fatiando a terra

Construindo uma base para ensino e pesquisa de geofísica

LEONARDO UIEDA

leouieda.com

histórico

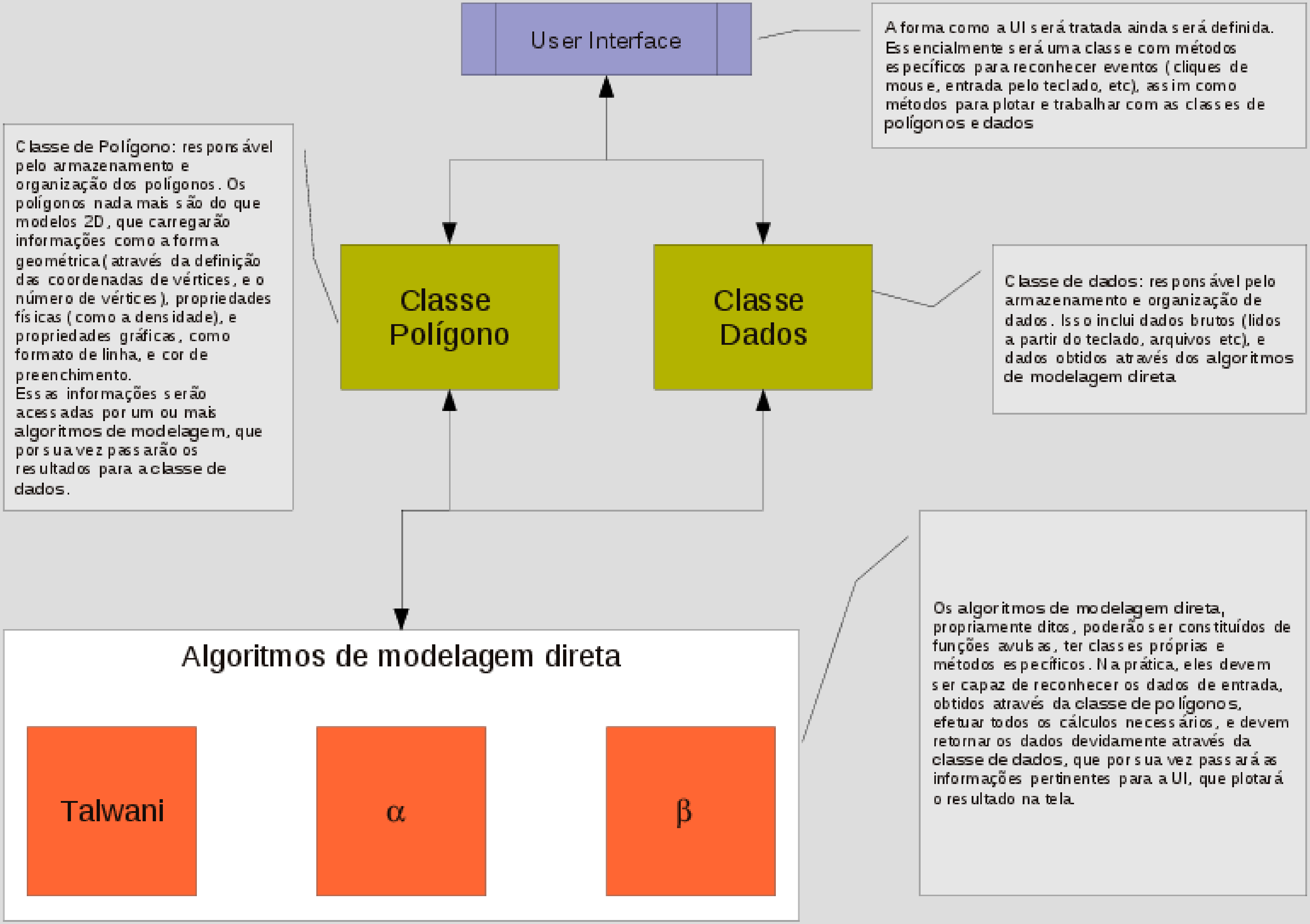
2004 — 2009


IAG
graduação em geofísica

~2009 - projeto

modelagem direta

grav-mag


User Interface
A forma como a UI será tratada ainda será definida. Essencialmente será uma classe com métodos específicos para reconhecer eventos (cliques de mouse, entrada pelo teclado, etc), assim como métodos para plotar e trabalhar com as classes de polígonos e dados
Classe de Polígono: responsável pelo armazenamento e organização dos polígonos. Os polígonos nada mais são do que modelos 2D, que carregarão informações como a forma geométrica (através da definição das coordenadas de vértices, e o número de vértices), propriedades físicas (como a densidade), e propriedades gráficas, como formato de linha, e cor de preenchimento.
Essas informações serão acessadas por um ou mais algoritmos de modelagem, que por sua vez passarão os resultados para a classe de dados.
Classe Polígono
Classe Dados
Classe de dados: responsável pelo armazenamento e organização de dados. Isso inclui dados brutos (lidos a partir do teclado, arquivos etc), e dados obtidos através dos algoritmos de modelagem direta
Algoritmos de modelagem direta
Talwani
α
β
Os algoritmos de modelagem direta, propriamente ditos, poderão ser constituídos de funções avulsas, ter classes próprias e métodos específicos. Na prática, eles devem ser capaz de reconhecer os dados de entrada, obtidos através da classe de polígonos, efetuar todos os cálculos necessários, e devem retornar os dados devidamente através da classe de dados, que por sua vez passará as informações pertinentes para a UI, que plotará o resultado na tela.

2010

mestrado

observatório nacional

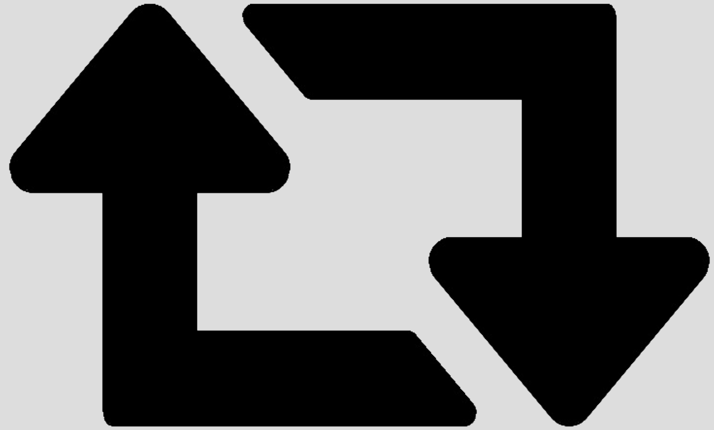
credit: [Leandro Ciuffo]

juntar código

matérias (inversão)

