Automated food log

Baptiste NOGARET

Supervised by Dr Stefan RÜGER

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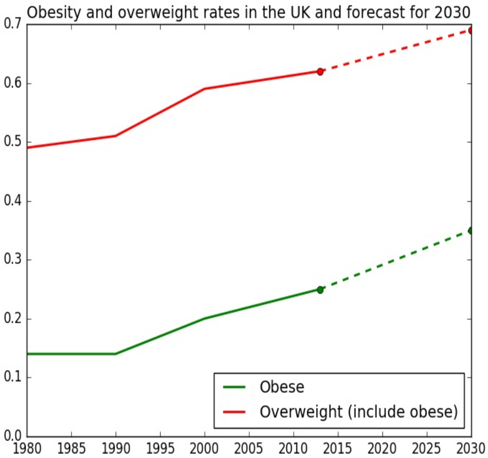
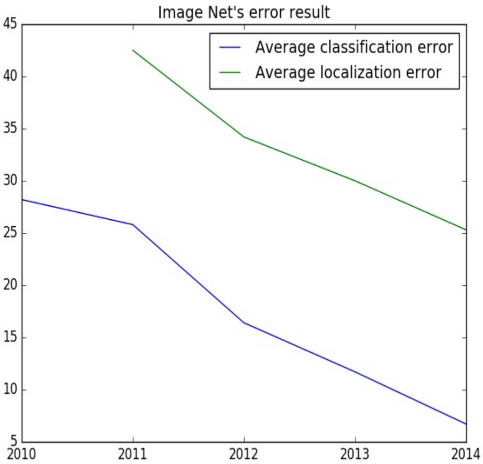
Why a food log analysis system?





Overall process

Roughly copying the procedure of FoodLog [1, 2, 3, 4, 5]:

- Generate a relevant dataset
- Extract characteristic
- Machine learning
- For a new picture from a user, classify and estimate intake

Focus on localization and classification

Dataset

Name	Release date	Number of pictures	Type of food	Number of classes	Multiple food items
PFID [6]	2009	4545	American fast-food	101	No
UEC FOOD 100 [7]	2012	14361	Japanese	100	Yes
FIDS 30 [8]	2013	971	Fruit	30	No
ETHZ Food-101 [9]	2014	101 000	European	100	No
FooDD [10]	2015	3000	Fruit	23	Yes
UEC FOOD 256 [11]	**2015**	**31395**	**World**	**256**	**Yes**

