Paris-Saclay
Center for Data Science

Open Software Initiative (OSI)

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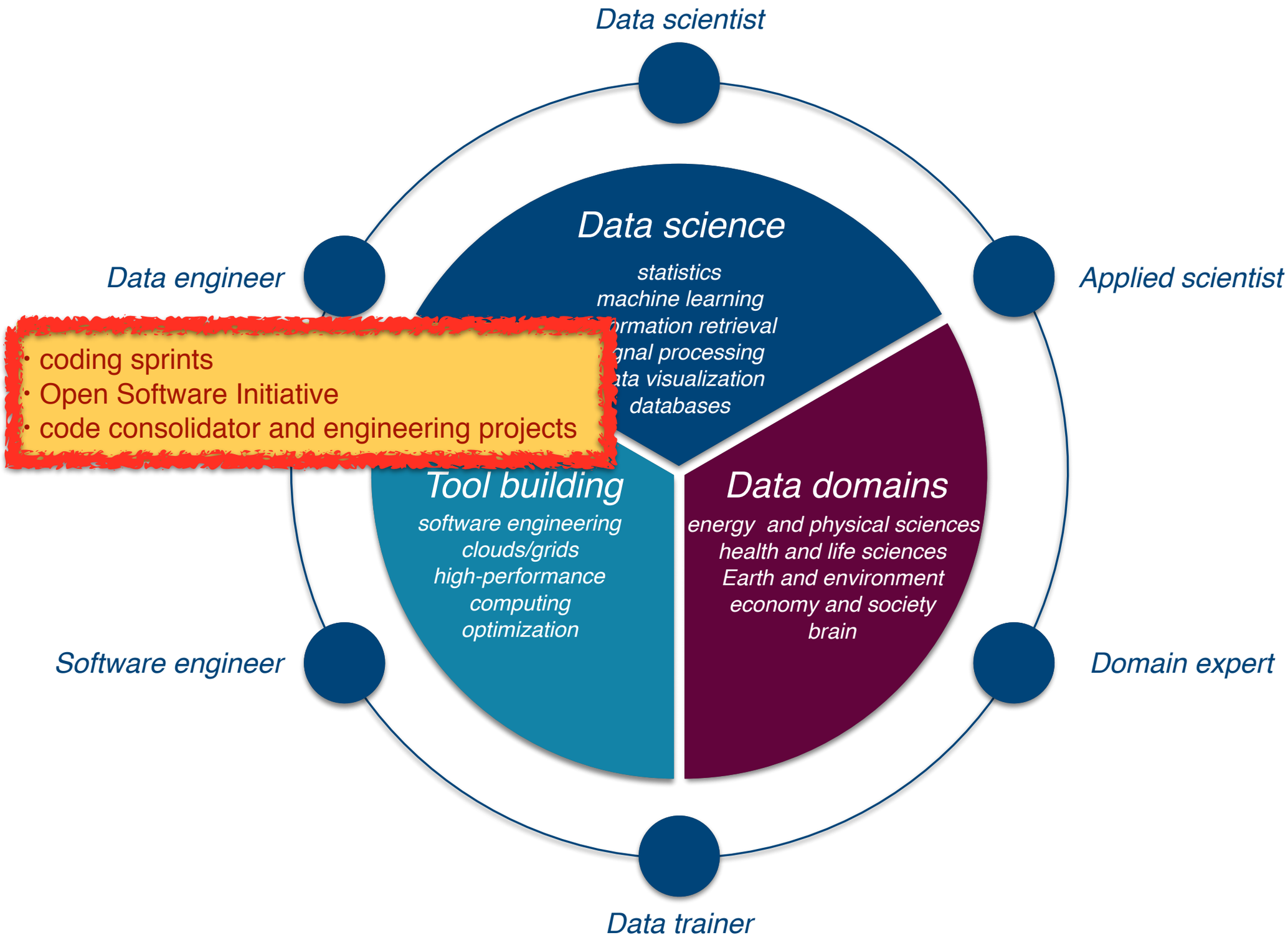
TOOLS IN THE DATA SCIENCE LANDSCAPE



