



# TEACHING GEOPYTHON IN A GEO-INFORMATION MASTER PROGRAMME

Barend Köbben <[b.j.kobben@utwente.nl](mailto:b.j.kobben@utwente.nl)>

Rolf de By, Mahdi Farnaghi, Peter Kabano, Robert Ohuru

# AGENDA

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- What's ITC (at University Twente)?
- The Geo-information MSc at ITC
- The Scientific GeoComputing Course
  - General setup
  - Learn–Code–Pair–Share
- Outlook
  - Use of the course in other programmes
  - The GeoAcademy Hub

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```
>>> excuse = 'Sorry, no code...'  
>>> print (excuse)
```

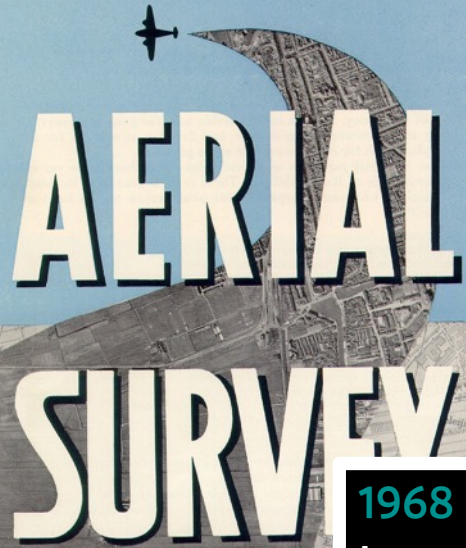
A large, multi-story brick building with a red-tiled roof, featuring many windows and a curved facade, set against a blue sky with light clouds. The building is the main subject of the image.

# **ITC FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION**

UNIVERSITY  
OF TWENTE.  
FACULTY ITC

**At ITC, the Faculty of Geo-Information Science and Earth Observation of the University of Twente, we have been educating geo-professionals for more than 70 years.**

INTERNATIONAL TRAINING CENTRE FOR



# AERIAL SURVEY

## ITC ESTABLISHED IN 1950

BY PRIME-MINISTER WILLEM SCHERMERHORN

