The Alan Turing Institute

# MLJ Workshop

Resources: **github.com/ablaom/MLJTutorial**

Anthony Blaom with Quinn Asena


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Institute


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Julia
computing

# The Team

**Core design:** A. B., Franz Kiraly, Sebastian Vollmer

**Lead development:** A. B., Thibaut Lienart

**Other contributors:** Diego Arenas, Samuel Okon, Yiannis Simillides, Julian Samaroo, Ayush Shridar, Geoffroy Dolphin, Mosè Giordano...

**Julia language consultants:** Avik Sengupta

# Some machine learning libraries in Julia

```
22-element Vector{String}:
 "OutlierDetectionNeighbors"
 "OutlierDetectionPython"
 "OutlierDetectionNetworks"
 "ScikitLearn"
 "DecisionTree"
 "MultivariateStats"
 "MLJModels"
 "BetaML"
 "MLJLinearModels"
 "LIBSVM"
 "EvoTrees"
 "NaiveBayes"
 "MLJFlux"
 "Clustering"
 "ParallelKMeans"
 "NearestNeighborModels"
 "PartialLeastSquaresRegressor"
 "LightGBM"
 "GLM"
 "TSVD"
 "MLJText"
 "XGBoost"
```

# Some multi-paradigm machine learning toolboxes in Julia

- ScikitLearn.jl - thin wrapper for Python's scikit-learn
- AutoMLPipeline.jl
- MLJ.jl
- FastAI.jl - specific to neural networks

# What?

## What's a machine learning toolbox?

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**What's a machine learning toolbox?**

- A toolbox provides a **uniform interface** for **fitting**, **evaluating** and **tuning** machine learning models.
- Provides common **preprocessing tasks** (such as data cleaning and type coercion )
- Allows for model **composition** (e.g., pipelining)

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## Why learn the MLJ toolbox?

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  - Easy access to core algorithms
  - Easier to customize
  - Easier to add new performant models
  - Greater transparency and reproducibility
  - Better composability with other libraries

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  - Easy access to core algorithms
  - Easier to customize
  - Easier to add new performant models
  - Greater transparency and reproducibility
  - Better composability with other libraries
- Start-of-the-art **model composition** that plays well with everything else.
- Meta-algorithms (e.g., tuning) are model wrappers

# How to entertain your kids at home - the case for MLJ


Playmobil ©


Lego ©

3 models dinosaurs + 15 user contributed models

We support you in building your snake powered train!

# Workshop Overview

- Recap of supervised and unsupervised learning
- Preview of model composition (stacking)
- Part 1 - **Data Representation** + exercises
- Part 2 - **Selecting, Training and Evaluating Models** + exercises
- Break
- Part 3 - **Transformers and Pipelines** + exercises
- Part 4 - **Tuning hyper-parameters** + exercises
- Part 5 - **Advanced model composition** (time permitting)

## Supervised Learning

Learning to **predict** some target variable **y** from a knowledge of some other variables **X** (the *input features*).

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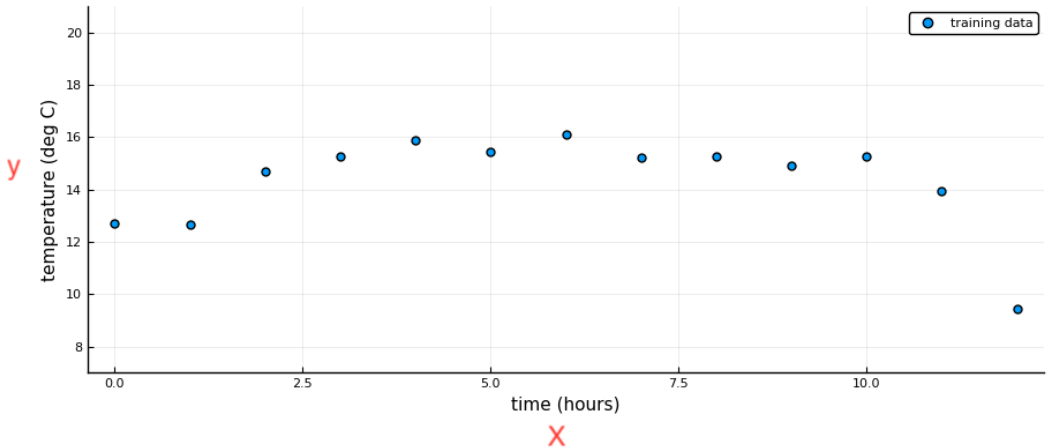
**X**

| time | room |
|---|---|
| Int64 | CategoricalValue{String,UInt32} |
| 5 | kitchen |
| 5 | bathroom |
| 5 | bedroom_1 |
| 5 | living_room |
| 6 | kitchen |
| 6 | bathroom |
| 6 | bedroom_1 |
| 6 | living_room |
| 7 | kitchen |
| 7 | bathroom |
| 7 | bedroom_1 |
| 7 | living_room |

