

Politecnico di Milano

 POLITECNICO DI MILANO



The Master of Sciences in Geoinformatics Engineering and its innovative teachings



Outline

Geoinformatics

framing in the new job offer

Geoinformatics

the MSc structure @ Politecnico di Milano

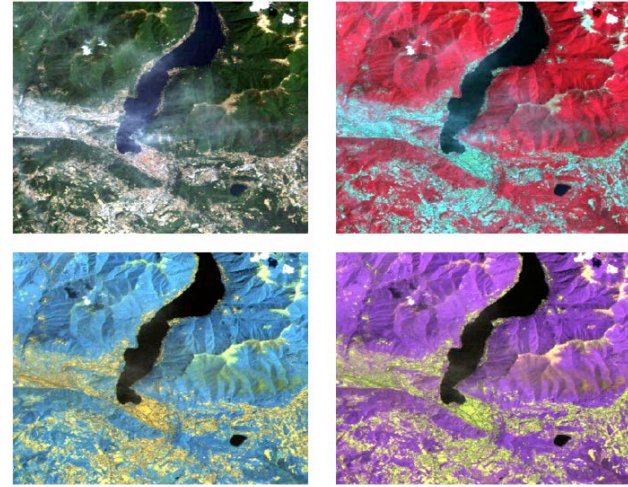
Innovative teachings and Passion in action

Geoinformatics initiatives in 2018/2019

Proposals for next (2019/2020) initiatives

Geospatial information

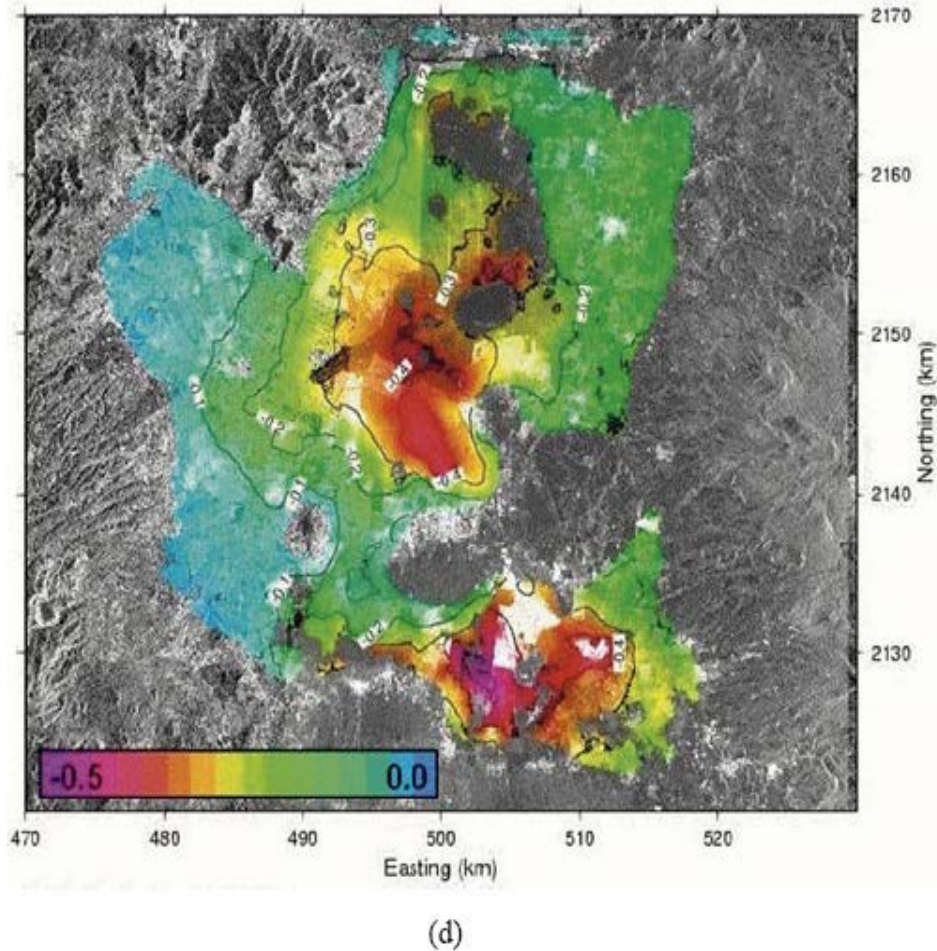
Data with coordinates in space
and in time



Geospatial information

Data sources

- In situ sensors
- Earth to satellites observations
- Satellites to Earth observations
- Volunteered Geographic Information
- Citizen Science



Geospatial information

Every day (2015) more than 10^{30} (quintillion / nonillion) bytes of data are produced:

