underdeveloped countries.
- We are aiming to develop a system that can detect the food from a captured image by smartphone.
- We propose the system that can also detect the nutrition level of the consumed food identified from the image.

Significance:

One of the critical problem in underdeveloped countries are

- Optimal nutrition in vulnerable populations.
- Problem with nutrition policies and programs, such as food fortification or dietary supplementation.
- The main issue comes from the lack of up- to-date, comprehensive and reliable data on individual dietary intake.
- In low income country (LIC), their existing methods to measure dietary intake took a lot of time.
- Again, it is costly, and skill/labor intensive.
- For this reason, we need to develop and evaluate improved methods to measure food and nutrient intake using innovative technology.

Innovative Thinking:

We are thinking a technology

- Which can have enhanced imaging methods to measure food intake.
- Will build an appropriate image recognition software to identify individual food images and convert food intake to nutrient intake.
- We will make sure that the solution is suitable to the challenges encountered in LIC settings.
- For example, lack of electricity or alternative power sources, poor lighting, unreliable internet connection and dietary practices that include shared food plates.

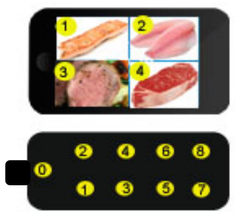

Fig. 1: Individual food selection from the mobile screen using mobile touch screen or pressing the button on spoon handle.

Our proposed innovative imaging technology

- Will measure food and nutrient intake which is adaptable to the context of poor and rich people.
- is an active imaging method that will overcome the limiting factors of the existing methodologies.
- will use smartphone camera for capturing the food image.
- offer the technology with an external camera that is supported by Bluetooth and Wi-Fi modules.
- will use the smartphone application to show the response from the user and the cloud server.
- will use low cost filter in front of the mobile camera.
- will allow the user to capture image easily whether he or she is in the kitchen, at home or at a restaurant.
- The user will communicate with the system interactively using voice and keypad input.
- The keypad shown in Figure 1 will be developed on a round shaped handle in such a way that spoon handle of different sizes can be attached to it.
- Colored bowl shown in Figure 4 can help us to calculate the food volume.

In the imaging system

- User can keep their hands free for cooking and eating.
- A L-shape stand is proposed for image capturing.
- Participants are able to capture their food image manually using the same camera they used for image processing.
- The L-shape stand can mount/hold smartphone or external camera to capture image from the top of the food or vegetable while cooking or eating (Figure 5).

The food image capturing and its nutrition analysis process are divided into three layers (Figure 3).

- First layer is called data input layer. In this layer, the image capturing, audio input and user's feedback data collection system are described.
- Secondly, the image processing algorithms are defined partly in the mobile app layer where machine learning tools are used for food classification in the mobile application.
- The mobile application layer supports the user in the offline mode getting more input. This layer interacts with the cloud server for further image processing if the internet is available.
- In the cloud computing layer, image spectrum analysis and nutrition level measurement algorithm are applied.
- Nutritionists will be invited
- Bowl with colored ring is considered here for volume identification.
- The imaging system can be used in restaurant setup

