PLATO for Information Mining in Satellite Imagery

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www.tsi.enst.fr/~rital

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PLATO stores and centralizes all data/metadata and tools using our multimedia data management system;

PLATO facilitates navigation and provides visualization tools, etc.

PLATO allows Test/Evaluation/Development: using both graphical interface and cluster power, the user develops and evaluates algorithms inside complex processing chains;

PLATO includes a Wiki between Plato users and bugs reports; it also helps to for demonstration design, and creates links between publications and data or tools.
System architecture…

AJAX, PYTHON Server Pages, POSTGRESQL, PYTHON, …
From data and tools to processing chain ...
Satellite images

- Satellite images are numerous
  - Example: SPOT5 satellite provides several terabytes / year
- Satellite images are underexploited
  - Less than 3% are used – by photointerpreters – visually
- Satellite images are semantically rich
  - Lots of applications
  - More and more very high resolution images (50cm/pixel)

=> Urgent need for automatic processing
PLATO and satellite images

- Basic data management:
  - metadata, images, results of processing

- Visualization tools:
  - 1 SPOT5 image = 12000x12000 pixels!
  - High/low precision
  - Facilities like « crop »

- Navigation inside images and help to annotation:
  - Image indexing
  - Active learning (relevance feedback)
    - A learning machine
    - A selection methods (what to present to the user)
    - An interactive interface

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options:
-s svm_type : set type of SVM (default 0)
  0 = C-SVC
  1 = nu-SVC
  2 = one-class SVM
  3 = epsilon-SVR
  4 = nu-SVR
-k kernel_type : set type of kernel function (default 2)
  0 = linear: y = x
  1 = polynomial: (gamma*x^d + coef0)^degree
  2 = radial basis function: exp(-gamma * ||x-v||^2)
  3 = sigmoid: tanh(gamma*x^2 + coef0)
  4 = precomputed kernel (kernel values in training_set_file)
-d degree : set degree in kernel function (default 3)
-g gamma : set gamma in kernel function (default 1)
-c coef0 : set coef0 in kernel function (default 0)
-c cost : set the parameter C of C-SVC, one-class SVM, and nu-SVR (default 1)
-n nu : set the parameter nu of nu-SVC, one-class SVM, and nu-SVR (default 0.5)
-e epsilon : set the epsilon in loss function of epsilon-SVR (default 0.1)
-m cache size : set cache memory size in MB (default 100)
-s epsilon : set tolerance of termination criterion (default 0.001)
-h shrinking : whether to use the shrinking heuristic, 0 or 1 (default 1)
-b probability : whether to train a SVC or SVR model for probability estimates, 0 or 1 (default 0)
-w C : set the parameter C of class i to weight*C, for C-SVC (default 1)
-v m: m-fold cross-validation mode
RESULT OF CLASSIFICATION
Conclusion

- **Is it new?**
  - PLATO is based on well-known technologies
  - Relevance feedback is well-known for a decade
- **To adapt CBIR systems to satellite images is new!**
  - Satellite images contain an enormous amount of data
    - PLATO proposes efficient storage means to keep original information untouched and to track applied processes
    - PLATO helps people navigating inside images
    - PLATO illustrates how active learning could help interpreters in their annotation work.
- **It is very useful to researchers!**

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Conclusion

- PLATO demos are available as films on [www.tsi.enst.fr/~rital](http://www.tsi.enst.fr/~rital)
  - Not only for satellite images but also for web photos

- Of course, results of learning can be memorized, associated to keywords and reused later.
  - Automatic annotation can be performed and text retrieval can be used to accelerate the retrieval process

- Memory management has been proposed by Mihai Costache (phd, sept. 08) : learning/unlearning

- Perspective : current work with photo-interpreters about major catastrophes management

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