



Automated food log

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21st July 2016

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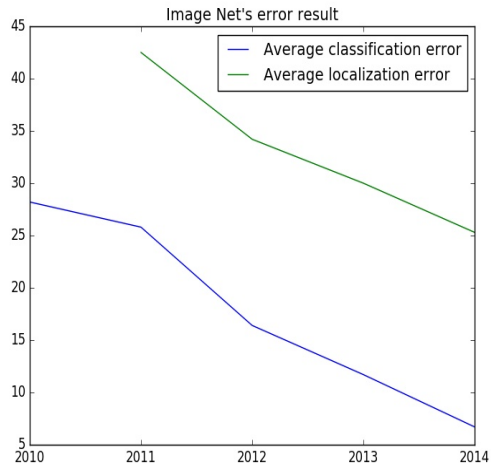
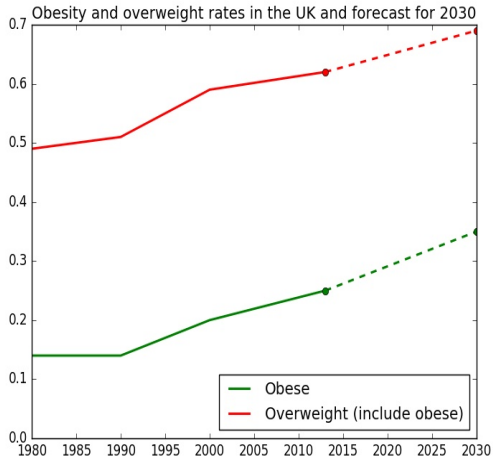


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Why a food log analysis system?





Overall process

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

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

Focus on the first three points

Challenges

High intra-class variability



Low inter-class variability





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

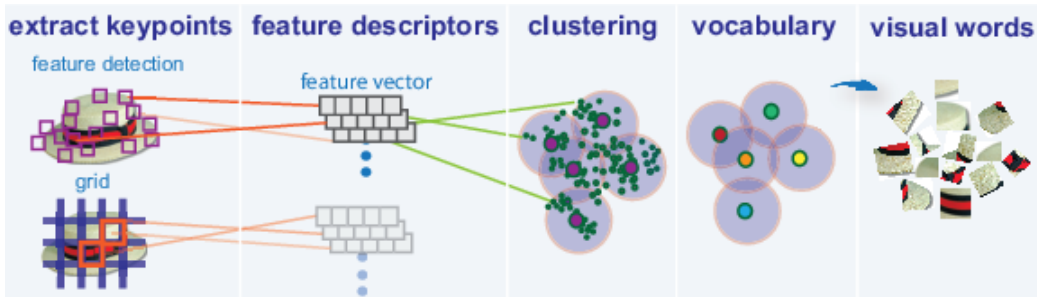
Example of multi-items



Feature description

Bag of visual words

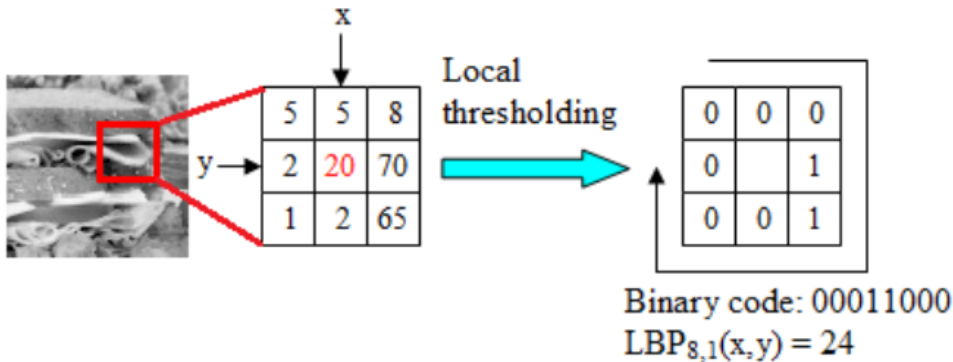
Common feature descriptor, use in [6, 12, 13]



Feature description

Local binary pattern

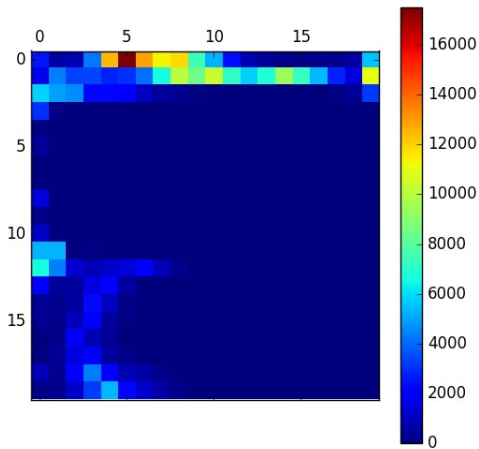
Use in [14, 15] for texture classification





