



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 6, June 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Image-Based Estimation of Real Food Size for Accurate Food Calorie Estimation

Nidhi Meshram, Prof. Rupesh Sushir

Department of Electronics and Telecommunication Engineering, P.R. Pote Patil Education & Welfare Trust's Group of Institutions, College of Engineering & Management, Amravati, Sant Gadge Baba Amravati University, Maharashtra, India

ABSTRACT: In this paper, we review our works on image-based estimation of real size of foods for accurate food calorie estimation which including three existing works and two new works: (1) "CalorieCam" which is a system to estimate real food size based on a reference object, (2) Region segmentation based food calorie estimation, (3) "AR DeepCalorieCam V2" which is based on visual inertial odometry built in the iOSARKit library, (4) "DepthCalorieCam" which employs stereo cameras on iPhone X/XS, and (5) "RiceCalorieCam" which exploits rice grains as reference objects. Especially, the last two new methods achieved 10% or less estimation error, which was enough for robust food calorie estimation.

I. INTRODUCTION

In food image recognition, CNN-based methods have achieved great improvement in recent years and some smartphone applications employ them. However, in most of the calorie estimation, the estimated calories are just associated with the estimated food categories and these applications often require users to enter information such as size or volume, there are problems that it is a troublesome and subjective evaluation. Currently, no applications which can estimate food calories automatically exist. Although most of the image recognition tasks including food category recognition have been almost solved due to great progress of CNN based image recognition methods, fully-automatic food calorie estimation from a food photo has still remained an unsolved problem. We think that food calorie estimation not only helps people's health a lot, but also is promising as a new problem of image recognition studies. In this paper, we review three of our works related to food size estimation, and propose two new methods for food size estimation.

- (1) "CalorieCam" which is a reference-object-based food calorie estimation system.
- (2) Weakly-supervised segmentation based food calorie estimation
- (3) "AR DeepCalorieCam V2" which is a real food size and calorie estimation system based on visual inertial odometry implemented in iOSARKit.
- (4) "DepthCalorieCam" (new system) which is a food calorie estimation system exploiting iPhone stereo cameras.
- (5) Rice grain based size estimation (new method) which uses rice grained the size of which are usually almost the same as a reference object.

CalorieCam

"CalorieCam" [1] is an image-based calorie estimation system which estimate food calories automatically by simply taking a food photo from the top with a pre-registered reference object. Taking into account usability and mobility of a system, we implemented the system as a stand-alone mobile application running on a normal Android smartphone. To estimate food calorie from a single image, a user needs to register a size-known reference object in advance and to take a food photo with the registered reference object. As a reference object, we assume a personal belonging which we are always carrying such as a wallet and a credit card-size card in a wallet (except a smartphone for taking a meal photo). After taking a meal photo with a reference object, the system carries out segmentation of food items and the pre-registered reference object. Because the real size of the reference object is known (e.g. In case of a credit card-size object, the size is 85.6mm x 54mm.), the system can estimate the real size of each detected food items by comparing the number of pixels of the reference objects and the detected food items. By using the estimated real size and the equations to calculate food calorie from their size, the system finally estimates the calorie of the food items in the real photo. Figure 1 shows an example of usage and a screen-shot of the proposed system.



Figure 1. (Upper) A user taking a food photo with the reference object. (Lower) A screen shot

II. CONCLUSION

In this paper, we reviewed our three previous works and proposed two new works. Currently, DepthCalorieCam is the most promising approach. However, large-scale calorie-annotated 3D food volume data is needed to extend the system into large-scale categories, which is very costly and time-consuming. In addition, the rice grain based method is also promising for meals containing white steamed rice. Especially it is appropriate for Japanese foods.

REFERENCES

- [1] K. Okamoto and K. Yanai. An automatic calorie estimation system of food images on a smartphone. In Proc. of ACM MM Workshop on Multimedia Assisted Dietary Management, 2016.
- [2] W. Shimoda and K. Yanai. CNN-based food image segmentation without pixel-wise annotation. In Proc. of IAPR International Conference on Image Analysis and Processing, 2015.
- [3] R. Tanno, T. Ege, and K. Yanai. AR DeepCalorieCam V2: Food calorie estimation with cnn and ar-based actual size estimation. In Proc. Of ACM Symposium on Virtual Reality Software and Technology (VRST), 2018.
- [4] C. Rother, V. Kolmogorov, and A. Blake. GrabCut: Interactive foreground extraction using iterated graph cuts. ACM Trans. on Graphics, 23(3):309–314, 2004.
- [5] R. Tanno, K. Okamoto, and K. Yanai. DeepFoodCam: A DCNN based real-time mobile food recognition system. In Proc. of ACM MM Workshop on Multimedia Assisted Dietary Management, 2016.
- [6] J. R. R. Uijlings, K. E. A. van de Sande, T. Gevers, and A. W. M. Smeulders. Selective search for object recognition. International Journal of Computer Vision, 104(2):154–171, 2013.
- [7] O. Ronneberger, P. Fischer, and T. Brox. U-net: Convolutional networks for biomedical image segmentation. Springer, pages 234–241, 2015.
- [8] Y. Matsuda, H. Hajime, and K. Yanai. Recognition of multiple-food images by detecting candidate regions. In Proc. of IEEE International Conference on Multimedia and Expo, pages 25–30, 2012.
- [9] K. Simonyan and A. Zisserman. Very deep convolutional networks for large-scale image recognition. In arXiv preprint arXiv:1409.1556, 2014.



**Impact Factor:
7.512**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

📞 9940 572 462 📞 6381 907 438 ✉ ijirset@gmail.com



www.ijirset.com

Scan to save the contact details