

ENSF 619.02 - Advanced Topics in Image Analysis and Machine Learning

Course Overview

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Electrical and Computer Engineering

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03 January 2023

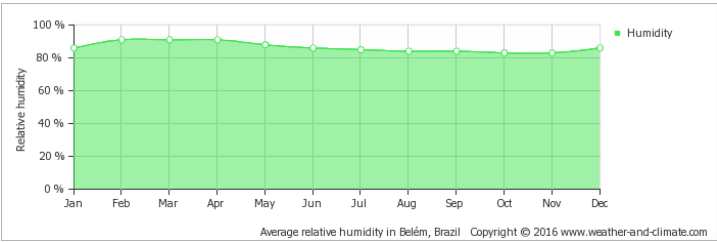
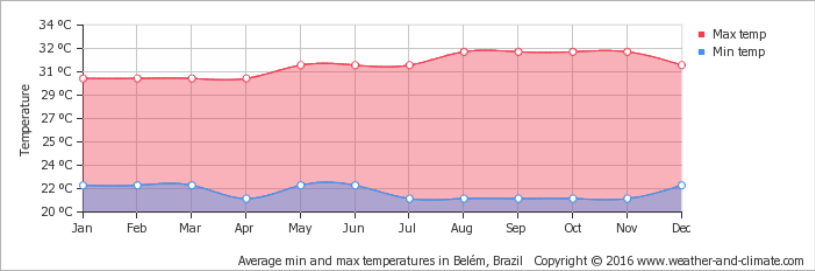


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First Class Goals

- Get to know the class better and vice-versa
- Set expectations and prepare you for what will come

