

Seminar - Spatial Data Science

Summer Term 2024

Schedule

The details of the schedule will be defined as soon as the individual preparation has been done. It will start in week 5 of the semester with one or two talks.

Topics

Introduction to Geospatial Data

Presenter: Edera

Qualification Goal: Learners shall understand how geospatial geometries are represented in the OGC standards, what constraints do apply to certain geometries, which operations (e.g., buffer) are defined, and how the data is represented in a memory-efficient way (WKB) or a human-readable way (WKT).

Material:

- The **OGC Simple Feature Access** Standard describes how geometry is modeled in OGC-compliant geoinformation systems <https://www.ogc.org/standard/sfa/>
(<https://www.ogc.org/standard/sfa/>)
- **Shapely** provides a Python library for trying out SFC data and operators
- **PostgreSQL with PostGIS** is a common geospatial database stack
- **GeoPackage** is an embedded database system for such data
- **ogrinfo** and **ogr2ogr** are command line tools for working with such files
- Martin provides slides from an introduction lecture as a starting point
- Maybe use **QGIS** to run SQL queries over geodatabases

Point Cloud Representation

Presenter: Paula

Qualification Goal: Learners shall learn how point clouds are typically represented in computers. Therefore, the commonly used LAS/LAZ file format is discussed and the integer-rounded nature of point cloud data is introduced. Further, some software for interacting with

point clouds shall be explained (e.g., CloudCompare, potree). In addition, the structure tensor is introduced as the most classical way to associate information from the surroundings to each point of a point cloud

Material:

- LAZ file format
- Integer-Rounded Data
- Software (screenshots)
- Structure Tensor and Eigenvalue-based features

Social Media Analysis as a Point Cloud Problem

Presenter: Sharayoo

Qualification Goal: Learners shall understand in how far social media generates point cloud data and how this perspective helps understand social media. The talk shall present an overview of approaches to societal challenges through social media data.

Material:

- Salcedo-Sanz, S., Ghamisi, P., Piles, M., Werner, M., Cuadra, L., Moreno-Martínez A, Izquierdo-Verdiguier, E., Muñoz-Marí J, Mosavi, A., & Camps-Valls, G. (2020). Machine learning information fusion in Earth observation: A comprehensive review of methods, applications and data sources. *Information Fusion*, 63, 256–272.
- <https://www.bgd.ed.tum.de/pdf/zhu2022geoinformation.pdf>
(<https://www.bgd.ed.tum.de/pdf/zhu2022geoinformation.pdf>)
- Werner, M. (2021). Spatially Supervised Text Mining for Social Media Cleaning and Preprocessing. 12th International Symposium on Digital Earth (ISDE12).
https://dl.acm.org/doi/10.1553/giscience2021_01_s68
(https://dl.acm.org/doi/10.1553/giscience2021_01_s68) [Online] [BibTeX]

Data Science Problems for Point Clouds

Presenter: Matthias Weil

Qualification Goal: Learners shall get an overview of the data science problems that occur in relation to point clouds including ground removal, plane fitting, (co-)registration, segmentation, classification, object detection and the like. Optionally, the way that PointNet is solving some of these tasks with Deep Learning can illustrate the talk.

Material:

- <https://publikationen.bibliothek.kit.edu/1000081641/7655183>
(<https://publikationen.bibliothek.kit.edu/1000081641/7655183>)
- <https://doi.org/10.1016/j.inffus.2020.11.002> (<https://doi.org/10.1016/j.inffus.2020.11.002>)
- <https://dl.acm.org/doi/10.5555/3295222.3295263> (<https://dl.acm.org/doi/10.5555/3295222.3295263>)

Photogrammetric Data Acquisition

Presenter: Matthias Strehmel

Qualification Goal: Learners shall learn how the photogrammetric data acquisition pipeline is working for dense 3D reconstruction of scenery from images of unknown camera pose.

Material:

- follow <https://alicevision.org/> (<https://alicevision.org/>)

Further Topic Opportunities

- KPConv: Flexible and Deformable Convolution for Point Clouds
- SIFT and SURF - how to find relations between images
- Introduction to SLAM
- Large-Scale ALS Point Clouds (e.g., AHN3)
- Spatio-temporal Point Clouds (e.g., Kijkduijn measurements)