Food/Non-food Image Classification and Food Categorization using Pre-Trained GoogLeNet Model

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Outline

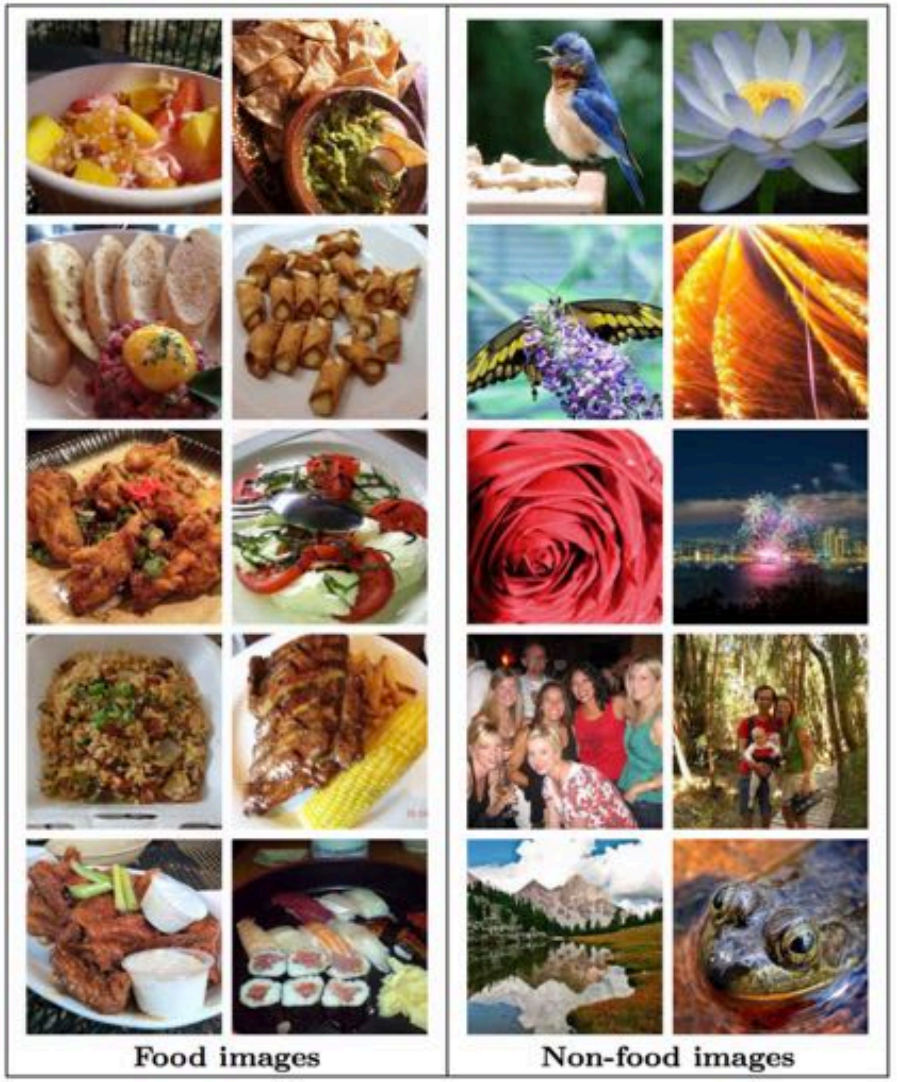
- Introduction
- Image Dataset
- Experiments and Analysis
- Demonstration
- Conclusion

- Dietary assessment based on multimedia techniques, e.g., image analysis
- Initial and crucial steps:
  - Detect food images from daily images
  - Identify food item in a food image

- Food categorization
  - Recognizing food in major categories may help in approx. estimation of nutritional value

- Objectives of the work
  - Food/non-food image classification
  - Food categorization (pre-defined 11 classes.)
- Convolutional Neural Networks (CNN) and pre-trained GoogLeNet model

- Food-5K
  - **2.5K food and 2.5K non-food**
  - Image source:
    - *Wearable camera*
    - *Mobile phone*
    - *Existing datasets:*
      - Food-101
      - UEC-FOOD-100
      - UEC-FOOD-256
  - High variety



- Food-11
  - 11 major food categories
  - Image source:
    - *Social media, e.g., Instagram, Flickr*
    - *Existing datasets:*
      - Food-101
  - Multiple types of food in each category

