Course Overview
+
IRIS

Dr. Michel Tsamados
m.tsamados@ucl.ac.uk

Overview

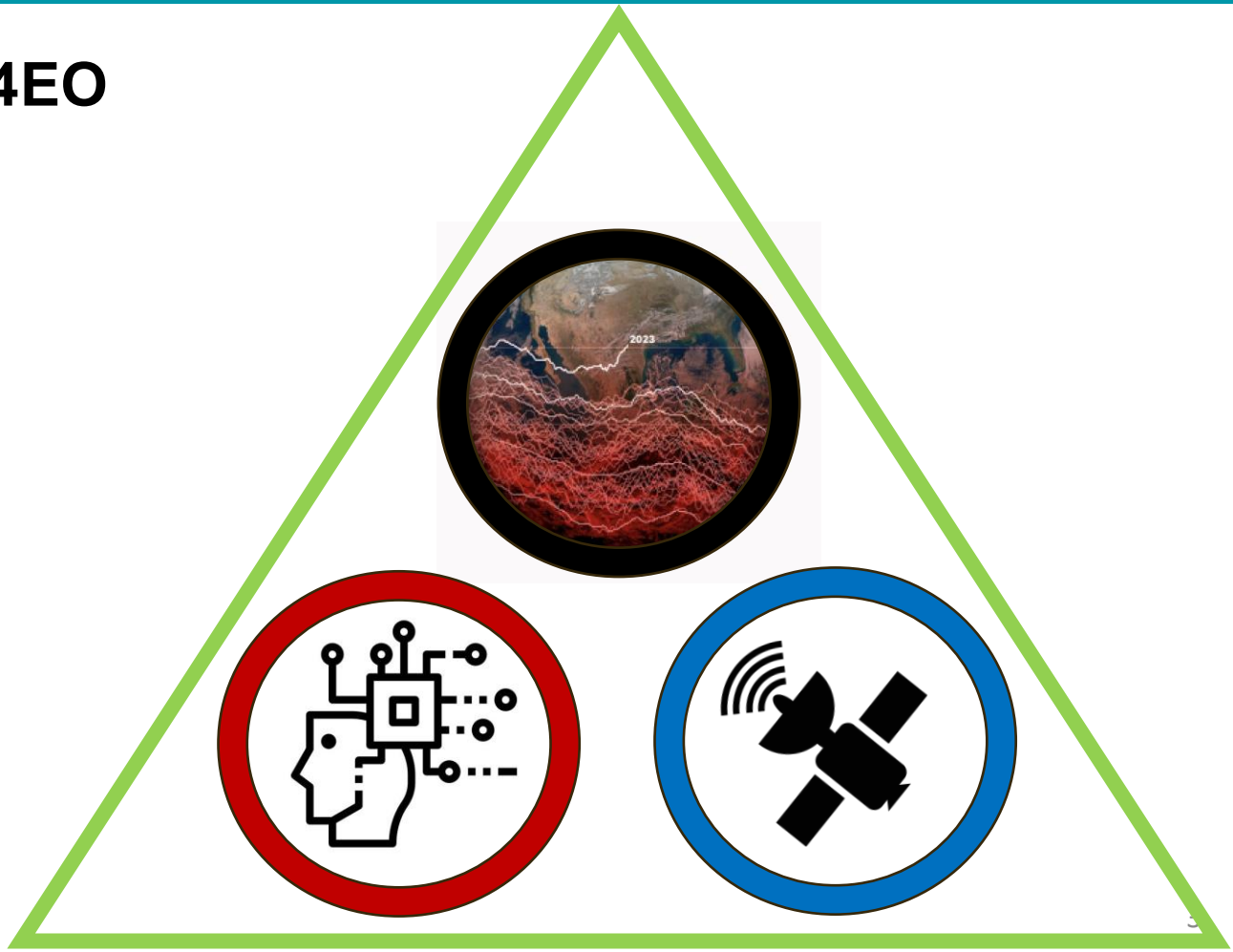
Part 1 - Overview of course

- Who we are, what are we doing here
- Course logistics
- What to expect and assessment
- Summary of course content

Part 2 – Intro to week 1

- Looking at our planet from space
- Google Colab
- IRIS

GEOL0069 – AI4EO



GEOL0069 – AI4EO

The course aims :

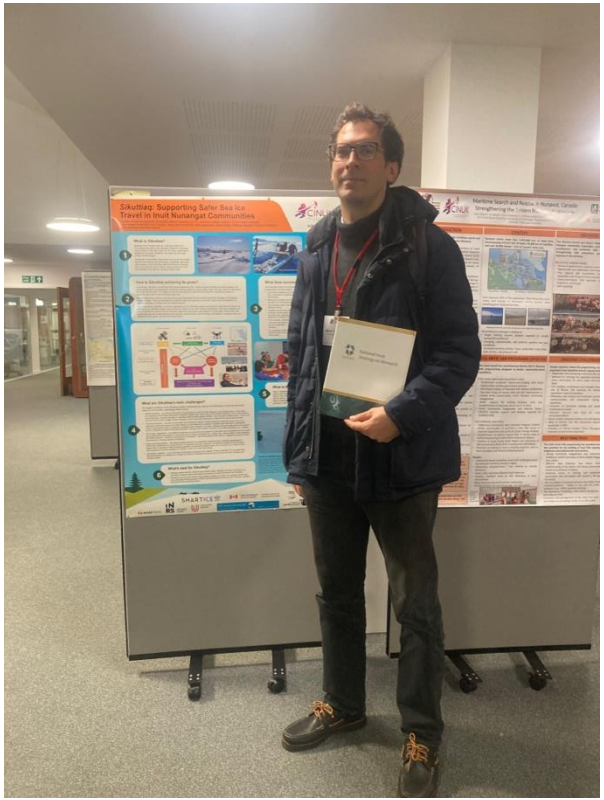
- To define the objectives of Earth Observations and the scientific underpinning for many of the societal challenges that EO can help address.
- To provide a basic introduction into the physics of some geophysical retrieval techniques.
- To provide a hands-on introduction to some of the latest AI tools at our disposal (Deep Learning, Gaussian processes, Feature tracking etc…).
- To provide an introduction to python for geospatial analysis and to cloud computing platforms (i.e. Google Engine).

