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
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

- Python
- IDL
- Fortran
- Matlab
WHY?

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

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

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

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

- Knowledge about machine learning theories 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
PSCB57 - PROF. HANNO REIN

SYLLABUS
• 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
You have to understand what you submit.
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<td>Geotab project</td>
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*Need at least 40% in assignments/quizzes to pass the course*
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
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
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
FLOATING POINT NUMBERS