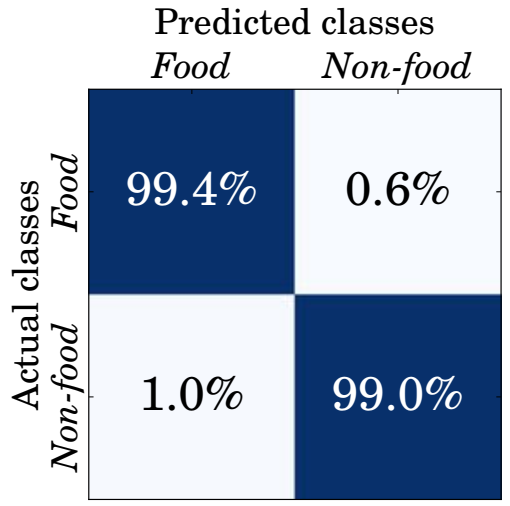
Dataset

- Food-11

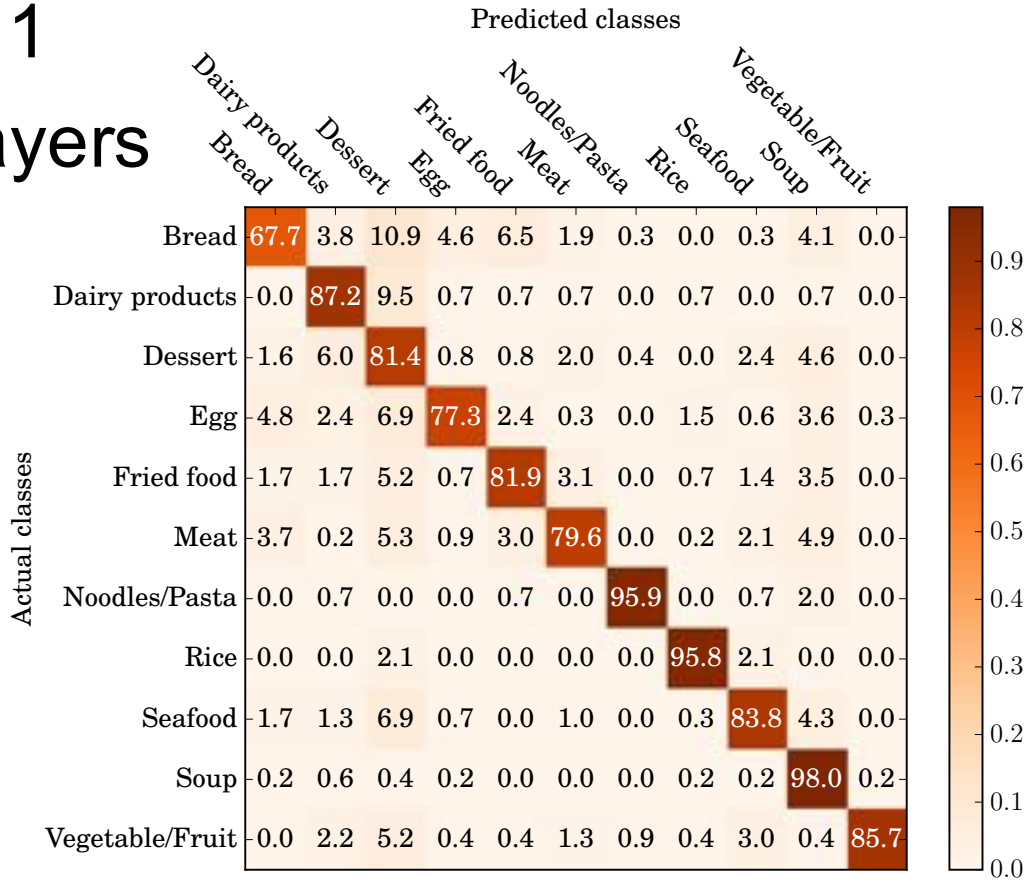
- Food-11

Category	Example items	Training	Validation	Evaluation
Bread	Bread, burger, pizza, pancakes, etc.	994	362	368
Dairy products	Milk, yogurt, cheese, butter, etc.	429	144	148
Dessert	Cakes, ice cream, cookies, chocolates, etc.	1500	500	500
Egg	Boiled and fried eggs, and omelette.	986	327	335
Fried food	French fries, spring rolls, fried calamari, etc.	848	326	287
Meat	Raw or cooked beef, pork, chicken, duck, etc.	1325	449	432
Noodles/Pasta	Flour/rice noodle, ramen, and spaghetti pasta.	440	147	147