Belém/Brazil



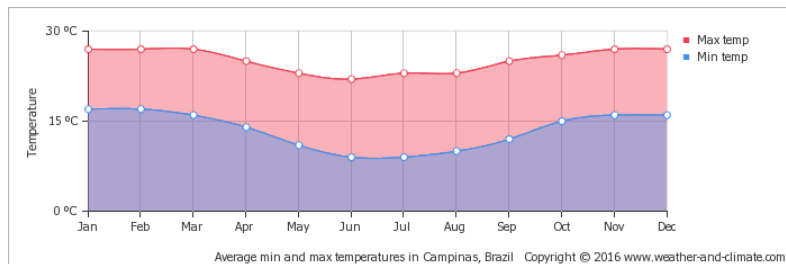
**Electrical Engineering
B.Sc. - 2011**



6-month exchange



Campinas/Brazil



UNICAMP

Computer Engineering

M.Sc. – 2014

Ph.D. – 2017

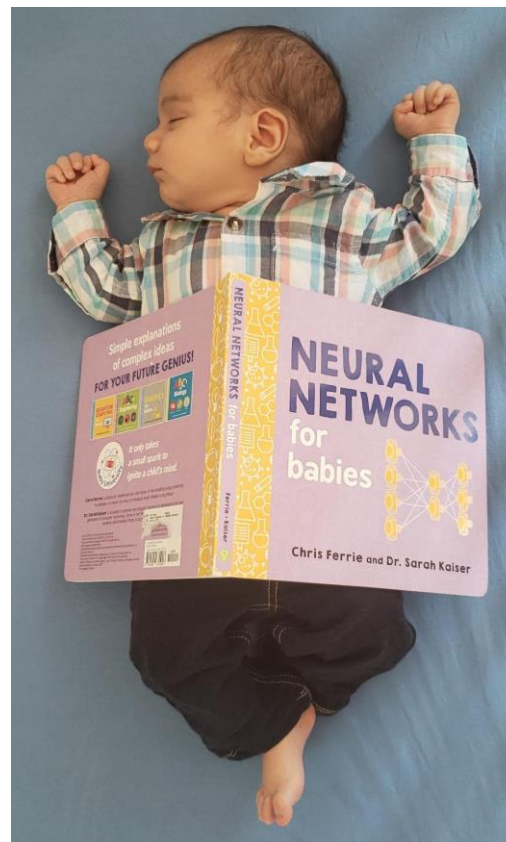


Calgary/Canada



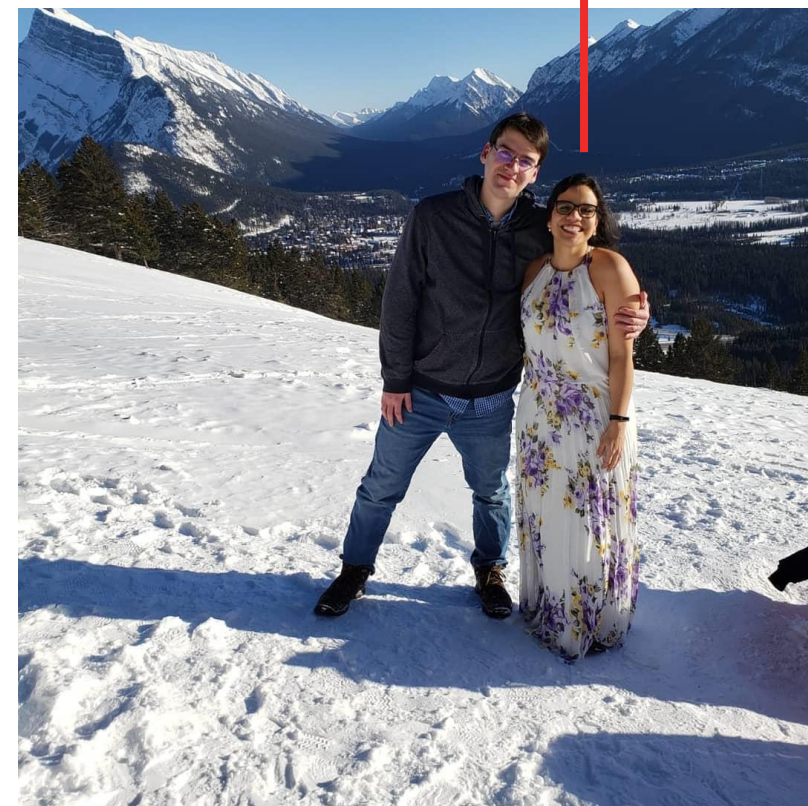
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Postdoctoral Fellow
June 2017 – June 2020
Assistant Professor
July 2020 - present



Baby Jorge – Born 12
September 2019

My wife (Mariana) also a
researcher in AI



Wedding in Banff (-30C!)
March 2019

AI runs in the family...

Meet and Greet

- Let's get to know you. If you are comfortable, please share:
 - Name
 - Supervisor
 - Background

Course Delivery

- Synchronous and in-person
 - MF – 11:00 am to 12:15 pm
 - Room ENF 334
- Office hours between 10 am and 10:50 am on M and W
 - Starts on the 2nd week of class
 - My office ICT 352C
- It is a large class, but **don't be a stranger! Come to the office hours with your questions.**

Course Syllabus

This course focuses on advanced machine learning and image analysis techniques. The course will cover the following topics: models of image segmentation, state-of-the-art methods on ImageNet, self-supervised learning, domain adaptation, generative models. A special emphasis will be given to recent cutting-edge techniques. The course will be hands-on.

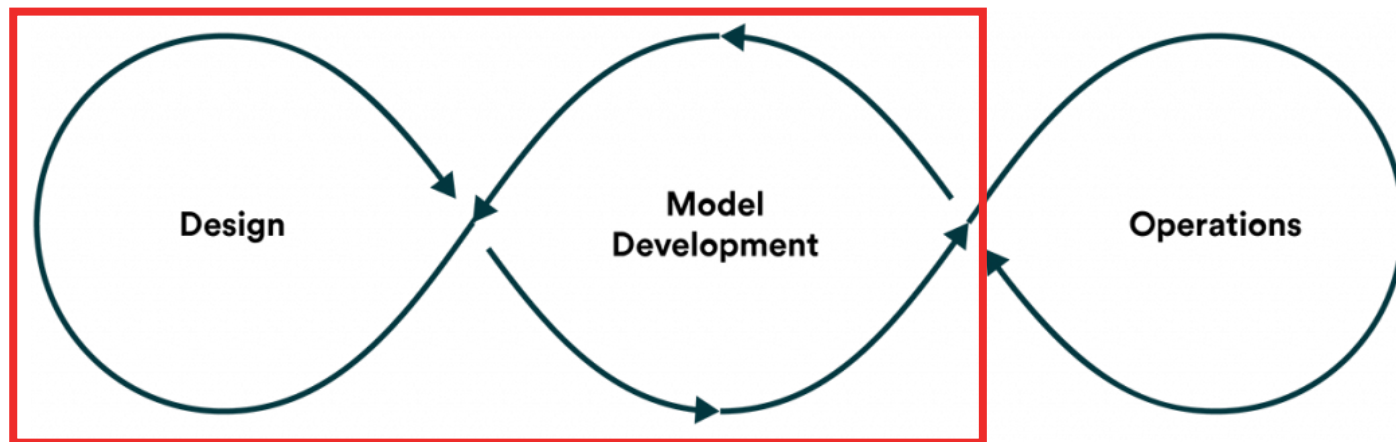
Course Syllabus (main topics)

- Python Bootcamp and machine learning concepts
- Data preparation and pre-processing
- Regularization techniques
- Neural Networks
- Transfer Learning and Domain Adaptation
- U-net model of image segmentation
- Generative models
- Self-supervised learning

Learning Outcomes

1. Acquire significant knowledge about cutting-edge image analysis and machine learning methods.
2. Design and develop image processing and machine learning solutions for relevant problems.
3. Acquire hands-on experience with image processing and machine learning programming frameworks (e.g., OpenCV, scikit-image, PyTorch, etc.).

