

pharo-ai

Sebastian JORDAN-MONTAÑO

sebastian.jordan@inria.fr

Oleksandr ZAITSEV

oleksandr.zaitsev@cirad.fr

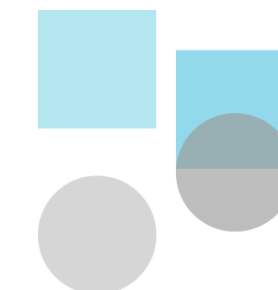
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September 2023

Part 1: ML Intro

- What is ML
- Why use ML
- Real life applications
- Types of ML problems

Part 2: pharo-ai

- Overview
- ML ecosystem
- Our ML algorithms

Part 1:

Machine Learning Introduction

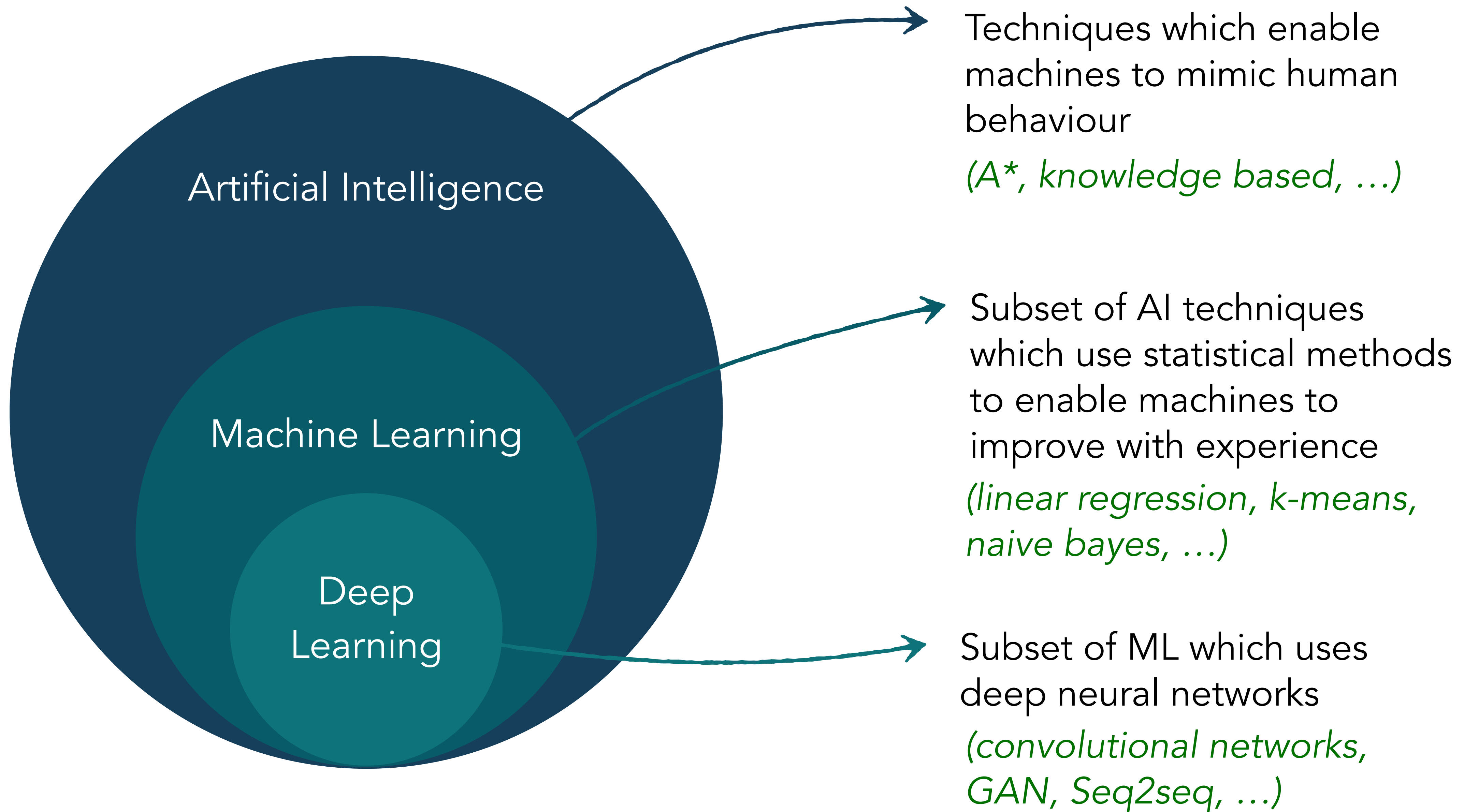
What is Machine Learning ?