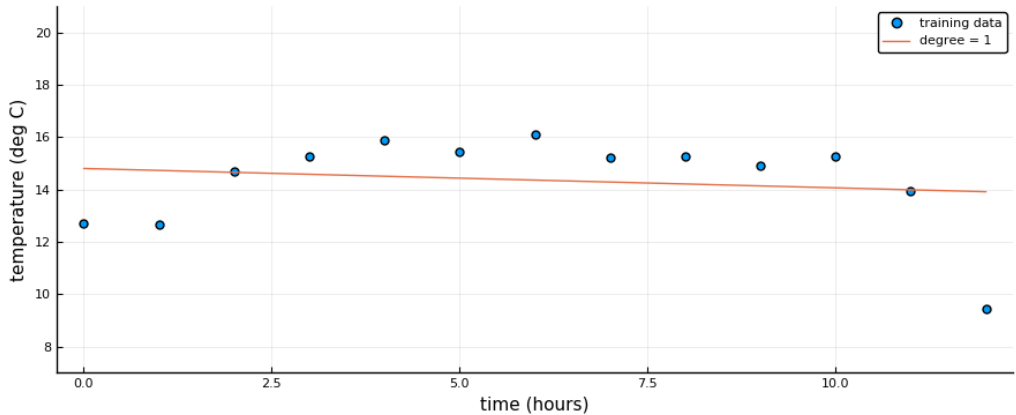
**y**

| temperature |
|---|
| Float64 |
| 18.5 |
| 18.3 |
| 18.3 |
| 17.4 |
| 16.6 |
| 20.7 |
| 18.9 |
| 20.2 |
| 20.4 |
| 19.9 |
| 16.2 |
| 17.3 |

# Supervised Learning



# Supervised Learning



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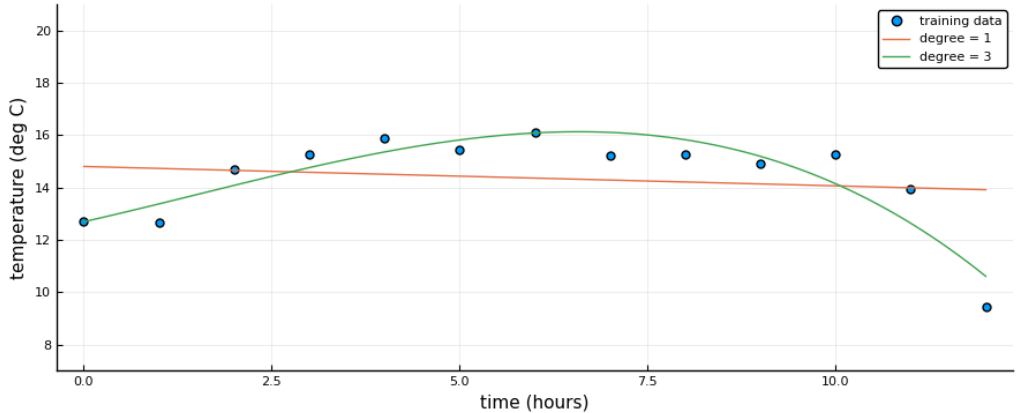

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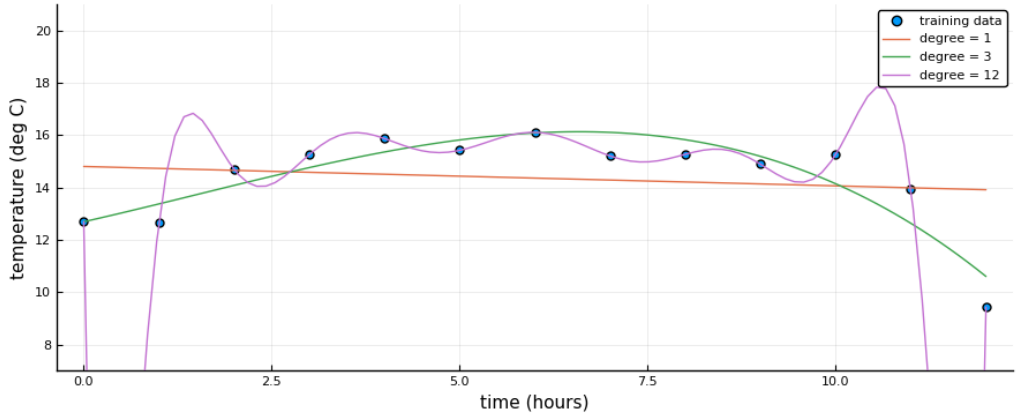

