# INAF Machine Learning School

# Table of Contents

**Day 1**

* Introduction to learning
  + Terminology
  + Intuitive (and not so) definition of learning
* Calculus and Gradient Descent
  + General Definition of GD
  + Concept of learning rate
  + Variations of Gradient Descent (plain, mini-batch, stochastic)
  + Mini-batch size
* GD and Chaos
  + Demonstration of how chaos emerges from linear regression with stochastic GD
* Model Validation
  + Bias and Variance
  + Overfitting and underfitting
  + Simple Split Approach (hold-out)
  + Data Leakage
  + Monte Carlo Cross Validation
  + k-Fold Cross Validation
  + Leave-one-out Cross Validation
  + Model Selection

*Hands-on*

* Introduction to Python and scikit-learn
* Gradient Descent from scratch

**Day 2**

* Algebra and PCA
  + Notes about matrices and their role in deep learning
  + Mathematics of PCA
* Neuron
  + Basic Functionalities
  + Activation Function(s)
  + How to train a single neuron
* Loss Function
  + MSE
  + MAE
  + Cross-Entropy (for classification)
* Linear and logistic regression with a single neuron
* Keras and TensorFlow