« Is the field of study that gives computers the ability to learn without being explicitly programmed. »

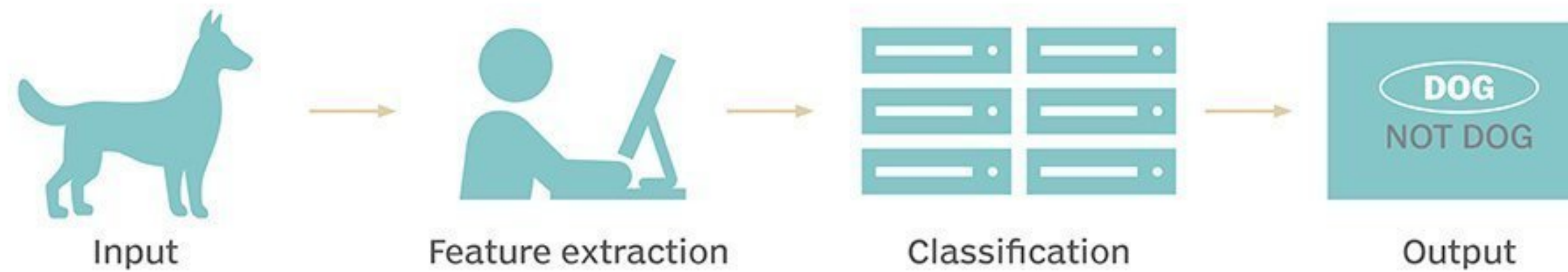
— Arthur Samuel 1959

*« A computer program is said to learn from experience **E** with respect to some task **T** and some performance measure **P**, if its performance on **T**, as measured by **P**, improves with experience **E**. »*

— Tom Mitchell 1997



TRADITIONAL MACHINE LEARNING



DEEP LEARNING



ILLUSTRATION: BUBAONE/ISTOCK

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Source: TechTarget

Machine Learning

```
graph TD; ML[Machine Learning] --> S[Supervised]; ML --> U[Unsupervised]; ML --> R[Reinforcement];
```

Supervised

- Labeled data
- First learn from examples, then apply to new data

(classification, regression,...)

Unsupervised

- No labeled data
- Extract patterns from the data

(clustering, anomaly detection,...)

Reinforcement

- Reward based learning
- Learn how to act in a certain environment
- Maximize reward

(game AI, self-driving cars, trading, ...)

When to use machine learning (and when not to...)

Machine Learning is great for ...

1. Problems for which existing solutions require **a lot of fine-tuning** or **long list of rules** (*e.g., face detection*)
2. **Complex problems** for which using a traditional approach yields no good solution (*e.g., playing chess*)
3. **Fluctuating environments**: machine learning can adapt to new data (*e.g., financial market*)
4. **Getting insights** about complex problems and large amounts of data (*e.g., unsupervised learning*)

5 Key Limitations of Machine Learning

1. **Ethics**: we trust data and algorithms more than personal insights
2. **Data**: require good amount of training data (often labeled data)
3. **Interpretability**: many machine learning algorithms produce results that can not be easily explained
4. **Nondeterminism**: based on randomness, contain noise, not well suited for tasks that require precision
5. **Reproducibility**: hard to reproduce and test

Some Examples of Applications

- ▶ Analysing images to classify them
- ▶ Detecting tumors in brain scans
- ▶ Automatically classifying news articles
- ▶ Flagging offensive comments
- ▶ Summarising long documents
- ▶ Chatbots and personal assistants
- ▶ Forecastings
- ▶ Voice comprehension
- ▶ Detecting credit card fraud
- ▶ Segmenting clients based on purchases
- ▶ Personalised recommendations
- ▶ Game AI

Part 2:


pharo-ai library

pharo-ai

a modular library for shallow machine
learning in Pharo (and more)

 github.com/pharo-ai

pharo-ai

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Overview

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pharo-ai

Artificial Intelligence and Machine Learning in Pharo

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The Pharo-AI Wiki

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ai Public

A meta package to load all related Machine Learning libraries in Pharo

Smalltalk ☆ 2 1

awesome-pharo-ml Public

List of projects, books, booklets, papers, and applications related to machine learning, AI, data science in Pharo