**1950**  
International  
Training Centre  
for Aerial  
Survey, ITC

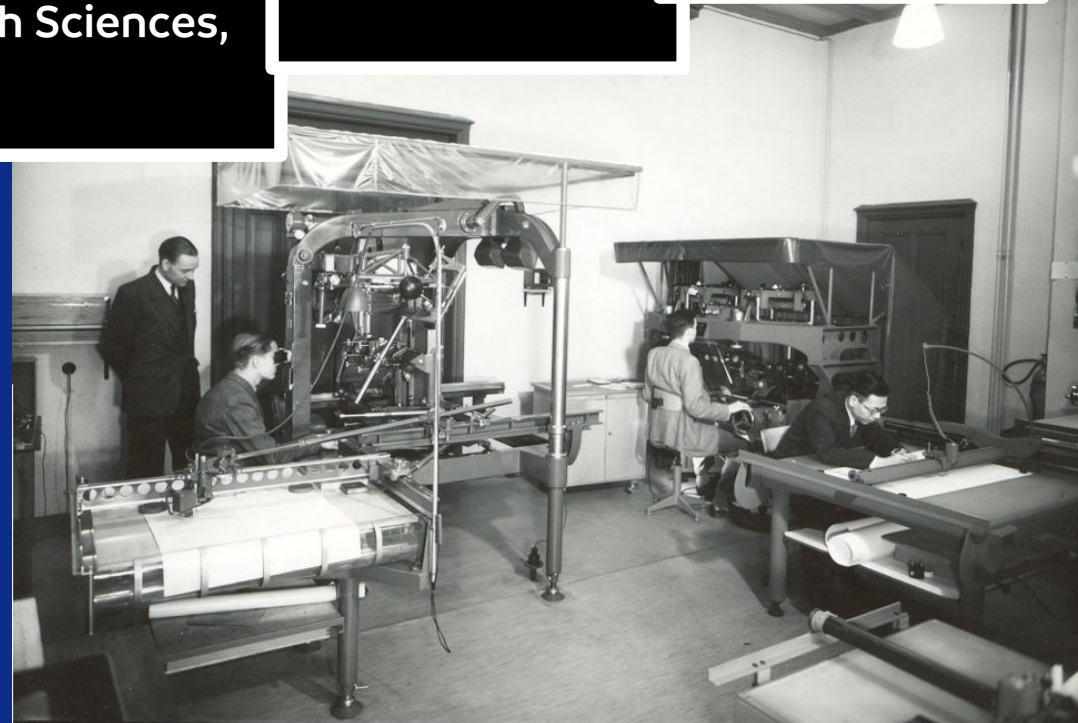
**1968**  
International  
Institute for  
Aerial Survey  
and Earth  
Sciences, ITC

**1985**  
International  
Institute for  
Aerospace  
Survey and  
Earth Sciences,  
ITC

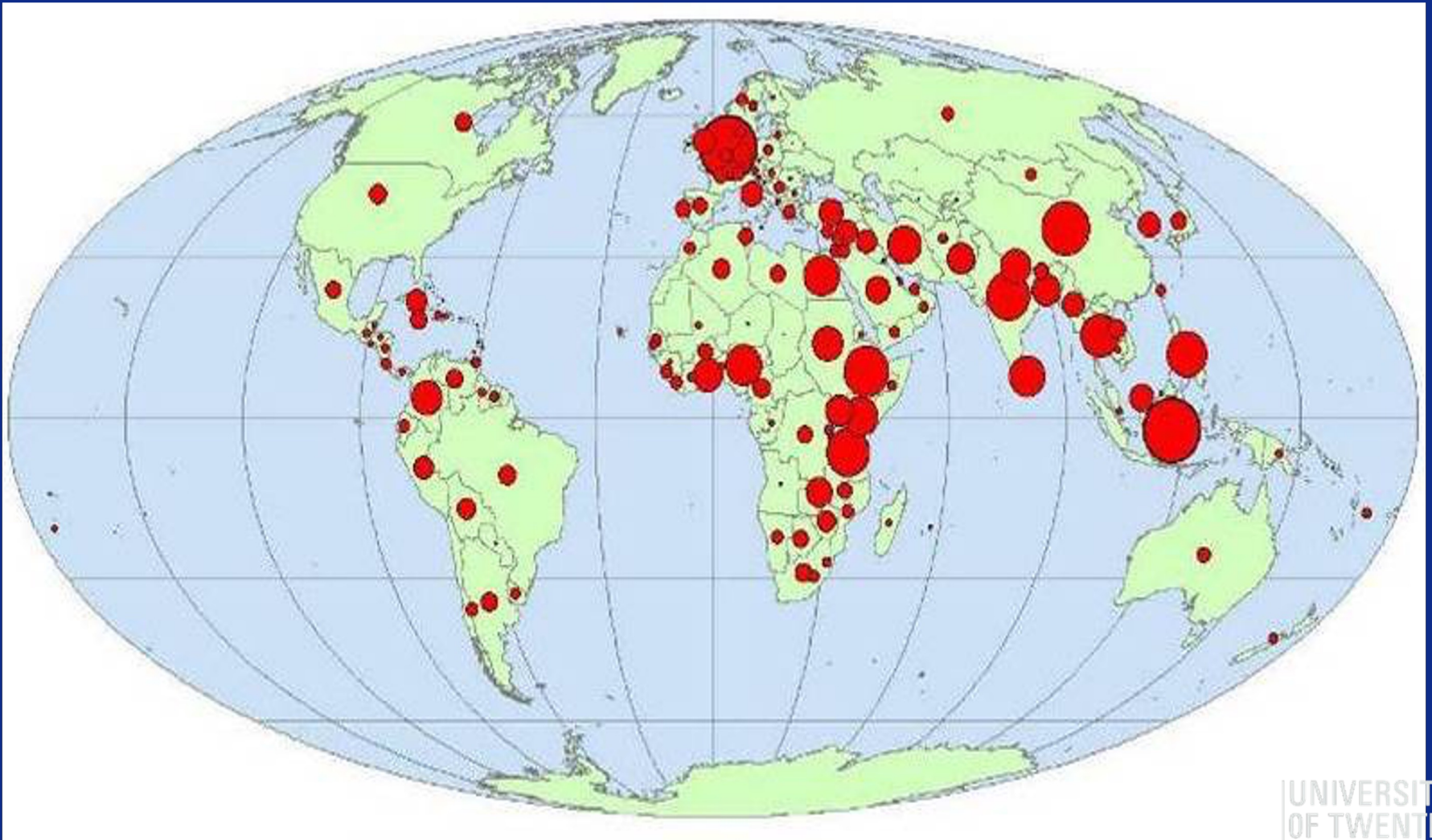
**2002**  
International  
Institute for  
Geo-Information  
Science and  
Earth  
Observation, ITC

**2010**  
Faculty of Geo-  
Information  
Science and  
Earth  
Observation,  
University of  
Twente

<https://www.itc.nl/alumni/70-years-of-ITC/>

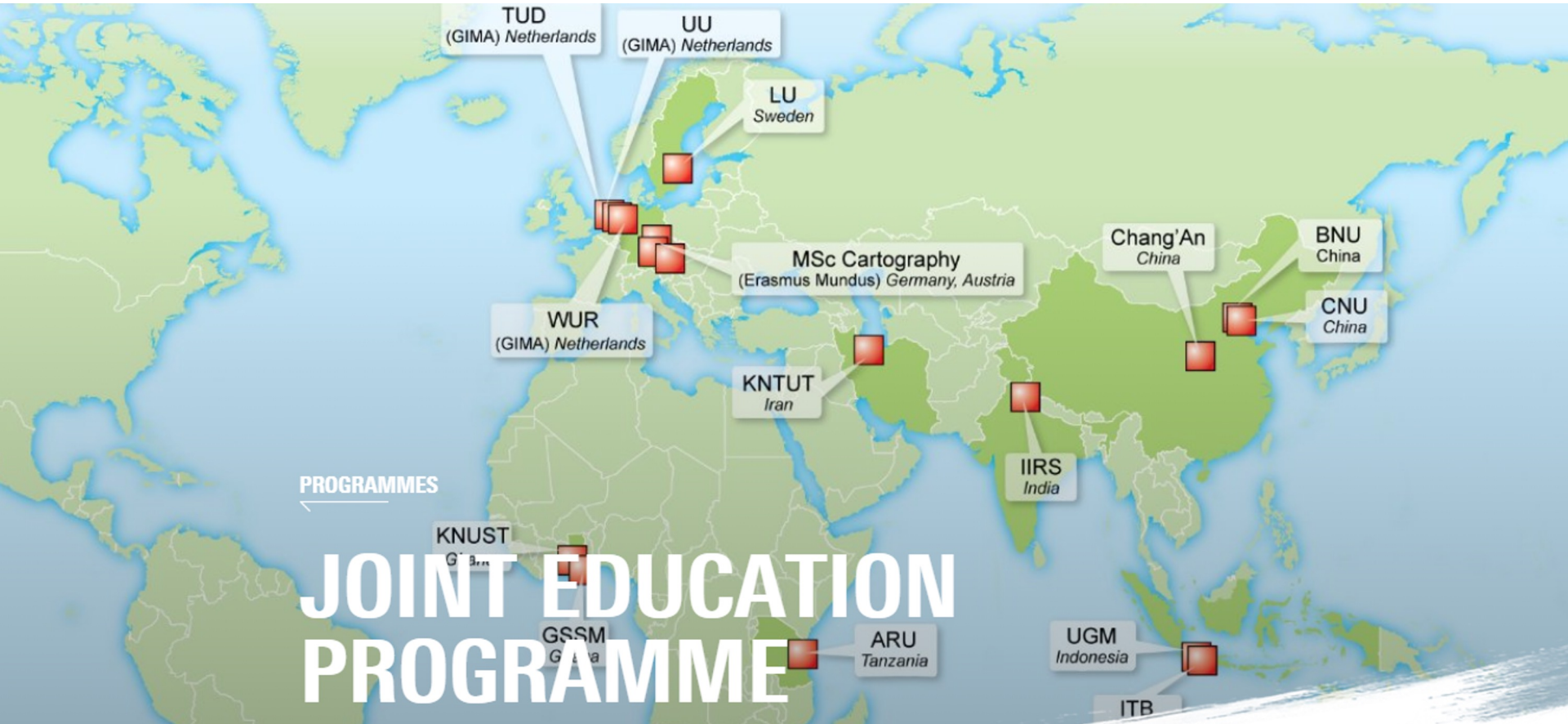


