Analyzing Regional Food Trends with Geo-tagged Twitter Food Photos

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1. INTRODUCTION

Regional differences are observed in the photos posted to Twitter, because peoples' lifestyles differ from region to region.

- Since foods are essential to human life, the regional differences are expected to be larger.

However, the regional difference on food images over Twitter has not been explored so far.

➡ **We analyze regional food trends !**

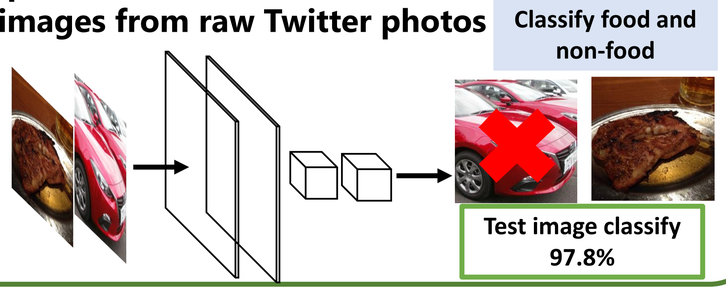
2. METHOD

[1] Classifying food and non-food photos

Fine-tuning ResNet to prepare food/non-food classifier
➡ **To select only food images from raw Twitter photos**

Food images
- **UECFOOD100[2]**
- **Food101[3]**

Non-Food images
- **ILSVRC2012 ImageNet**
- **Kawano et al [4] images**

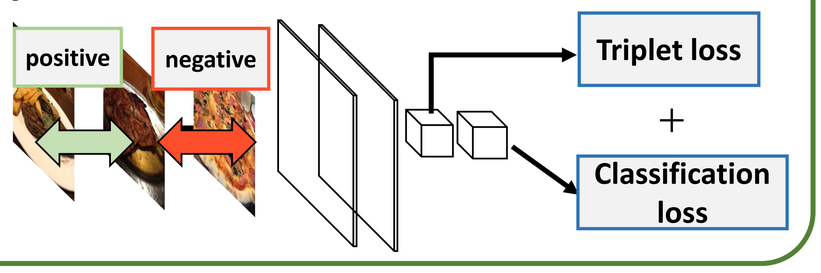


[2] Extracting food CNN features

Training of new CNN features by fine-tuning VGG16 with Triplet & cls. loss
➡ **To extract food-specialized features which can discriminate small differences**

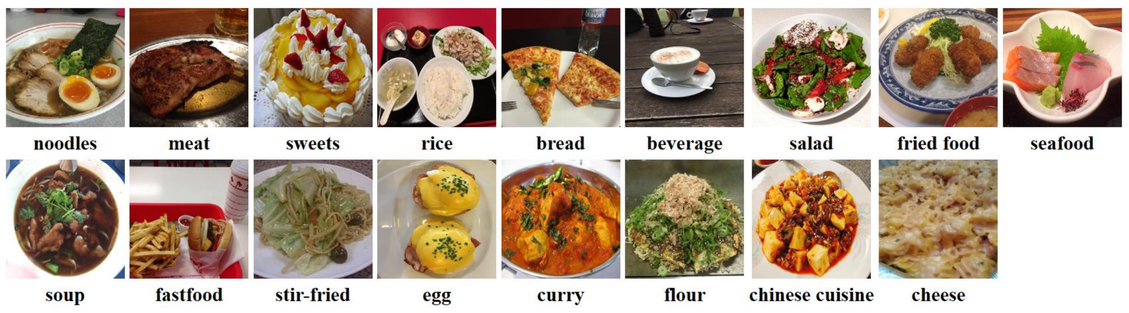
Food images
- **UECFOOD100[2]**
- **Food101 [3]**

The entire loss
$$L = L_T + L_C$$



[3] Clustering and analyzing of regional tendency

K-means clustering for the food images using the food CNN features
➡ **classification cluster of the image into 17 food represent categories**

