Inria's participation at ImageCLEF 2013 Plant Identication Task

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The ImageCLEF 2013 Plant Task

"Species retrieval" task:
- 20985 train images covering 250 species
- 5092 test images without ground truth
- for each test image give a list of species

Specific metric attempting to reduce some bias due to repetitive test images from a same individual plant (same "event")

$$S = \frac{1}{U}\sum_{u=1}^{U}\frac{1}{P_u}\sum_{p=1}^{P_u}\frac{1}{N_{u,p}}\sum_{n=1}^{N_{u,p}} s_{u,p,n}$$

Categories & Methods

Scan or "Scan-like" of Leaf
"SheetAsBackground" category
uniform (white) background

1. Shape approaches + fusion
-> multiples features
-> multiples image tests

Leaf - Flower - Fruit – Stem - Entire
"NaturalBackground" category
with more or less cluttered background

2. a. Large scale matching approach + fusion (feature, image tests, flowering time)

2. b. Fisher vector +SVM approach

SheetAsBackground category

Multiscale triangular shape descriptors [Mouine2013]
- local matching of shapes
- robust
- fast to compute
- validated on various leaf databases

One local feature, 2 versions:
-**TOA:** successive Oriented Angles
-**TSLA:** Length and Angles

20 triangles described for each
400 local features

Matching

Test images from a same plant observation

TOA → Training (TOA LSH) → Min rank → Knn → Run 1

approximate knn search based on Locality Sensitive Hashing

1. 1011
2.2340
3.3245
4. 9873
5. 4234
6. …

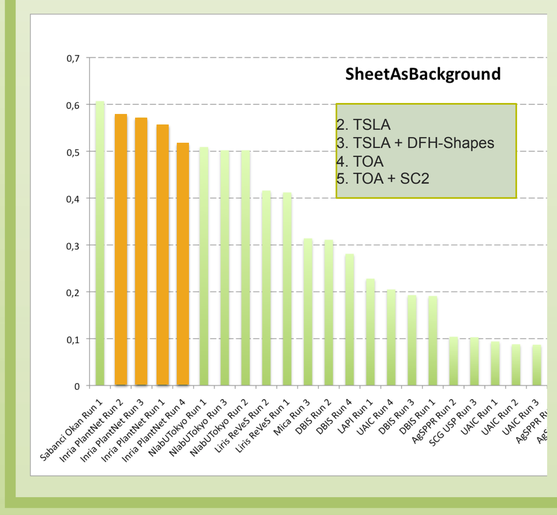
1. 1011
2.2340
3.4879
4.3245
5. 895
6. 9873
7. 4234
8. …

1.Ulmus minor
2.Corylus avelana
3.Ulmus laevis
4.…

Run 2
with TSLA

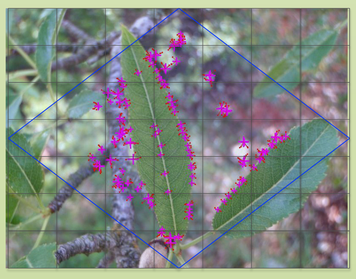
Run 3 &4: combination with two previous successful shape based methods on ImageCLEF 2011 &2012 Plant Tasks

Results



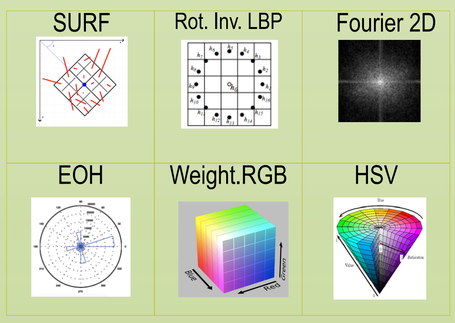
NaturalBackground: Main Steps (Run 1, 2 & 3)

Constrained Harris corner detection

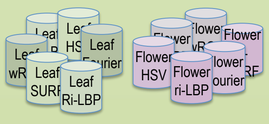


Filtering Rhomboid mask
200 "best" points following a 7x7 grid and a Gaussian like distribution

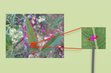
Local feature extraction



Large Scale Matching with RMMH



Etc 30 indices



$$h(\omega) = sgn\left(\sum_{i=1}^{m} \alpha_i^* \kappa(\mathbf{x}_i^*, \omega) + b_m\right)$$

m objects selected at random

RMMH Hash code = 256 bits

(1 0 1 1 1 0 1 0 0 1 0 0 1 0 0) Key Value

Ex: SURF $(x_1\ x_2\ x_3 \ldots x_n)$

Response list to probabilities (CIN)

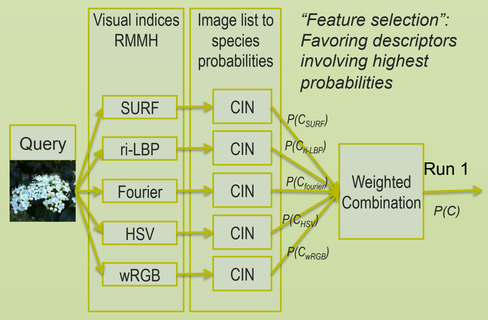
favoring **visual diversity** within a same species

p(VT)>p(SN)

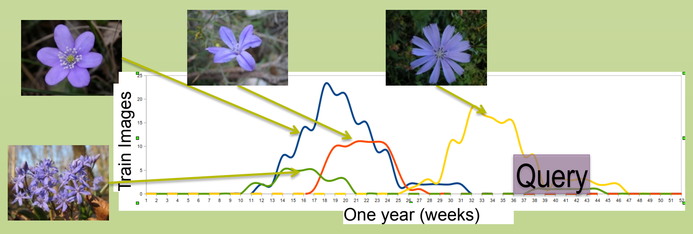
Require at least 2 distinct plants
Keep only the 2 most similar images from distinct plants
Based on the average of the number of matches