Feature description

Color moments and histograms



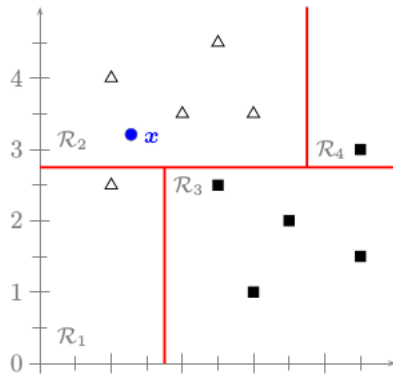
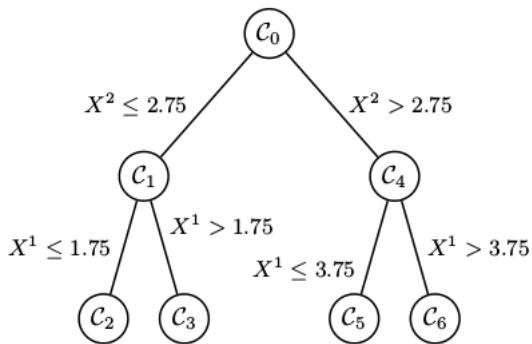
Mean:

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

Variance:

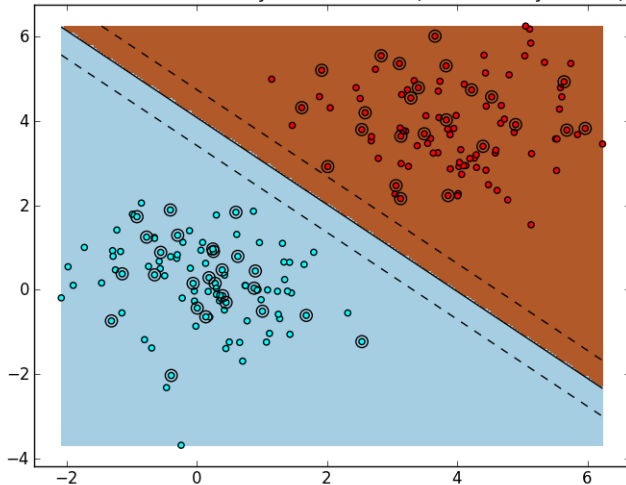
$$\text{Var}(X) = \sum_{i=1}^n p_i \cdot (x_i - \mu)^2$$

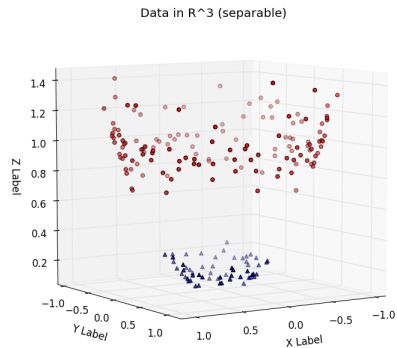
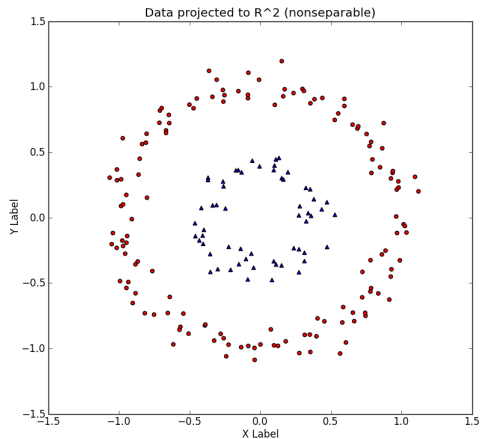
Tree and random forest