GEOL0069 – AI4EO

Intended learning outcomes:

- An intro to a range of remote sensing datasets and how they are processed
- A critical view of these datasets and of their spatio-temporal resolution
- A familiarity with the domain of applicability of these datasets to a wide range of societal problems
- Confidence in using python-based algorithms to process parts of these datasets to tackle a variety of problems
- A beginner's understanding of the wide range of AI based techniques
- The capacity to develop a well document code and report on specific case studies

Michel Tsamados



Weibin Chen

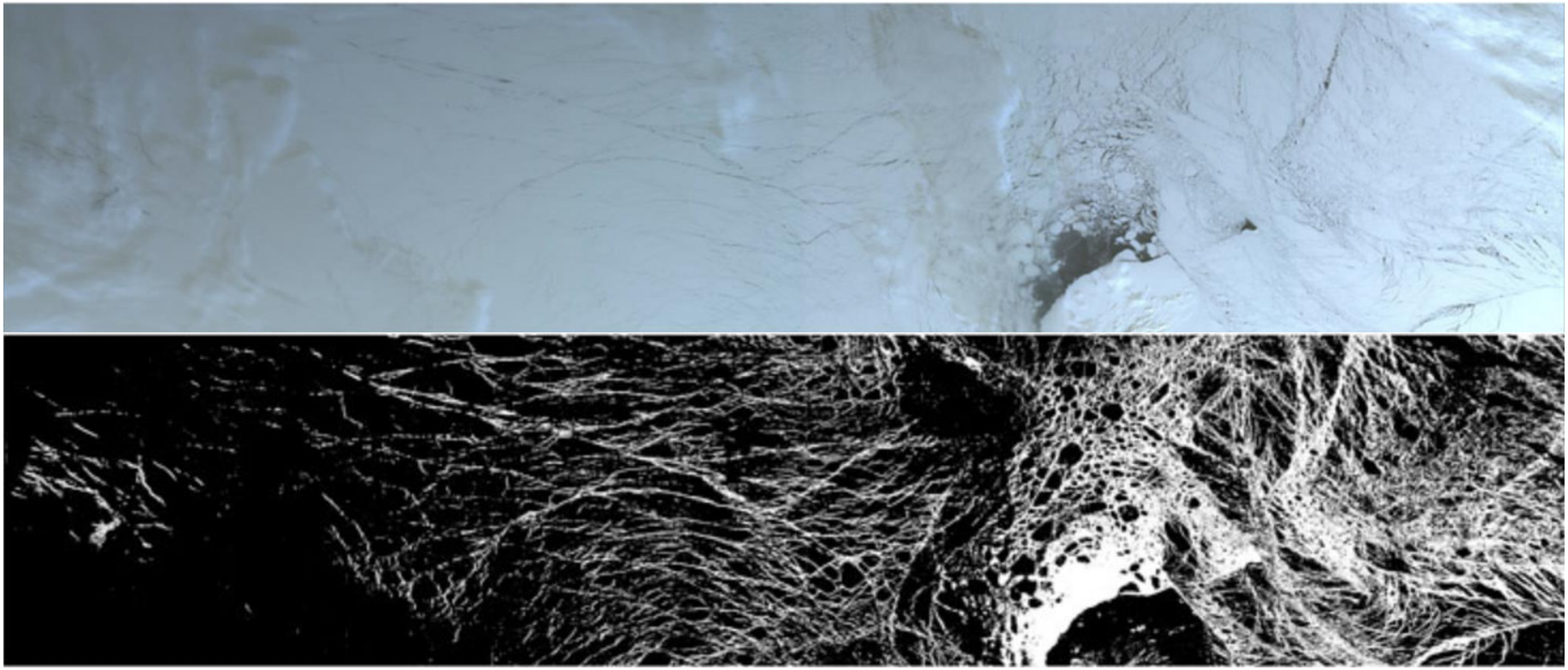
Shambhu Bhandari Sharma

UCL team in a nutshell

Michel Tsamados (Assoc. Prof, satellite and model)
Rosie Willatt (Assist. Prof, polar climate)
Alan Muir (software and IT and much much more)
Thomas Newman (PDRA, radar, drone, sea ice, snow)
Ado Farsi (PDRA, FDEM, AI)
Webin Chen (PhD, AI, Transformers)
Thomas Johnson (PhD, SVR, sea ice roughness)
Connor Nelson (PhD, Passive microwave, altimeter)
Alistair Duffey (PhD, CMIP6, geoengineering)
Ben Mellor (PhD, Met Office, DA, AI)
Sabbie Binti (PhD, ESA, Antarctic, radar)
Carmen Nab (PDRA, Radar)
Ronald Maceachern (RA, AI)
Robbie Mallett (PhD, snow)
William Gregory (PhD, AI, Altimetry)
So Takao (PDRA, general AI expertise)
+ many more (including master students, visitors, etc…)

