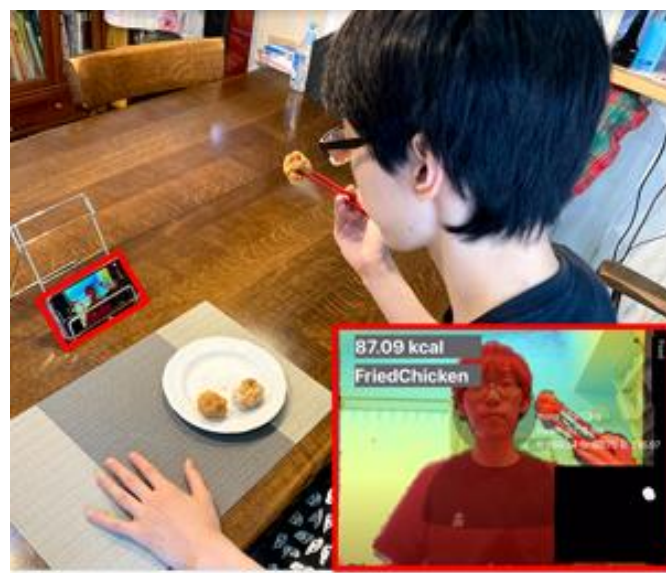


Kento Adach, Keiji Yanai

The University of Electro-Communications, Tokyo, Japan

Summary

Mobile meal recording system estimates food calories in real-time by eating action recognition with RGB-D images using TrueDepth camera on iPhone.



Previous Method Issues

Okamoto et al. proposed **GrillCam [1]** that enables users to check their calorie intake in real time by placing a smartphone on a table and taking a picture of themselves while eating.

The portion sizes of individual food instances are not considered.



Proposed Method

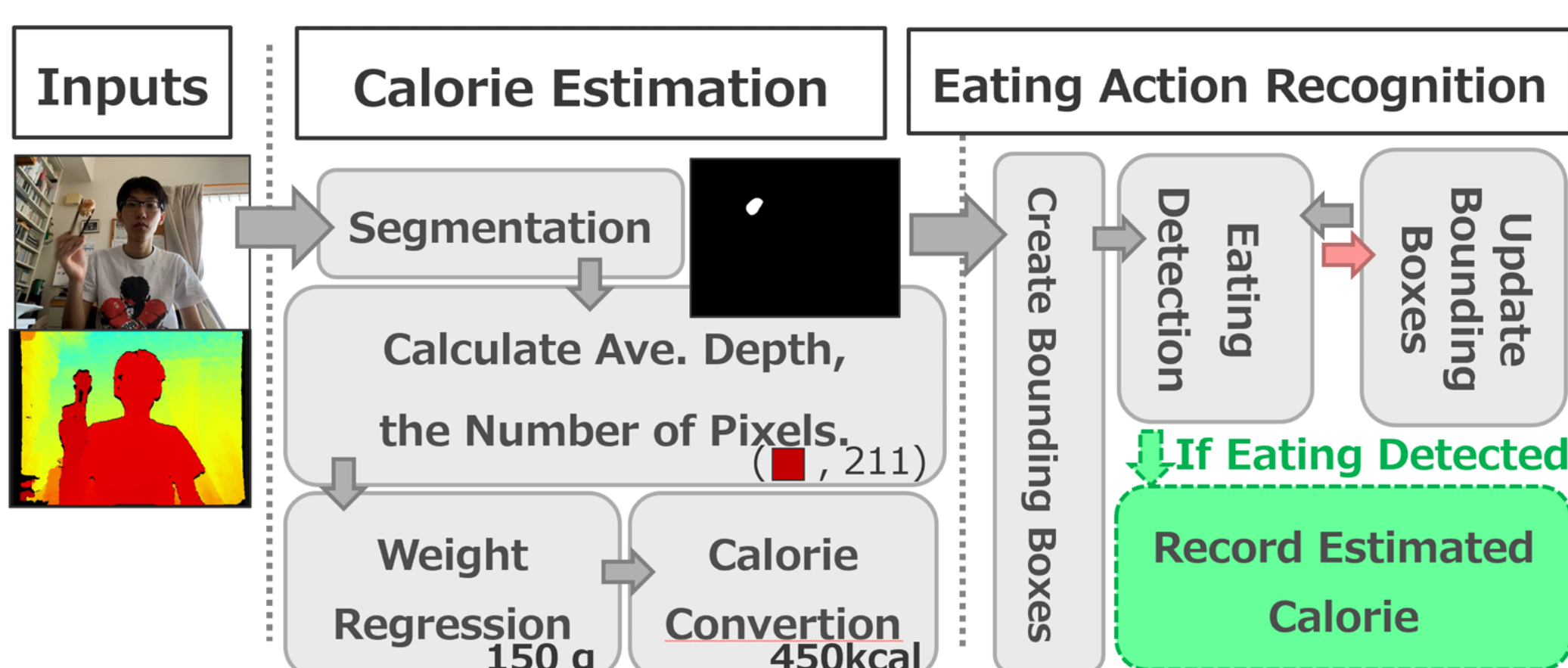
Combining **calorie estimation** and **eating action recognition** to provide a real-time food calorie recording system using iPhone placed on a tabletop.

Food Calorie Estimation

1. Classify food in each pixel with DeepLabV3.
2. Mass Regression from pixel count and average depth using neural network.
3. Convert to calorie using calorie density per weight calculated beforehand.