80% are geospatial data

Geospatial knowledge is fundamental in environmental applications

Geospatial knowledge is needed by many applications, even beyond environmental

Environmental applications

Land planning,
monitoring and
management

Risks prevision,
prevention, and
protection

Support to the
decisions
(emergency
resilience)



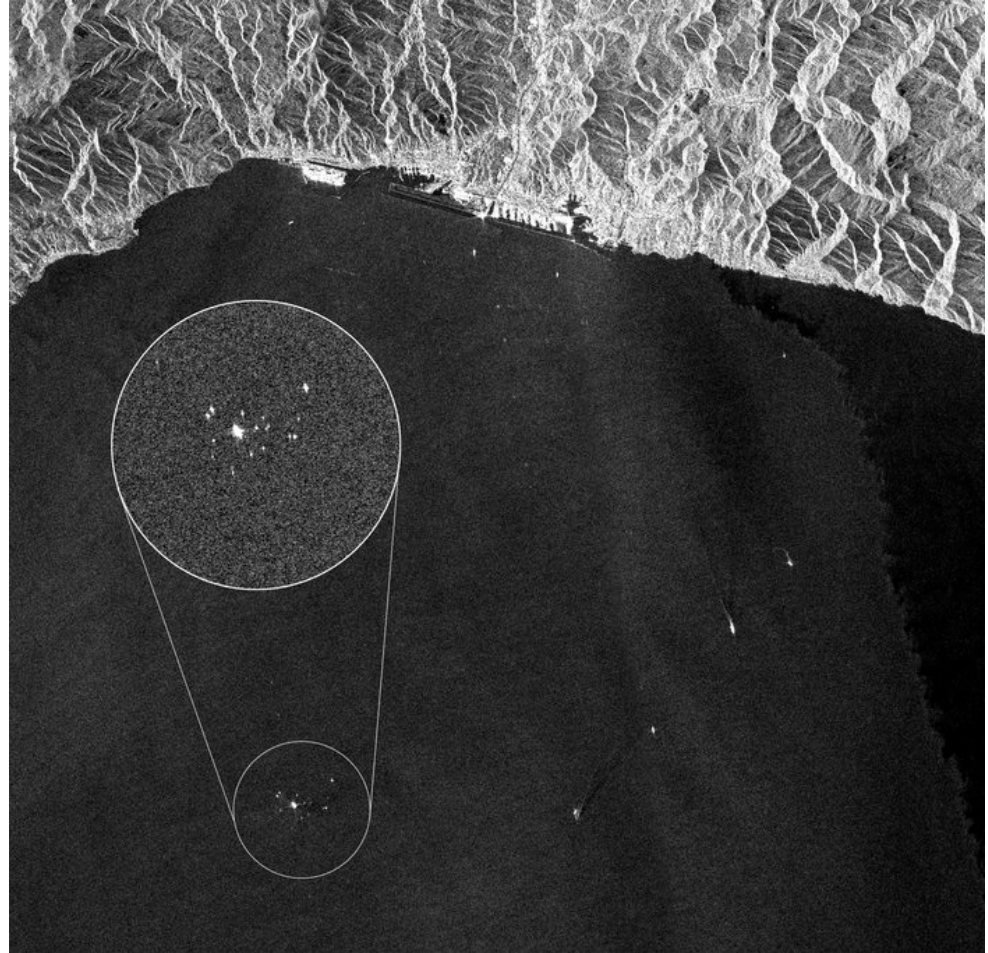
General engagements of geospatial experts

Urban monitoring, planning,
management

Logistics problems:
fleets/individual

Geoanalytics

... all the applications
requiring
geospatial data



Geoinformatics Engineers: job opportunities

GIS sector

IT: managing of (geo) databases, logistics, planning
Big industries related to Earth Observation

Local and national authorities for

- cartography,
- cadaster,
- spatial data infrastructures,
- city and country planning

Geoinformatics Engineering: job opportunities

Big companies (telecommunication) that need experts of geospatial information

Industries that develop environmental sensors

Industries that develop IT tools for Land and Environment

Research institutions on Internet of Places, Big Geodata, Sensor Enablement, Urban Data City Analytics, Earth Observation, Citizen Science,...

Geoinformatics Engineering

Interdisciplinary between Environmental and Computer Science Engineering

Geospatial data:

acquisition, validation, classification, storing, analysis, processing, representation, publication, geoservices, ...

HW / SW infrastructures:

computer security software engineering, data bases, big data, image analysis, web technologies, ...

Geoinformatics Engineering at Politecnico di Milano

First Italian Geoinformatics Engineering Master of Science (quite revolutionary in Europe)

Shared between Environmental and Computer Sciences Engineering Schools

Two years (120 CFU)

International

General organization of the Master

Propaedeutic courses: 10 ECFU:

Geo-fundamentals / Info Fundamentals

Elective and optional courses: 95 ECFU:

Geospatial data analysis,

Geographic Information Systems,

Positioning and Location Based services,

Data Bases and SW engineering,

Computing infrastructures and computer security,

...