☆ 57 7

graph-algorithms Public

A graph algorithms library implemented in Pharo

Smalltalk ☆ 16 9

linear-models Public

Linear models like linear and logistic regression implementation

Smalltalk ☆ 1 2

k-means Public

K-means clustering in Pharo

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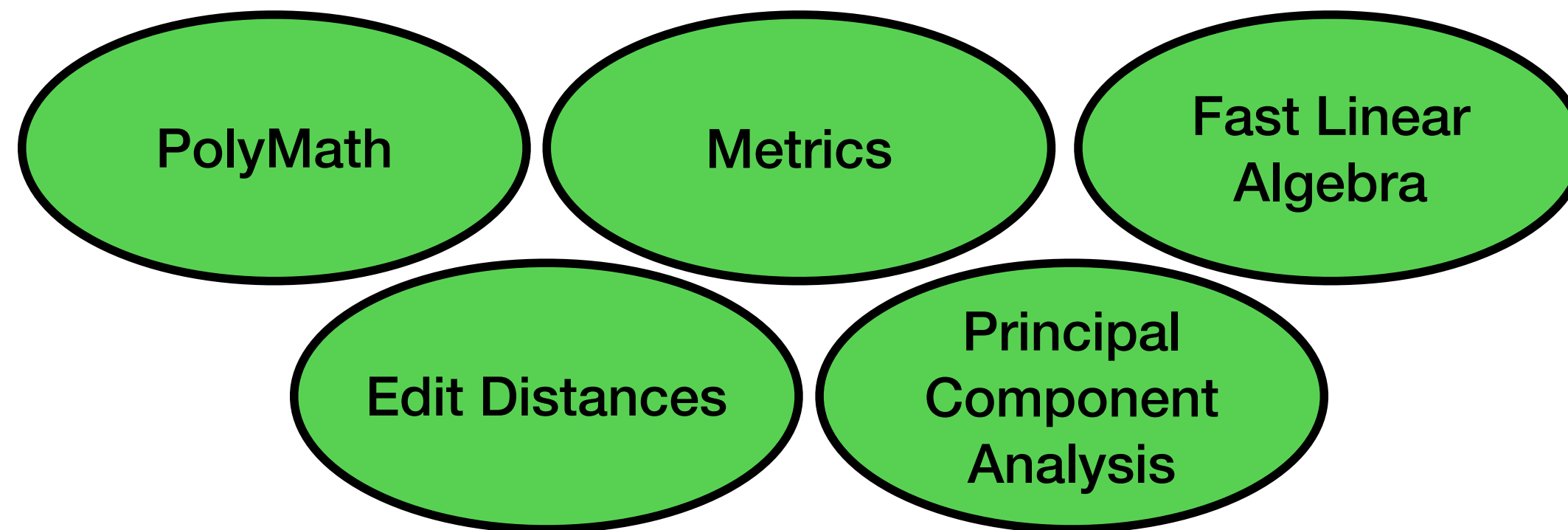
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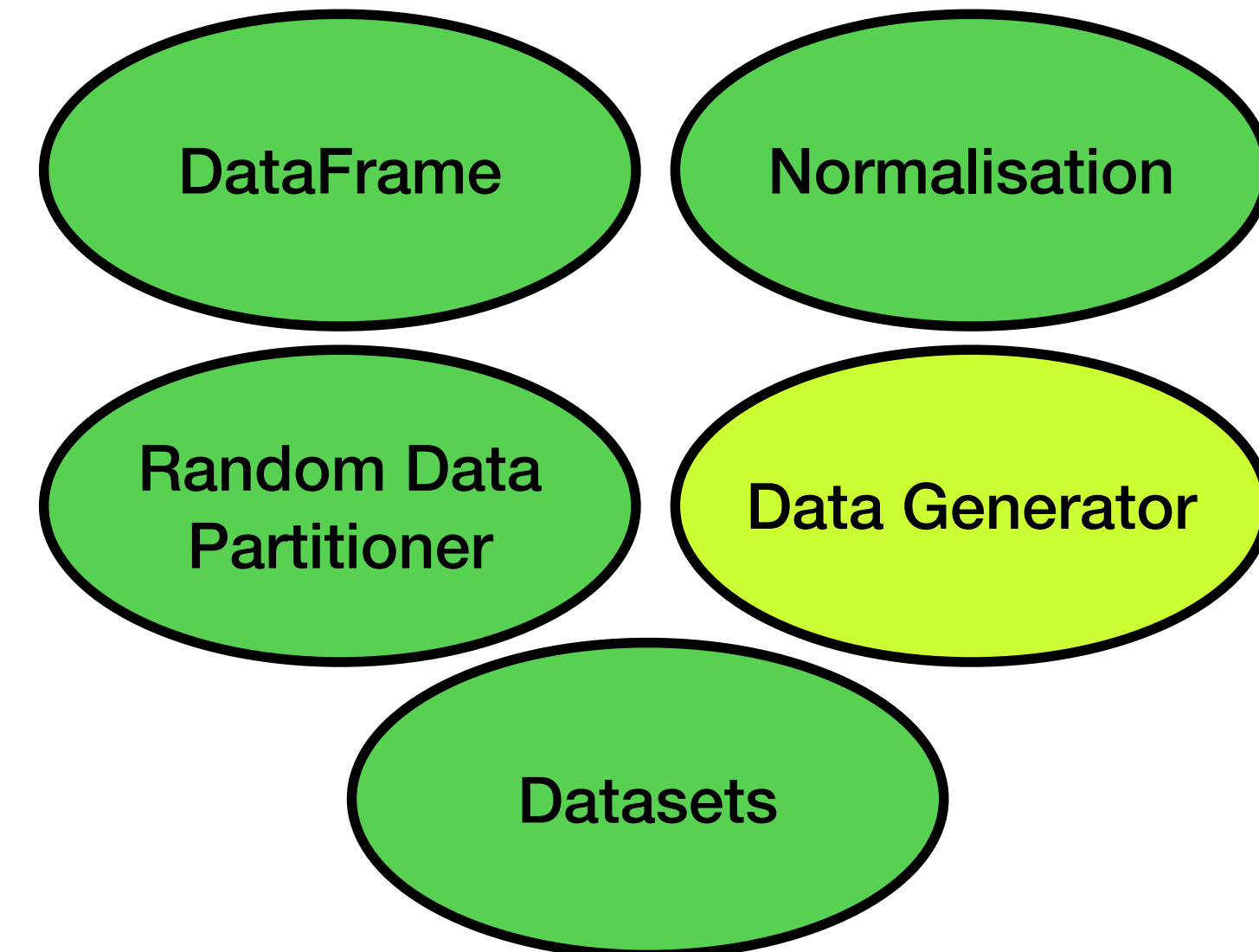
How do we position ourselves

	Python	R	Pharo
Data Analysis & Manipulation	pandas	data.frame, dplyr	DataFrame
Algebra & Statistics	numpy, scipy	MASS, SparseM	PolyMath
Shallow Learning	scikit-learn	caret, ml3	pharo-ai
Deep Learning	TensorFlow, Keras	TensorFlow, Keras	TensorFlow (not maintained)
Visualisation	matplotlib	ggplot	Roassal3