Rice	Boiled and fried rice.	280	96	96
Seafood	Fish, shellfish, and shrimp; raw or cooked.	855	347	303
Soup	Various kinds of soup.	1500	500	500
Vegetable/Fruit	Fresh or cooked vegetables, salad, and fruits.	709	232	231
Total		9866	3430	3347

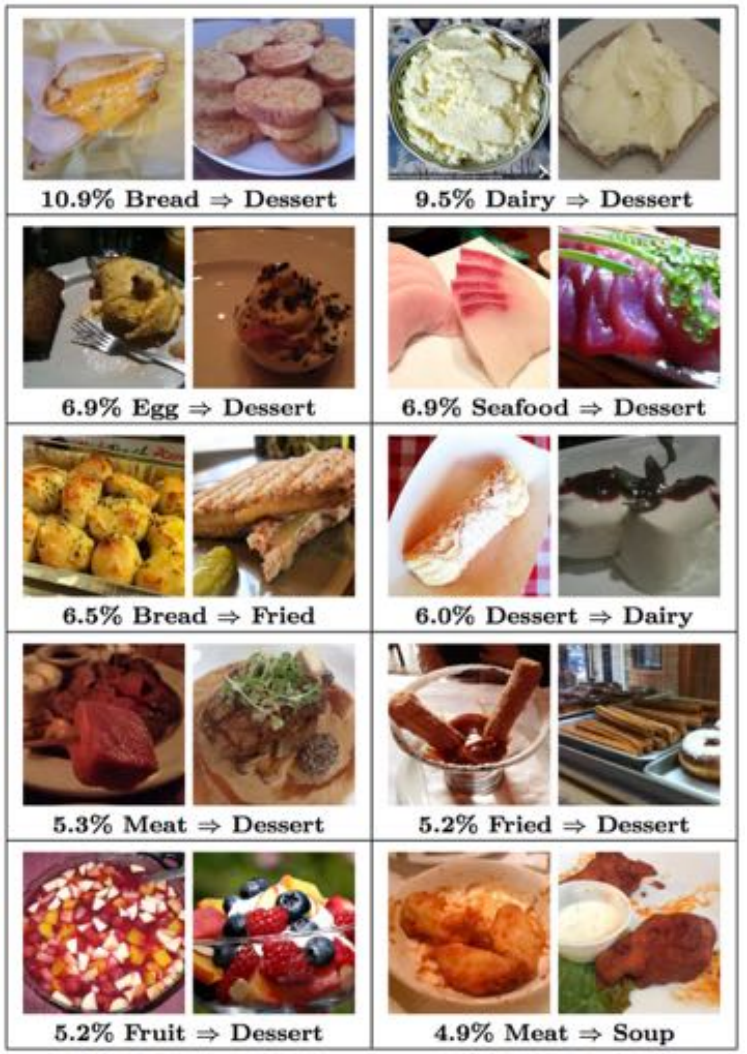
- Food/Non-food Classification
  - Fine tuning on the last 6 layers of a pre-trained GoogLeNet model, on Food-5K
  - 3K training, 1K validation and 1K testing
  - Max. acc. of 99.2%



- Food Category Recognition
  - Fine-tune on Food-11
  - GoogLeNet: last 6 layers
  - Best results:
    - *Overall Acc. 83.5%*
    - *F-measure 0.911*
    - *Kappa 0.816*

