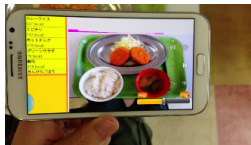


Introduction

- Many recording meal apps
⇒ Semi-automatic calorie estimation
 - need to teach food amounts manually [ex. FoodCam]
 - need to register a size-known reference object in advance [ex. CalorieCam]

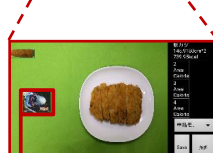
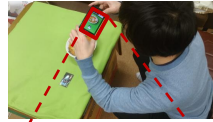


FoodCam [Kawano et al. 2014]



Need to teach the amount of foods by the slider

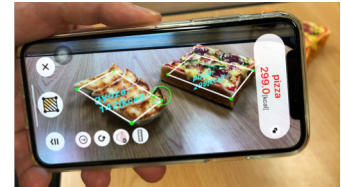
CalorieCam [Okamoto et al. 2016]



Need to prepare a reference object

New system: AR DeepCalorieCam V2

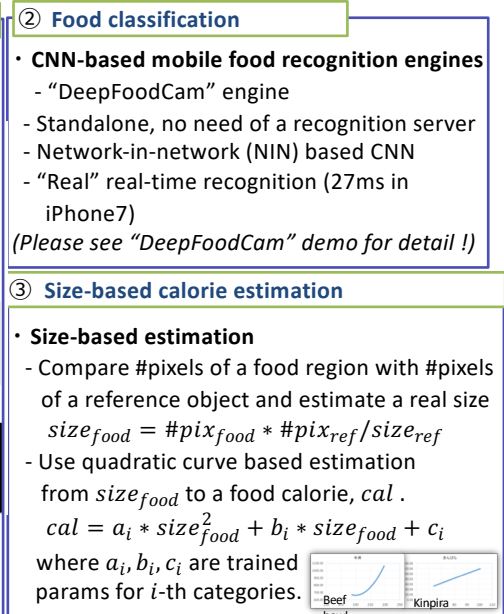
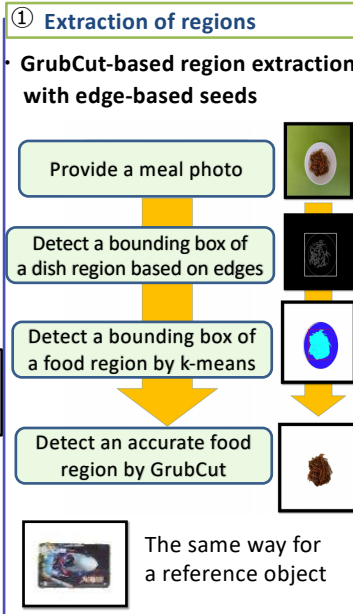
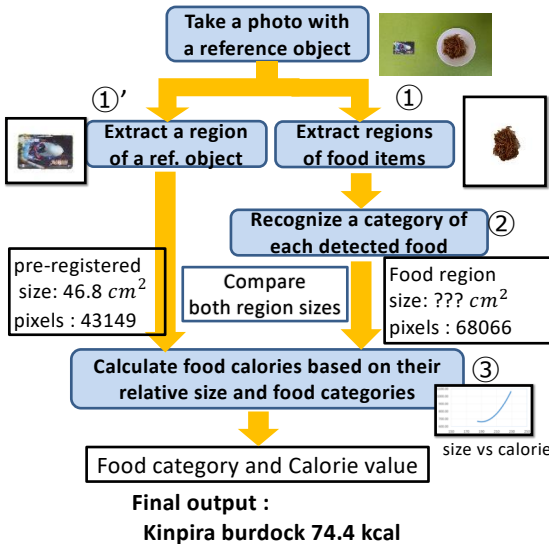
- Food Calorie Estimation with CNN and AR-based Actual Size Estimation
⇒ No need a reference object
- Measuring the meal area directly
⇒ Calculate the size more accurately than in the previous method



Previous Method

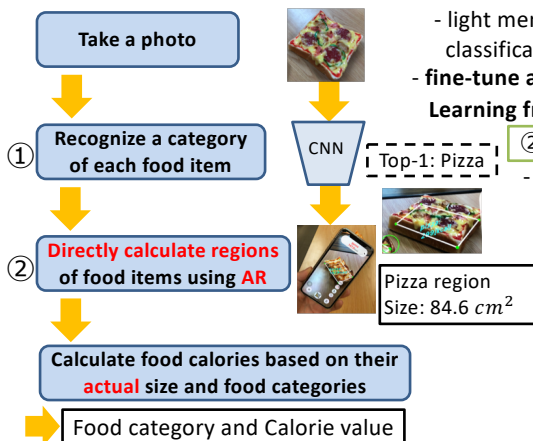
Ex. CalorieCam [Okamoto et al. 2016]

⇒ Reference object is absolutely necessary



Proposed Method

No reference object required



① Food Category Recognition

- Convolutional Neural Networks (CNN) based food recognition engine employs "Inception-v3[4]"
- light memory, faster inference and high classification accuracy
- fine-tune a pre-trained ImageNet model in Keras Deep Learning framework with UEC-FOOD100 dataset

② AR-based Actual Size Estimation

- Measure the actual size of the meal area using Apple ARKit framework
- acquiring the coordinates on the real world as a three-dimensional vector
- calculate food calories based on their actual size and food categories

Evaluation of automatic calorie estimation

Dish	GT	FoodCam		CalorieCam		Proposed	
		Avg. err	Avg.SD	Avg. err	Avg.SD	Avg. err	Avg.SD
Beef bowl	962	-53.25	±209.79	-242	±55.10	-67.14	±18.8
Croquette	552	-242	±91.26	-47.08	±52.52	-127.0	±9.0
Salad	14	54.83	±36.28	4.86	±11.87	-0.95	±0.16

Demo 1

Conclusions

- Propose a new approach for food calorie estimation with CNN and AR-based actual size estimation

Future Works

- Combines the proposed method and segmentation, taking into account the size of the meal area