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Combining image retrieval, metadata processing and naive Bayes classification at PLANT IDENTIFICATION 2013

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Abstract

*This paper aims to combine intuition and practical experience in the context of ImageCLEF 2013 Plant Identification task. We propose a flexible, modular system which allows us to analyse and combine the results after applying methods such as **image retrieval using LIRe**, **metadata clustering** and **naive Bayes classification**. Although the training collection is quite extensive, covering a large number of species, in order to obtain accurate results with our photo annotation algorithm we enriched our system with **new images from a reliable source**. As a result, we performed four runs with different configurations, and the best run was ranked **5th out of a total of 12 group participants**.*

Pre-processing and enrichment

Training data and Wikimedia: In order to expand our image collection, thus increasing the performance of our system, we chose **Wikimedia Commons**, which hosts a wide variety of photos, including plants, and provides a **human annotated image repository**.

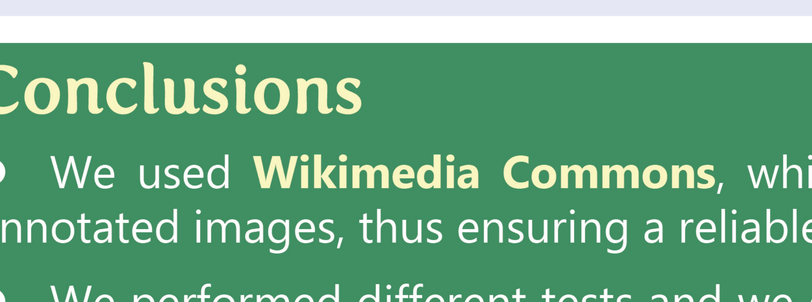
Extraction of visual features and indexing

Using **LIRe**, we extracted the following features from the train images: color histogram, edge histogram, Tamura features, CEDD, FCTH, JCD. Then we created an **index** in which we added a document for each train image, containing the previously mentioned features.

Classification

Using LIRe: Using the image index, we searched for all the images in the test set, extracting only those documents that contained images of the same type (entire, flower, fruit, leaf or stem) and then filtering the results by using the JCD feature. We retained the first 500 results.

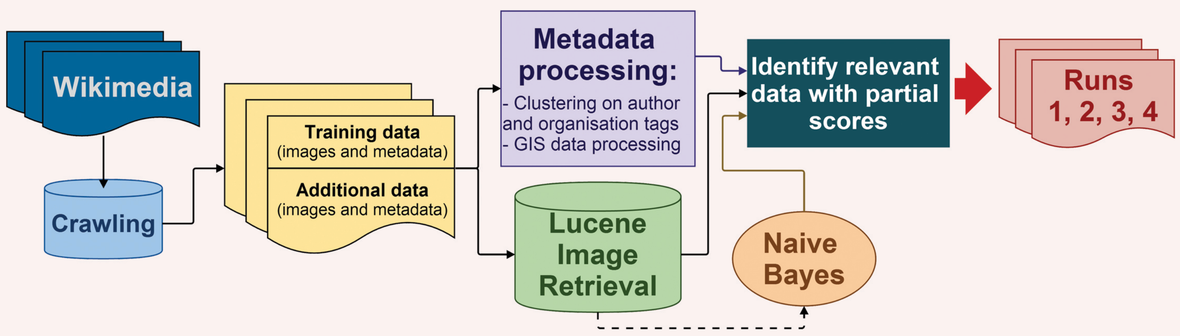
Using training data set tags: We clustered the training images based on their location, using the **quadtree** data structure and the **Haversine formula** for distance. The results were further refined and ranked based on author and organization tags.



System description

Our system has a modular and flexible structure and can easily be extended with some other feature extractors' algorithms. We have used both features extracted from pictures and metadata information, and to find a way to combine them.

- ***Run 1*** (run_wiki_sum_3): **Image retrieval** using the extended collection of images. The final score of a ClassId is the **sum** of partial results obtained after retrieval, divided by the largest sum.
- ***Run 2*** (run_author10_GSP10_lire80): **Image retrieval** using the extended collection of images. The final score of a ClassId is **10% author**, **10% GPS coordinates** and **80% LIRe score**.
- ***Run 3*** (run_lire_naivebayes): **Nearest neighbors** (from the training set) are computed based on image content and they are replaced by their ClassId. The final score are the **posterior probabilities** obtained by running a **Naive Bayes classifier**.
- ***Run 4*** (run_wiki_max_1): **Image retrieval** using the extended collection of images. The final score of a ClassId is the **maximum** value from the partial results obtained after retrieval.



Results of our submitted runs

#Run	Entire	Flower	Fruit	Leaf	Stem	Natural Background
run_wiki_max_1	0,09	**0,136**	0,12	0,08	**0,128**	**0,127**
run_wiki_sum_3	0,089	0,109	**0,132**	0,093	0,104	0,119
run_author10_GPS10_lire80	**0,092**	0,105	0,127	**0,096**	0,11	0,117
run_lire_naivebayes	0,068	0,055	0,111	0,049	0,102	0,081

Conclusions

- We used **Wikimedia Commons**, which offers human annotated images, thus ensuring a reliable content.
- We performed different tests and we decided that **JCD** was the better choice for our image types.
- A single score for each ClassId was obtained using three methods: the **maximum score** for a ClassId, computing **the sum of all scores** for a ClassId and then dividing by the largest sum, or training a **naive Bayes classifier**.
- We believe that, in the future, our **modular architecture** will allow us to dynamically integrate new techniques and new algorithms to achieve suitable matches.