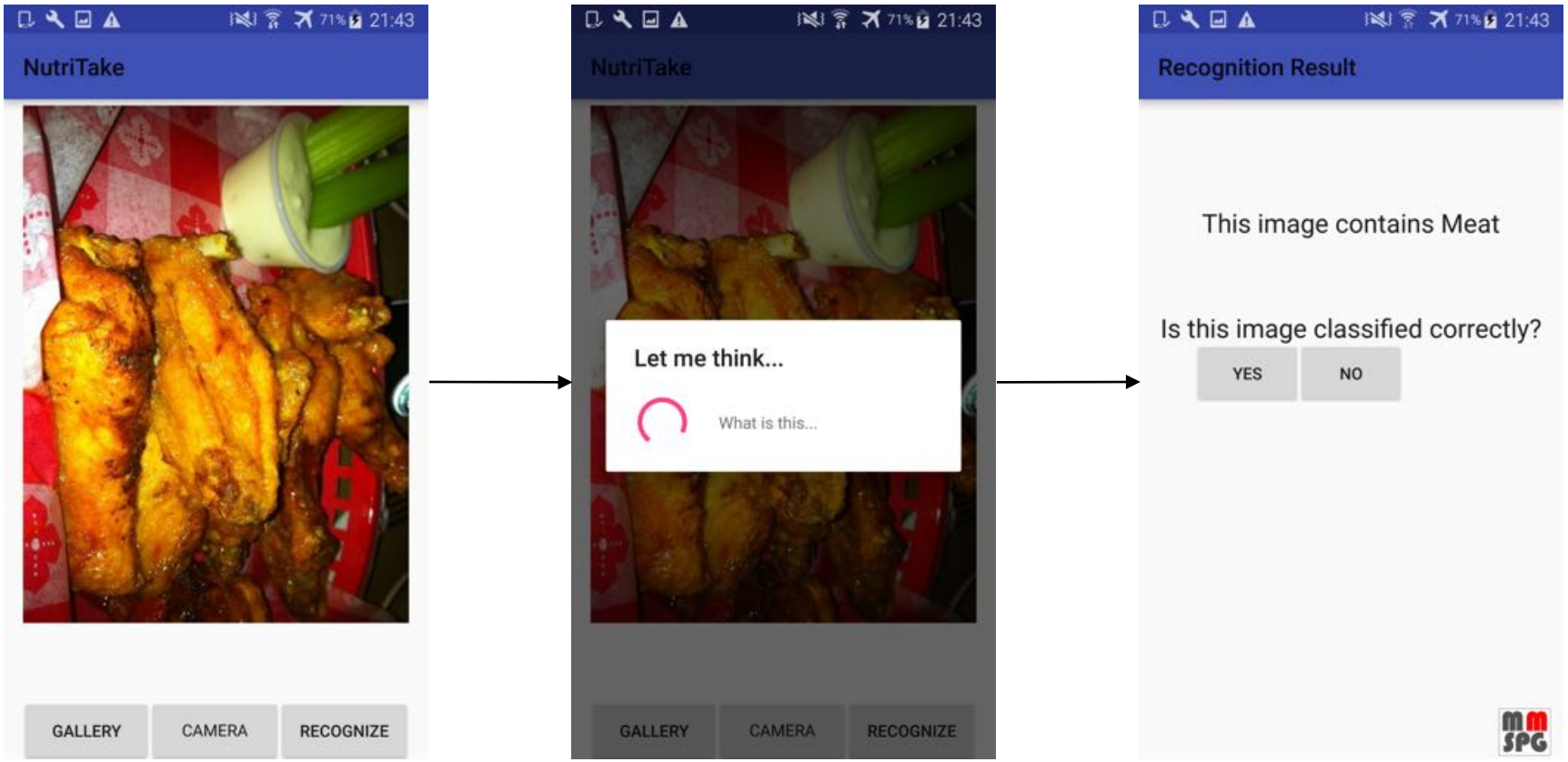


- Food Category Recognition
  - Top 10 misclassified pairs
  - Reasons:
    - *Images within different classes have similar appearance, shape or color.*
    - *Images have more than one type of food items mixed.*



Demonstration

- NutriTake Android App



Conclusion

- Two datasets
  - Food-5K: 5,000 food/non-food images
  - Fodd-11: 11 food categories
- Pre-trained GoogLeNet model for
  - Food/non-food classification
    - *Max. accuracy of 99.2%*
  - Food categorization
    - *Max. accuracy of 83.5%*

Link to dataset/App:

- A. Singla, L. Yuan, and T. Ebrahimi. Food/Non-food Image Classification and Food Categorization using Pre-Trained GoogLeNet Model. In *Proceedings of the 2nd International Workshop on Multimedia Assisted Dietary Management* (MADiMa '16).

Questions