

GrillCam:

A Real-time Eating Action Recognition System

The University of Electro-Communications, Tokyo

Koichi Okamoto and Keiji Yanai

Introduction

Previous work

- Take photo before eating



Individual plate
steak, hamburger, ramen, ...



FoodCam (MMM2014 Best Demo)



smartphone

Proposed System

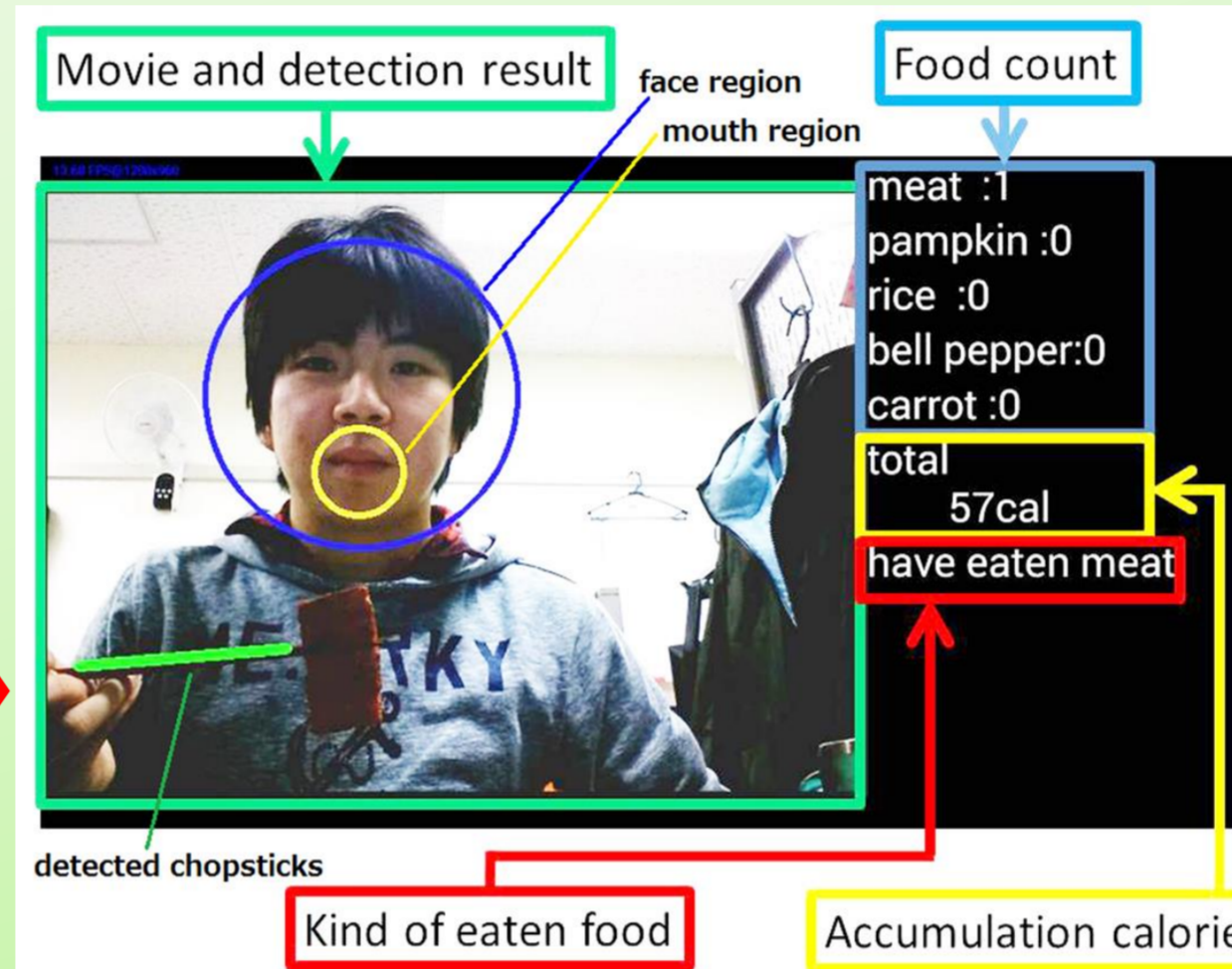
- Recognize eating action continuously while eating

The amount of eaten foods is **not decided in advance!!**

Cannot take a food photo before eating



Sharing meals
hot pot, BBQ, Chinese dish, ...



