Tutorial: Analysis and visualization of 3D data in Python

14th International Symposium on Visual Computing
Lake Tahoe, Nevada, USA
October 7-9, 2019
http://www.isvc.net

Tutorial abstract

- This hands-on tutorial teaches how to analyze three dimensional stacked / volumetric images at scale in Python, primarily using scikit-image and scikit-learn. The material is formatted as a sequence of interactive Jupyter notebooks designed to investigate aspects of analysis such as counting, object relationships, and shape measurements. Real-world examples are given from various domains such as material science and biomedicine, and all data and code are made available freely. For each section above, we show how to implement the solution, and then provide several hands-on exercises so that attendees can become more familiar with the techniques while applying the new concepts to the provided datasets.

Tutorial description

- Objectives: a) a brief overview of scikit-image and related packages in the scientific Python ecosystem; b) exploration and visualization of large 2D and 3D images, including filters and segmentation; c) inspection, counting, and measuring attributes of objects; routines that extract shape, color and texture features; how to use topological description to calculate equidistant boundaries; d) data reduction algorithms using priors from image acquisition instruments and/or sample architecture; e) parallel data processing pipelines for accelerating image analysis.
- Intended audience and any background requirements: researchers with basic to intermediate knowledge of Python and machine learning.
- Duration: half-day
- Schedule: we expect 5 sessions of 50 minutes each, which will include hands-on exercises.

- 12:30pm: fundamentals; scikit image;
  - 1:30pm: intro to datasets; 2D and 3D visualization tools;
  - 2:30pm: filters and segmentation;
  - 3:30pm: feature extraction and data reduction;
  - 4:30pm: I/O and parallel pipelines;
- Instructions:
  - Requirements: https://github.com/BIDS/ISVC2019
  - Additional reading material: book "Elegant SciPy" by Juan Nunez-Iglesias, Stéfan van der Walt, Harriet Dashnow.

Organizers

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Dani Ushizima, Ph.D. is a data scientist at BIDS, University of California Berkeley, and a staff scientist at Lawrence Berkeley National Laboratory. With 20 years of R&D in computer vision, she has worked on algorithms that handle images across domains, especially microscopy of new materials as part of her work under the U.S. Department of Energy Early Career Researcher program.

Alex de Siqueira, Ph.D. is a postdoctoral researcher at BIDS, University of California, Berkeley, working on open source algorithms for processing computed tomography (CT) 3D images. A core developer of scikit-image, he is an open source and free software developer contributing to several projects and events in Latin America and Europe.

Stéfan van der Walt, Ph.D. is a researcher at BIDS, University of California, Berkeley. Stéfan has been developing scientific open source software for more than a decade, focusing mainly on Python packages such as NumPy & SciPy. He is the founder of scikit-image and co-author of Elegant SciPy.

Date

- Sunday, October 6, 2019 (tentatively)