



GEOTUTORIAL SOFTWARE:

PENGENALAN SOFTWARE PYTHON



**Himpunan Mahasiswa Geofisika FMIPA
Universitas Tanjungpura**




Jumat, 31 Januari 2025

Ida Bagus Suananda Yogi

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**Dosen Universitas Lampung
2019 - Sekarang**

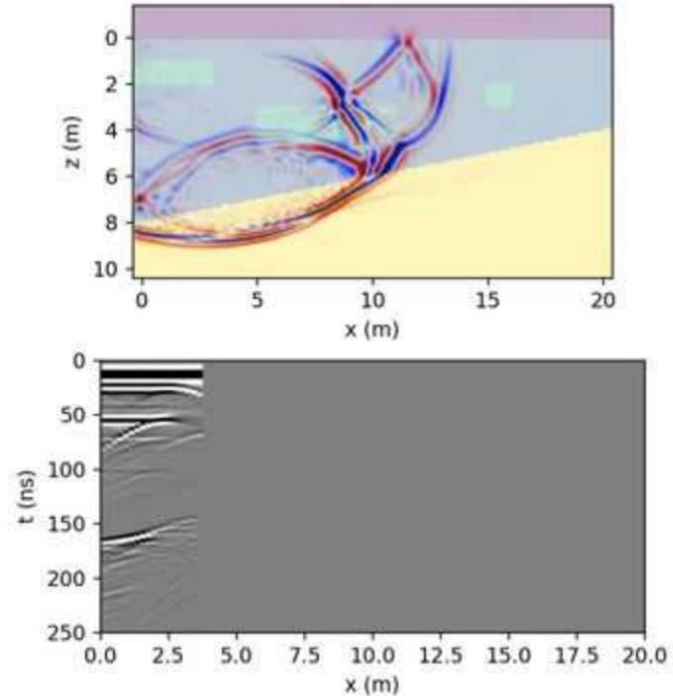
S-1	S-2	S3
Institut Teknologi Bandung ITB 	Institut Teknologi Bandung ITB 	Universiti Teknologi Petronas UTP 
Teknik Geofisika	Teknik Geofisika	Petroleum Geoscience
2012 – 2016	2016 – 2017	2023 – sekarang
Program Inversi <i>Time Domain</i> <i>Electromagnetic</i> Konfigurasi <i>Central Loop</i> Berdasar Pendekatan <i>Adaptive Born</i> <i>Forward Mapping</i> dan Algoritma Levenberg- Marquardt	Pemodelan Inversi Non-Linier 1D untuk Data Sintetik 3D TDEM pada Simulasi Pemantauan Injeksi Karbon Dioksida (CO2)	<i>Seismic and CSEM Joint Inversion</i> <i>Algorithm to Enhance</i> <i>Hydrocarbon Reservoir</i> <i>Characterization</i>
Fortran Matlab Python	Fortran Python	Fortran Python Machine Learning (Tensorflow)

Mengapa Belajar Python?

- Open source dan gratis
- Komunitas yang besar dan aktif
- Banyak library khusus untuk geofisika
- Skill yang sangat dicari di industri
- Machine learning standard

Contoh Penggunaan di Industri

- Pengolahan / simulasi data Geofisika
- Pemodelan geofisika
- Visualisasi data
- Machine learning untuk prediksi dan interpretasi data



Tools Dasar Python untuk Geofisika

Scientific Python:

- **NumPy**: Perhitungan numerik
- **Pandas**: Pengolahan data
- **Matplotlib**: Visualisasi
- **SciPy**: Komputasi saintifik
- **Tensorflow**: Machine Learning

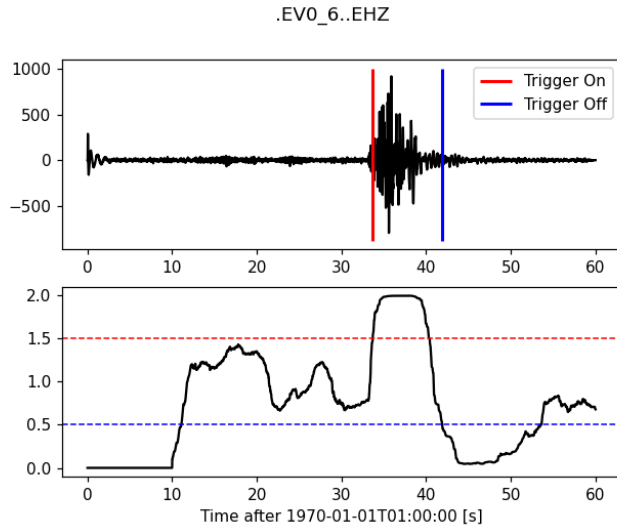
Library Khusus Geofisika

Tools Spesialis:

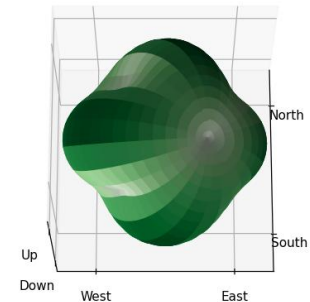
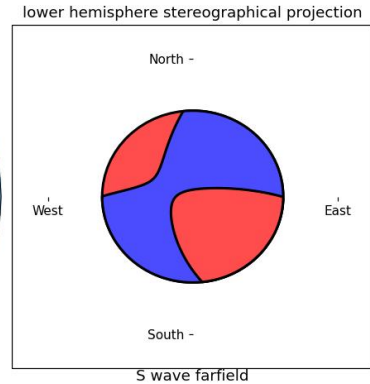
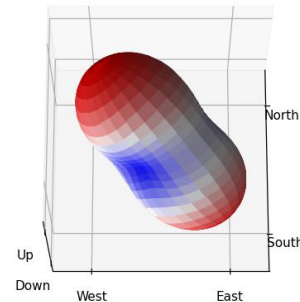
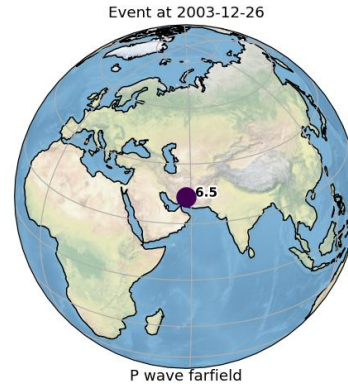
- **ObsPy**: Pengolahan data gempabumi
- **PyGIMLI**: Inversi geofisika
- **PyGMT**: Plotting peta dan data spasial
- **SimPEG**: Simulasi geofisika