Eating Action Recognition

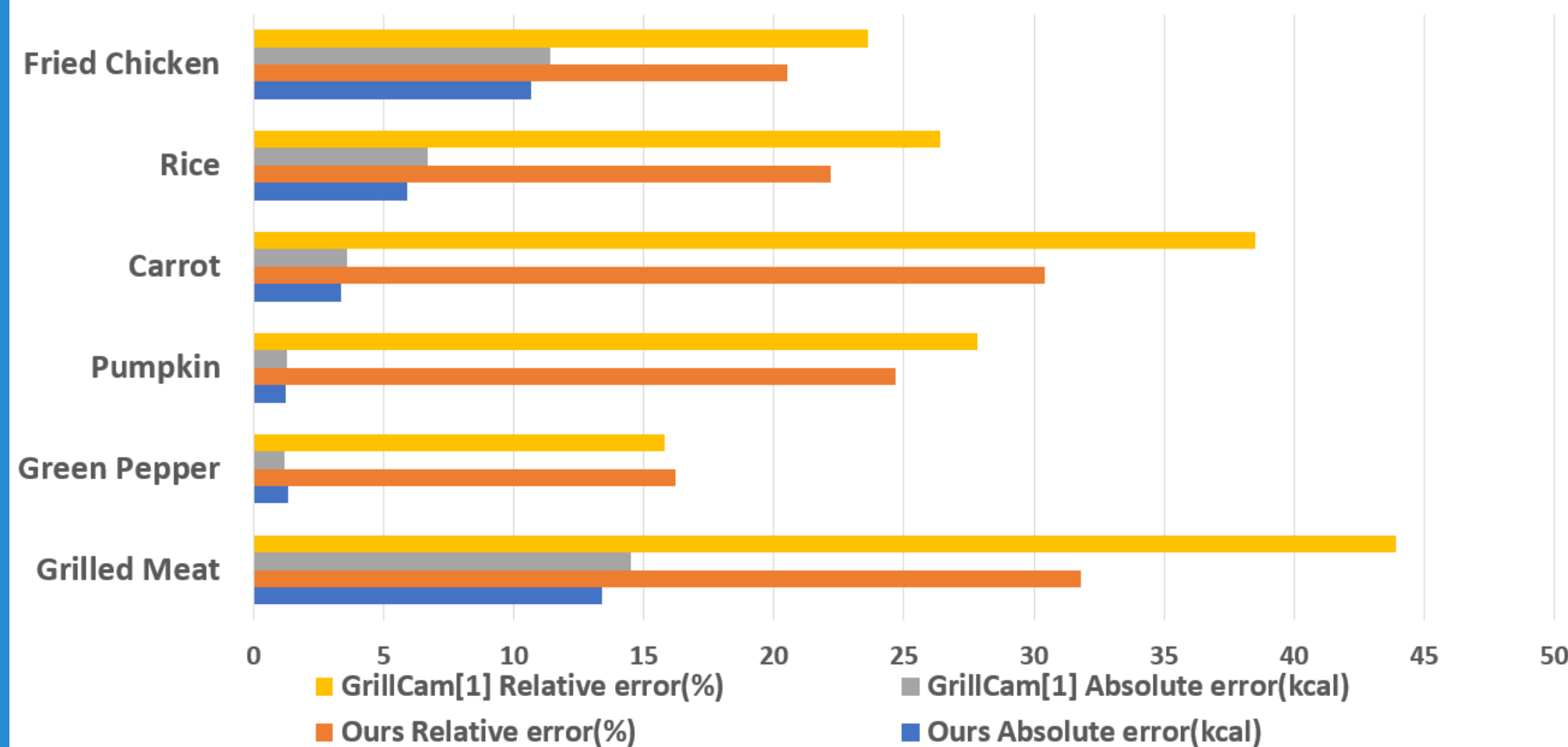
1. Track bounding boxes of mouth and food.
2. Detect overlap each other three-dimensionally.
3. Record estimated calorie if eating detected.



Calorie Estimation

The accuracy of the proposed method exceeds the baseline in all food categories except peppers.

28% accuracy improvement comparing to the baseline in the **grilled meat** category.



Eating Action Recognition

The proposed method is **6.67 times more accurate than GrillCam [1]** in recognizing correct food category.

$$\text{correct ratio}(CR) = \frac{CORRECT}{CORRECT + INCORRECT}$$

$$\text{success ratio}(SR) = \frac{CORRECT}{CORRECT + INCORRECT + FAILURE}$$

	category	data	correct	incorrect	failure	CR	SR
	Ours	grilled meat	70	6	9	55	0.4000
greenpepper		70	65	1	4	0.9848	0.9286
pumpkin		70	53	11	6	0.8281	0.7571
carrot		70	18	1	51	0.9474	0.2571
rice		70	43	1	26	0.9773	0.6143
overall		350	185	23	142	0.8894	0.5286

	category	data	correct	uncorrect	failure	CR	SR
	GrillCam[1]	grilled meat	70	4	13	53	0.2353
greenpepper		70	2	18	50	0.1000	0.0286
pumpkin		70	0	3	67	0.0000	0.0000
carrot		70	2	7	61	0.2222	0.0286
rice		70	0	11	59	0.0000	0.0000
overall		350	8	52	290	0.1333	0.0229

Future Work

1. Add more **category** with expanding dataset.
2. Increase **accuracy** with considering three-dimensional food shape.

Application



DepthGrillCam is now available on App Store.