# FOCUS ON “GLOBAL SOUTH” (3<sup>rd</sup> world, developing countries, ...)



ALUMNI (2013)

# EDUCATION PARTNERSHIPS ITC



# MASTER PROGRAMMES OFFERED BY FACULTY ITC


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- MSc Geo-Information Science & Earth Observation
  - 6 specialisations:
    - Applied Earth Sciences, Land Administration, Natural Resources, , Water Resources, Urban Planning & Management
    - and **Geoinformatics**
  
- MSc Spatial Engineering
  
- Erasmus+ with TU Munich + Vienna + Dresden:



**Cartography M.Sc.**



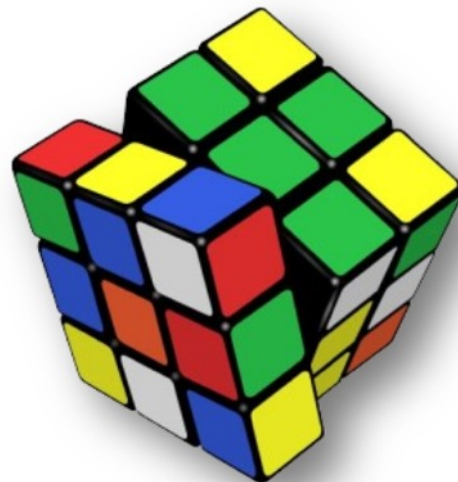


# THE GEO-INFORMATION MSC AT ITC

# TEACHING GEOMATICS: GEO IN COMPUTER SCIENCE

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- We train our students to become spatial *engineers*
- For that they need a thorough knowledge of the processes required to solve geospatial problems
- Teaching them only off-the-shelf GIS tools will create *button-pushers*
- This age needs *problem solvers*.
- The only way to accomplish that is learning how to:
  - design,
  - develop and
  - implementyour own solutions.



# TEACHING GEOMATICS: GEO IN COMPUTER SCIENCE

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We teach using the principles of

**SDI**light

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## SDI<sup>light</sup>

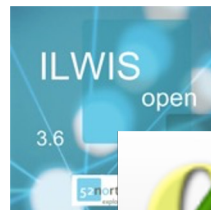
- the technology of Spatial Data Infrastructures (SDI), applied in simple and cost-effective ways
- to provide students with a platform for low-cost, yet powerful ways of sharing data and maps
- Open Standards whenever available
- Open Source where possible



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+ ...



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We teach using the principles of

## SDI<sup>light</sup>

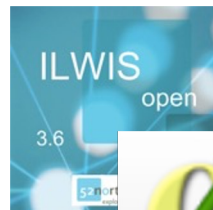
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# SCIENTIFIC GEOCOMPUTING

## GENERAL SETUP



# SCIENTIFIC GEOCOMPUTING MODULE

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- we cannot teach our students everything about geo-computing & coding in a 7 EC course.
- So we focus on enabling them to develop their capacity to explore, develop and find out things themselves independently.