What this course is about?

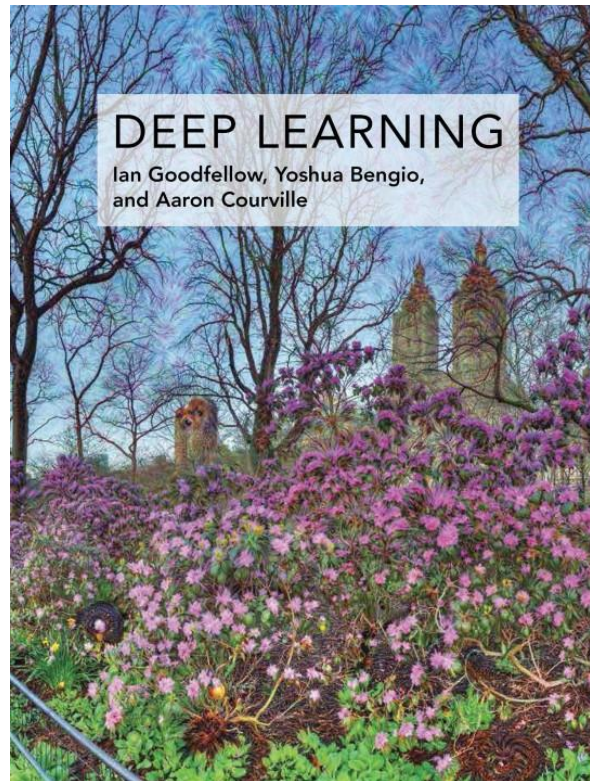


- Model deployment
- CI/CD pipelines
- Monitoring & triggering

This course is about designing and developing machine learning models to achieve the best quantitative metrics* to the problems being modelled.

Textbook

- No mandatory textbook for this course



Starting at chapter 5

Course Assessment

Component	Learning Outcomes	Weight
Participation	1, 2	5%
Assignments (2)	1, 2, 3	40%
Quizzes (2)	1, 2	10%
Final Project	1, 2, 3	45%

- The lowest quiz grade will be dropped

Participation (5%)

- Student participation will account for 5% of the final grade. How participation will be measured?
 - Students questions and answers during class
 - Students participation on the D2L discussion board
 - Students helping each other during class

Assignments (40%)

- Individual or in pairs
- **Assignment 01 (20%):**
 - Create a machine learning hands-on tutorial
 - **Due:** February 27th (midnight) | **Delivery method:** D2L dropbox
- **Assignment 02 (20%):**
 - Reading assignment – present in class
 - **Due:** presentations will be scheduled in class | **Delivery method:** D2L dropbox

Quizzes (10%)

- 2 quizzes –highest grade is kept
- Quizzes are individual
- Content: all topics covered until the day of the quiz
- **Quiz 01: January 27th**
- **Quiz 02: February 27th**
- The dropped quiz is to accommodate potential student absence

Final Project (45%)

- 6-page report + 1 additional page only with references (if necessary)
- Report template
 - Overleaf - please make a copy for your team.
 - Microsoft word
- Report due date: **March 27 at 9 am**
- Final project presentations: **March 27th to April 3th**
 - 10-minute presentation + 5-minutes for questions
 - Send slides one day before your presentation

Grades

Letter Grade	Total Mark (T)
A+	$T \geq 95\%$
A	$90\% \leq T < 95\%$
A-	$85\% \leq T < 90\%$
B+	$80\% \leq T < 85\%$
B	$75\% \leq T < 80\%$
B-	$70\% \leq T < 75\%$
C+	$65\% \leq T < 70\%$
C	$60\% \leq T < 65\%$
C-	$55\% \leq T < 60\%$
D+	$50\% \leq T < 55\%$
D	$45\% \leq T < 50\%$
F	$T < 45\%$

The Programming Environment (Part 1)



<https://colab.research.google.com/>



<https://jupyter.org/>



<https://github.com/rmsouza01/ENEL645>



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Research Computing Services

https://rcs.ucalgary.ca/index.php/RCS_Home_Page

The Programming Environment (Part 2)

- Python 3
- Python libraries:
 - siamxt
 - NumPy
 - SciPy
 - Matplotlib
 - Scikit-learn
 - Scikit-image
 - Pandas
 - Tensorflow (version ≥ 2.0)
 - PyTorch
- Please have your programming environment in your computer or on Google Colab set up asap

Deep Learning Framework



**I hope you enjoy the
class 😊**

Questions?