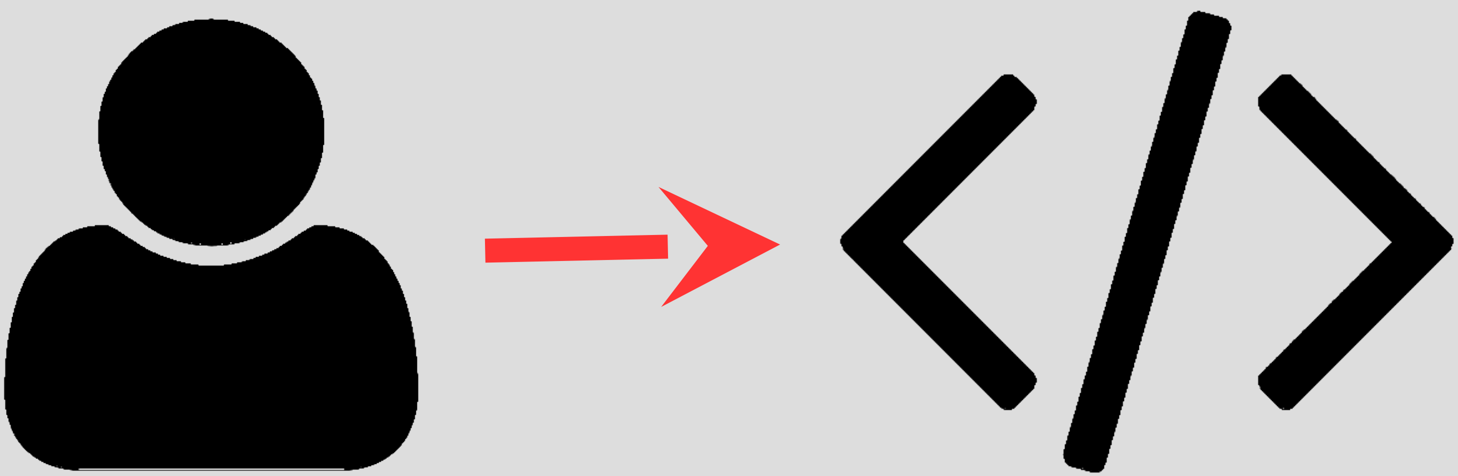
dissertação, extra

reutilizar



muita

re-implementação

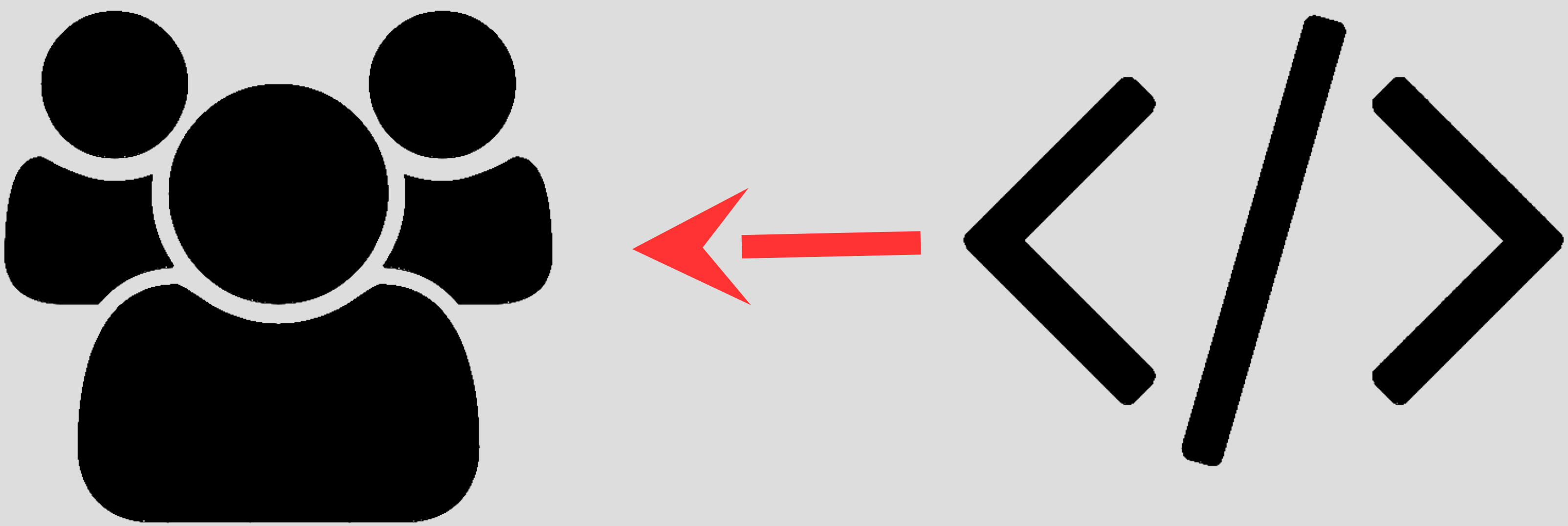


repetição

leva a erros

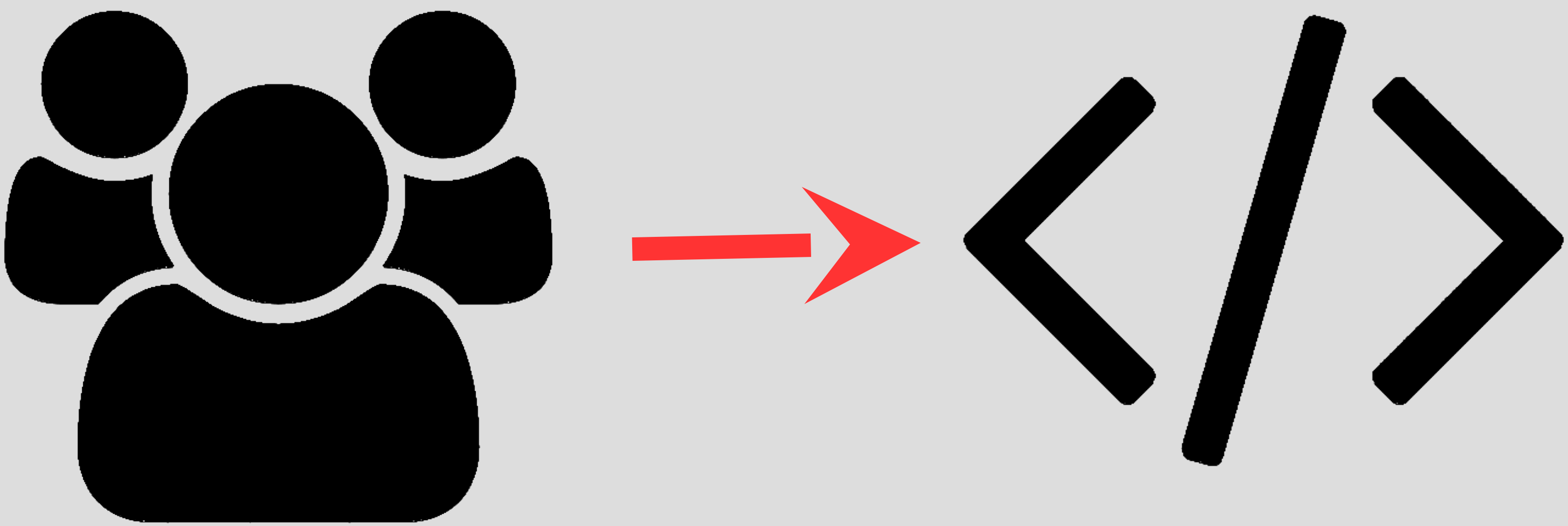
1 código

++ usuários



1 código

++ programadores



biblioteca

(funções, classes, etc)