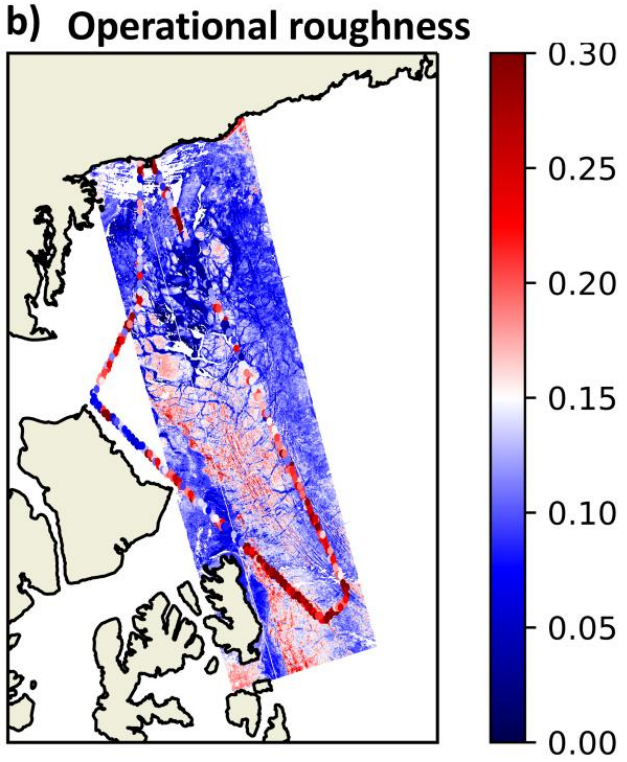
Part 1: Image classification using deep learning and other machine learning tools (Week1 to Week 2)

Chen et al. (2024)



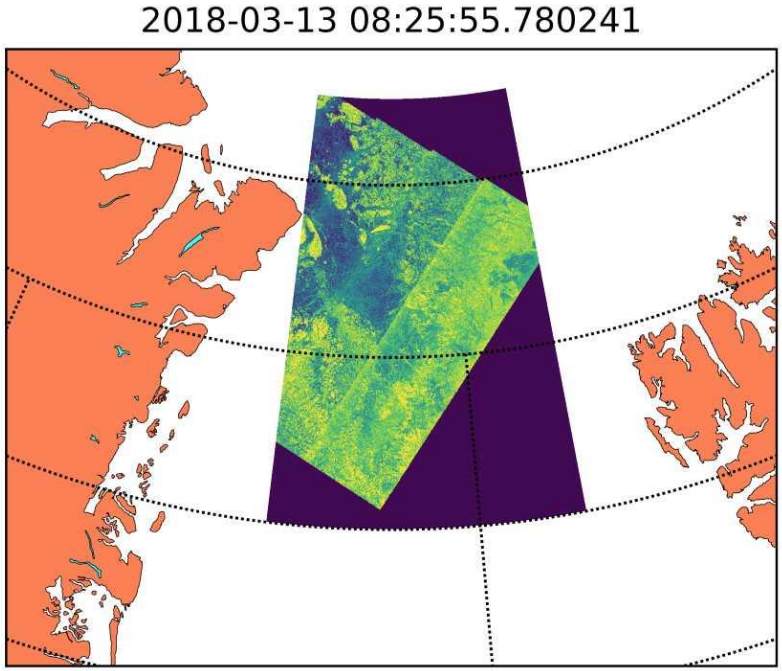
Part 2: Regression using deep learning and other machine learning tools (Week3 + Week 5)

Johnson et al. (2022)



Part 3: Image preprocessing: e.g. collocation and alignment using pattern matching and image tracking algorithms (Week 4 + Week 6)

Sea ice velocities from Sentinel1 pair of images (Fram)



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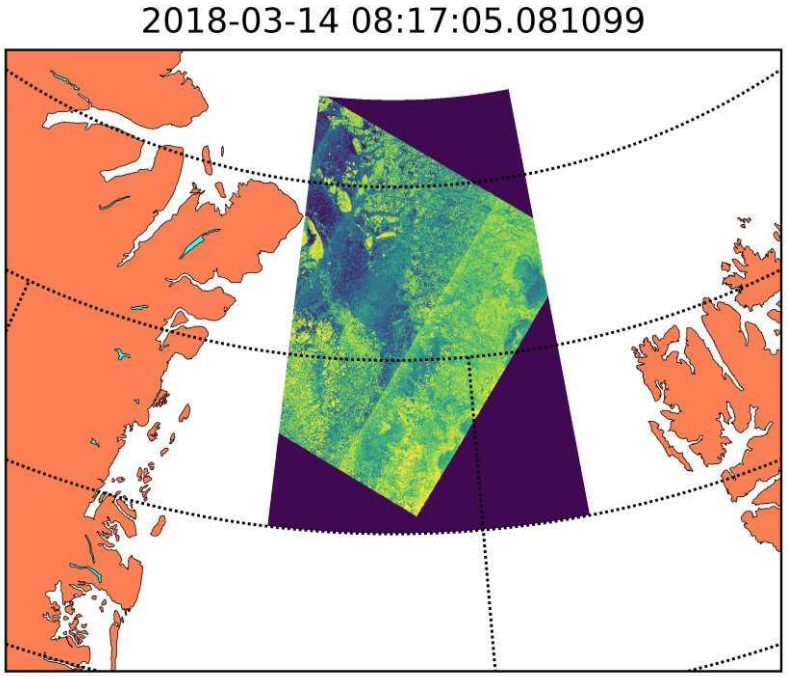