Obspy

<https://docs.obspy.org/tutorial/index.html>

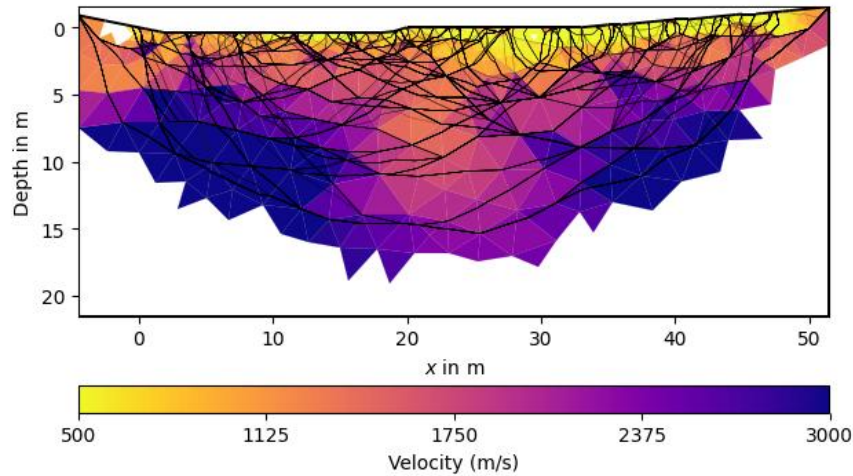


Pengolahan data Gempabumi

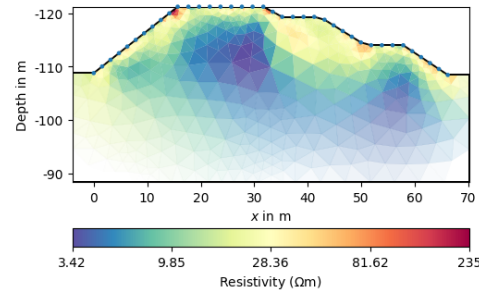


PyGIMLI

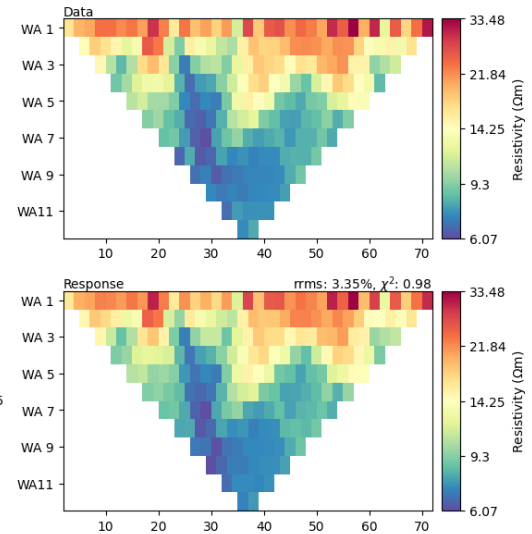
<https://www.pygimli.org/>



Tomografi seismik refraksi

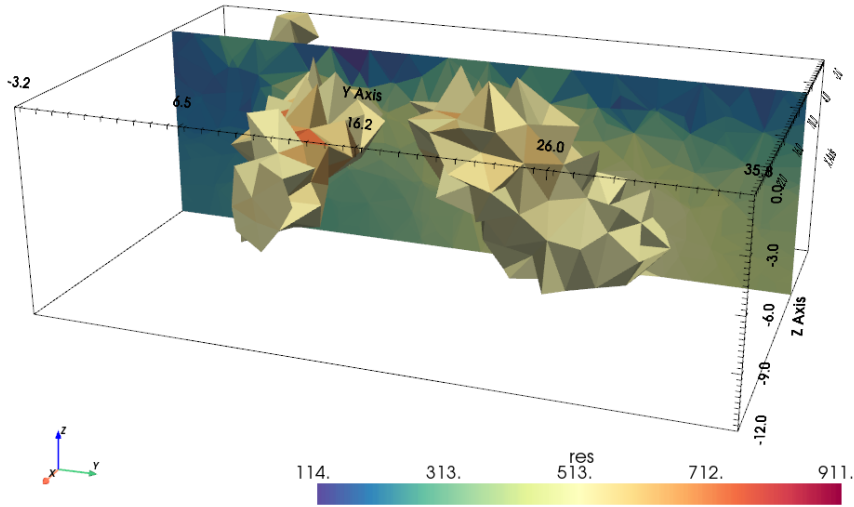


Inversi Geolistriik / Resistivitas 2D

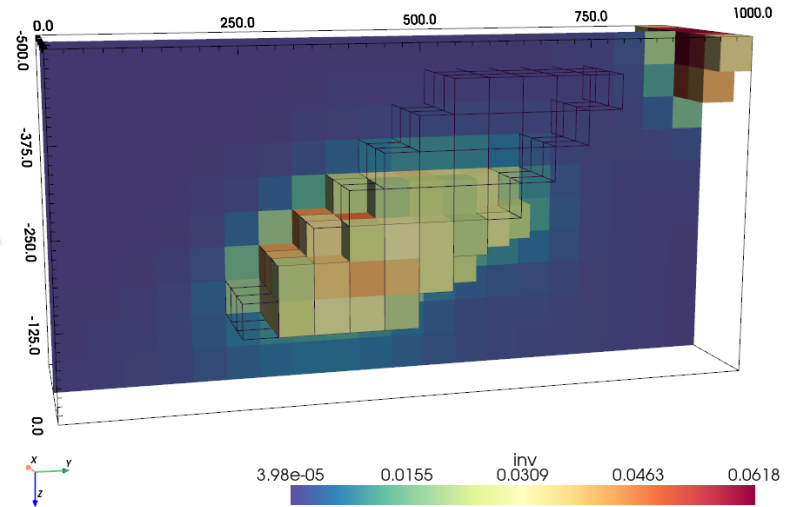


PyGIMLI

<https://www.pygimli.org/>



Inversi Geolistrik / Resistivitas 3D

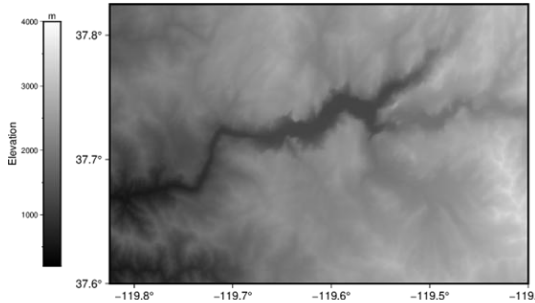


Inversi metode Gayaberat 3D

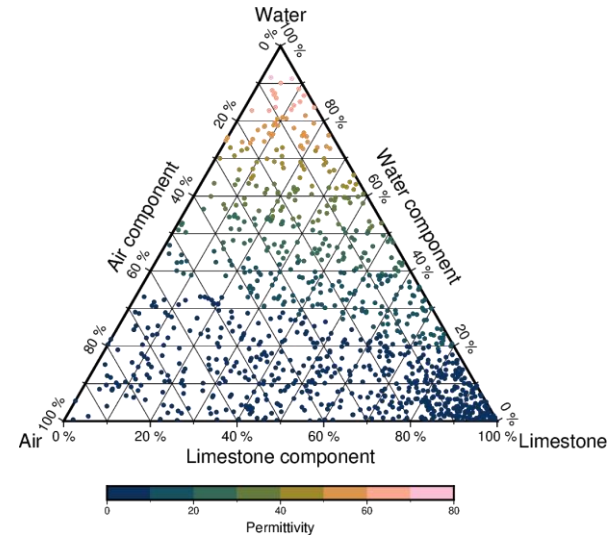
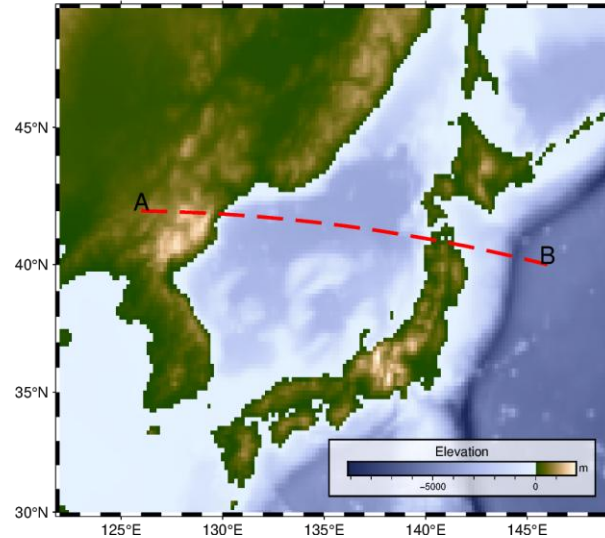