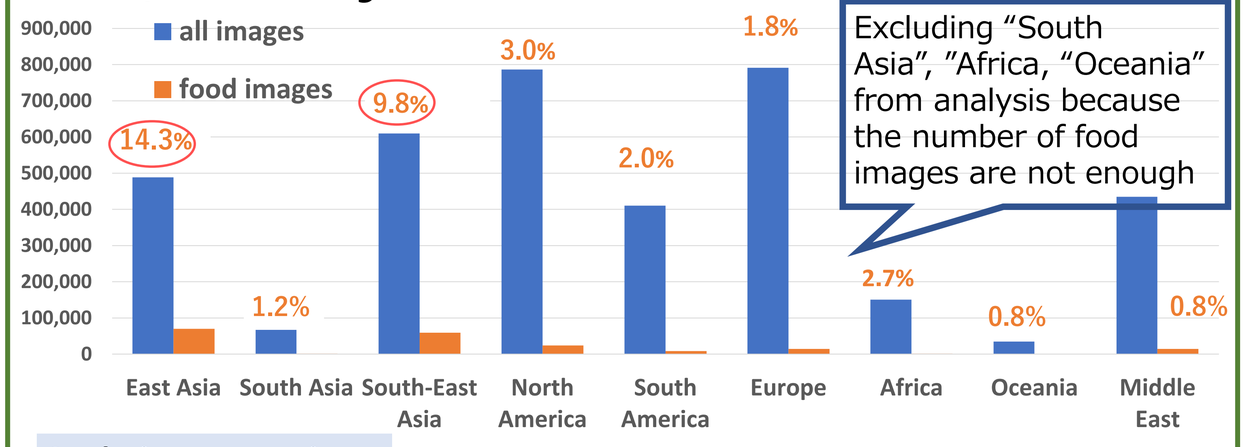


[4] Visualization of regional parts

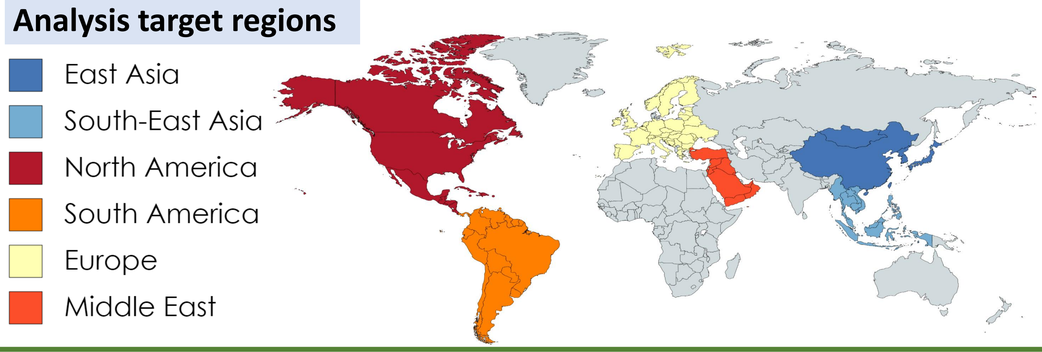
- **We find out which parts of the food images correspond to regional features by Grad-CAM [1].**
- **To visualize regional features, we train region classifiers on some of the pre-defined food categories.**

3-1.EXPERIMENTS[1]: Twitter Geotagged Food Images

Selecting food images from Twitter images in 2016 for whole a year with the food/non-food classifier
➡ **190,000 food images from 3.78 million raw Twitter images**