New system: GrillCam

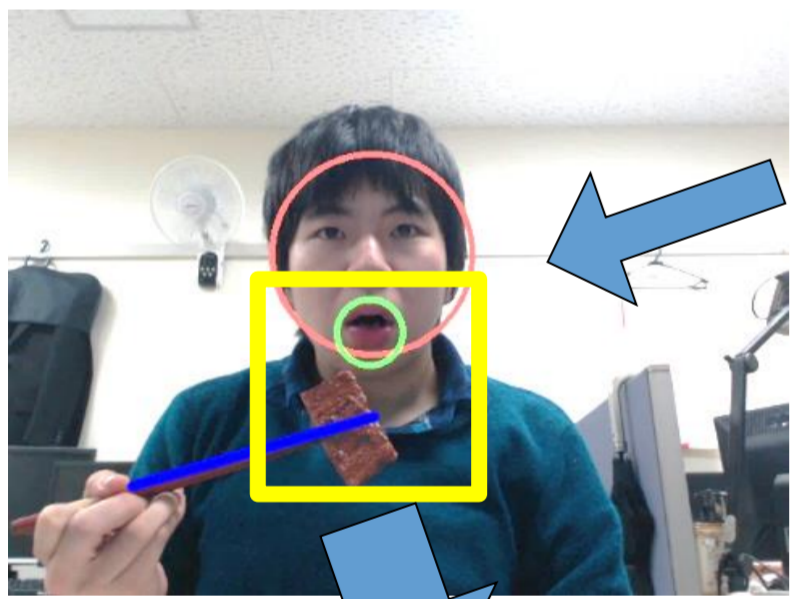


smartphone

System Overview

Mouth and chopsticks detection

if chopsticks get close to mouth



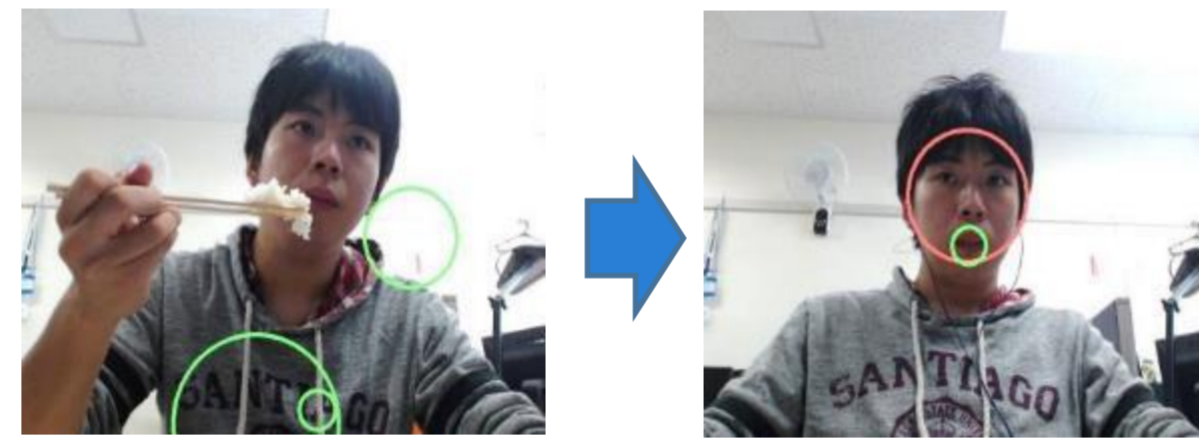
Eating region detection

Food item Recognition

Record eaten items and estimate calorie

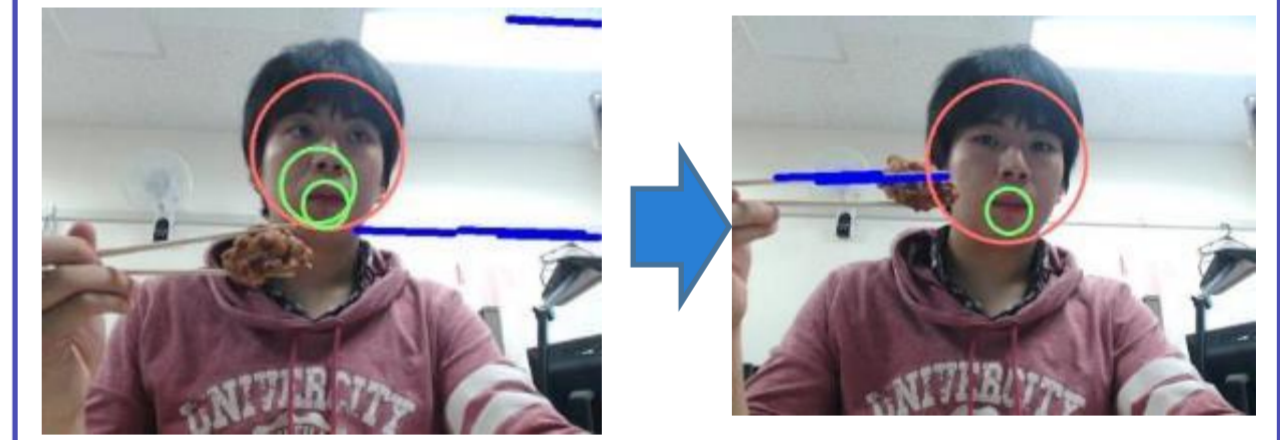
Mouth detection

- Detect a mouth from the face region



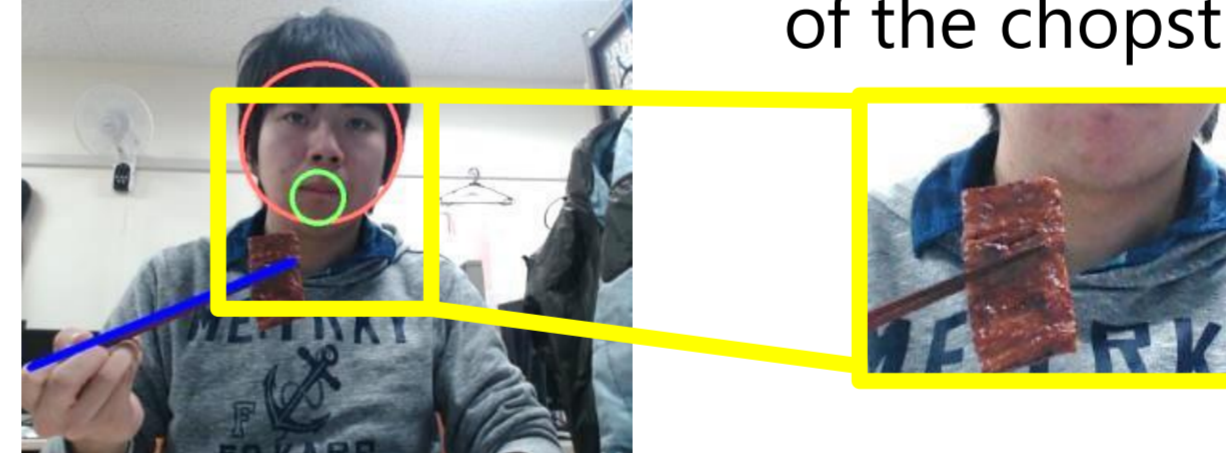
Chopsticks detection

- Detect lines from the moving areas



Eating region detection

- Cut out the region around the tip of the chopsticks



Food Item Classification

- Image features :
 - ORB features
 - HSV color histogram
- Image representation :
 - Fisher Vector(FV)
- Classifier :
 - Linear SVM with late fusion

Experiments

Datasets: two kinds of Japanese meals



■ **Yakiniku** : Meat, Rice, Bell pepper, Pumpkin, Carrot

■ **Oden** : Radish, Egg, Hanpen (Boiled Fish Cake), Konjac, chikuwa (Grilled Fish cake)

User study

- Question : Is this system easy to take eating record?
- 5-step evaluation 5 (better) ... 3 (so-so) ... 1 (bad)

Baseline (manual system w/o recognition)	GrillCam
2.36±1.12	4.36±1.41

Classification accuracy of food items

Yakiniku(BoF)	Yakiniku(FV)	Oden(FV)
74.8%	87.7%	80.8%

- Each Category: Training images "450", Test images "50"
- All Categories : Training images "3000", Test images "500"

Conclusions

- Our system recognizes eating action during a meal
- We obtained a better rating than the manual system

Future works

- Add other types of meals
- Estimate the food volume
- Improve classification accuracy