

PSCB57 - PROF. HANNO REIN

WELCOME!



WHAT YOU'LL LEARN IN THIS COURSE

1. NUMERICAL ALGORITHMS
2. PYTHON
3. DATA ANALYSIS

NUMERICAL ALGORITHMS

1. LU Decomposition
2. Interpolation and Extrapolation
3. Solving integrals
4. Solving differential equations
5. Grid based methods
6. Monte Carlo Sampling

PYTHON

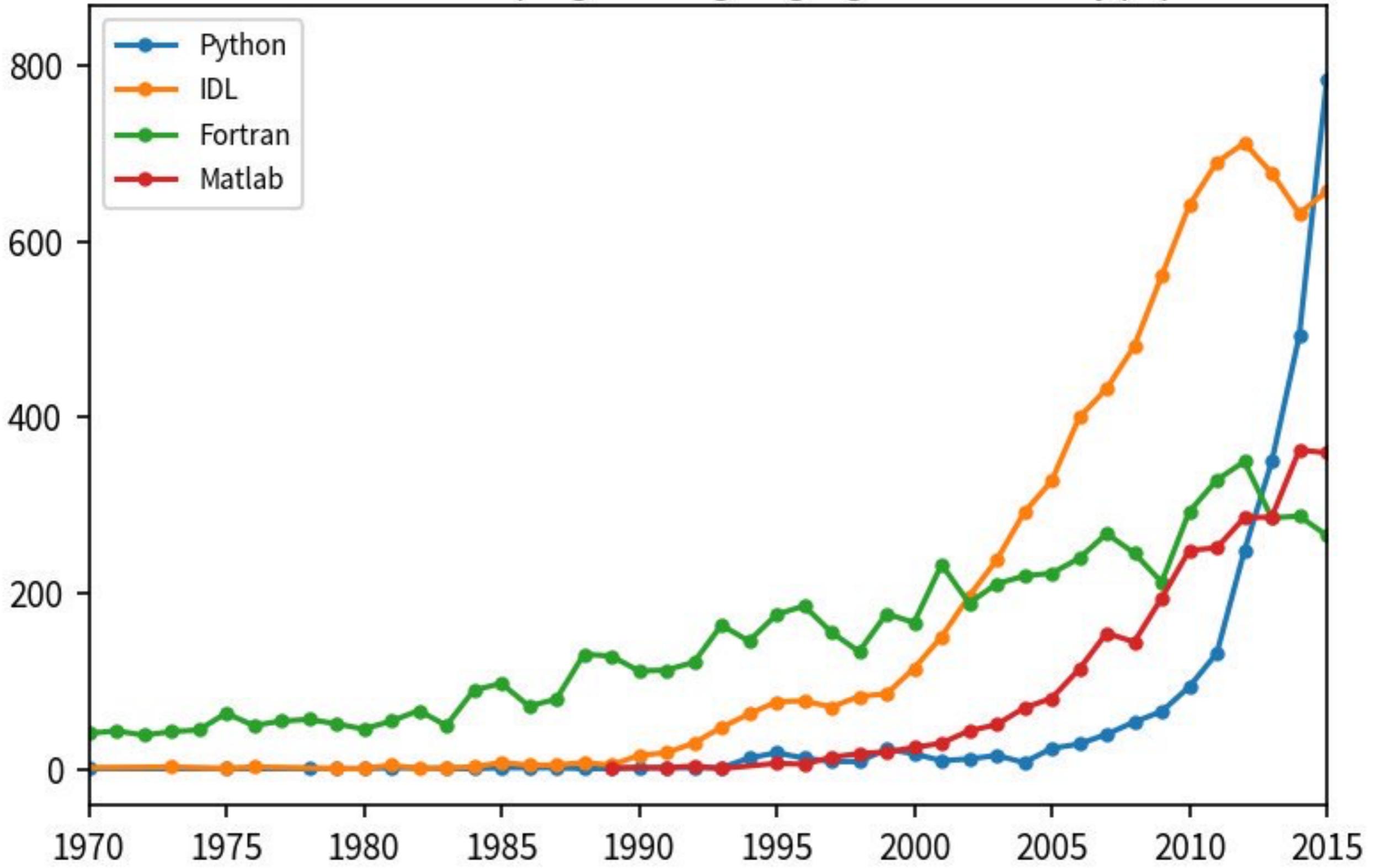
1. Simple programs
2. Floating point numbers
3. Working with arrays and matrices
4. Plotting

DATA ANALYSIS

1. Working with python
2. Jupyter notebooks workflow
3. Real data, collected by yourself
4. Monte Carlo

WHY?

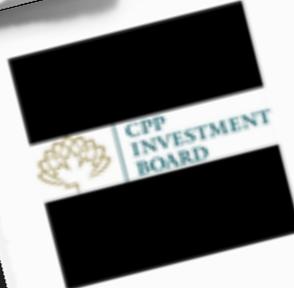
Full text mentions of programming languages in Astronomy papers



WHY?