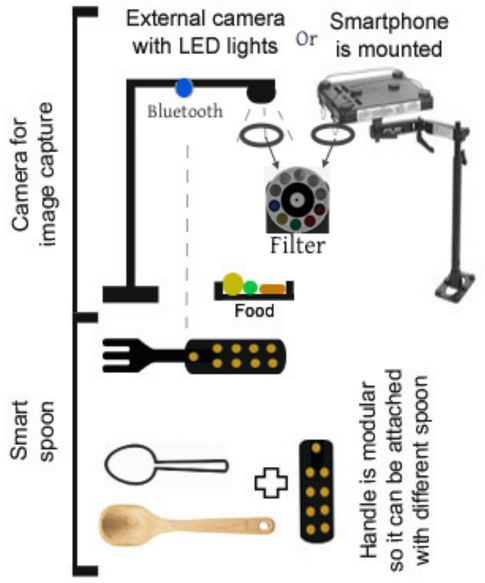

Fig.2 : Smartphone camera and smart spoon

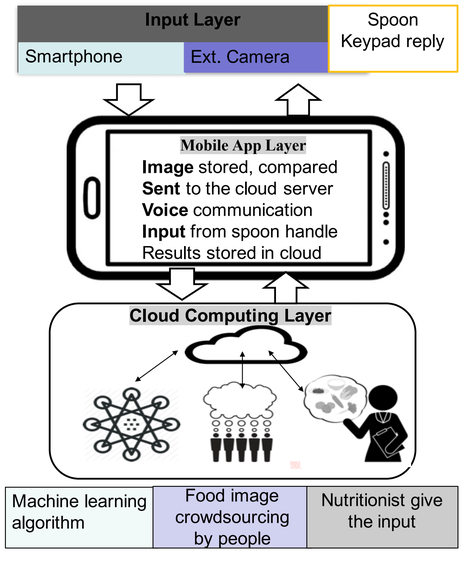

Fig.3 : Image identification and nutrition level detection flowchart

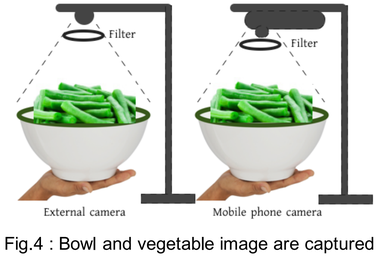

Fig.4 : Bowl and vegetable image are captured

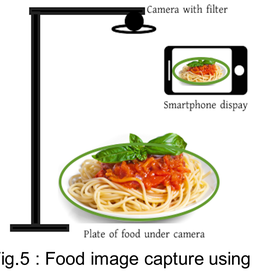

Fig.5 : Food image capture using camera

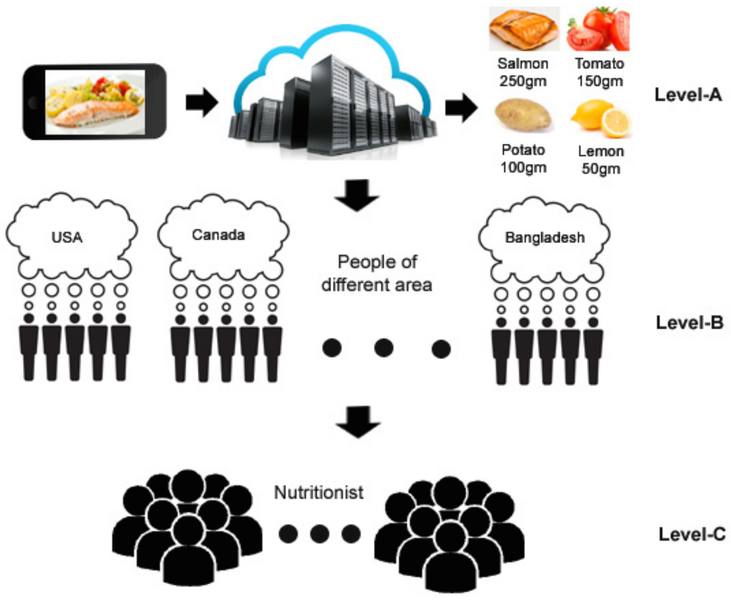

Fig.6 : Different layer of input can make the food and nutrition identification successful

The whole process will be accomplished in three levels:

Level A

- Food image will be analyzed on the cloud
- Cloud algorithm will suggest the probable food name and its ingredients.
- It will be able to calculate the volume of the ingredients
- Provide and assumption of the probable nutrient level for each food item.

Level B

- The crowd people will see only the food consumed in their area.
- Different group of people are providing their important input on food ad its ingredients name.
- The machine learning algorithm will learn from both of the source
- One output is comping from the food classification algorithm and another output is coming from the crowdsourcing people.

Level C

- For this validation process, there will be a reward system for the valid input to the crowd people.
- Nutritionists are involved with respect to their area.
- Nutritionist can cross check this nutrition levels for each food and ingredients.

Conclusion:

- Food and nutrition level detection technique is presented
- Urban and rural area people can use the system
- The system works in food processing and consuming place
- Cloud and mobile phone based image processing is proposed
- Crowdsourcing input is considered

[1] Kawano, Yoshiyuki, and Keiji Yanai. "Foodcam: A real-time food recognition system on a smartphone." *Multimedia Tools and Applications* 74.14 (2015): 5263-5287.
[2] Kamruzzaman, Mohammed, Yoshio Makino, and Seiichi Oshita. "Parsimonious model development for real-time monitoring of moisture in red meat using hyperspectral imaging." *Food chemistry* 196 (2016): 1084-1091.

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