scikit-learn: machine learning in Python — scikit-learn 0.14 documentation

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scikit-learn.org/stable/

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scikit learn

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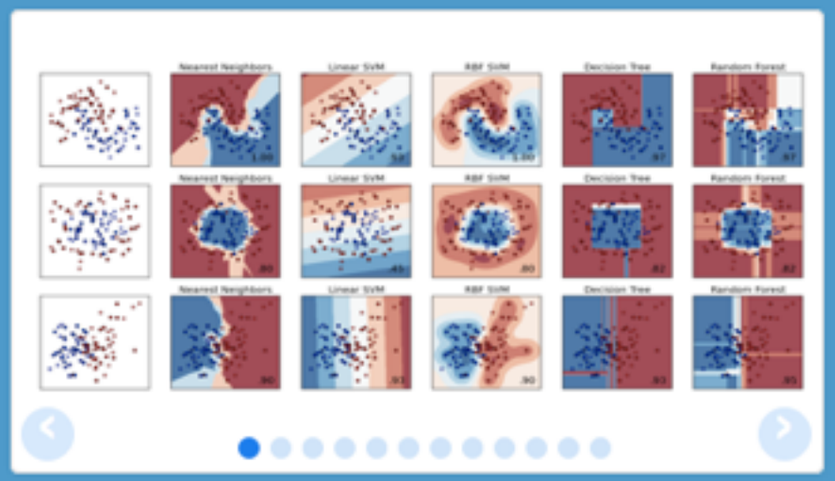

scikit-learn

Machine Learning in Python

- Simple and efficient tools for data mining and data analysis
- Accessible to everybody, and reusable in various contexts
- Built on NumPy, SciPy, and matplotlib
- Open source, commercially usable - BSD license

Classification

Identifying to which set of categories a new observation belong to.

Applications: Spam detection, Image recognition.
Algorithms: *SVM*, *nearest neighbors*, *random forest*, ... — *Examples*

Regression

Predicting a continuous value for a new example.

Applications: Drug response, Stock prices.
Algorithms: *SVR*, *ridge regression*, *Lasso*, ... — *Examples*

Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes
Algorithms: *k-Means*, *spectral clustering*, *mean-shift*, ... — *Examples*

Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency
Algorithms: *PCA*, *Isomap*, *non-negative matrix factorization*. — *Examples*

Model selection

Comparing, validating and choosing parameters and models.

Goal: Improved accuracy via parameter tuning
Modules: *grid search*, *cross validation*, *metrics*. — *Examples*

Preprocessing

Feature extraction and normalization.

Application: Transforming input data such as text for use with machine learning algorithms.
Modules: *preprocessing*, *feature extraction*. — *Examples*

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Reducing the numbe
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Applications: Visua
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Started in 2010 at:

université PARIS-SACLAY

In a Nutshell, scikit learn...

... has had 20,181 commits made by 650 contributors
representing 179,355 lines of code

... is mostly written in Python
with a well-commented source code

... has a well established, mature codebase
maintained by a very large development team
with stable Y-O-Y commits

... took an estimated 47 years of effort (COCOMO model)
starting with its first commit in January, 2010
ending with its most recent commit 3 days ago

source: https://www.openhub.net/p/scikit-learn

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Funding:

Inria INVENTEURS DU MONDE NUMÉRIQUE

TELECOM ParisTech

Google

NYU CENTER FOR DATA SCIENCE

Paris-Saclay Center for Data Science

criteo

source: https://www. scikit-learn

PeerIndex

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Inria
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TELECOM ParisTech

DataRobot

lovely

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how about we...

okc

Spotify

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Comma Soft AG

DATA PUBLICA

dataiku
Write your own data story

airbnb

AWeber
COMMUNICATIONS

Bestof MEDIA GROUP

RANGE SPAN

EVERNOTE

http://scikit-learn.org/stable/testimonials/testimonials.html

- Installed on 1% of debian systems
- 1200 job offers on Stack-Overflow
- Users: 60% academics & 40% industry

http://scikit-learn.org/stable/testimonials/testimonials.html

BEYOND SCIKIT-LEARN @ UPSA (… IN MY WORLD)

MNE
MEG + EEG ANALYSIS & VISUALIZATION

neo

NiBabel
Access a cacophony of neuro-imaging file formats

and certainly many more....