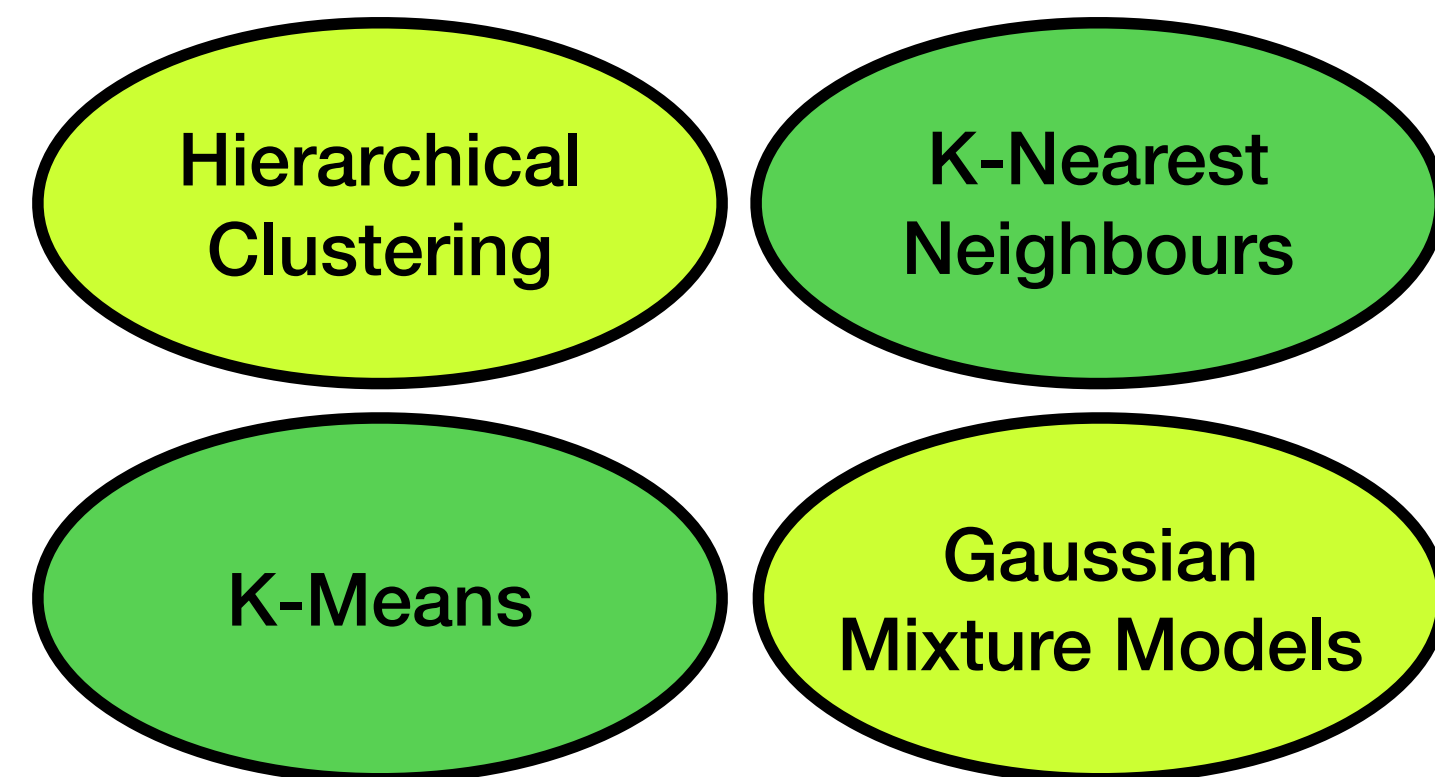
Scientific Computation