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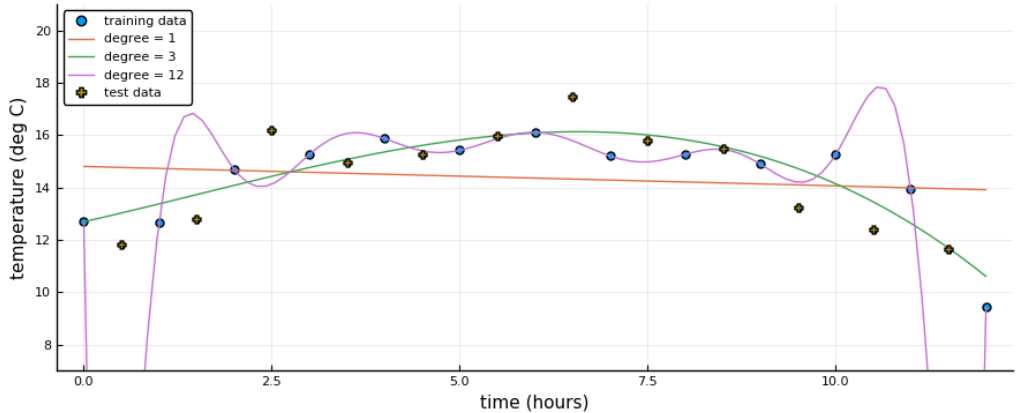

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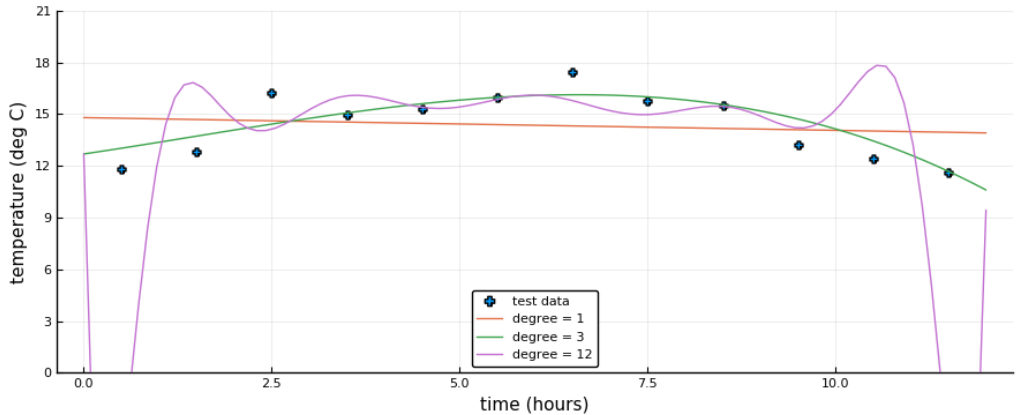
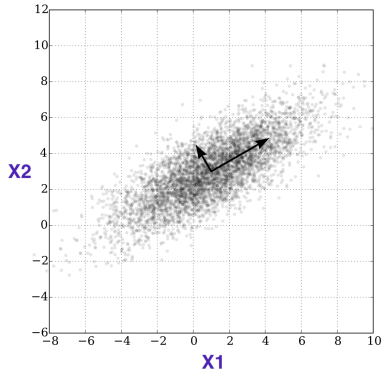


# Unsupervised Learning

Learning data **transformations**, e.g., dimension reduction



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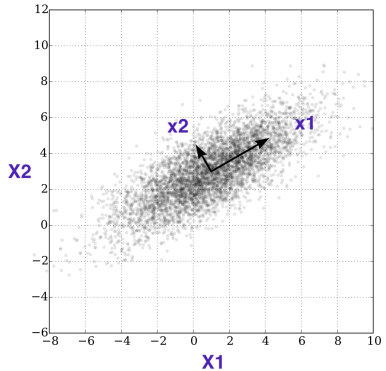
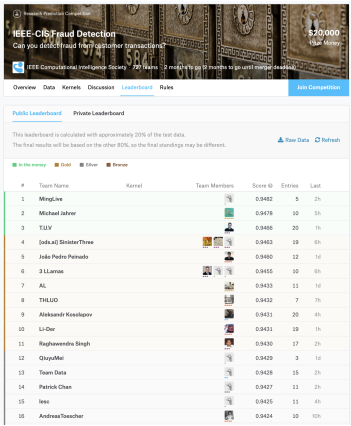
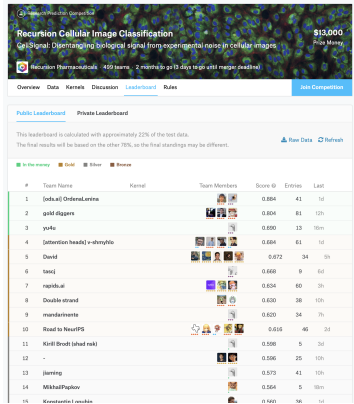
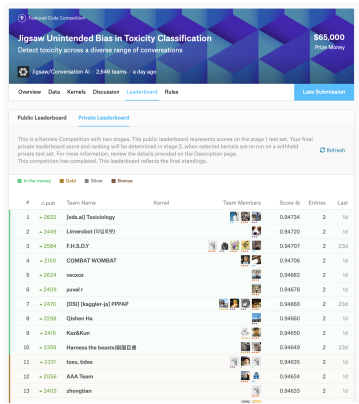


# Data science competitions (kaggle)



# Installing the tutorials

**github.com/ablaom/MLJTutorial**

turing.ac.uk
@turinginst