Agenzia Spaziale Italiana

SPACE IT UP!

The Space It Up! project

Prof. Maria Antonia Brovelli

Politecnico di Torino

ISPRS GEOSPATIAL WEEK 2025 DUBAI

POLITECNICO MILANO 1863

Tutorial “Urban monitoring and analysis with remote sensing and spatial information technology” (POLIMI - BUCEA)

- Tutorial developed within the **International Joint Laboratory POLIMI – BUCEA** (Politecnico di Milano – Beijing University of Civil Engineering and Architecture), supported by the Ministry of Education (China)
- The common theme is the **Sustainable Preservation and Development of Historical and Cultural Cities/Safety and Energy Conservation for Ancient Buildings**
- The Joint Lab is meant to share research results, models, and novel methodologies

Within the present tutorial, Politecnico di Milano will present the following parts:

- **Urban heat island and LCZ mapping**, Dr. Alberto Vavassori (*Space It Up!*)
- **Air pollution**, Dr. Vasil Yordanov (*Space It Up!*)

Tutorial “Urban monitoring and analysis with remote sensing and spatial information technology” (POLIMI - BUCEA)

Moderators

Prof. Maria Brovelli

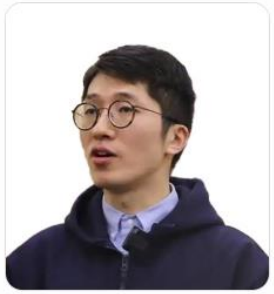
Prof. Jiang Jie

Instructors

Alberto Vavassori

Vasil Yordanov

Liu Xianglei



Guo Xian

Chen Qiang

Wang Runjie

Tutorial “Urban monitoring and analysis with remote sensing and spatial information technology” (POLIMI - BUCEA)

- **Urban information extraction from images (30 minutes + Q&A):** Introduction to necessity and problem of urban information extraction, especially for urban infrastructure. The basic principles, technical methods, and application practices of urban information extraction are introduced using optical remote sensing and microwave remote sensing. Moreover, a High-speed videogramemtry is also introduced to obtain the 3D spatial information of infrastructure model for shaking table experiment.
- **Urban heat island and LCZ mapping (30 minutes + Q&A):** Introduction to the urban heat island phenomenon and its impact on cities; overview of the local climate zone (LCZ) classification system and its real-world applications; presentation of data and methods used in LCZ mapping. A hands-on exercise is foreseen using data from Milan, Italy: participants will work with a Landsat 8 multispectral image and additional urban morphology data; they will learn to digitize training and testing samples, apply a classification algorithm, and assess the accuracy of the LCZ map; the result will be compared to air temperature data from local monitoring stations. This hands-on exercise has been created in the frame of the Space It Up project, funded by the Italian Space Agency (ASI) and the Italian Ministry of University and Research (MUR) under contract n. 2024-5-E.0 – CUP n. I53D24000060005.
- **Air pollution (30 minutes + Q&A)**: A general introduction to the problem of urban air quality and its analysis using remotely sensed data. We will introduce thematic satellite missions and explore data repositories for accessing and distributing their data through web platforms and APIs. An introduction to Copernicus services will also be provided, along with an overview of Sentinel-5P products. Hands-on examples of geospatial processing pipelines will be presented, focusing on tasks such as data collection, preprocessing and validation for air quality assessments, with a case study centered on Milan, Italy. These hands-on examples have been created in the frame of the Space It Up project, funded by the Italian Space Agency (ASI) and the Italian Ministry of University and Research (MUR) under contract n. 2024-5-E.0 – CUP n. I53D24000060005.
- **Analysis of urban spatial pattern (30 minutes + Q&A)**: Introduction to urban spatial structure and methods for identifying urban spatial forms. A case study on the spatial evolution of a major metropolitan area. A hands-on exercise will engage participants in spatial pattern analysis using QGIS or Python, where they will apply spatial indices to assess the compactness, density, and connectivity of urban areas. The session will also include the use of urban sensing data and point-of-interest (POI) data to enhance understanding of urban function zones.

Space It Up is a project funded by the Italian Space Agency and the Ministry of University and Research

Partners

- 12 Universities
- 11 Research Institutions
- 9 Companies & Industry Partners

Objectives

- Foster collaboration between universities, research institutions, and private industry in space-related projects
- Support technology transfer and innovation in the Italian space sector
- Develop new capabilities in space exploration, Earth observation, and satellite technology
- Promote international cooperation and knowledge exchange in space research
- Enhance education and training in space sciences for future professionals

SPOKE 7: Space for the sustainable development of the planet

Pollution Monitoring

Innovative methods for monitoring pollutant concentrations and emissions in urban areas and agricultural contexts:

- Air Pollution: Measuring and analyzing urban air quality.
- Marine Pollution: Monitoring plastics and litter in marine environments.

Monitoring Urban and Suburban Environments

Creation of data fusion-based techniques for:

- Urban heat island and heat wave analysis.
- Mapping urban local climate zones.
- Microclimate monitoring with specialized sensors.
- Identifying solar energy potential sites/buildings.
- Supporting ground deformation calibration studies.
- Assessing land use/land cover changes using Earth Observation (EO) data.

Monitoring Carbon Cycle

Advanced spatial modeling methods for forest carbon storage and sink estimation.

- Addressing uncertainty in carbon cycle modeling with next-gen satellite sensors.
- Monitoring and mapping forest disturbances to assess their impact on the carbon cycle.

GIS GEOlab Team
www.gisgeolab.polimi.it

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SPACE IT UP! Grant Agreement ASI n. 2024-5-E.0
[CUP Master I53D2400006000]

Thank you for your attention

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