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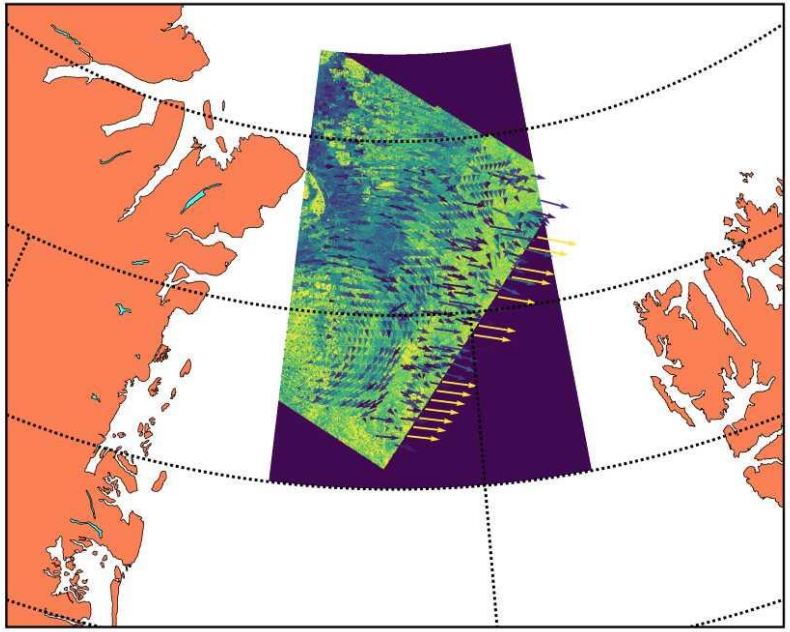
Sea ice velocities from Sentinel1 pair of images (Fram)

-> Pattern Matching



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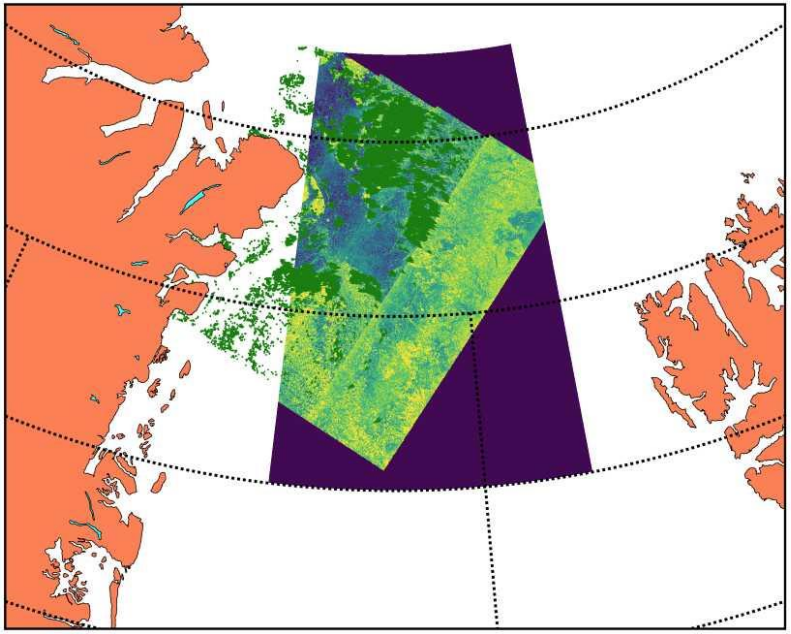
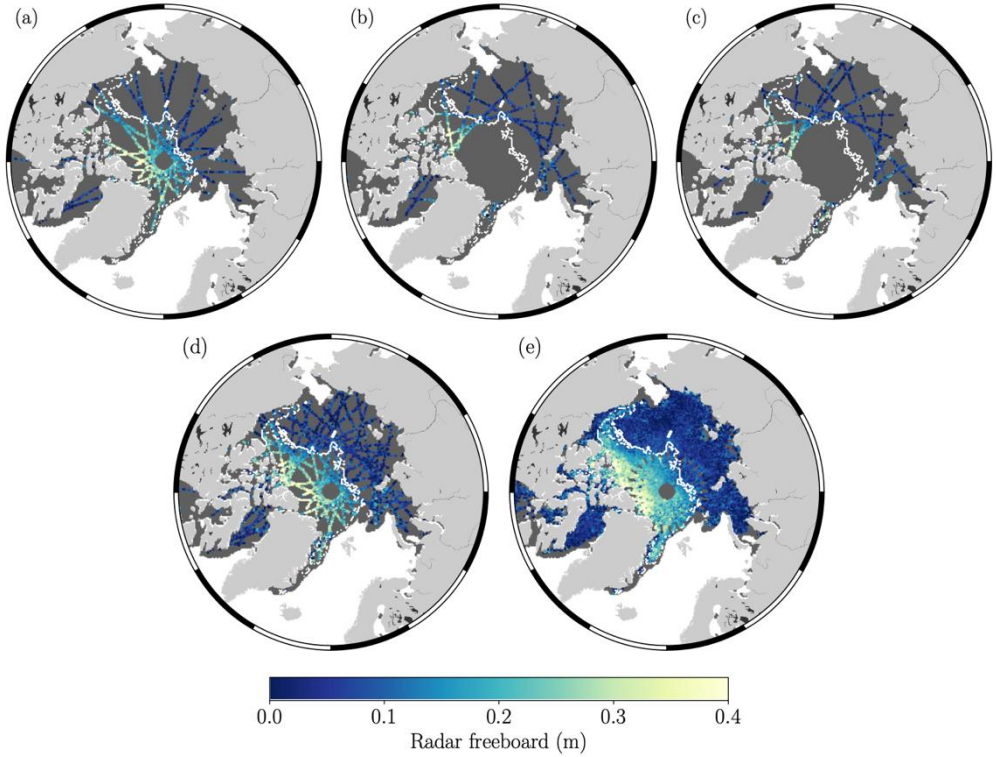
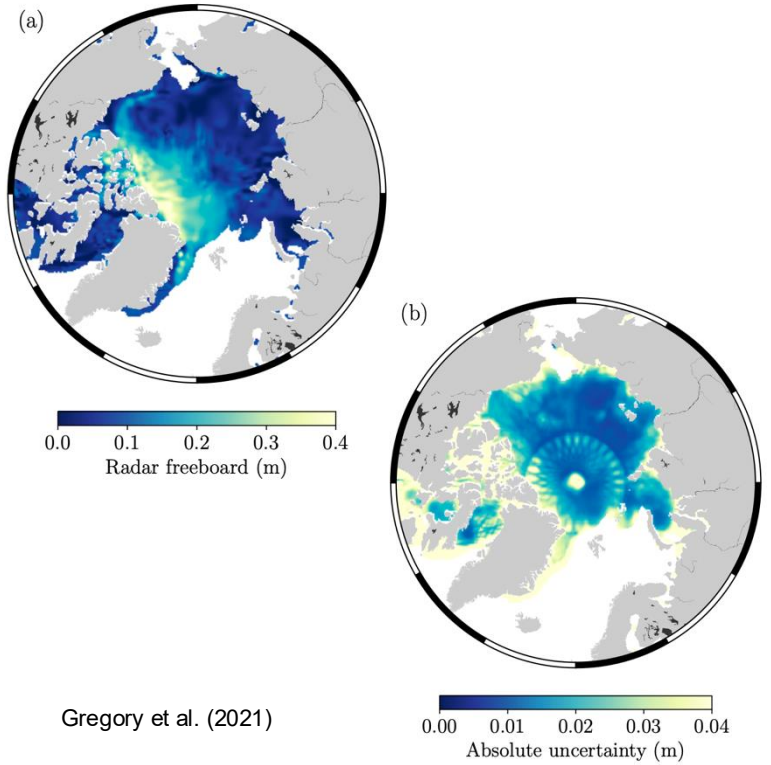
Sea ice velocities from Sentinel1 pair of images (Fram)