python™

fácil de aprender
rápido de implementar

github.com

GitHub, Inc. (US) https://github.com/fatiando/fatiando/tree/928515b0fcfdccecbc4f661ed2469390ef43ec1d

tree: 928515b0fc

fatiando / +

Restructured the repos. Made fatiando python package with directmods,… …

```
… math, utils and geoinv. Includes direct models for prism gravity, sclimate signal from heat well
log, and simple cartesian tomography. Geoinv has the inversion program for the single perturbation
climate signal, and simple tomography (including using an image as a model).

--HG--
extra : convert_revision : svn%3A2c9857fa-f4c4-11dd-ada4-5153b8187bf2/trunk%4037
```

leouieda authored on 30 Apr 2010 latest commit 928515b0fc

c	Restructured the repos. Made fatiando python package with directmods,…	5 years ago
fatiando	Restructured the repos. Made fatiando python package with directmods,…	5 years ago
old	Moved the old src of the project to trunk/old. Don't think it'll be u…	5 years ago
SConstruct	Restructured the repos. Made fatiando python package with directmods,…	5 years ago
test.py	Restructured the repos. Made fatiando python package with directmods,…	5 years ago

github.com

GitHub, Inc. (US) https://github.com/fatiando/fatiando/tree/928515b0fcfdccecbc4f661ed2469390ef43ec1d

tree: **928515b0fc** fatiando / +

Restructured the repos. Made fatiando python package with directmods,… …

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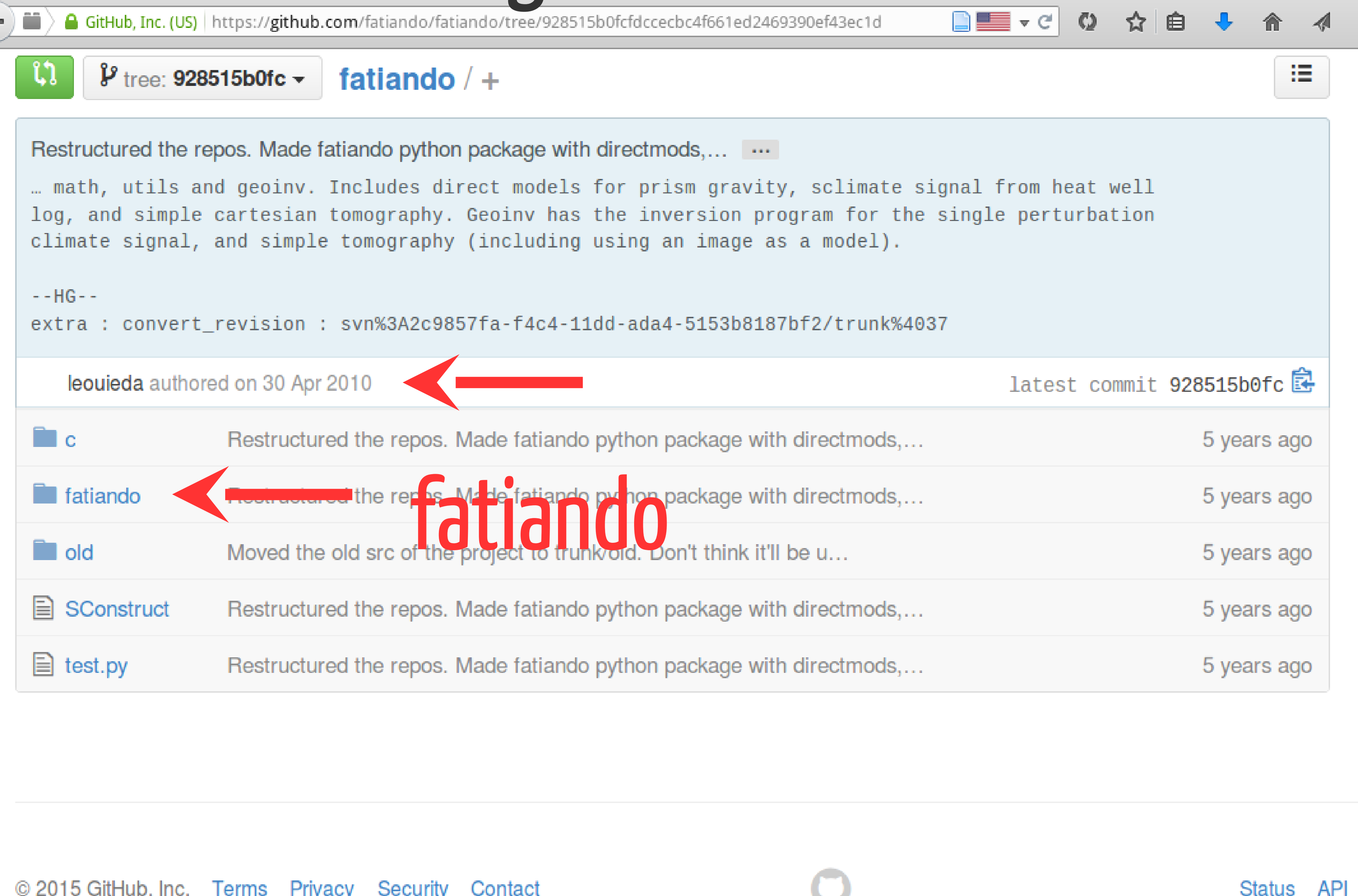
github.com


GitHub, Inc. (US) https://github.com/fatiando/fatiando/tree/928515b0fcfdccecbc4f661ed2469390ef43ec1d
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fatiando / +
Restructured the repos. Made fatiando python package with directmods,… …
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--HG--
extra : convert_revision : svn%3A2c9857fa-f4c4-11dd-ada4-5153b8187bf2/trunk%4037
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c Restructured the repos. Made fatiando python package with directmods,… 5 years ago
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test.py Restructured the repos. Made fatiando python package with directmods,… 5 years ago
fatiando
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Status API