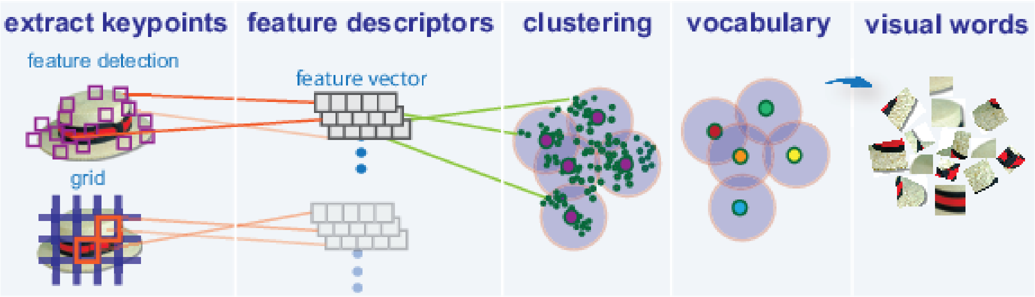
Dataset

Example of multi-items

Feature description

Bag of visual words

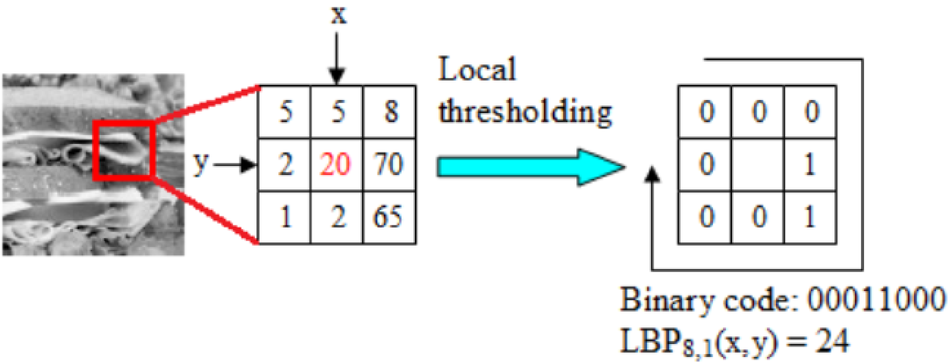
Common feature descriptor, use in [6, 12, 13]



Feature description

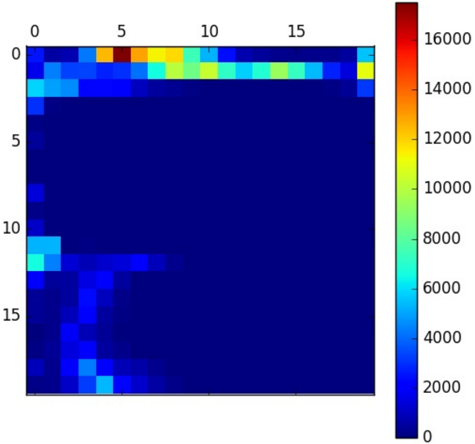
Local binary pattern

Use in [14, 15] for texture description



Feature description

Color moments and histograms



Mean:

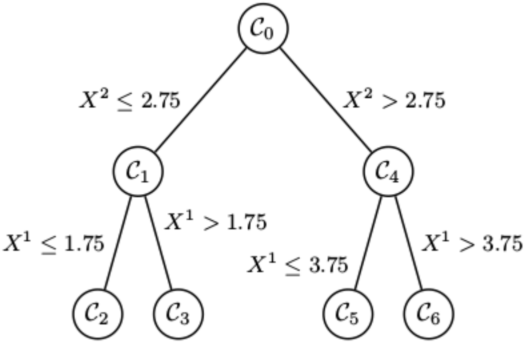
$$\mu = \frac{1}{n}\sum_{i=1}^{n} x_i$$

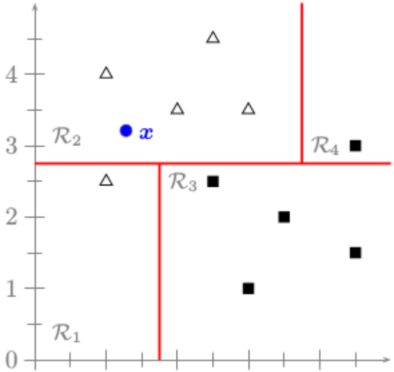
Variance:

$$\mathrm{Var}(X) = \sum_{i=1}^{n} p_i \cdot (x_i - \mu)^2$$

Classifiers

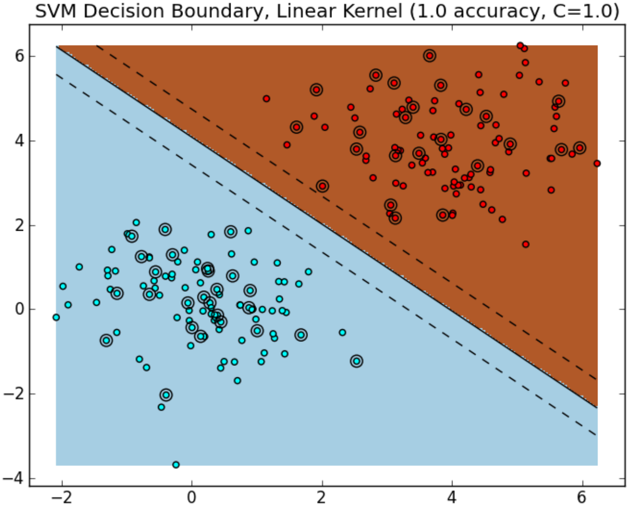
Decision tree and random forest





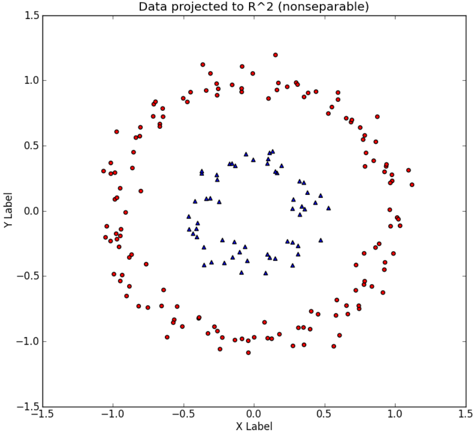
Classifiers

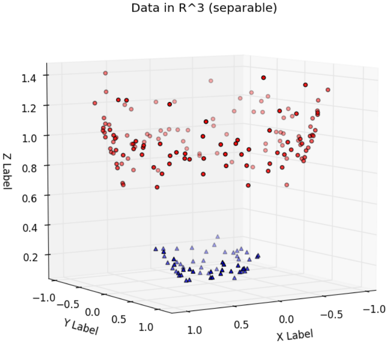
SVM



Classifiers

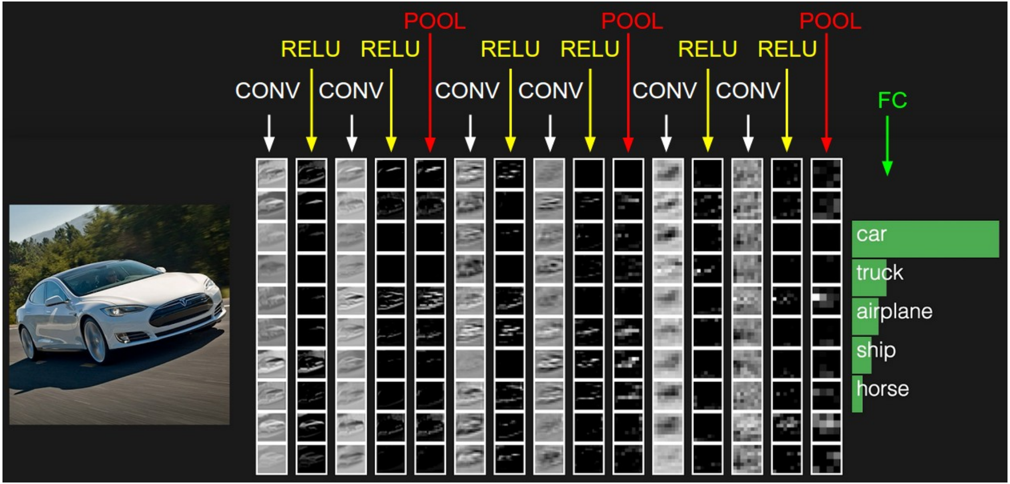
SVM and kernel trick



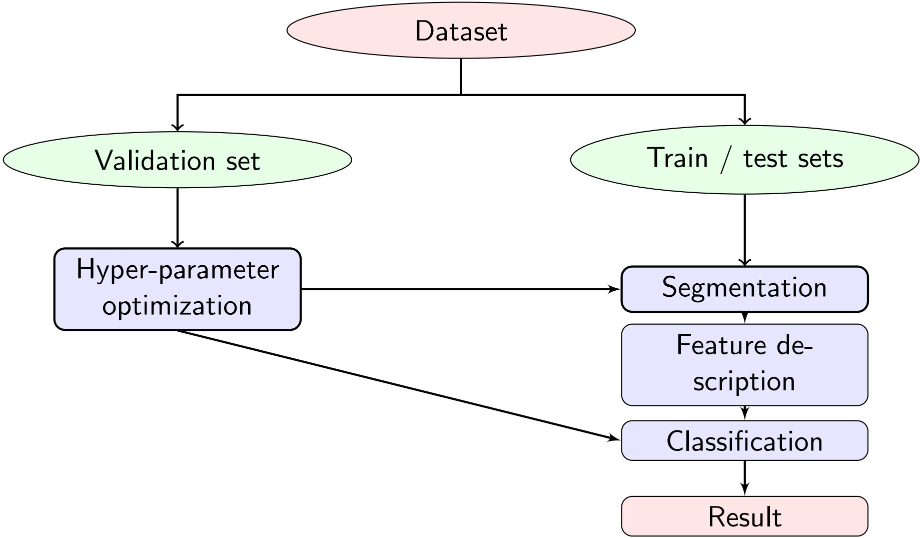


Classifiers

CNN



Structure


Dataset
Validation set
Train / test sets
Hyper-parameter optimization
Segmentation
Feature de-scription
Classification
Result

Results

Localization

Using a DCNN pre-trained on [16] to detect saliency object

Correcteness metric: As describe in [17], must have an intersection over union greater than 50 %

$$IoU = \frac{area(B_p \cap B_{gt})}{area(B_p \cup B_{gt})}$$

Metric	My method	DCNN from [18]
Accuracy	**73 %**	60 %
Recall	**74 %**	80 %
Precision	**79 %**	70 %

Results

Classification

Method	Average accuracy
CNN as descriptor + RF	**40 %**
BoW (1000 words)+ SVM with χ^2	10 %
LBP + color historams and moments + Decision tree	5 %