-> Feature tracking



Part 4: Optimal interpolation using Gaussian Processes (Week 7 + Week 8)





Gregory et al. (2021)

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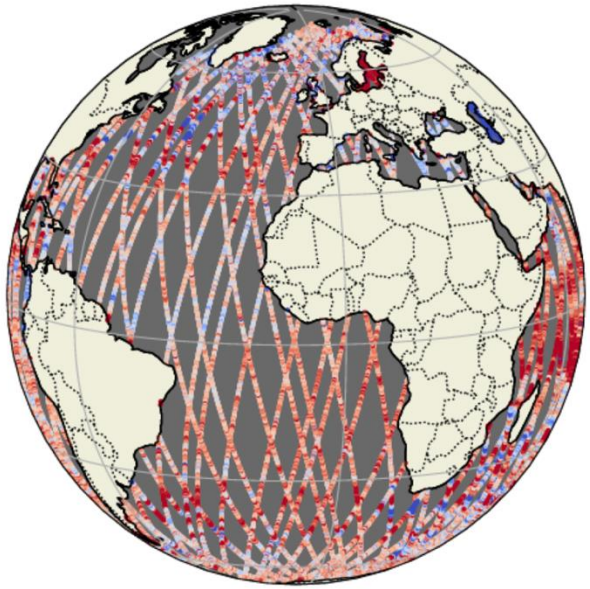
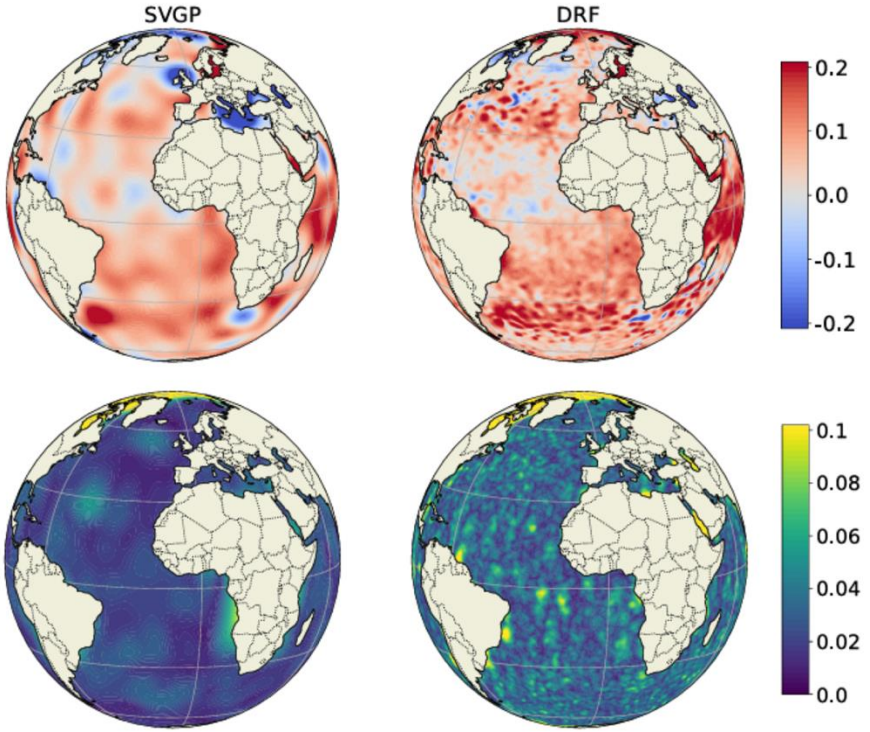
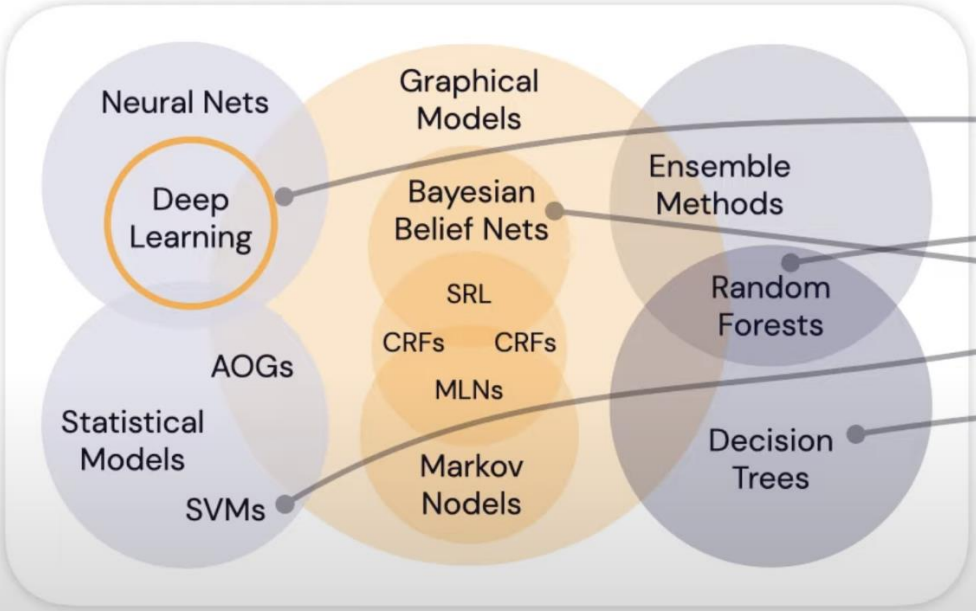