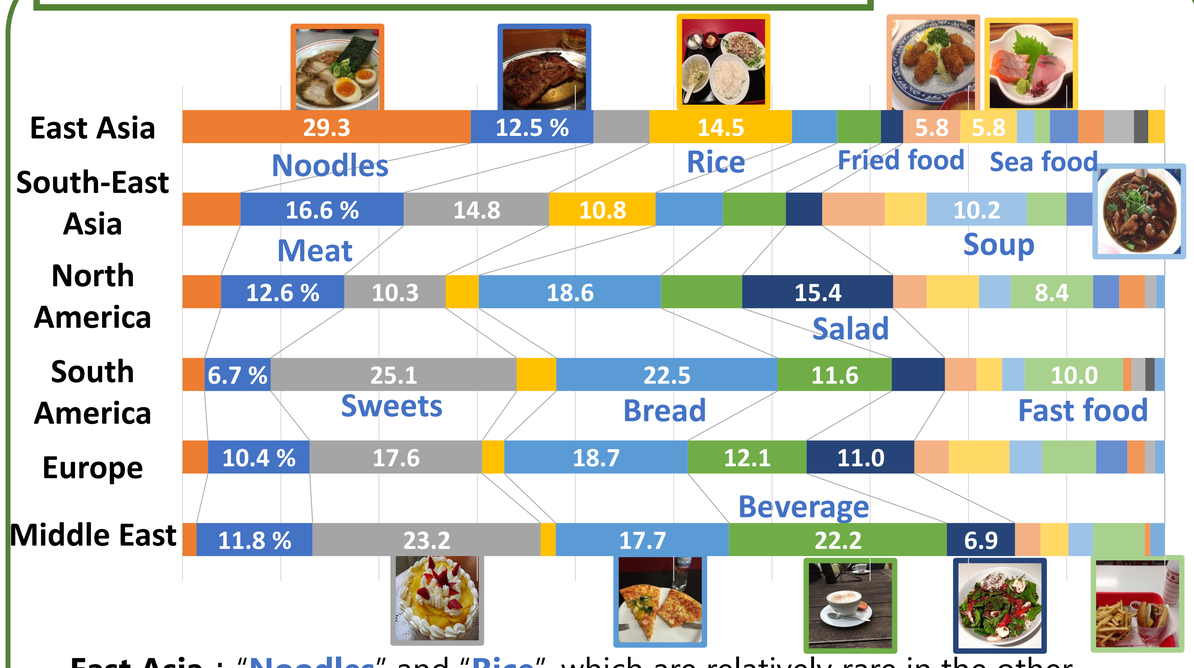


Analysis target regions



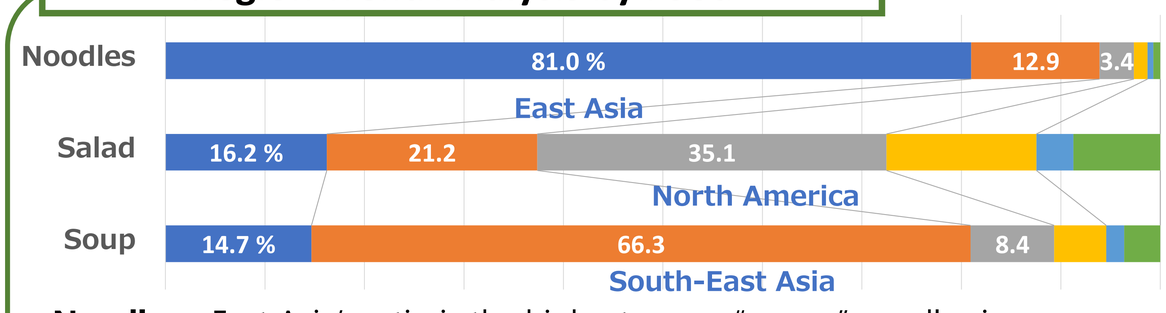
3-2.EXPERIMENTS[2] : Trend Analysis

Food Trend Analysis by Region



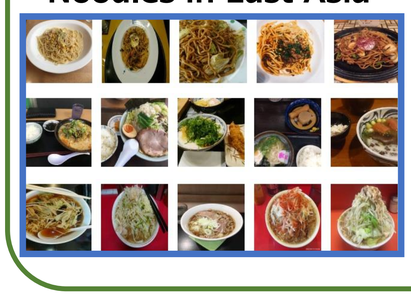
- **East Asia** : "**Noodles**" and "**Rice**", which are relatively rare in the other regions, are included at the top.
- **South-East Asia** : **"Soup"** is ranked at the top, and many dishes are made of vegetables and meats in soup.
- **North America, South America, Europe** : It turned out that 4 items of the top 5 items of the categories are the same
- **Middle East** : The top five food categories are the same as Europe. However there are many brown coffee photos which are a unique type to Middle East.