- Main coding language used is **Python**  
(also SQL & Javascript)
- Takes the students from absolute beginners with no coding experience to become confident users of Python and associated coding tools to solve geospatial problems.

# EDUCATIONAL SETUP OF OUR COURSE

- Theory of computing
- Pragmatics
- Literate programming

Algorithmics

General programming  
(with Python  
and SQL)

- Syntax
- Reading & writing code
- Data structures
- Coding patterns
- Database operations

Visualization  
& Web  
development

Geocomputing

- Scientific visualization
- Web development

- Vector processing
- Image processing
- Combined vector/raster projects



# EDUCATIONAL CHALLENGES

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- wide range of existing skills in the group
- we need to offer something for all skill levels:
  - build up from ground level, to allow also the least experienced to get it, take it in, and make it work
  - challenges and deepening to cater for more experienced

# EDUCATIONAL SETUP (1)

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- short **lectures** (1hr) that focus on key issues
- basic slide set made available *before* the lecture
- richer slide set made available *after* the lecture
  - allows to read back and deepen the knowledge and understanding
  - reading this longer version is standard home assignment
- every lecture starts with “flipped class”: lecturer poses questions about previous parts

## EDUCATIONAL SETUP (2)

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- each lecture followed by **practical**  
(exercises available on learning platform)
- after the practical, an answer sheet is made available to allow verification
- students organise themselves in pairs with “practical buddy”:  
*together you learn more than alone*

# EDUCATIONAL SETUP: ASSESSMENT

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- two assignments to hand in: [20%]
  - do together with the “practical buddy”
  - no collaboration with others: 2-student team's original work
- practical skills test [30%]
  - online, open book
- theory test [40%]
  - written, closed book
- personal reflection report [10%]



# SCIENTIFIC GEOCOMPUTING

LEARN-CODE-PAIR-SHARE

# THE GEOCOMPUTING COMPONENT

- use of Python with/in GIS technology

Background GI  
Science Knowledge

Math, statistics, and  
geostatistics

Computer science and  
programming skills



*How to apply the first two through the computer science and programming skills to a problem space in GI*





# GEOCOMPUTING: A CHALLENGE TO TEACH

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Learning all useful libraries is impossible

- start from basic library use
- teach geo-libs by main example (GDAL/OGR)
- but where to go from there...?

## Base data science libraries

NumPy

Matplotlib

## Geospatial Libraries

GDAL/OGR

## Next?

Geopandas

GeoPy

Fiona

Rasterio

...?



# SOLUTION: LEARN – CODE – PAIR – SHARE

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- Each group will LEARN a new Geospatial Library and TEACH it to others

Learn and Code: Groups of 2 work on a new Geospatial library



Pair: Groups will join forces



Share: Groups will present

- generate a Jupyter Notebook on the shared platform (CRIB)
- describe different aspects of the library, with code snippets that work
- combine/select/trim the Jupyter Notebooks
- prepare 8 min presentation (using the platform)
- combined team will present for other students
- other students and instructors ask questions



# WHY DO WE DO IT THIS WAY?

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- because it works well for this course!
- because it ticks other boxes:

LEARNING BY DOING

ACTIVE LEARNERS

LEARN HOW TO LEARN

LIFE-LONG LEARNING




# OUTLOOK

# USE OF THE COURSE IN OTHER PROGRAMMES

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- the course is useful for almost all students in the geo domains
- the course can function “stand-alone”, no specific pre-requirements
- current timetable is 2 days/week spread over 1 semester (10 weeks)
  - condensed version(s) possible (eg. full 4 weeks)
  - other teaching modes (online, hybrid?)
  - but currently no staffing available

*E.g. possibly as elective in Spatial Engineering MSc*



THANK YOU FOR YOUR  
ATTENTION!

Questions welcome  
now...

...or later on [bj.kobben@utwente.nl](mailto:bj.kobben@utwente.nl)