Chen et al. (2025)



Part 5: Explainable AI (Week 9 + Week 10)



Weekly Timetable

Tuesdays, 9AM-11AM – **Lecture/Practical**

Location: G01 - Gower Street (66-72)

Fridays, 4PM-6PM – **Lecture/Practical**

Location: Anatomy G04 Gavin de Beer LT

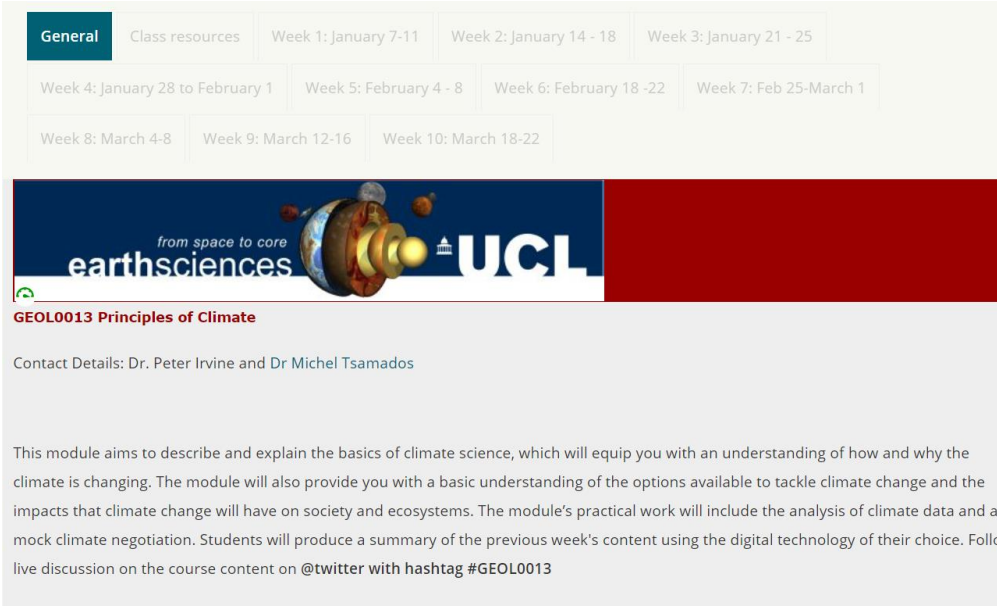
Office hours @ Kathleen Lonsdale Building 301 B/C

- You don't have access so email in advance

Moodle

All course material will be available on the course moodle page, organized by week

- Lecture slides
- Readings
- Assessments



Accessibility

If you have any accessibility issues, please let us know!

- m.tsamados@ucl.ac.uk

Lectures/Practicals

Bring your laptop!

Course Assessment

30% - Continuous assessment (Throughout module)

A continuous assessment component where each student will upload regular content following the hands-on coding practicals.

20% - In class coding assessment (During Term 2)

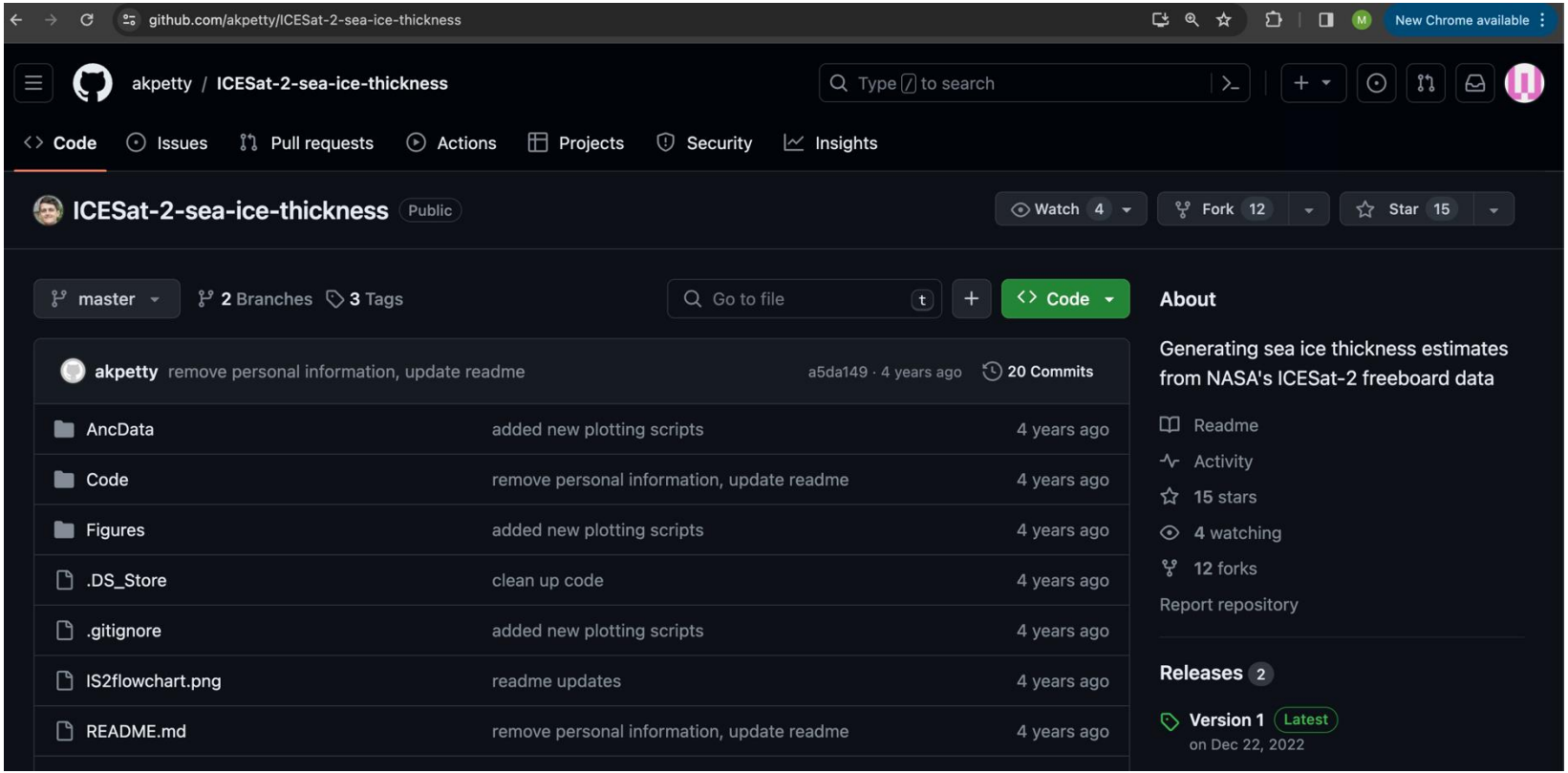
Two practical sessions will serve as graded assessments. During these 2-hour sessions, you will be required to complete specific coding tasks to demonstrate your practical skills.