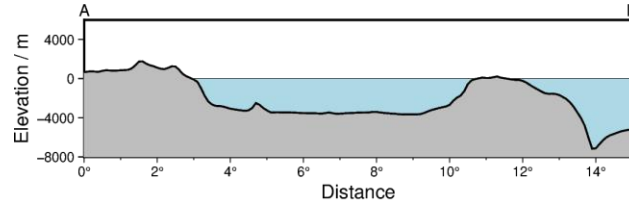
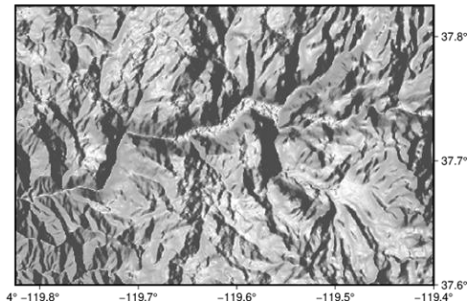
PyGMT

www.pygmt.org

Original Data Elevation Model




Hillshade Map



Visualisasi Saintifik

Publikasi kebumian dengan python

- <https://www.sciencedirect.com/search?qs=python&pub=Computers%20&%20Geosciences&cid=271720>

 ScienceDirect

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- ☐ Errata (1)

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Research article • Open access

SEISMIC, a Python-based code of the quantas package to calculate the phase and group acoustic velocities in crystals

