Visión por computador para las geociencias:

desde el procesamiento de imágenes digitales hasta el aprendizaje profundo

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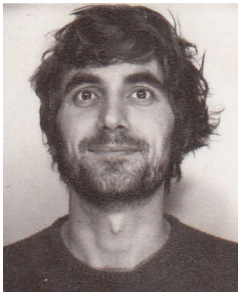
Overview

1. Lecturers
2. Goals of the course
3. Course content
4. Course material
5. Points to discuss

Lecturers

Sébastien Valade



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- Volcanologist, research focus on Remote Sensing & Geophysics
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Manuel Wöllhaf

- Research and teaching associate at TU-Berlin
- Computer Scientist, research focus on Computer Vision and Deep Learning
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Goals of the course

- acquire theoretical & practical knowledge to process digital images *(photographs, satellite imagery, microscope imagery, video, etc.)*
- progression from classical computer vision (CV) methods, to advanced artificial intelligence (AI) methods, using the Python programming language
- examples and applications inspired from geoscience problems

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Course content 1/3

1. **Crash course to Python**
   - Introduction to the main Python libraries used for scientific applications
     (numpy, matplotlib, pip, pandas)
   - Introduction to the programming tools used during the course
     (Jupyter, Git version control)

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Course content 2/3

2. Digital Image Processing

- Digital image
  what is a digital image and how to manipulate it
- Image Filtering
  what is a filter, how to code it, how to use standard image processing libraries in Python
- Image Morphology
  erosion, dilation, opening and closing operators
- Image Segmentation
  why segment an image and how to do so
- Examples in geoscience applications

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3. Machine Learning Methods

- Introduction to the basic concepts of statistical learning:
  - supervised / unsupervised learning
  - input / output domain
  - test / training / validation datasets
  - overfitting / underfitting
  - features and performance evaluation
- Classical Learning approach
  - Introduction to Python's Scikit-learn classifier interface
  - dimensionality reduction (PCA)
  - kNN (k-nearest neighbors): definition and implementation exercice
  - SVM (Support Vector Machines): definition and implementation exercice
- Deep Learning approach
  - Introduction to Python's TensorFlow / Keras library
  - CNN (Convolutional Neural Networks): definition and implementation exercice
  - AutoEncoder: definition and presentation of usage in geosciences

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Course material

- Programming language: Python
- Programming environment: Jupyter notebooks

Points to discuss

- Course lectures Fridays 10:00-14:00 ?
- Key dates
  - 2021-02-19 (today)= first meeting
  - 2021-03-29 to 2021-04-02 = semester break
  - 2021-06-11 = semester end
- Experience with Python ? With Jupyter notebooks ? Operating system used ?
- Evaluation ?
  3 partial exams, final grade = mean of the 2 best ones
- Why are slides in English ? Will some lectures be in English ?

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