50% - Coding assignment (Due in Term 3)

A coding assignment to cover a broader AI4EO problem (doesn't have to be on sea ice). This will build on some of the tools we have covered during the class. Your result should include the following elements

- A description of the problem to be tacked
- A figure illustrating the remote sensing technique
- A diagram of the AI algorithm and its implementation
- A well-documented GitHub repository with your well documented python code

Coding assignments



Your Feedback to us

Informal feedback during course

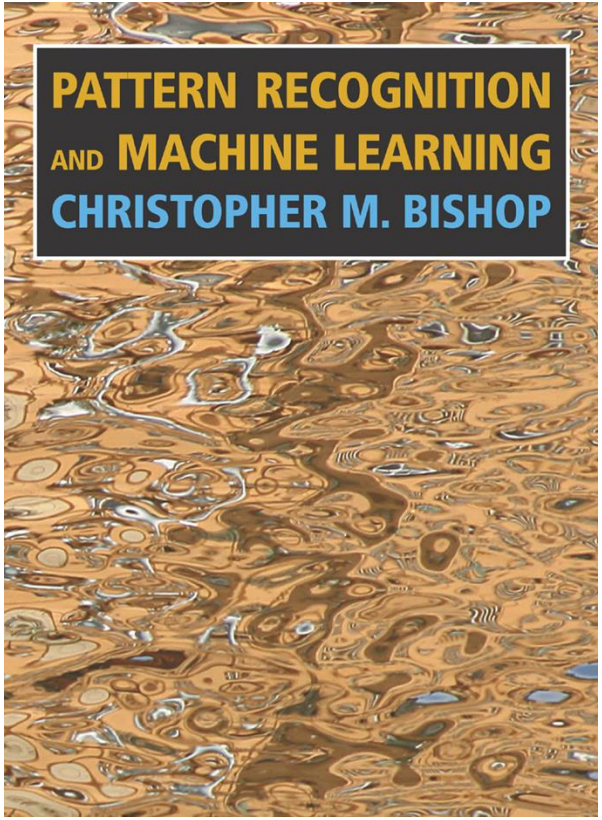
- Let us know any questions you have on moodle
- Give us anonymous feedback (NOT on moodle), details TBD

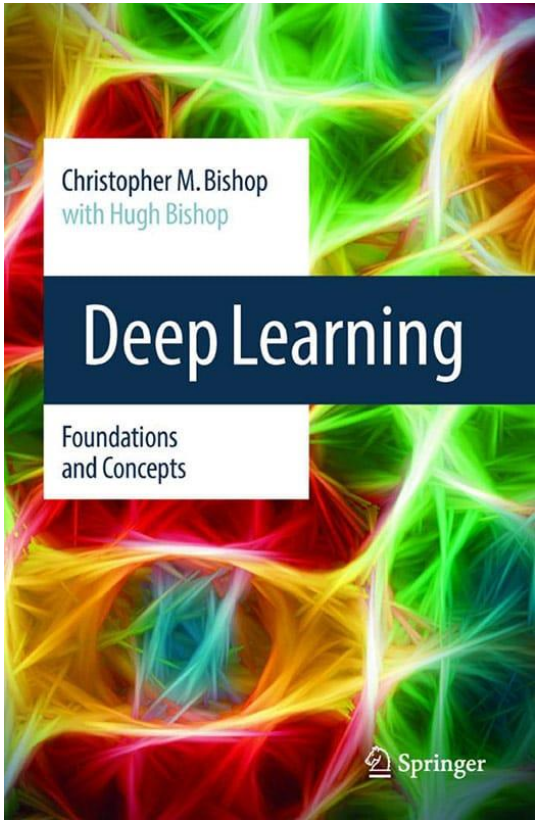
LinkedIn / BlueSky discussion: #GEOL0069