Thesis: 15 ECFU

Italian degree class

According to the Italian laws (DM 16/03/2007, art. 1 c. 3), the Geoinformatics Engineering MSc degree can be either in

LM32: Computer Science Engineering

LM35: Environmental Engineering

(Italian) students must choose according to their scientific / cultural / technical interests and confirm the choice at the end of the first year.

At least 45 CFU in Computer Science (LM-32)

(55 for students not from CompSc)

At least 45 CFU in Environmental (LM-35)

(55 for students not from EnvEng)

Innovative teachings within Geoinformatics

Rationale

- Action 1: Let the students face and solve 'geoinformatic' problems by coding
- Action 2: Increase students' awareness by geospatial information

Boundary constraints

- Small classes
- Heterogeneous bachelor expertizes
- Different lacks to fill

Innovative teachings within Geoinformatics

2018/2019 Innovative activities within curricular courses

Positioning and Location Based Services (3 CFU flipped class)

Geoinformatics Project (2 CFU flipped class)

2018/2019 Passion in action activities

Humanitarian Collaborative Mapping

The Living Planet Symposium

Positioning and LBS Services (10 CFU)

Ten course not central topics are split in **General methodology** and **Numerical implementation**

General methodology / theory is shortly explained in class.

The **numerical** tables with the practical **implementations** of **GM** are given to students, who learn how to read and use the tables.

Students, grouped by two, code numerical examples with readable output. Ten classwork slots of 3 hours are planned where they work interacting with professor (myself).

One example: satellite orbit computation

General Theory

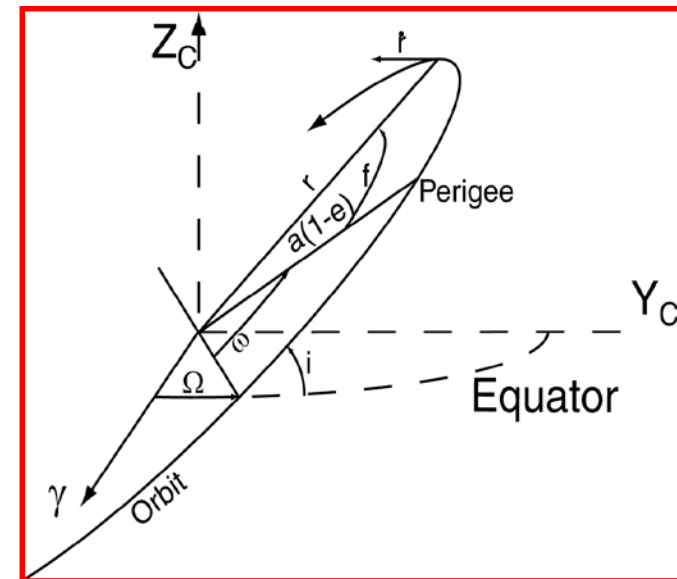
$$n = \frac{2\pi}{T} = \sqrt{\frac{GM_E}{a^3}}$$

Kepler laws

- orbit dynamic rules,
- ephemerides of a satellite

Numerical Tables

Practical implementation of
orbit computation specifically
for GNSS satellites
(a table of about 15 sequential formulas)



