



[Cooperative Institute for Research in the Atmosphere \(CIRA\)](#)

CIRA Short Course on Machine Learning for Weather and Climate

Update (Dec 4 2023): The Colab notebooks are back! We apologize to everyone who tried to access the notebooks in the last month or so and was told “access denied”. We also lost access to our own notebooks. We have regained access and put them somewhere with better long-term storage, so this should never happen again.

Instructors:

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This course was originally developed for research scientists from [CIRA](#) and [NOAA-GSL](#). It consists of six lectures (90 min) delivered once a week from Sept 16-Oct 21, 2020.

Below you find links to Video recordings and to Jupyter Notebooks (Colab).

Update (Dec 23, 2021): all videos have now been uploaded to Youtube and the links below have been updated accordingly.

Ppt/pdf-files of the slides are in a separate folder: [HERE](#).

Github repository: [HERE](#). This contains the code for all the subroutines used in the Colab notebooks. Special credit to [David John Gagne II](#) (NCAR), who co-developed some of the notebooks used in this course together with Ryan Lagerquist.

Lecture 1: Sept 16, 2020

Topic: Introduction to ML, ML opportunities and pitfalls, ten sample CIRA application of ML

[Video recording \(new Youtube link\)](#) [Colab Notebook](#)

Lecture 2: Sept 23, 2020

Topic: Linear and logistic regression, regularization, training/validation/testing, model evaluation

[Video recording \(new Youtube link\)](#) [Colab Notebook](#)

Lecture 3: Sept 30, 2020

Topic: Decision trees and their ensembles, clustering - primarily *K*-means (slides and Notebook also cover hierarchical clustering and DBscan)

[Video recording \(new Youtube link\)](#) [Colab Notebook](#)

Lecture 4: Oct 7, 2020

Topic: Fully connected ("traditional") neural networks and intro to ML interpretation

[Video recording \(new Youtube link\)](#) [Colab Notebook](#)

Lecture 5: Oct 14, 2020

Topic: Convolutional neural networks and more ML interpretation

[Video recording \(new Youtube link\)](#) [Colab Notebook](#)

Lecture 6: Oct 21, 2020

Topic: General recommendations and resources, CNNs for image-to-image translation, CIRA applications, Generative Adversarial Networks (GANs)

[Video recording \(new Youtube link\)](#)

Additional recommended resources (tutorials, sample code, manuals):

- [Official scikit-learn website](#)
- [Official Tensorflow/Keras website](#)
- [Jupyter notebooks for the book "Deep Learning with Python"](#) (Francois, Chollet. "Deep learning with Python.", Manning Publications, 2017)

Highly recommended books:

- Excellent to get started in ML in general:
Géron, Aurélien. **Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems.** O'Reilly Media, 2019.
- Excellent to get started in neural networks (prereq: basic knowledge of ML):
I. Goodfellow, Y. Bengio and A. Courville, "**Deep Learning**", MIT Press, 2016.