Late fusion

"Feature selection": Favoring descriptors involving highest probabilities

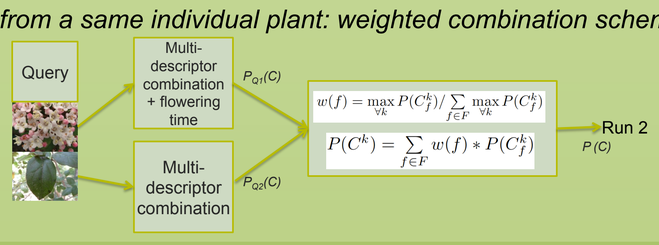


Flowering time & multiple image queries (Run 2)



Pre-filter image response before probabilities computation. Intersection with a 6 weeks window centered around the test image

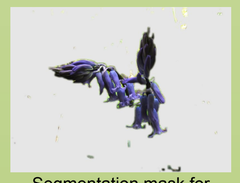
+ test images from a same individual plant: weighted combination schema



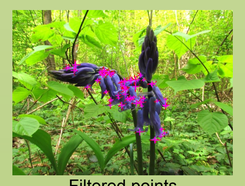
Segmentation (Run 3)

Initial point selection (run1)

Run 1 with less points (-30%)

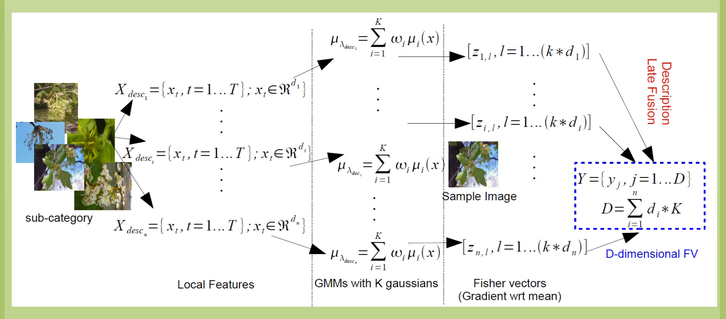


Segmentation mask for points filtering

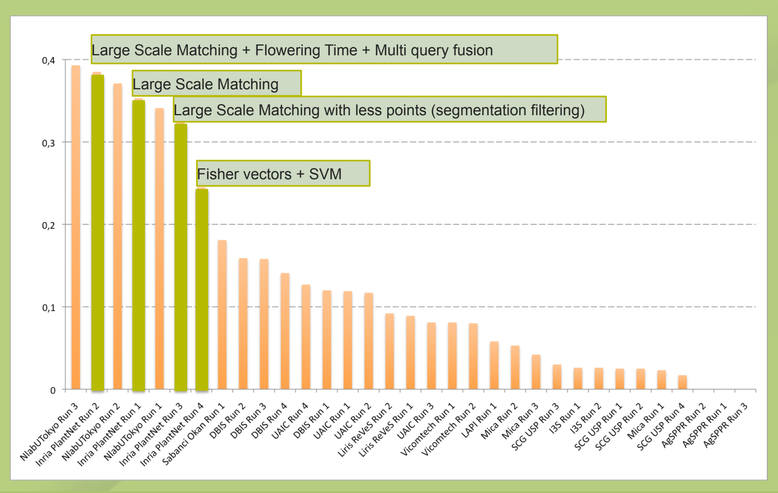


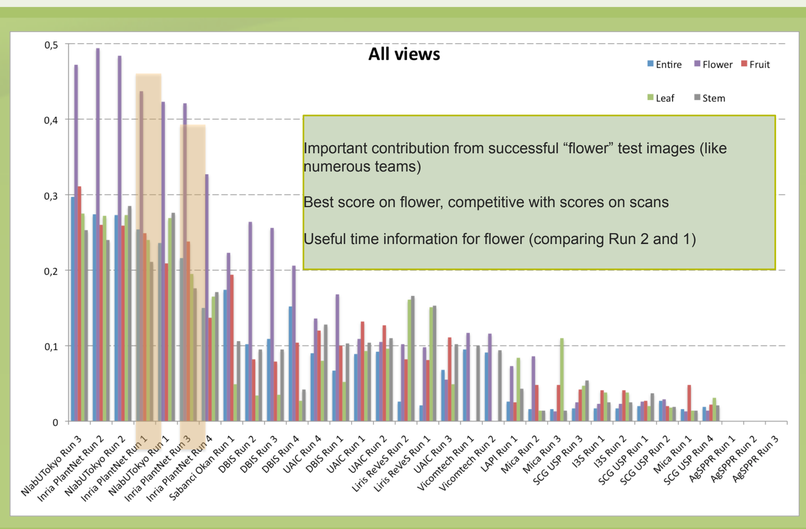
Filtered points

Fisher Vectors + svm (Run 4)



Results on Natural Background Category





Conclusion, Future Work

- local shape matching for scans
- combination of test images coming from a same plant observation
- focusing description at the center for photos
- an efficient visual search engine with RMMH
- independent indices for each type of visual description
- late fusion of visual descriptors with a feature selection mechanism
- a profitable use of time for flower

Pl@ntNet mobile app:
method used in "Inria PlantNet Run 2" in beta version (next update)

iOS