Objective is too teach students to replicate the scikit-learn model or at least contribute to it

Open Software Initiative @ CDS 1

- 6 projects funded (5 missions doctorales + 1 code consolidator 3 months)
  - N. Goix (LTCI) : Scikit-Learn "Outlier/Novelty detection algorithm (IForest, etc.)"
  - M. Cherti (UpSud) : Scikit-Learn "Multivariate Additive Regression Splines (MARS)"
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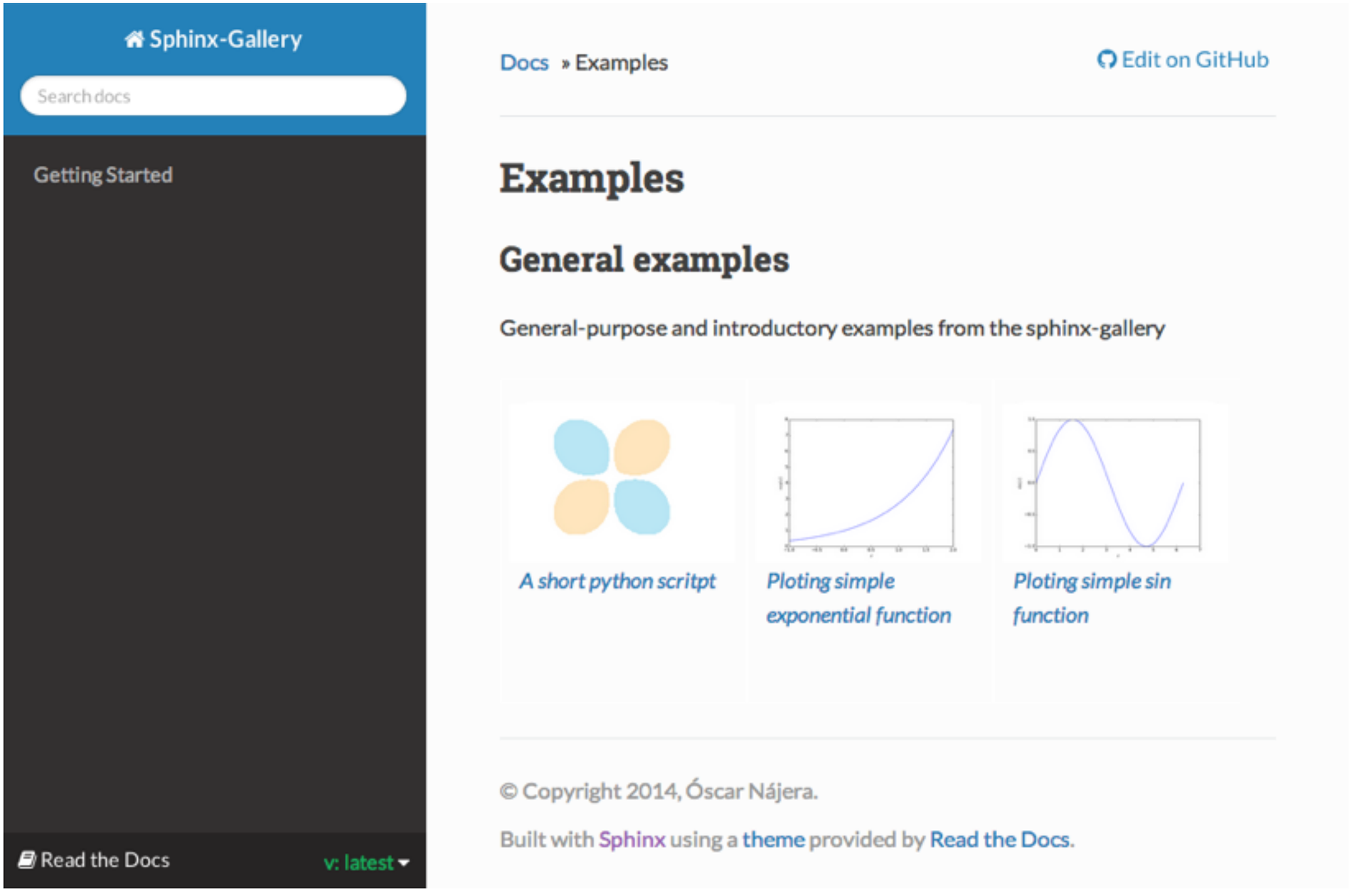
OSI : O. Najera “Sphinx-Gallery”



http://sphinx-gallery.readthedocs.io/en/latest/

https://github.com/sphinx-gallery/sphinx-gallery

Welcome to Sphinx-Gallery's documentation!