Computers & Geosciences, June 2024

Gianfranco Ulian, Giovanni Valdrè

 View PDF

Research article • Open access

pySimFrac: A Python library for synthetic fracture generation and analysis

Computers & Geosciences, September 2024

Eric Guiltinan, Javier E. Santos, ... Jeffrey D. Hyman

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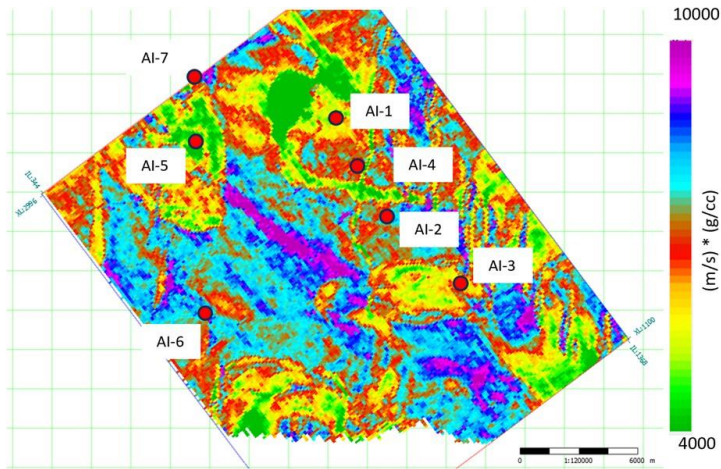
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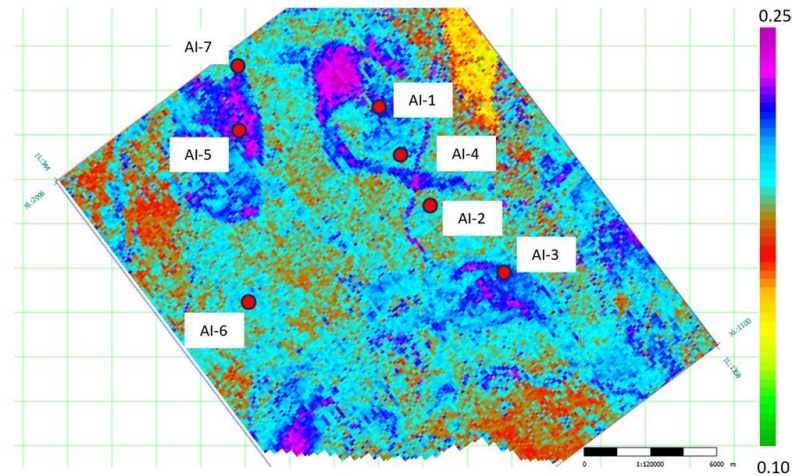
Machine Learning

- Prediksi porositas langsung dari data seismik



(a)

$V_p \times \text{density} = \text{Acoustic Impedance}$



(b)






















Predicted Porosity

A review of Earth Artificial Intelligence

<https://doi.org/10.1016/j.cageo.2022.105034>

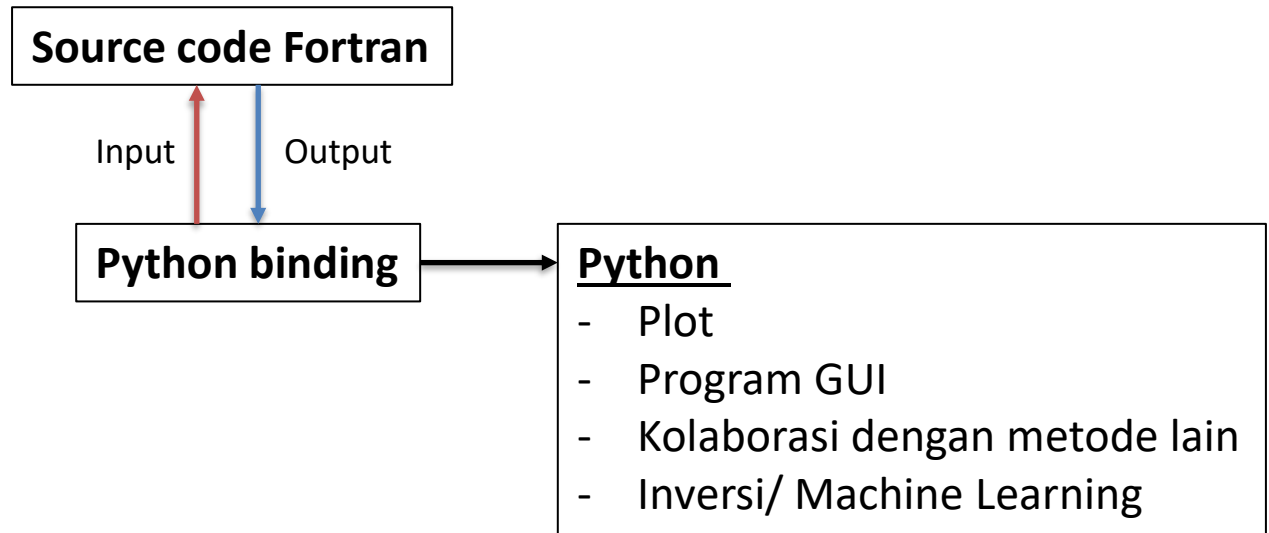
- python

Table 2
Python ecosystem for earth AI.