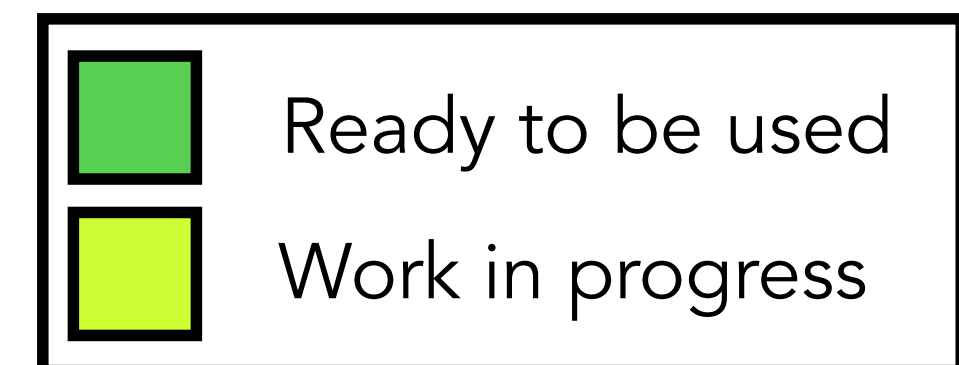
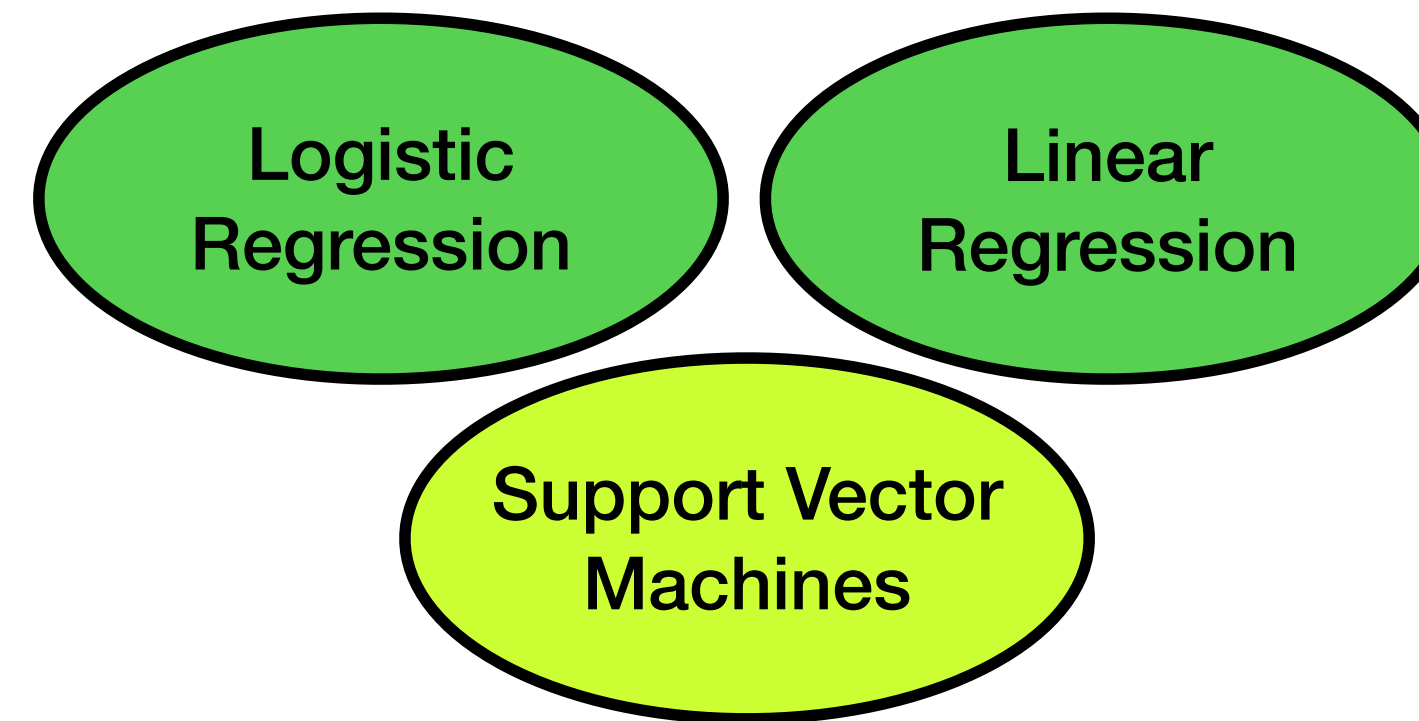
Data manipulation