A Sphinx extension that builds an HTML gallery of examples from any set of Python scripts.

It is extracted from the scikit-learn project and aims to be an independent general purpose extension.

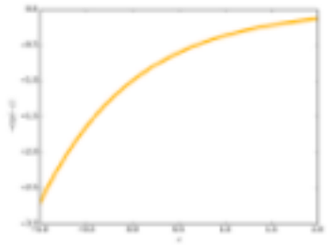
Why Sphinx-Gallery?

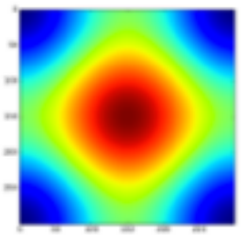
- Simple examples that run out of the box are the best way to learn a library
- Pleasing, organized, visual layouts
- Links, searching, backlinks throughout examples and documentation

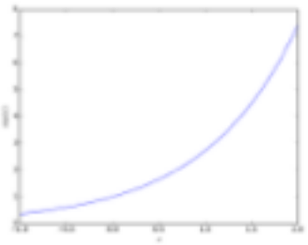
What does it look like?

Here is an example gallery generated from a few Python scripts.

Examples using `numpy.linspace`







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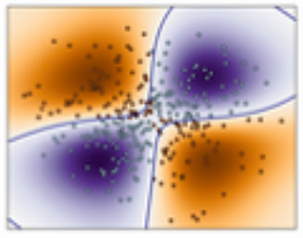
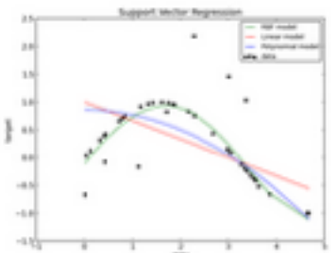
http://scikit-learn.org/stable/auto_examples/index.html

Support Vector Machines

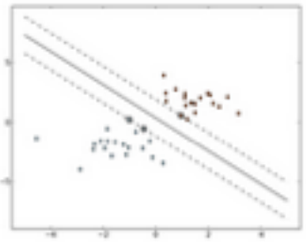
Examples concerning the `sklearn.svm` package.



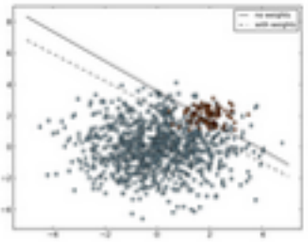
Non-linear SVM



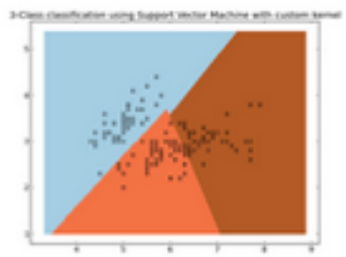
Support Vector Regression (SVR) using linear and non-linear kernels



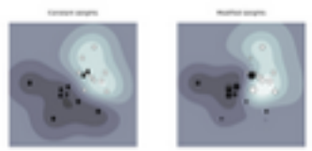
SVM: Maximum margin separating hyperplane



