



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Astrostatistics

2122-1-F5802Q014

---

#### Aims

The use of statistics is ubiquitous in astronomy and astrophysics. Modern advances are made possible by the application of increasingly sophisticated tools, often dubbed as "data mining", "machine learning", and "artificial intelligence". This class provides an introduction to (some of) these statistical techniques in a very practical fashion, pairing formal derivations to hands-on computational applications. Although examples will be taken almost exclusively from the realm of astronomy, this class is appropriate to all Physics students interested in machine learning.

#### Contents

##### Detailed program

Statistics topic covered:

- Brief recap on probability and statistical inference.
- Bayesian inference (role of priors, difference and similarities with the frequentist approach, model selection, MCMC).
- Looking for structure in the data (cluster algorithms, parametric vs non-parametric estimators).
- Dimensionality reduction (e.g. Principal Component Analysis).
- Regression problems (overfitting, gaussian process regression).
- Classification problems (neural networks, ROC curves).
- Deep learning.
- Time-series analyses.

Some examples of astrophysical datasets we might use include (TBC):



## **Semester**

Second semester.

## **Assessment method**

The class will be assessed with an oral exam. A computational problem will be assigned beforehand; students will need to complete it in their own time and discuss it during the exam.

-----

## **Office hours**

Any time, please contact me by email.

---