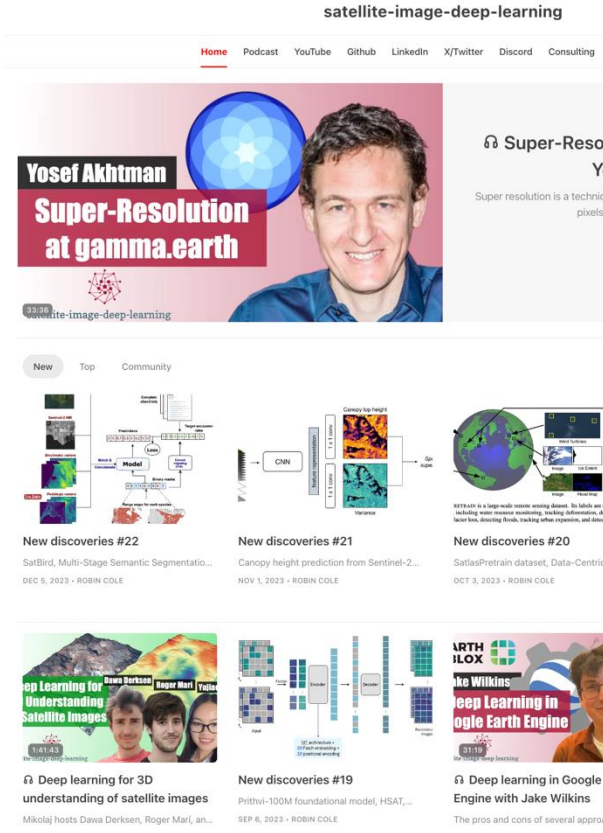
- Share questions, articles, etc.

Formal feedback after course – Please complete!

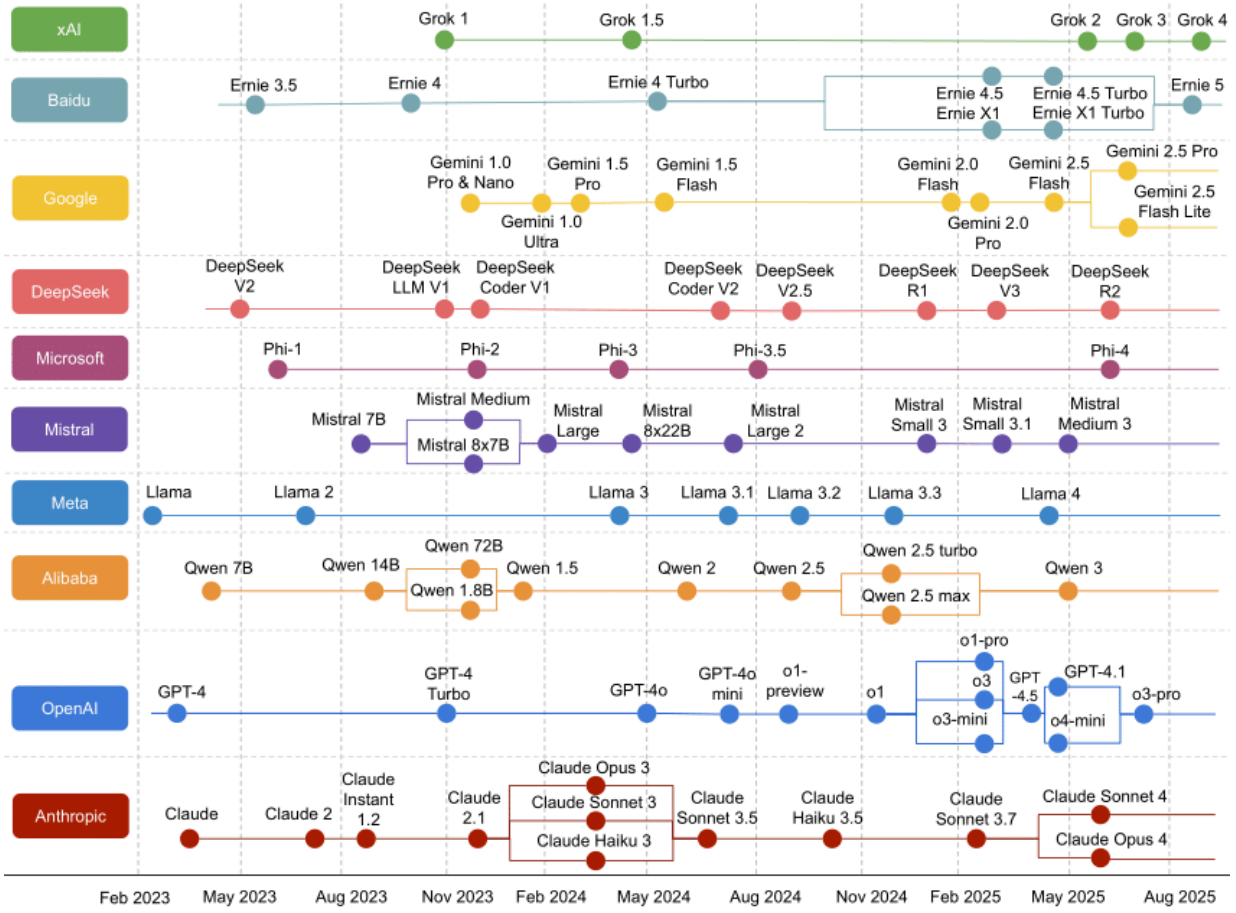
Some useful references and blogs







Use of LLM



https://arxiv.org/html/2507.18479v1

Is AI the doom of ecology (optional but important)

"Fields Medal-winning mathematician Cédric Villani and polar climate expert Michel Tsamados (University College London) come together in Chania for a rare and thought-provoking public discussion as part of Festum π."

https://www.festum-pi.eu/post/is-ai-the-doom-of-ecology-chania-cultural-centre-july-21-20-30

Attendance

Mentimeter -> student number