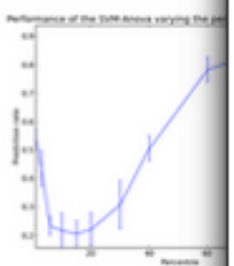
SVM: Separating hyperplane for



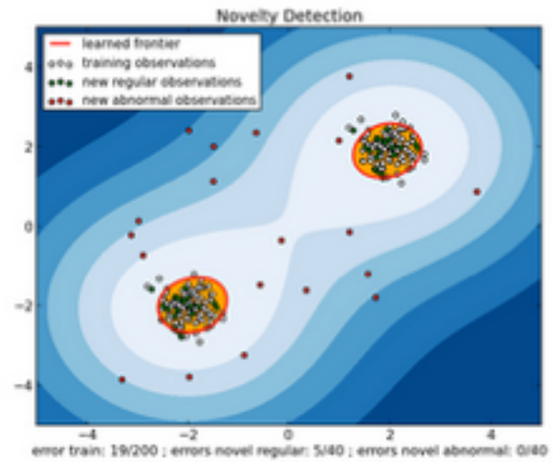
SVM with custom kernel



SVM: Weighted samples



SVM-Anova: SV univariate featu selection

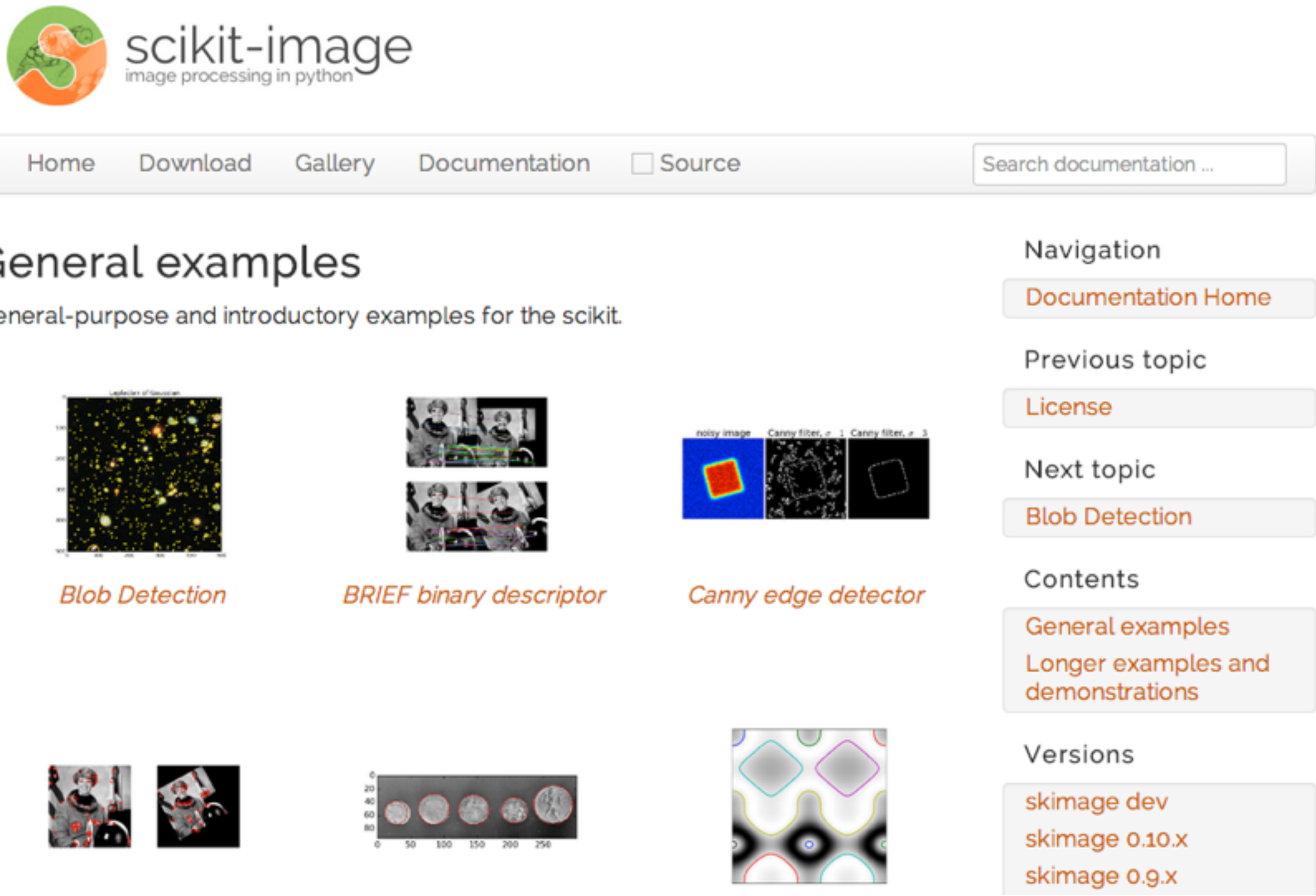


One-class SVM with non-linear kernel (RBF)

An example using a one-class SVM for novelty detection.