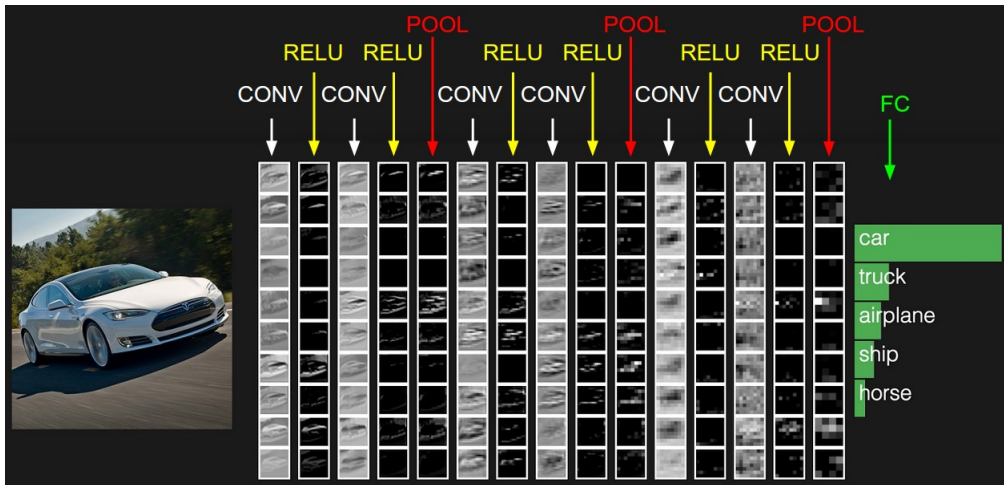
Classifiers

SVM Decision Boundary, Linear Kernel (1.0 accuracy, $C=1.0$)

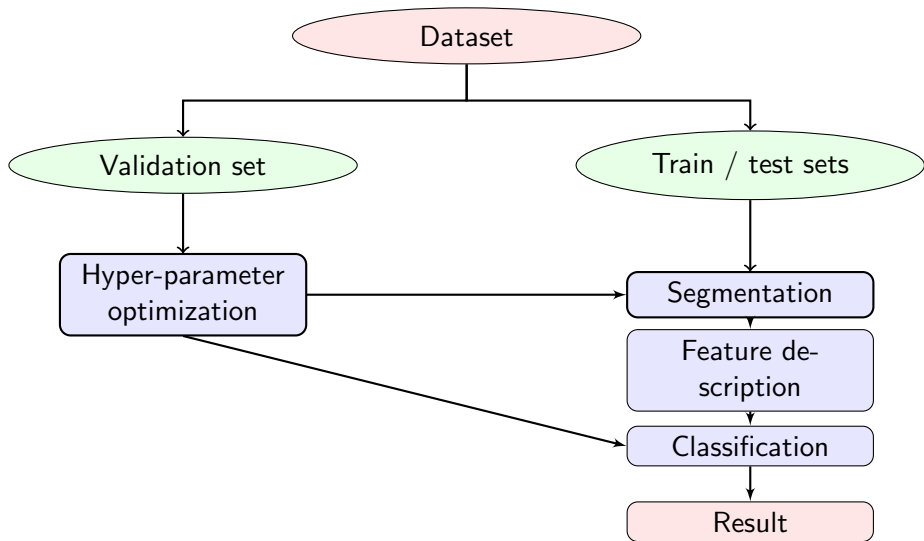




Classifiers



Structure





Results

Segmentation

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

Correctness 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 %

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 %

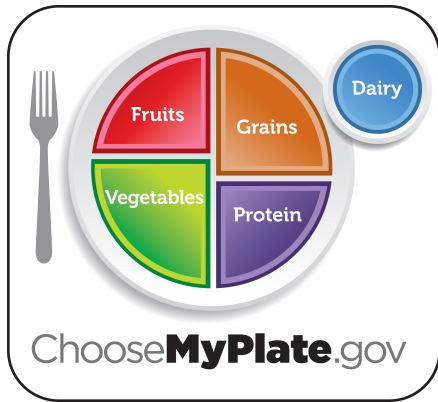
UEC FOOD 100

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



Future work and comment

- Regroup the classification in 5 big categories for food intake as in [4]
- Use a better feature descriptor / classifier
- Segmentation suppose that the food is the main focus of the picture



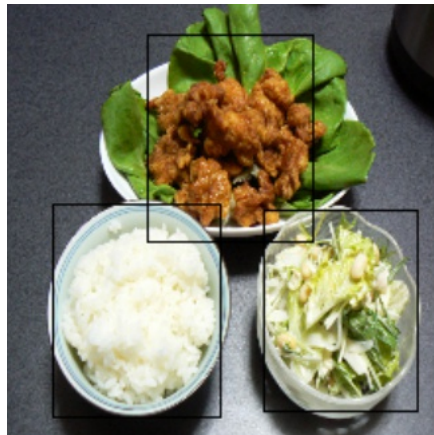


Food log analysis - Baptiste NOGARET

Segmentation and classification applied on two reference datasets

Obtain better segmentation than the reference

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





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