Category	Name	Description	License	Github Repo
DL	 Keras	A friendly API running on top of Tensorflow	MIT	keras-team/keras
	 PyTorch	Multidimensional array (tensor) computation with strong GPU acceleration, for deep neural networks	BSD	pytorch/pytorch
	 Tensorflow	A powerful open-source platform for ML	Apache-2.0	tensorflow
	 Chainer	DL framework aiming at flexibility	MIT	chainer/chainer
	 Caffe	Fast DL	BSD	BVLC/caffe
ML	 Mxnet	Efficient and flexible DL	Apache 2.0	apache/incubator-mxnet
	 Scikit-learn	ML built on SciPy	BSD	scikit-learn/scikit-learn
	 OpenCV	Computer vision and ML	BSD	opencv/opencv
Non-ML AI	 PyKe	Knowledge-based inference engine	MIT	e-loue/pyke
Data I/O	 Numpy	A basic package to provide N-d arrays, and linear algebra methods, and mathematical transforms for conveniently manipulating N-d arrays.	BSD	numpy/numpy
	 Pandas	Support various data operations like reshape, merge, slice, extract, clean, etc.	BSD	pandas-dev/pandas
	 Xarray	Simple labeled multi-dimensional arrays	Apache	pydata/xarray
	 Zarr	Chunked, compressed, N-dimensional arrays	MIT	zarr-developers/zarr-python
	 Shapely	Manipulation and analysis of planar geometric objects	BSD	Toblerity/Shapely
	 Geopandas	Support for geographic data in pandas	BSD	geopandas/geopandas
	 Rasterio	Read and write gridded or raster datasets, with API based on N-D arrays	BSD	mapbox/rasterio
	 Dask	Parallel computing with task scheduling	BSD	dask/dask
	 Ray	Building and running fast distributed applications	Apache-2.0	ray-project/ray
Visualization	 Matplotlib	Static, animated, and interactive visualizations	PSF	matplotlib/matplotlib
	 Plotly.py	Interactive, open-source, and browser-based graphing and apps	MIT	plotly/plotly.py
	 hvPlot	Interactive plotting and apps directly from your xarray, pandas, dask, or geopandas data	BSD	holoviz/hvplot

Memanggil Bahasa Program lain (*Binding*)

Paper EM th 1990 menggunakan Fortran -> Python untuk memanfaatkan tanpa merubah



*Menggunakan numpy f2py

Cara Memulai Belajar

Langkah 1: Python Dasar

- Variable dan tipe data
- Operasi matematika dasar
- List
- Loop dan fungsi

Langkah 2: Scientific Python

- Array NumPy
- Plotting dasar
- Fungsi scientific Scipy (i.e. filter, fft, dll.)

Resources Belajar Gratis

Kursus Online:

- Python for Everybody (Coursera)
- Scientific Computing with Python (freeCodeCamp)
- Software Carpentry

Tutorial:

- Kuliah-kuliah Universitas luar negeri
- Youtube

Resources Belajar Gratis

freeCodeCamp (🔥)



1



Responsive Web Design Certification

2



JavaScript Algorithms and Data Structures Certification

3



Front End Development Libraries Certification

4



Data Visualization Certification

5



Relational Database Certification

6



Back End Development and APIs Certification

7



Quality Assurance Certification

8



Scientific Computing with Python Certification

9



Data Analysis with Python Certification

10



Information Security Certification

11



Machine Learning with Python Certification

12



College Algebra with Python Certification

Scientific Computing with Python



The Scientific Computing with Python curriculum will equip you with the skills to analyze and manipulate data using Python, a powerful and versatile programming language. You'll learn key concepts like data structures, algorithm, Object Oriented Programming, and how to perform complex calculations using a variety of tools.

This comprehensive course will guide you through the fundamentals of scientific computing, including data structures, and algorithms.