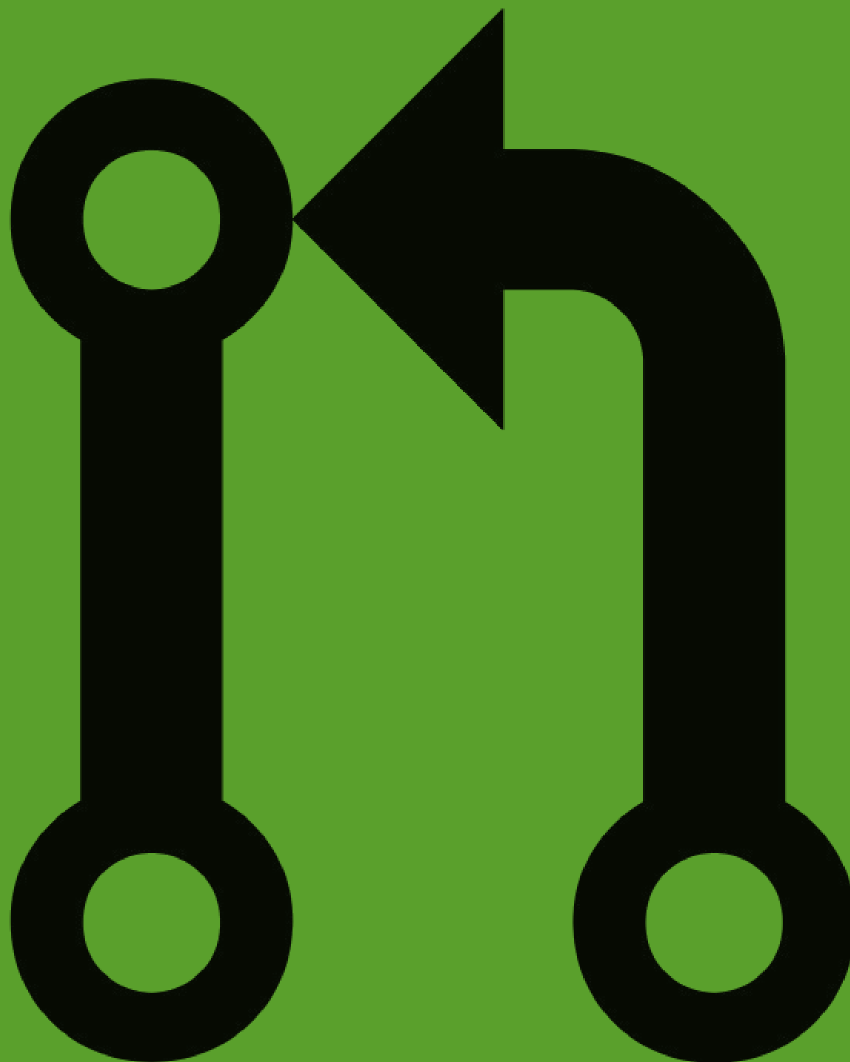
controle de versão (VCS)

ctrl+z

∞

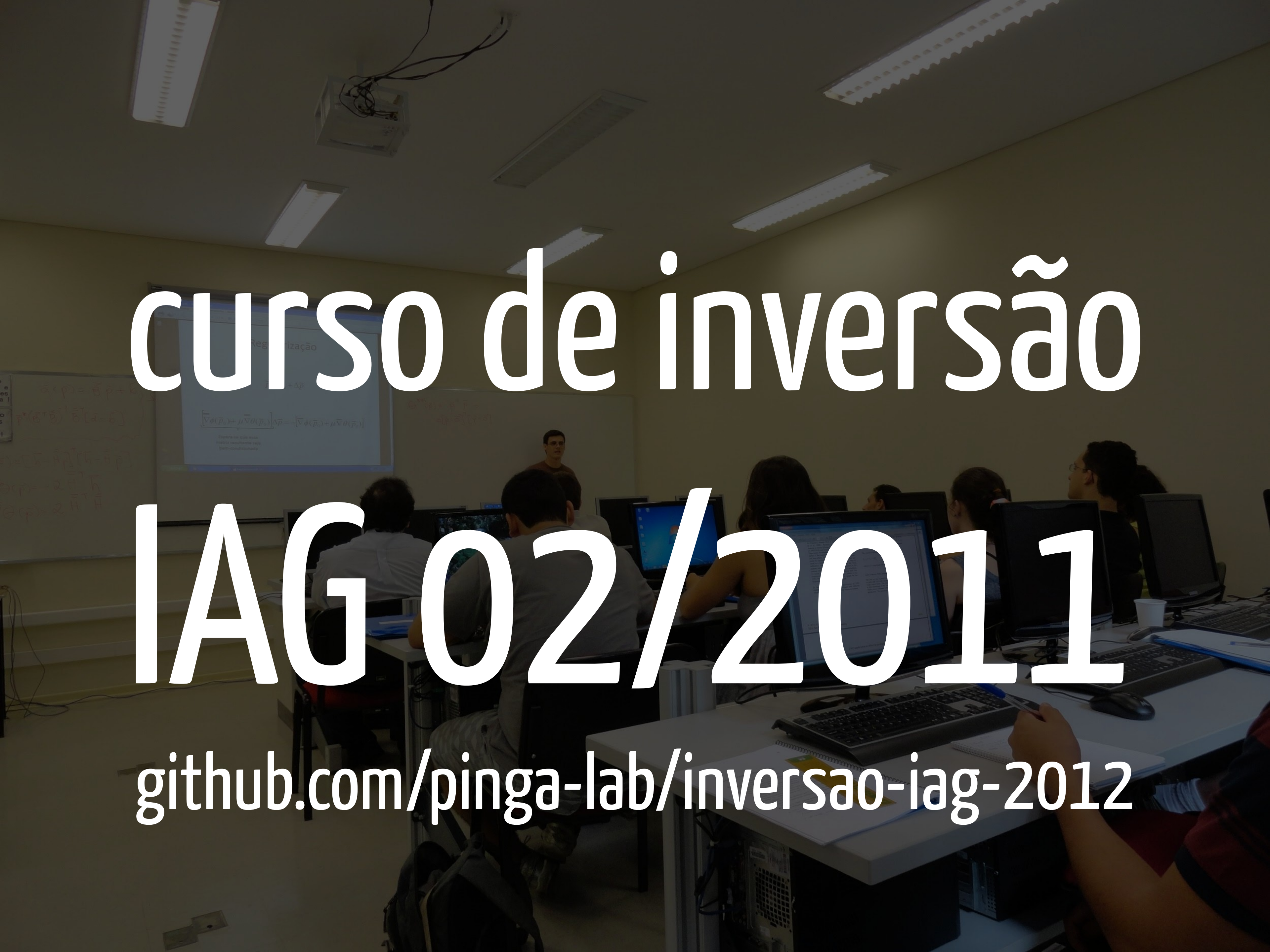
git/mercurial

software-carpentry.org



v0.0.1

(pré-beta-dev-testing)



curso de inversão

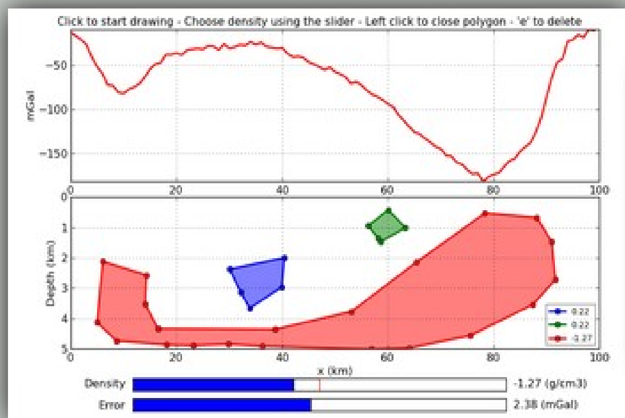
IAG 02/2011

github.com/pinga-lab/inversao-iag-2012

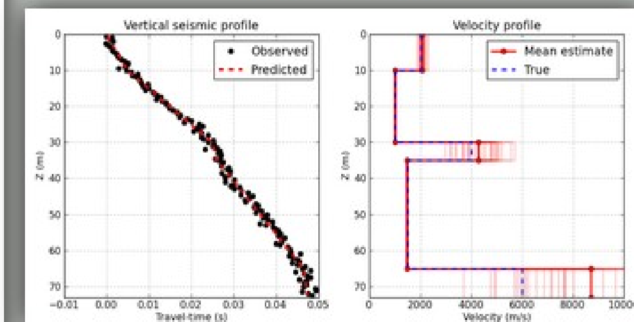
Example Gallery

Some of the functionality already implemented:

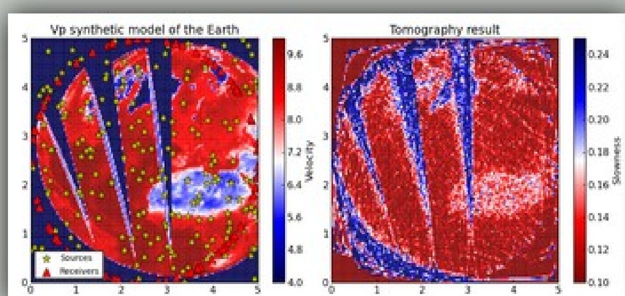
Moulder - 2D gravimetric direct modeling



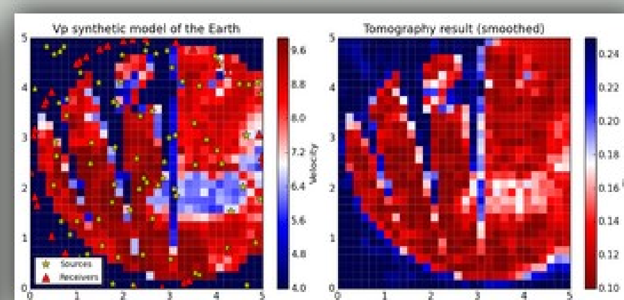
Inversion of synthetic vertical seismic profile data



Straight-ray travel-time tomography of large models using sparse linear algebra



Straight-ray travel-time tomography



Simple inversion for the relief of tha 2D triangular basin

... and also a trapezoidal basin

⏭ 2016

fatiando 0.4 Installing Documentation Cookbook Developer Guide

Search

fatiando a terra

An open-source Python library for modeling and inversion in geophysics.

Our goal is provide a comprehensive and extensible framework for geophysical data analysis and the development of new methodologies.

Research: Fatiando allows you to write Python scripts to perform your data analysis and generate figures in a reproducible way.

Development: Designed for extensibility, Fatiando offers tools for users to build upon the existing infrastructure and develop new inversion methods. We take care of the boilerplate.

Teaching: Fatiando can be combined with the Jupyter notebook to make rich, interactive documents. Great for teaching fundamental concepts of geophysics.

Overview

Gravity and magnetics

Modeling, inversion, and processing for potential field methods.

3D forward modeling with prisms, polygonal prisms, spheres, and tesseroids. Handles the potential, acceleration, gradient tensor, magnetic induction, total field magnetic anomaly.

Seismology and Seismics

Simple modeling functions for

Toy problems for: Cartesian st
estimation. Experimental finite

fatiando.org

fatiando 0.4 Installing Documentation Cookbook Developer Guide

Search

fatiando a terra

An open-source Python library for modeling and inversion in geophysics

Our goal is provide ... development of new

~950 downloads/mês

7 citações

Research: Fatiando all... be combined with the scripts to perform your ... rich, interactive generate figures in a rep... ching fundamental

Overview

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Seismology and Seismics

Simple modeling functions for

Toy problems for: Cartesian st... estimation. Experimental finite

fatiando.org

NATURE | LETTER

日本語要約

Upper-plate controls on co-seismic slip in the 2011 magnitude 9.0 Tohoku-oki earthquake

Dan Bassett, David T. Sandwell, Yuri Fialko & Anthony B. Watts

Affiliations | Contributions | Corresponding author

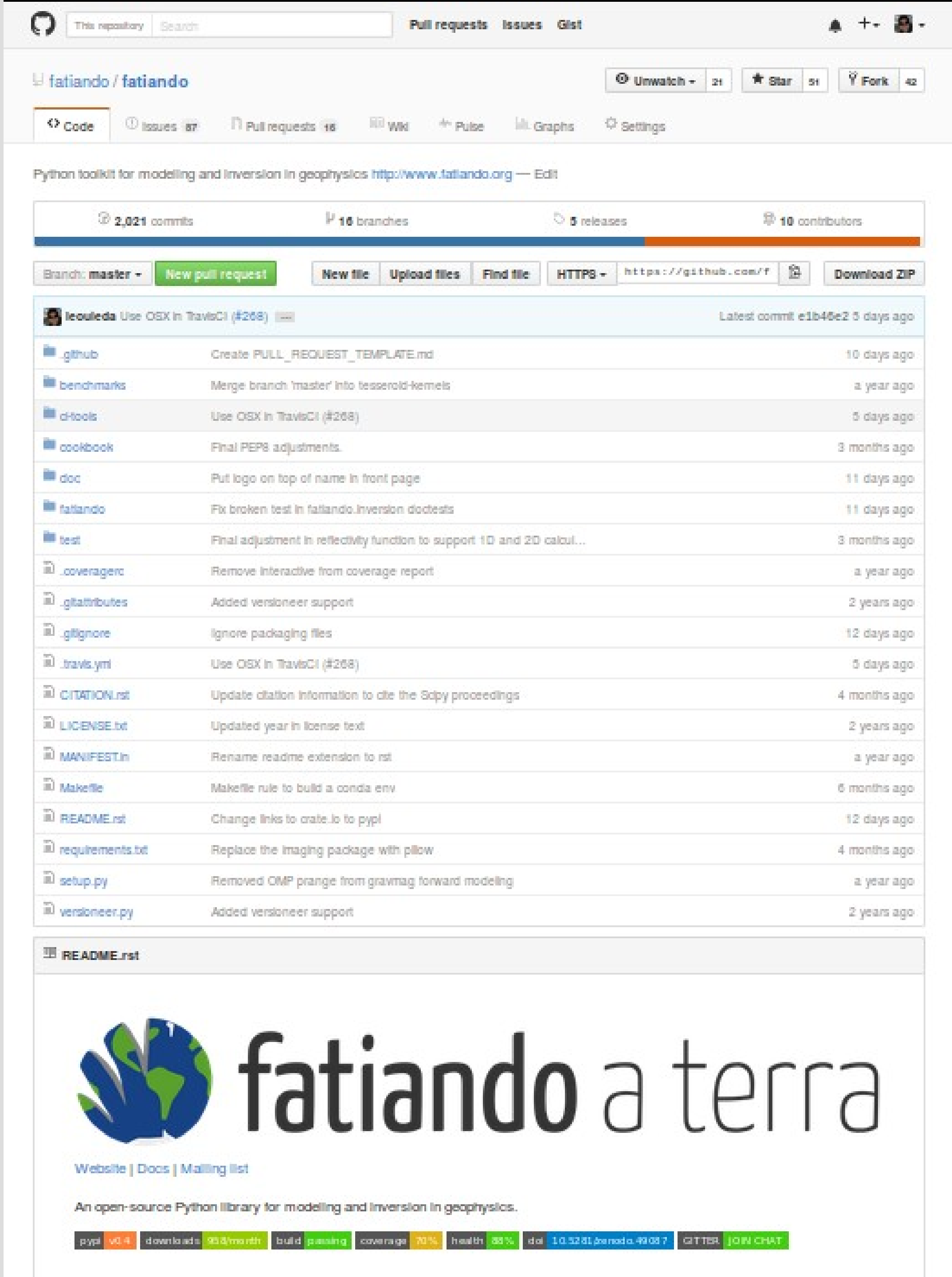
Nature **531**, 92–96 (03 March 2016) | doi:10.1038/nature16945
Received 26 June 2015 | Accepted 11 December 2015 | Published online 02 March 2016