OSI : O. Najera “Sphinx-Gallery”

http://scikit-image.org/docs/dev/auto_examples/



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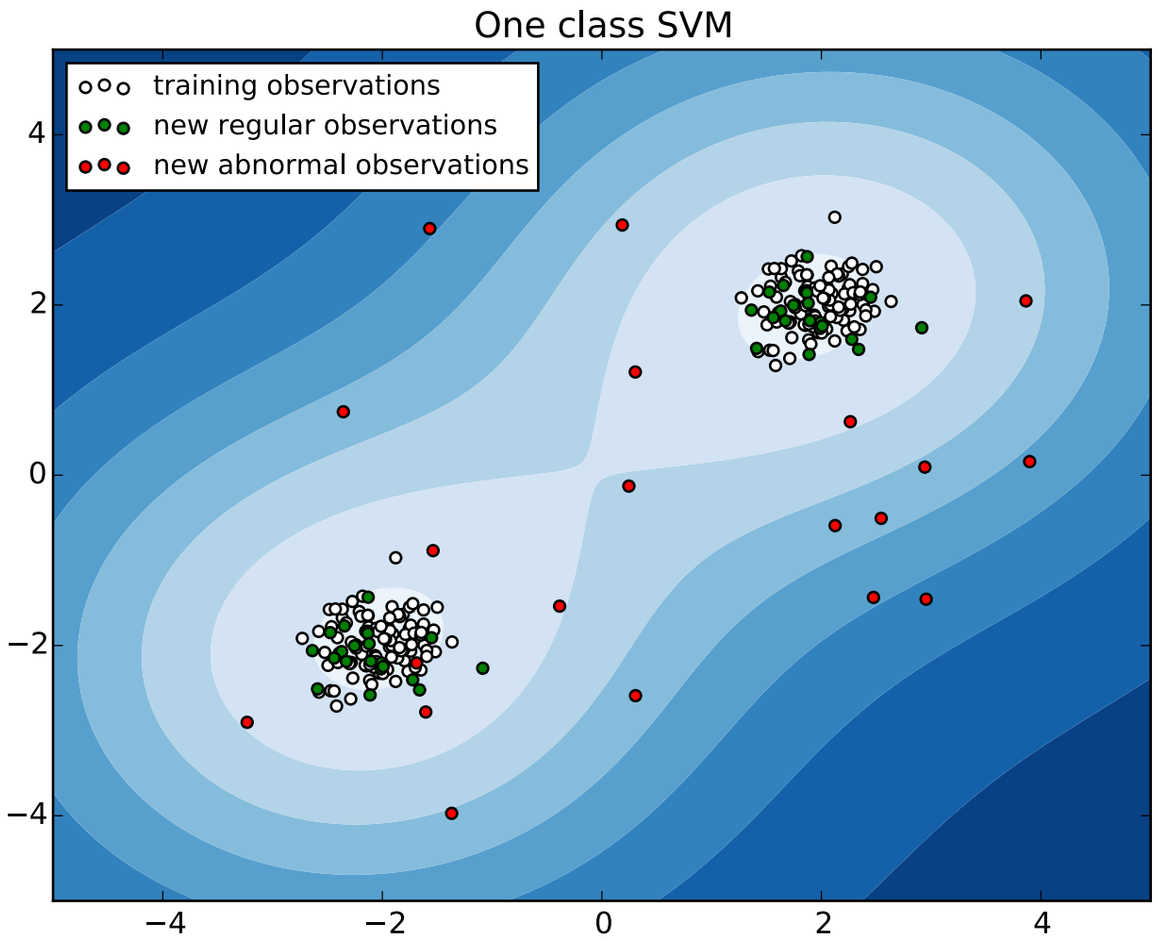