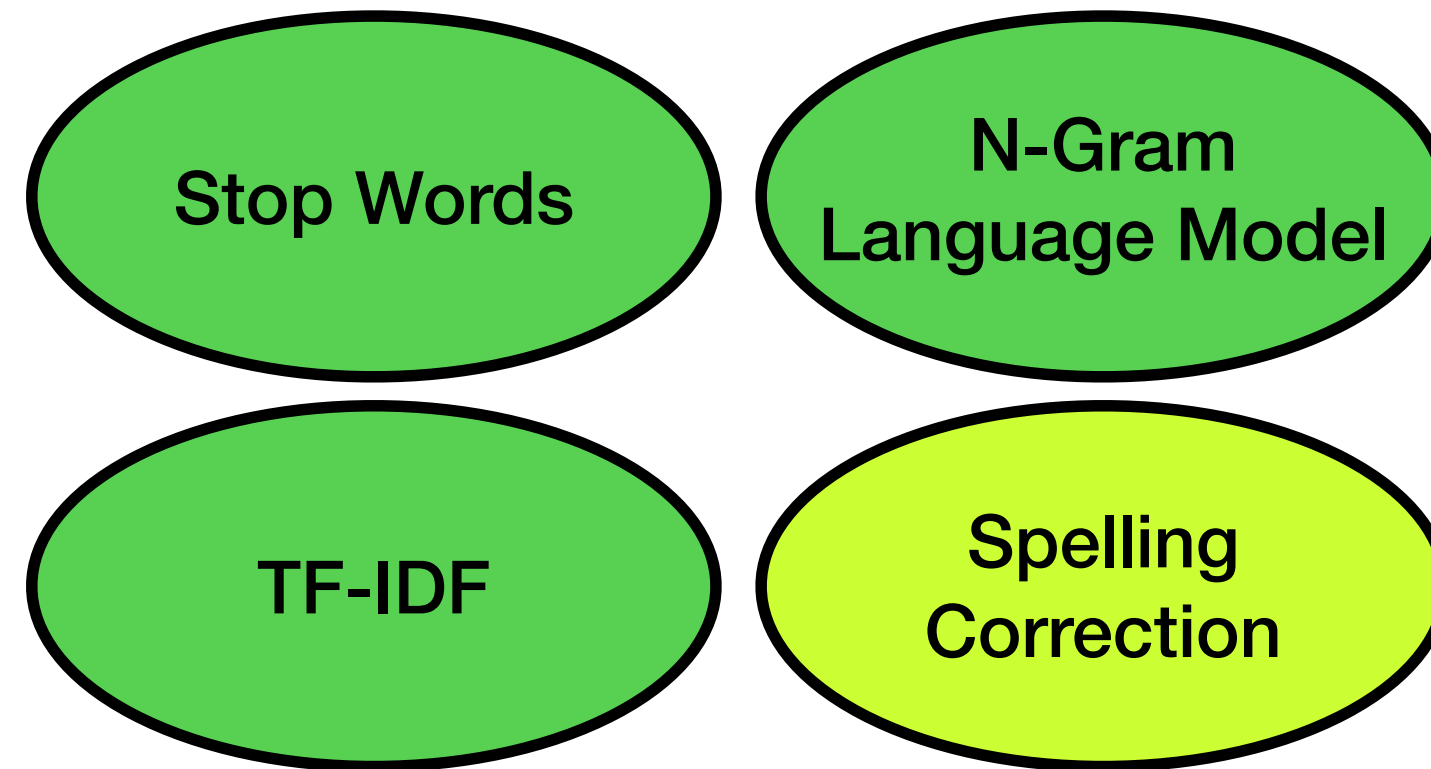
Clustering



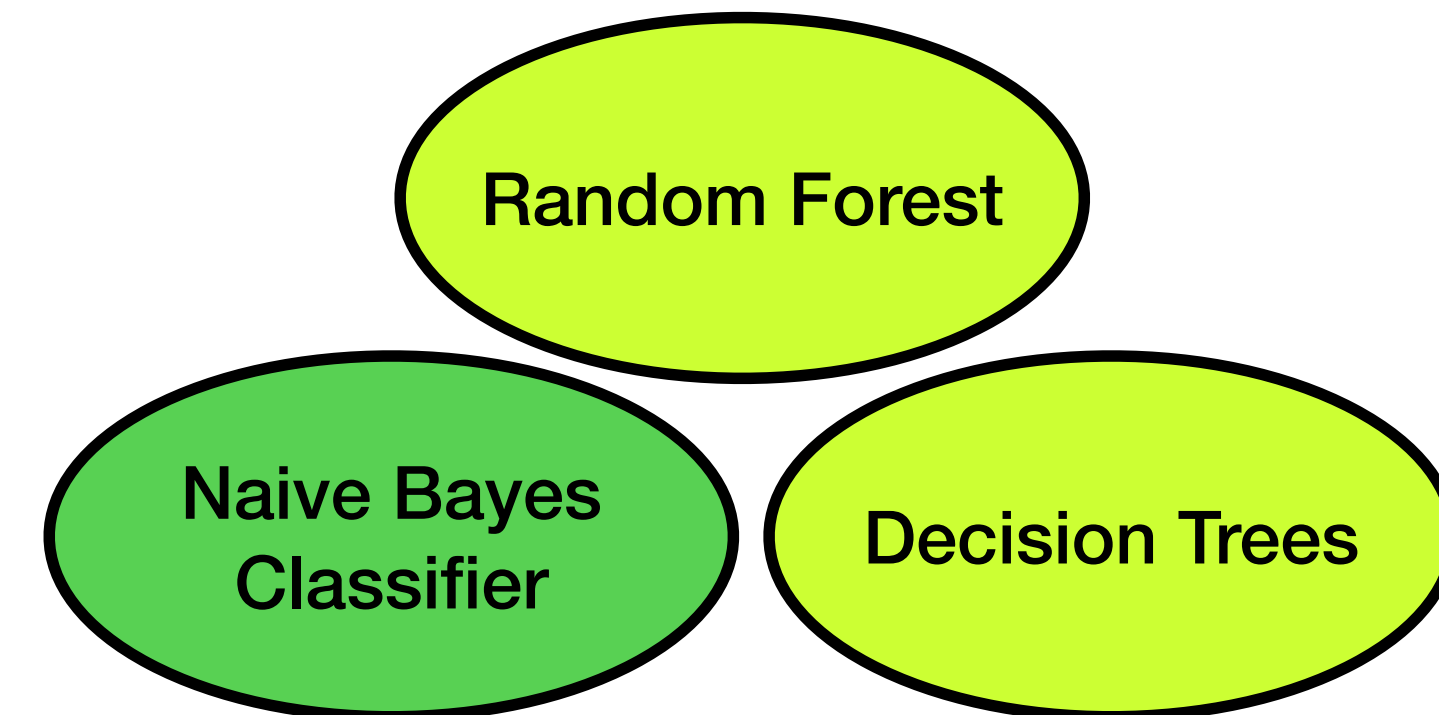
Regression



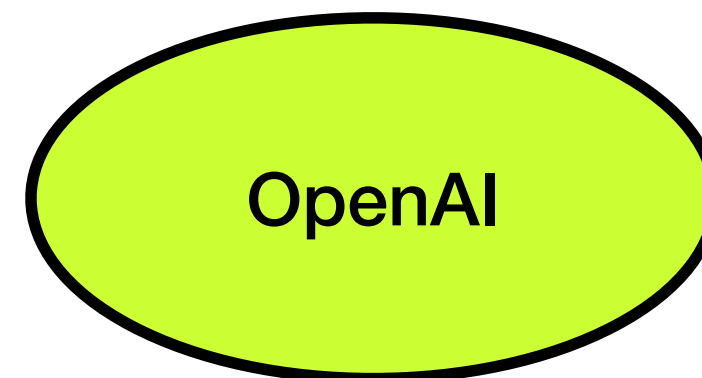
Natural Language Processing