The March 2011 Tohoku-oki earthquake was only the second giant (moment magnitude $M_w \geq 9.0$) earthquake to occur in the last 50 years and is the most recent to be recorded using modern geophysical techniques. Available data place high-resolution constraints on the kinematics of earthquake rupture[1], which have challenged prior knowledge about how much a fault can slip in a

Editor's summary

Dan Bassett *et al.* use residual gravity anomalies to characteri
structures in the region of the T
megathrust earthquake of Marc
point to a …

código
github.com



Implement tilt filter #261

Open **mtb-za** wants to merge 7 commits into `fatiando:master` from `mtb-za:tilt_filter`

Conversation 25 Commits 7 Files changed 3

mtb-za commented 25 days ago Fatiando a Terra member

This will create a filter to determine the tilt of a potential field, as developed by Miller and Singh (1994).

I could use some suggestions on how to create a sensible test for this.

This is the first of a few potential field filters that I want to implement.

Checklist:

- [ ] Make tests for new code
- [x] Create/update docstrings
- [x] Include relevant equations and citations in docstrings
- [ ] Code follows PEP8 style conventions
- [ ] Code and docs have been spellchecked
- [x] Include new dependencies in docs, requirements.txt, README, and .travis.yml
- [ ] Documentation builds properly
- [ ] All tests pass

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Pad arrays #239

Open **drandykass** wants to merge 22 commits into `fatiando:master` from `drandykass:pad_arrays`

Conversation 67 Commits 22 Files changed 5

drandykass commented on Dec 2, 2015 Fatiando a Terra member

This is an incomplete pull request for the addition of array padding and unpadding routines to gridder.

Some talking points:
--The padding function expects the array to be of the same dimension as intended--that is, no 'flattened' arrays.
--The unpadding function currently is set up to return unpadded coordinate vectors. However, I think that may be completely unnecessary.
--Still working on cleaning up the docs, the actual code, and need to create the test functions.

Update 03-12-2015 (**@leouieda**): Added the checklist below.

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Conversation 67 · Commits 22 · Files changed 5

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Radial Average of Power Spectrum #230

Open **santis19** wants to merge 2 commits into `fatiando:master` from `santis19:fft-radial-average`

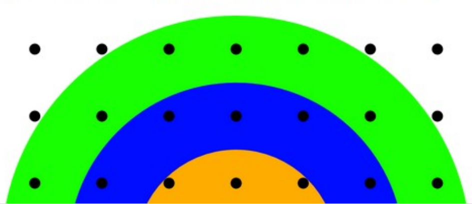
Conversation 7 · Commits 2 · Files changed 2

santis19 commented on Aug 11, 2015

I've made a first try to implement the Radial Average of a Power Spectrum (or any real fft function) proposed in #224.

It needs a Power Spectrum in a square grid with odd number of points per axis in order to make sure that there is a grid point in the zero wave number.

The radial average is made by concentric rings using a grid of indexes in order to avoid troubles with frequencies. The rings have an inner radius equal to i - 1/2 and outer radius i+1/2, where i is an integer index ranging from 0 to half the grid's number of points per axis. The first ring (i=0) is a circle containing only the zero frecuency point. The next is a ring surrounding this circle, and so on.



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Conversation 25 | Commits 7 | Files changed 3

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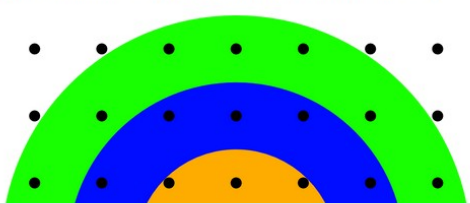

Convolutional model for seismic data (using a depth mode #190

Merged **leouieda** merged 65 commits into `fatiando:master` from `victortxa:convolutional_model` on Feb 2

Conversation 77 | Commits 65 | Files changed 9

victortxa commented on Mar 30, 2015 — Fatiando a Terra member

Generate a convolutional model from a depth geological model (Vp; density optional). It's useful to put direct in geology instead of a model in time, avoiding lose the main information. It can be helpful in situations when it's boring to convert from depth to time.

Checklist:

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fatiando

diversos métodos
+
inversão
+
visualização

biblioteca

pacotes >

módulos >

funções/classes

fatiando/

gravmag/	gridder
seismic/	mesher
inversion/	utils
vis/	constants
	datasets
pacotes	módulos

tour

Jupyter notebook

jupyter.org

aulas

exploração

interatividade

credit: AVTC Series

modelos
dados sintéticos
dados reais

Jupyter

+

fatiando

exemplo 1

anomalia magnética

exemplo 2

gravimetria e tectônica

pesquisa

grupo de pesquisa

PINGA

Grupo de problemas inversos em geofísica

pinga-lab.org

artigos novos

método no fatiando

testes e aplicações

em notebooks

PINGAlab About Research People Papers

Papers >

Estimation of the total magnetization direction of approximately spherical bodies

by Oliveira Jr, V. C., D. P. Sales, V. C. F. Barbosa, and L. Uieda (2015)

This article is unpublished and is currently undergoing peer-review.

Info

Open-Access

Repository: pinga-lab/Total-magnetization-of-spherical-bodies

Journal: Nonlinear Processes in Geophysics

DOI: 10.5194/npgd-1-1465-2014

Supplement: 10.5281/zenodo.16191

Article Level Metrics

Abstract

We have developed a fast total-field anomaly inversion to estimate the magnetization direction of multiple sources with approximately spherical shape and known centres. Our method can be applied to interpret multiple sources with different magnetization directions. It neither requires the prior computation of any transformation like reduction to the pole nor the use of regularly spaced data on a horizontal grid. The method contains flexibility to be implemented as [illegible]linear or [illegible]n-linear inverse problem, which results, respectively, in a least-squares or robust estima[illegible] the [illegible] of the [illegible] vector of the sources. [illegible] data [illegible] interfering anomalies and errors in the location of the sources' cen[illegible]e. Be[illegible] the feasibility [illegible] the upward continuation to interpret non-spherical sources [illegible] Alkaline Province (GAP), Brazil, show the good performance of our method in estimating ge[illegible] meaningful magnetization directions. The results obtained for a region of the GAP, near from the alkaline complex of Diorama, suggest the presence of non-outcropping sources marked by strong remanent magnetization with inclination and declination close to -70.35° and -19.81°, respectively. This estimated magnetization direction leads to predominantly positive reduced-to-the-pole anomalies, even for other region of the GAP, in the alkaline complex of Montes Claros de Goiás. These results show that the non-outcropping sources near from the alkaline complex of Diorama have almost the same magnetization direction of that ones in the alkaline complex of Montes Claros de Goiás, strongly suggesting that these sources have emplaced the crust almost within the same geological time interval.

código

Review

Total magnetization estimation methods (`fatiando.gravmag.magdir`)

Estimation of the total magnetization vector of homogeneous bodies.