Region Trend Analysis by Food

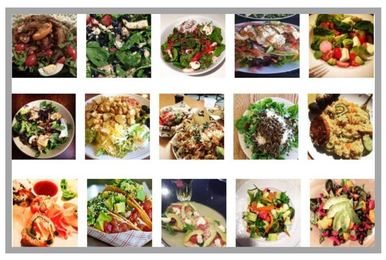


- **Noodles** : East Asia's ratio is the highest, many "ramen" noodles images are shown
- **Salad** : North America's ratio is the highest
- **Soup** : East-South Asia's ratio is the highest, using other categories of food

Noodles in East Asia



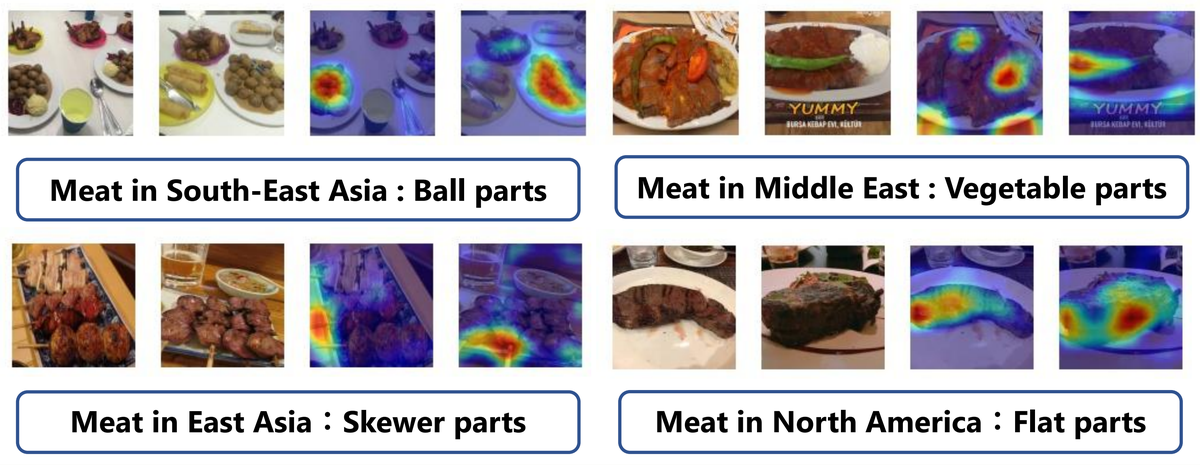
Salad in North America



Soup in East-South Asia

3-3.EXPERIMENTS[3]: Visualization of Regional Features

Example of clear regional features



Meat in South-East Asia : Ball parts

Meat in Middle East : Vegetable parts

Meat in East Asia : Skewer parts

Meat in North America : Flat parts

4 .CONCLUSIONS AND FUTURE WORK

- **We have analyzed regional food tendency on only the geo-tagged food images without using any textual information.**
- Integration image data of the areas that could not be analyzed from the other photo SNSs such as Instagram and Weibo.

[1] R. R. Selvaraju, M. Cogswell, A. Das, R. Vedantam, D. Parikh, and D. Batra. Grad-CAM: Visual explanations from deep networks via gradient-based localization. In CVPR, 2016.
[2] Y. Matsuda, H. Hoashi, and K. Yanai. Recognition of multiplefood images by detecting candidate regions. In ICME, 2012.
[3] B. Lukas, G. Matthieu, and V.G. Luc. Food-101 – mining discriminative components with random forests. In ECCV, 2014.
[4] Y. Kawano and K. Yanai. Automatic expansion of a food image dataset leveraging existing categories with domain adaptation. In ECCVWS, 2014