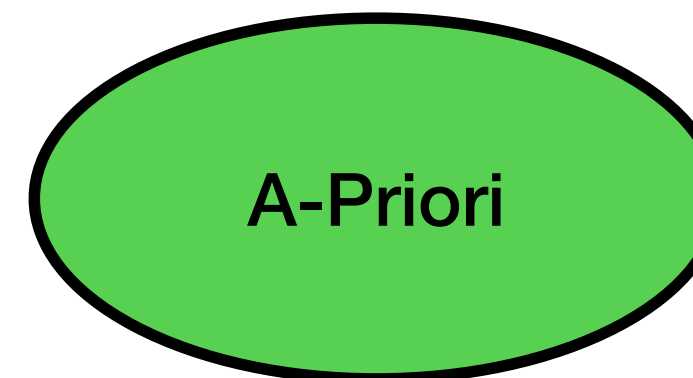
Classification



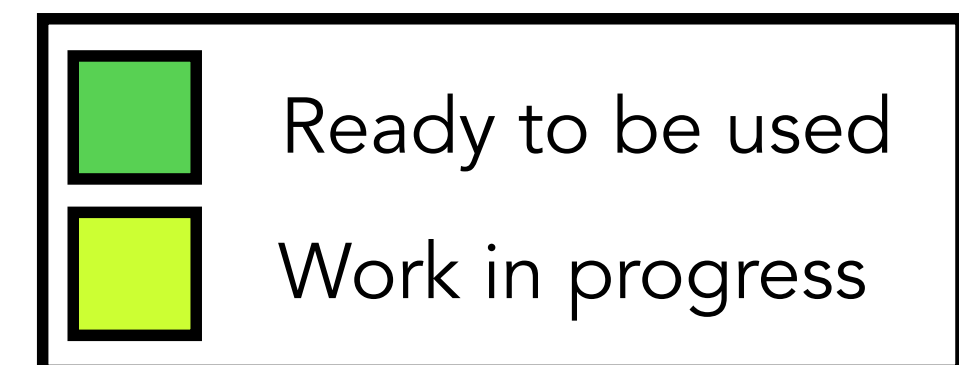
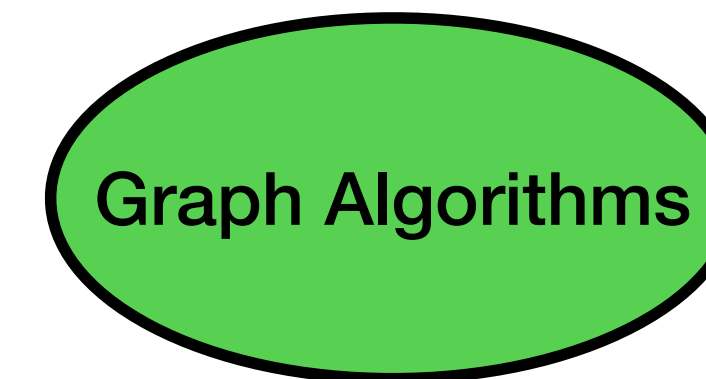
OpenAI Binding