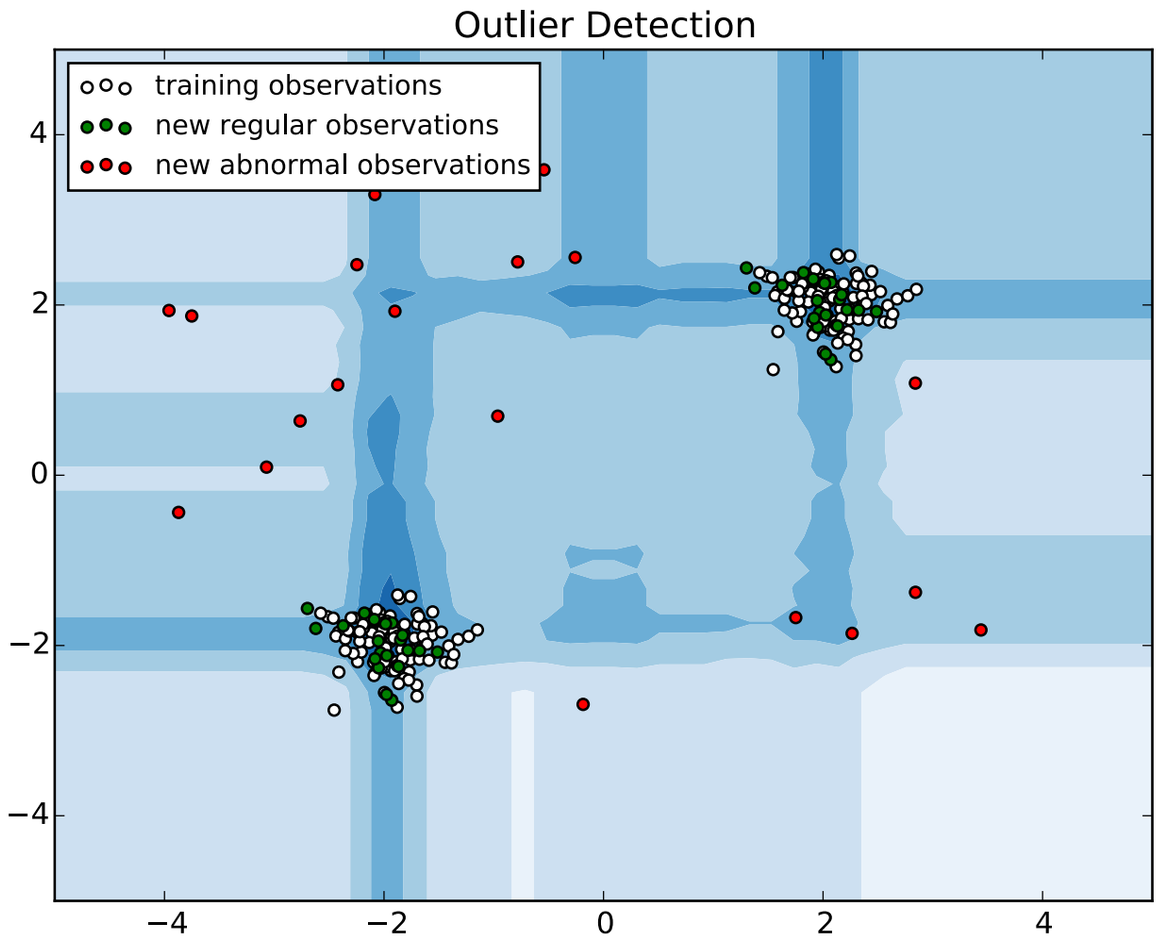

http://scikit-learn.org/stable/modules/generated/sklearn.ensemble.IsolationForest.html

F.T. Liu, Kai Ming Ting, and Zhi-Hua Zhou. Isolation forest. In Data Mining, 2008. ICDM '08. Eighth IEEE International Conference on, pages 413--422, Dec 2008.