Courses

☐ Learn String Manipulation by Building a Cipher

☐ Learn How to Work with Numbers and Strings by Implementing the Luhn Algorithm

☐ Learn Lambda Functions by Building an Expense Tracker

☐ Learn Python List Comprehension by Building a Case Converter Program

☐ Learn the Bisection Method by Finding the Square Root of a Number

Certification Project

☐ Build an Arithmetic Formatter Project

This is one of the required projects to claim your certification.

Machine Learning with Python



Machine learning has many practical applications that you can use in your projects or on the job.

In the Machine Learning with Python Certification, you'll use the TensorFlow framework to build several neural networks and explore more advanced techniques like natural language processing and reinforcement learning.

You'll also dive into neural networks, and learn the principles behind how deep, recurrent, and convolutional neural networks work.

Courses

TensorFlow

TensorFlow is an open source framework that makes machine learning and neural networking easier to use.

The following video course was created by Tim Ruscica, also known as "Tech With Tim". It will help you to understand TensorFlow and some of its powerful capabilities.

▼ Collapse course

0/32

☐ Introduction: Machine Learning Fundamentals

☐ Introduction to TensorFlow

☐ Core Learning Algorithms

☐ Core Learning Algorithms: Working with Data

☐ Core Learning Algorithms: Training and Testing Data

☐ Core Learning Algorithms: The Training Process

☐ Core Learning Algorithms: Classification

☐ Core Learning Algorithms: Building the Model

☐ Core Learning Algorithms: Clustering

☐ Core Learning Algorithms: Hidden Markov Models

Core Learning Algorithms: Using Probabilities to make

www.freecodecamp.org

AI Assistant untuk Belajar

Tools Gratis:

- Google Colab + Gemini

Cara Menggunakan:

- Debugging code – memperbaiki error
- Penjelasan konsep
- Bantuan error message
- Contoh code sederhana

Contoh Prompt untuk AI

Untuk debug

"Tolong jelaskan error ini: [error message]"

Untuk belajar

"Jelaskan konsep array NumPy dengan analogi sederhana"

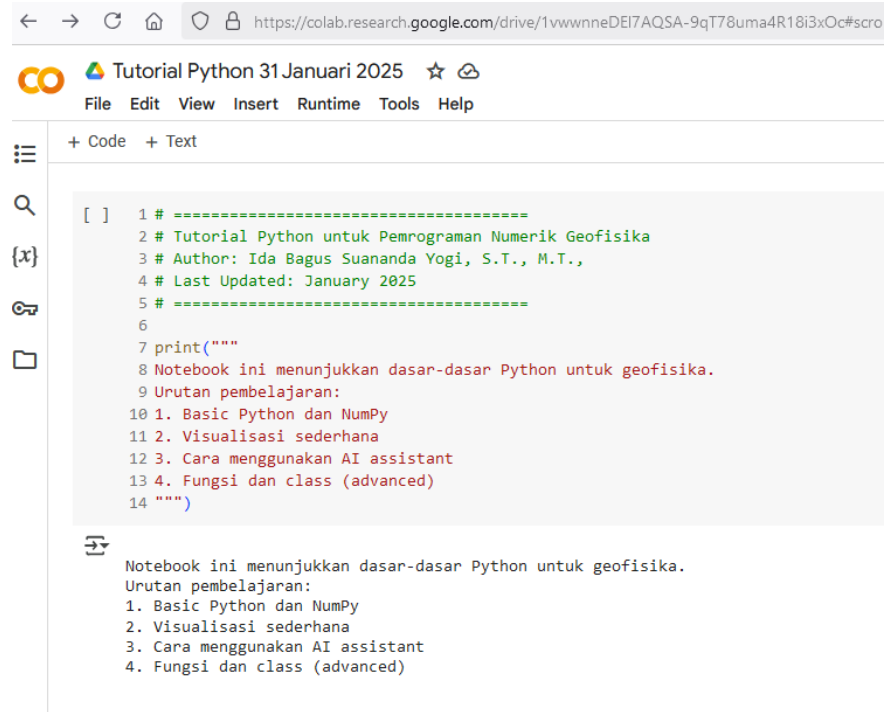
Untuk coding

"Bagaimana cara plot data seismik dengan ObsPy?"