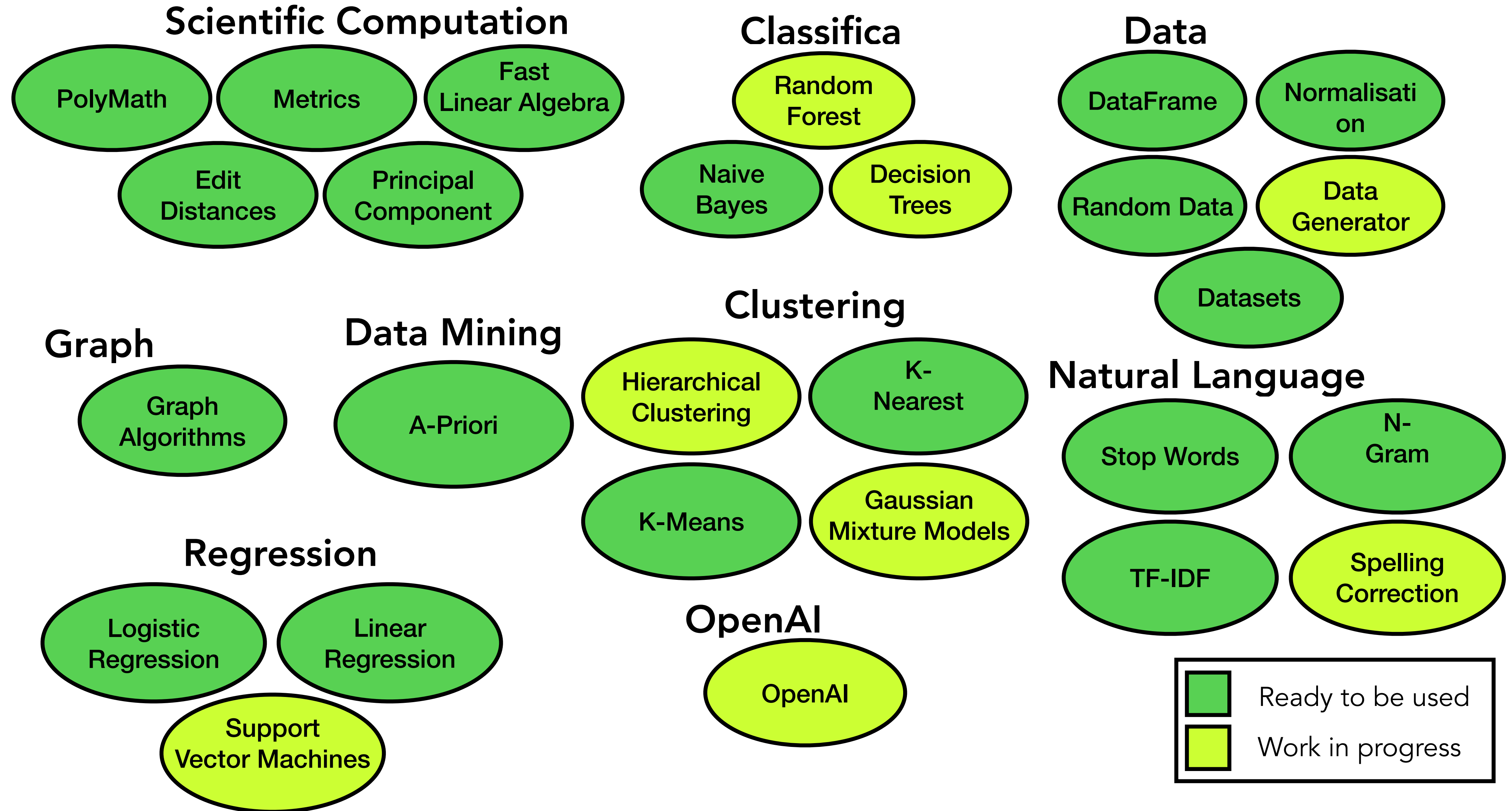


Data Mining



Graph Algorithms



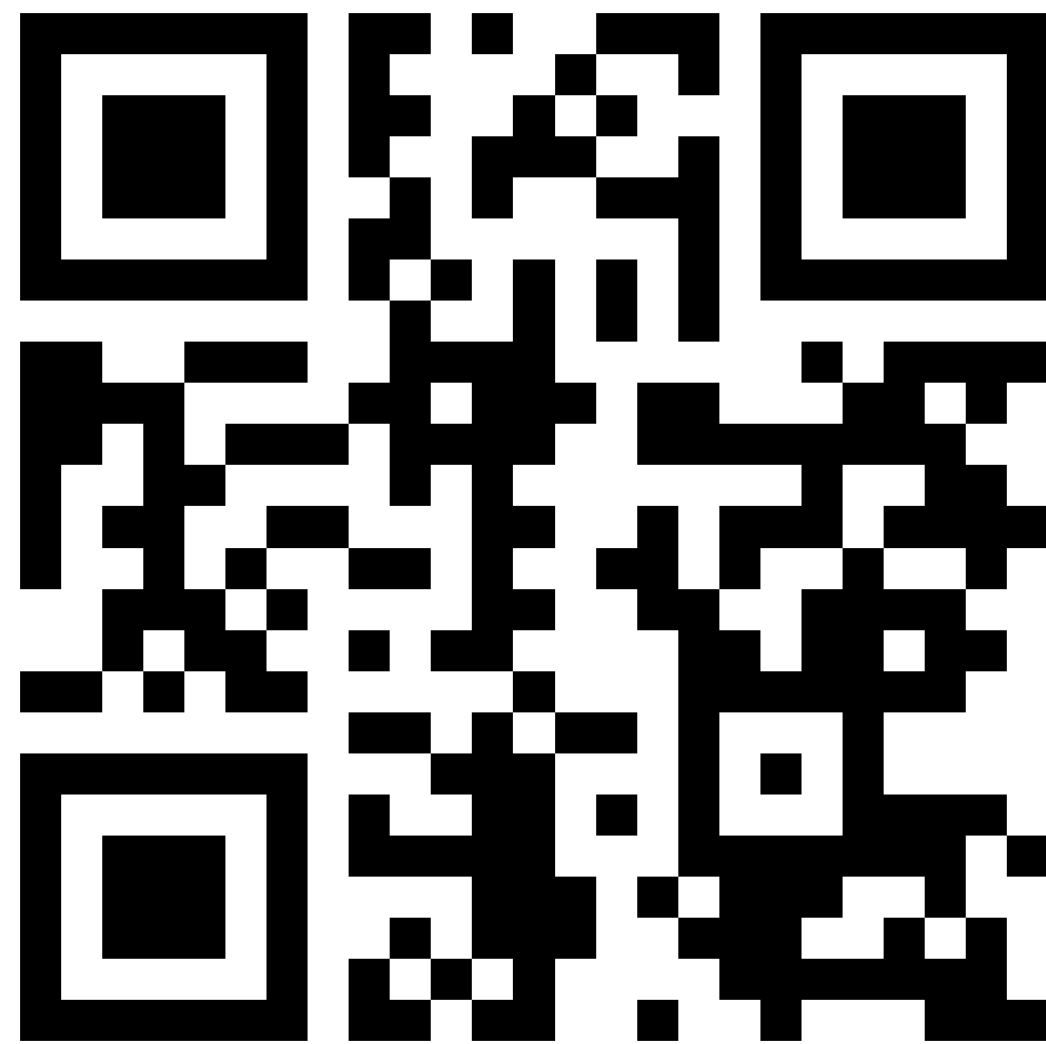


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 **Start here**

Pharo-ai Wiki: <https://github.com/pharo-ai/wiki>



Visit Us !

Play, Use, and Contribute

Other ML projects in Pharo: <https://github.com/pharo-ai/awesome-pharo-ml>