Data Analyst - Finance
VerticalScope Inc. - Toronto, ON, Canada
Remote



Specialist Developer Capital Markets Technology
Canada Pension Plan Investment Board - Toronto, ON, Canada



Mobile Product Manager
TD Bank Group - Toronto, ON, Canada



Machine Learning Engineer
AdeptMind Inc. - Toronto, ON, Canada
C\$100k - 170k **Visa sponsor** **Paid relocation**

should be able to check off most things

- Knowledge about machine learning theory and algorithms: SVM, random forest, gradient boosting methods, graphical models, bayesian methods, etc.
- Some Knowledge about deep learning theory, algorithms and tricks: RNN, ConvNet, seq2seq, dropout, attention mechanism, data augmentation, batch normalization, adversarial learning, VAE, GAN, etc.
- Knowledge about model optimization methods: 1st/2nd order methods, bayesian optimization, etc
- Algorithm, data structure and object oriented programming skills
- Proficiency in Python
- Experience in applying machine learning algorithms for natural language processing/generation tasks
- Experience with the Linux stack(bash, git, package management etc.)
- Experience in processing large amounts of data

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SYLLABUS

GENERAL

- Office hours:
Monday 11 - noon (today: 1pm-2pm)
Tuesday 1pm - 2pm
Any other time!
- hanno.rein@utoronto.ca
- @hannorein

LECTURES

- Be on time!
- 10 minute break
- No food in the lecture
- Notes on paper are encouraged
- No phones
- Computers allowed, but only if course related, no Facebook

TUTORIALS

- Be on time!
- Bring your computer! If you use the lab computers, bring your USB stick.
- Python introduction, help with assignments, ask questions about the course, quizzes

ASSIGNMENTS / QUIZZES

- Coding assignments
- Submit the jupyter notebook (ipynb)
- Quizzes in lecture or tutorial
- Quizzes will test your knowledge about
 - Course material
 - Assignment
 - YOUR assignment

PLAGIARISM

OK

- Using the internet
- Asking your professor / TA for help
- Talking to other students

NOT OK

- Copy and pasting code from the internet or other students
- Not understanding what you submit

PLAGIARISM

You have to understand
what you submit.

GRADES

Assignments and quizzes	25*
Geotab project	20
Midterm	20
Final exam	35

*Need at least 40% in assignments/quizzes to pass the course

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GEO TAB PROJECT

WHAT IS IT?

- Team based project you'll work on the entire term
- Devices generously provided by Geotab
- 20% of your grade
- 3 deliverables:
proposal / report / presentation

WHAT DO YOU HAVE TO DO?

- Use a GPS tracker for cars to collect data
- Come up with a clever idea on how to use the data
- Write a program in python



The screenshot displays the my.geotab.com web application interface. At the top, the browser address bar shows "my.geotab.com". The navigation bar includes a "Filter..." search box, a dropdown menu set to "All", and user information: "G560", "0 Notifications", and "user@company.com".

The left sidebar contains the "myGEOTAB" logo and a menu with the following items: "Getting Started & Help", "Summary", "Map" (highlighted), "Vehicle", "Activity", "Engine & Maintenance", "Zones", "Rules & Groups", and "Administration".

The main content area features a map of Orlando, Florida, with a blue location pin. Above the map are controls for "Vehicle, VIN, zone, route or add", "Map", "Add zone", and "Trips history". A popup window over the pin displays the following information:

- John R. Smith**
- Driving at 65mph
- Eastbound on FL-408

The map shows major roads like I-4 and I-95, and various neighborhoods including Fairview Shores, Winter Park, and College Park.

FIRST GEOTAB DELIVERABLE IS DUE OCT 20TH!

- Start to think about project ideas now!
- Start to form teams (5-6 students)!
- Try to form a team with diverse skills! Not just your friends!
- Team formed? Come see me to get a geotab device!

ON CHOOSING THE RIGHT PROJECT IDEAS

- Don't try to do something that is too complicated!
- Do something simple and focus on the report, the execution, and the implementation.
- If possible, try to make it *scientific*.

WHY THIS GEOTAB PROJECT?

- Real world data
- Apply what you learned:
 - Python, jupyter-notebooks
 - Working with lists and arrays
 - Interpolation, extrapolation
 - Plotting
- How to solve a problem when something doesn't work

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SOFTWARE

SOFTWARE

You need access to a computer with

- Python 3.x
- Jupyter-notebooks
- `numpy`, `scipy`, `matplotlib`

SOFTWARE

Two options:

- Install it on your own computer (e.g. anaconda)
- Boot linux from a USB stick and use any computer, including the lab computers in physics

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FLOATING POINT NUMBERS



-00:00:17