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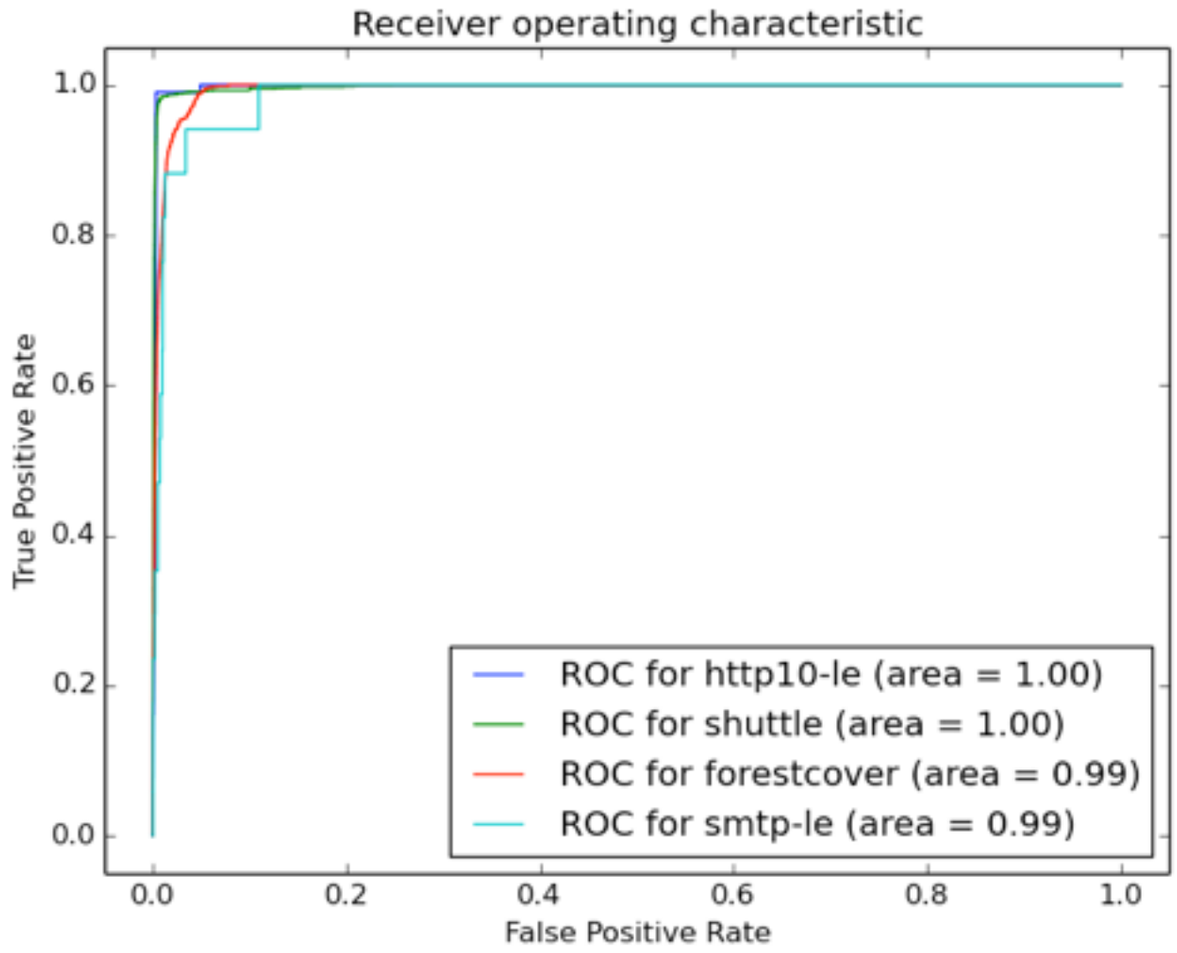

Result on
KDD 99 dataset

http://scikit-learn.org/stable/modules/generated/sklearn.ensemble.IsolationForest.html

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How to apply?

- Process:
  - Software project proposes eventually a topic. List from 2015:
    - https://github.com/paris-saclay-cds/open-software-initiative/wiki/Projects
  - Student applies by writing a project proposal of 2 pages with a roadmap
  - Proposal is refined by iterating between mentor and student

Coding sprints

MNE (http://martinos.org/mne) and NiLearn (http://nilearn.github.io/)

1 week sprint in June 2014 at Telecom ParisTech
15 attendees (from Saclay, UK, Finland, Austria, Germany, USA)

CONCLUSIONS

- OSI:
  - offers great training for students (team development, collaborative work)
  - offers visibility for the students !
  - teaches students how to write code that others can read so good code !
  - makes students discover a new scientific field