Platform Belajar

Coding Environment:

- Online:
 - Google Colab
- Lokal:
 - Visual Studio Code dengan Anaconda



The screenshot shows the Google Colab web interface. The browser address bar displays the URL: <https://colab.research.google.com/drive/1vwwnneDEI7AQSA-9qT78uma4R18i3xOc#scro>. The page title is "Tutorial Python 31 Januari 2025". The interface includes a menu bar with "File", "Edit", "View", "Insert", "Runtime", "Tools", and "Help". Below the menu bar, there are tabs for "+ Code" and "+ Text". The main area displays a Python notebook with the following code:

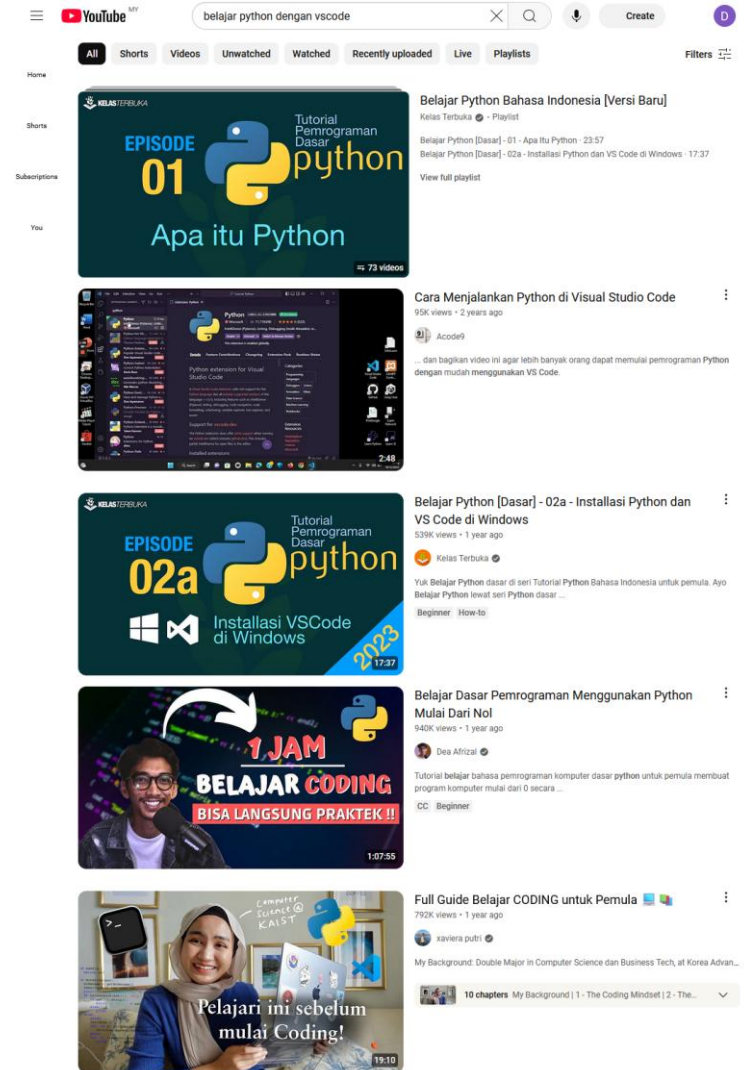
```
[ ] 1 # =====
2 # Tutorial Python untuk Pemrograman Numerik Geofisika
3 # Author: Ida Bagus Suananda Yogi, S.T., M.T.,
4 # Last Updated: January 2025
5 # =====
6
7 print("""
8 Notebook ini menunjukkan dasar-dasar Python untuk geofisika.
9 Urutan pembelajaran:
10 1. Basic Python dan NumPy
11 2. Visualisasi sederhana
12 3. Cara menggunakan AI assistant
13 4. Fungsi dan class (advanced)
14 """)
```

Below the code, there is a text area that repeats the content of the notebook's print statement:

Notebook ini menunjukkan dasar-dasar Python untuk geofisika.
Urutan pembelajaran:
1. Basic Python dan NumPy
2. Visualisasi sederhana
3. Cara menggunakan AI assistant
4. Fungsi dan class (advanced)

Tips Belajar Mandiri

- Cari contoh script dari berbagai sumber (buku, web, YouTube, GitHub)
- Duplikasi dan modifikasi project kecil
- Jangan takut error
- Gunakan AI assistant untuk bantuan



Repository Tutorial

- GitHub:
<https://github.com/SuanandaYogi/TutorialPyhton2025>
- Google Colab Notebook
- Materi presentasi

Pertanyaan?

Kontak:

- Email: suanandayogi@gmail.com
- GitHub: <https://github.com/SuanandaYogi/>