It estimates parameters related to the magnetization vector of homogeneous bodies.

Algorithms

- `DipoleMagDir`: This class estimates the Cartesian components of the magnetization vector of homogeneous dipolar bodies with known center. The estimated magnetization vector is converted to dipole moment, inclination (positive down) and declination (with respect to x, North).

---

class `fatiando.gravmag.magdir.`**`DipoleMagDir`**(*x*, *y*, *z*, *data*, *inc*, *dec*, *points*) [source]

Bases: `fatiando.inversion.base.Misfit`

Estimate the magnetization vector of a set of dipoles from magnetic total field anomaly.

By using the well-known first-order approximation of the total field anomaly (Blakely, 1996, p. 179) produced by a set of dipoles, the estimation of the Cartesian components of the magnetization vectors is formulated as linear inverse problem. After estimating the magnetization vectors, they are converted to dipole moment, inclination (positive down) and declination (with respect to x, North).

Reference

Blakely, R. (1996), Potential theory in gravity and magnetic applications. CU

Note

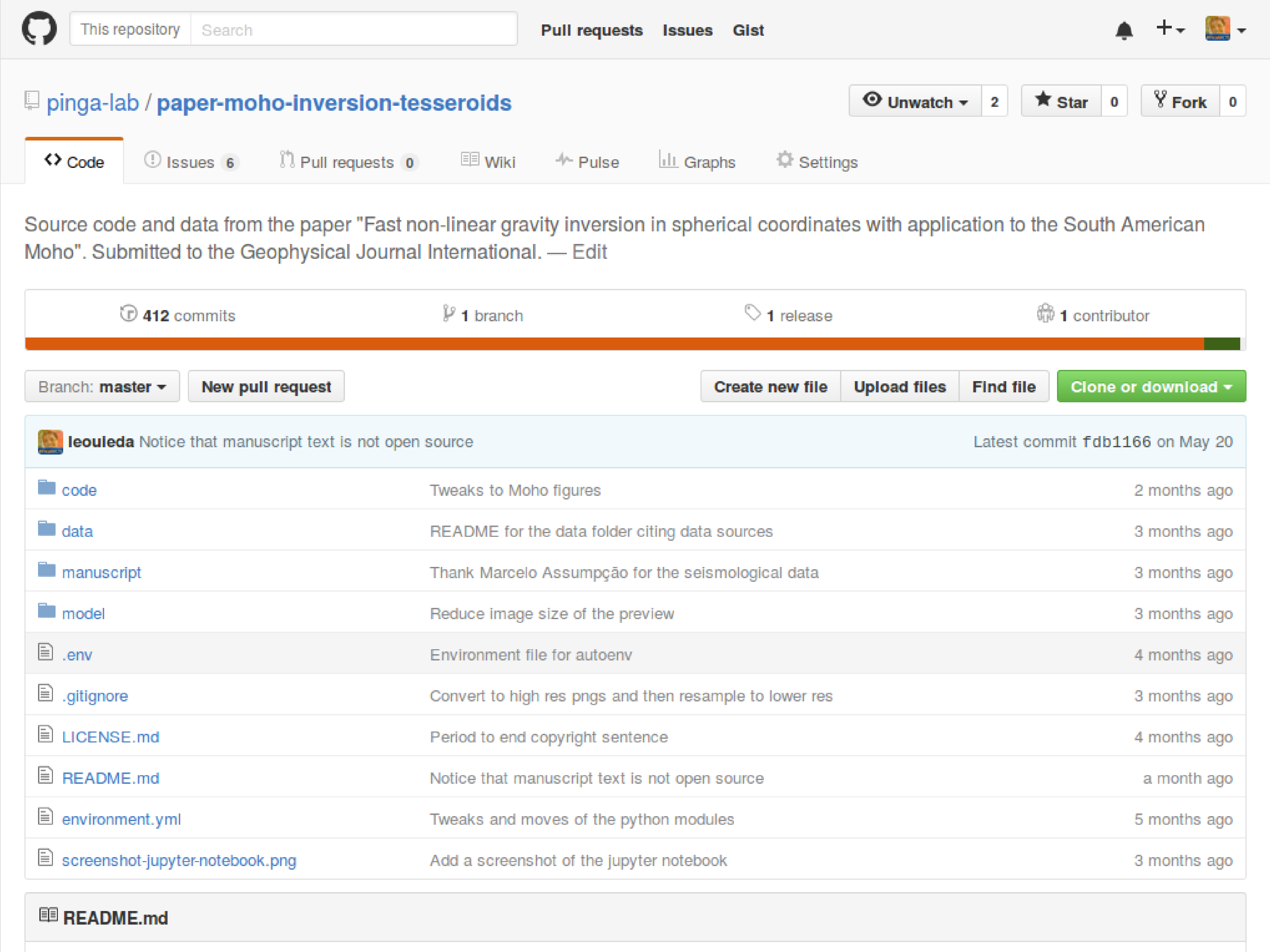
Assumes x = North, y = East, z = Down.

implementação

Parameters:

- **x, y, z** : ***1d-arrays***

  The x, y, z coordinates of each data point.


This repository
Search
Pull requests
Issues
Gist
pinga-lab / paper-moho-inversion-tesseroids
Unwatch 2
Star 0
Fork 0
Code
Issues 6
Pull requests 0
Wiki
Pulse
Graphs
Settings
Source code and data from the paper "Fast non-linear gravity inversion in spherical coordinates with application to the South American Moho". Submitted to the Geophysical Journal International. — Edit
412 commits
1 branch
1 release
1 contributor
Branch: master
New pull request
Create new file
Upload files
Find file
Clone or download
leouieda Notice that manuscript text is not open source
Latest commit fdb1166 on May 20
code
Tweaks to Moho figures
2 months ago
data
README for the data folder citing data sources
3 months ago
manuscript
Thank Marcelo Assumpção for the seismological data
3 months ago
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README.md

Test on synthetic data generated from the CRUST1.0 model

This notebook runs a more complex test using synthetic data generated from the CRUST1.0 model. The area will be restricted to South America and the model will use a homogeneous density contrast along the anomalous Moho. Thus, we'll only the Moho depth information from CRUST1.0.

The test is meant to simulate what we expect from the real data application (south-america-moho.ipynb). We will assume that the reference Moho depth and density contrast are unknown. Both of these hyperparameters, along with the regularization parameter, will be determined through cross-validation. For the reference depth and density contrast, we'll use seismic point data to score solutions. These data will also be simulated using the CRUST1.0 model.

Package imports

Load the necessary libraries to run the inversion and make graphs.

In [1]:

```
# Insert the plots into the notebook
%matplotlib inline
```

Load the standard scientific Python stack to numerical analysis and plotting.