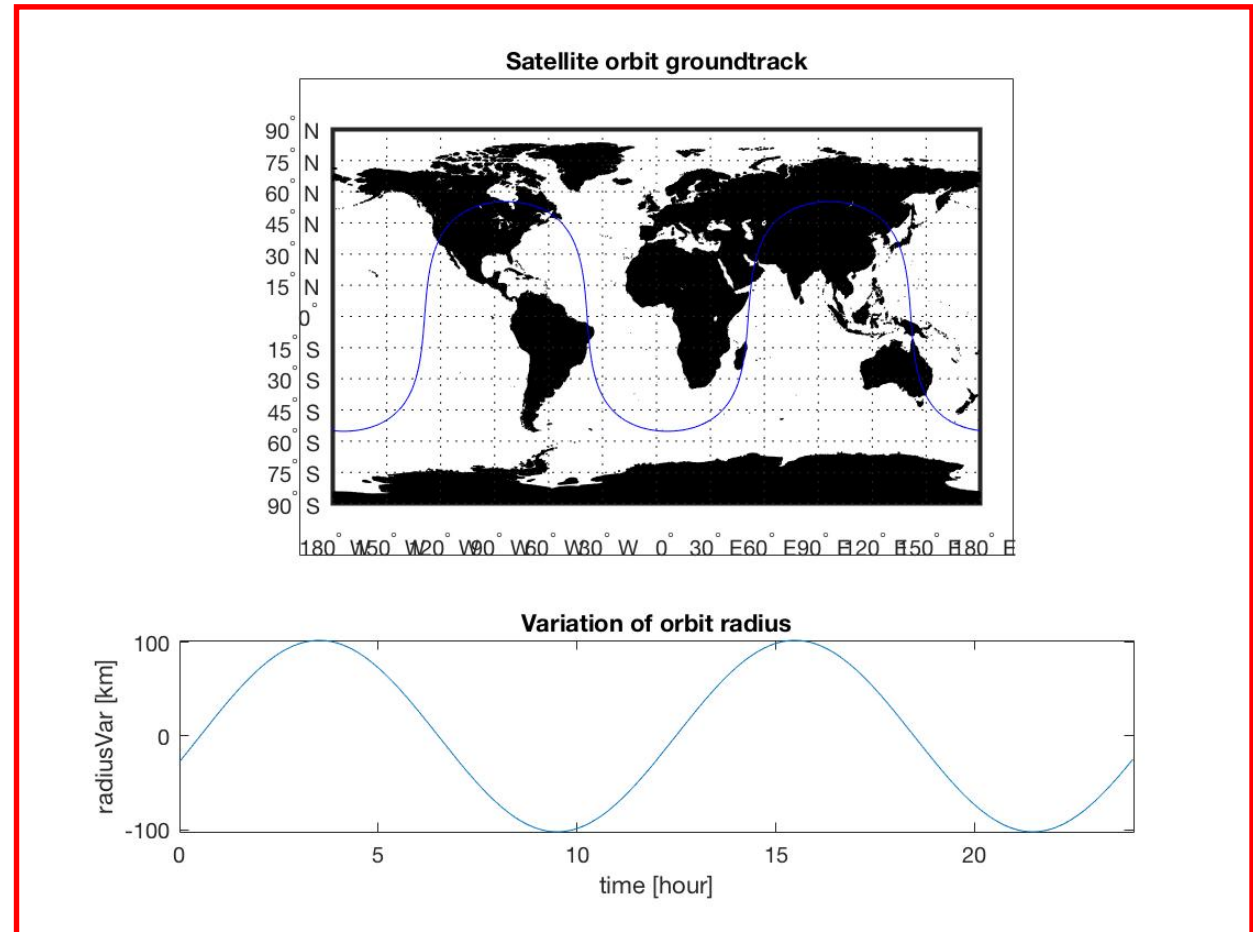
One example: satellite orbit computation

Student work

Given the tables for
a GNSS satellite,

code the orbit
computation
for 24 hours
and plot a
groundtrack map

consign the final
code



Positioning and LBS Services: evaluation

Before the oral exam, the students consign codes: a discussion of the implementation choices and the numerical results follows; no interrogation on implemented formulas

In the oral exam only central topics are discussed

Advantages ...

By individual activities instead of 'guided' classworks, students learn how to manage and code positioning problems

... Problems

the classwork slots require intense problem solving by the professor

the check of individual codes is time spending

Geoinformatics Project (5 CFU)

Different projects on Geoinformatics topics are proposed and discussed with students

Groups of two / three students are formed

During the semester, each group works on a project, under the supervision of the professor / tutor

At the end the project is discussed with professor and tutors

One example:

**Marina Ranghetti & Naomi Petrushevsky project,
supervision Prof.ssa Brovelli**

Humanitarian Collaborative Mapping

In Cooperation with PoliMapper, a PoliMi students' Chapter of the YouthMapper international association.

Six mapathons for humanitarian projects: deforestation, diseases, ..



Humanitarian Collaborative Mapping

Participants

- are involved in humanitarian activities
- learn the principles of collaborative mapping
- learn to use new technological tools



Living Planet Symposium 2019



Symposium focuses:

how Earth Observation contributes to science and society
and how disruptive technologies and actors are changing
the traditional Earth Observation landscape.

For the first time,
the European Space Agency (ESA) Symposium
was held in Milano, from 13th to 17th May 2019.

Living Planet Symposium and Passion in Action



The Living Planet Passion in Action Activity was planned in strict cooperation between

Politecnico di Milano
and

ESA's Organizing Committee of Living Planet Symposium.

Living Planet Symposium Action

Participants to Living Planet Action were involved in the Symposium for its whole duration.

They actively participated to the Symposium organization and management, as Symposium Volunteers, for two days and a half.

In the remaining days of the Symposium they had the opportunity to freely attend the scientific sessions.

60 volunteers were expected:
we had to stop enrollment at 120!

Plans for 2019/2020

Adapt Pos&LBS activities to students suggestions
(2018/ 2019 Google questionnaire)

Start new activities in GIS course
(co-tutelage with industry)

A more focused Mapping activity on a single topic
(walk able paths in urban environment)



Thanks!

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