LBP + color historams and moments + SVM	11 %
LBP + color historams and moments + RF	16 %
DCNN from [18]	63 %
DCNN from [19]	67 %

Results

Segmentation and classification

Segmentation: DCNN followed by the classification: CNN as a descriptor and RF

UEC FOOD 256

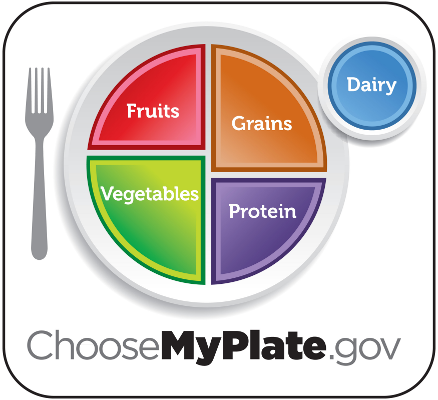
Accuracy	My method	DCNN from [18]
Overall	**28 %**	36 %
Segmentation	**74 %**	60 %
Classification	**38 %**	60 %

UEC FOOD 100

Accuracy	My method	[20]	[21]
Overall	**33 %**	-	-
Segmentation	**67 %**	60 %	-
Classification	**50 %**	-	72 %

Future work and comment

- Use a better feature descriptor / classifier
- Regroup the classification in 5 big categories for food intake as in [4]



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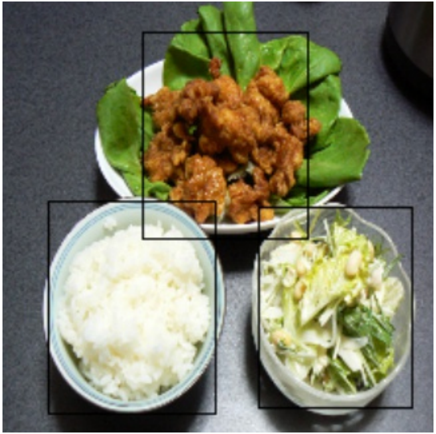
Segmentation and classfication applied on two reference datasets

Obtain great localization results

Overall accuracy of 28 % (to date, the best result is 36 % in [18]).



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