In [2]:

```
from __future__ import division, print_function
import multiprocessing
import zipfile
import datetime
import cPickle as pickle
import itertools
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap
import seaborn  # Makes the default style of the plots nicer
```

```
/home/leo/bin/anaconda/envs/moho/lib/python2.7/site-packages/matplotlib/__init__.py:872: UserWarning: axes.col
  warnings.warn(self.msg_depr % (key, alt_key))
```

The computations generate a lot of run-time warnings. They aren't anything to be concerned about so disable them to avoid clutter.

In [3]:

```
import warnings
warnings.simplefilter('ignore')
```

Make the figures for the paper

This notebook generates the figures used in the paper. **No results are calculated here**. We'll only load the results from files produced by other notebooks. All figures will be saved in EPS format to the `manuscript/figures` folder.

Package imports

In [1]:
```
# Insert the plots into the notebook
%matplotlib inline
```

In [2]:
```
from __future__ import division
import cPickle as pickle
import zipfile
import numpy as np
import matplotlib.pyplot as plt
from matplotlib import ticker
from mpl_toolkits.basemap import Basemap
from mpl_toolkits.axes_grid1 import AxesGrid, make_axes_locatable
import seaborn  # Makes the default style of the plots nicer
```

```
/home/leo/bin/anaconda/envs/moho/lib/python2.7/site-packages/matplotlib/__init__.py:872: UserWarning: axes.col
  warnings.warn(self.msg_depr % (key, alt_key))
```

In [3]:
```
from datasets import fetch_crust1, load_icgem_gdf, down_sample, fetch_assumpcao_moho_points
from mohoinv import predict_seismic
```

Set the global plot style parameters.

In [4]:
```
seaborn.set_context('paper')
config = dict(fontsize=6)
plt.rcParams['font.size'] = config['fontsize']
plt.rcParams['axes.labelsize'] = config['fontsize']
plt.rcParams['xtick.labelsize'] = config['fontsize']
plt.rcParams['ytick.labelsize'] = config['fontsize']
plt.rcParams['legend.fontsize'] = config['fontsize']
plt.rcParams['xtick.major.pad'] = 3
plt.rcParams['ytick.major.pad'] = 3
```

Reproducing the results

You can download a copy of all the files in this repository by cloning the git repository:

```
git clone https://github.com/pinga-lab/paper-moho-inversion-tesseroids.git
```

or click here to download a zip archive.

Setting up your environment

You'll need a working Python **2.7** environment with all the standard scientific packages installed (numpy, scipy, matplotlib, etc). The easiest (and recommended) way to get this is to download and install the Anaconda Python distribution. Make sure you get the **Python 2.7** version. All the packages that you'll need are specified in the `environmet.yml` file. You'll also need to install the latest development version of the Fatiando a Terra library.

Unzip the contents of this repository (if you've downloaded the zip file) and `cd` into the root of the repository. You can use `conda` package manager (included in Anaconda) to create a virtual environment with all the required packages installed (including Fatiando). Run the following command in the repository folder (where `environment.yml` is located):

```
conda env create
```

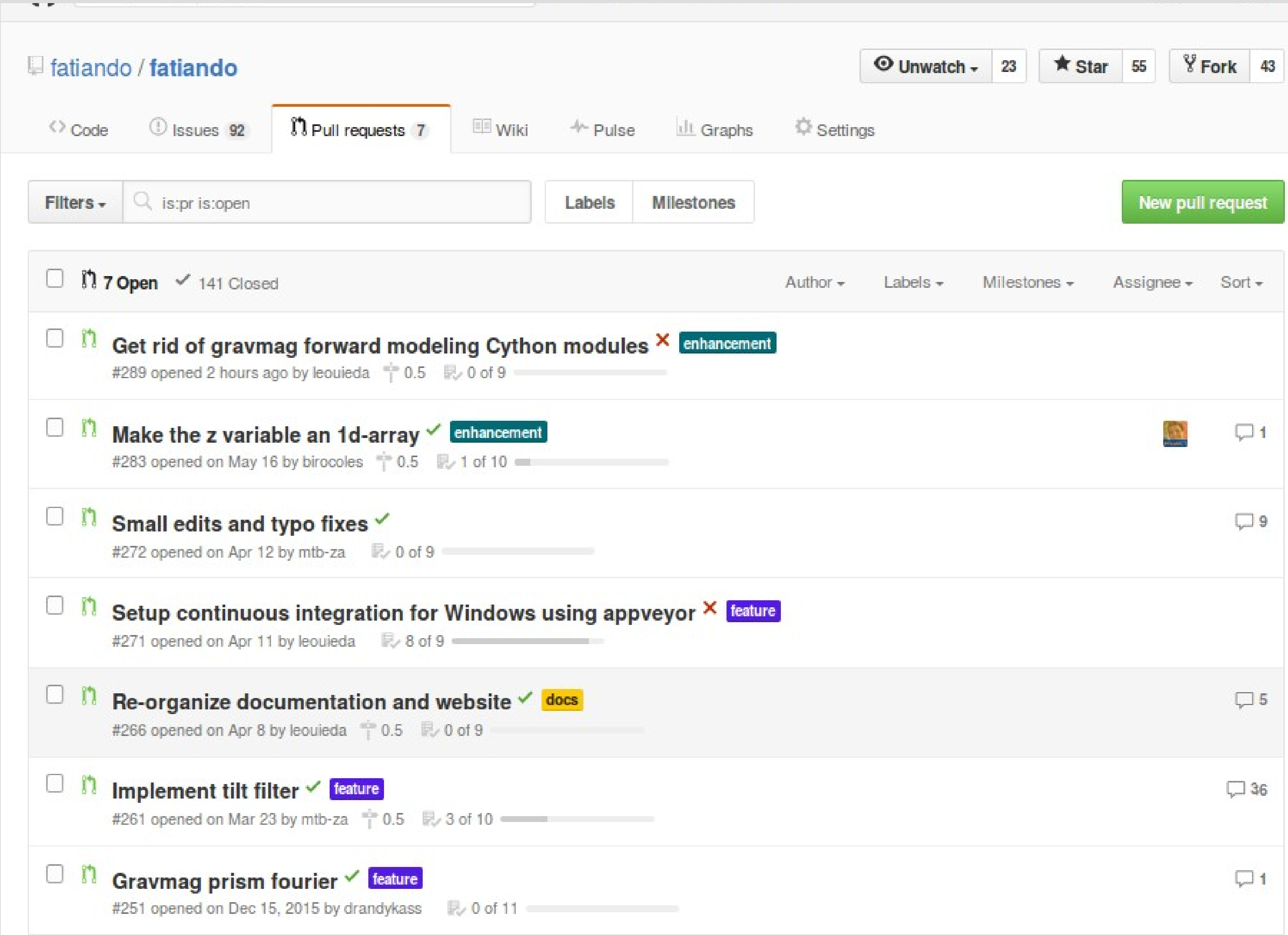
To activate the conda environment, run

```
source activate moho
```

or, if you're on Windows,

conclusão

Desenvolvimento contínuo



construir

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credit: [Greg Emmerich]

Informações

fatiando.org

pinga-lab.org