DATA SCIENCE
DEVELOPMENT SERIES

MACHINE LEARNING 101
Wednesday, 5/27

by **JINGJING CANNON**
Data Scientist & Six Sigma Green Belt

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by Nikolaos Vasiloglou, 6/10
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by Brian O'Connor, 6/17
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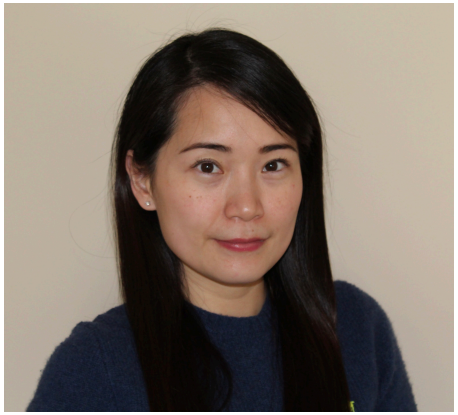
by Trey Grainger, 6/24
Session 6: RECOMMENDATIONS 101
by Khalifeh Al Jadda, 7/1

For more information, please follow:

Southern Data Science Conference

Information Technology & Services · Atlanta, GA

About the presenter



- PHD in Computational Neuroscience at Georgia State University
- Previous working experience:
  - Credit risk analyst in finance.
  - Jr. Data Scientist in Telecom.
  - Data Scientist at The Home Depot Online Data Science Team.

LinkedIn : https://www.linkedin.com/in/jingjing-cannon-23a56524/

Agenda

https://github.com/jingjingsky120/MachineLearning_101

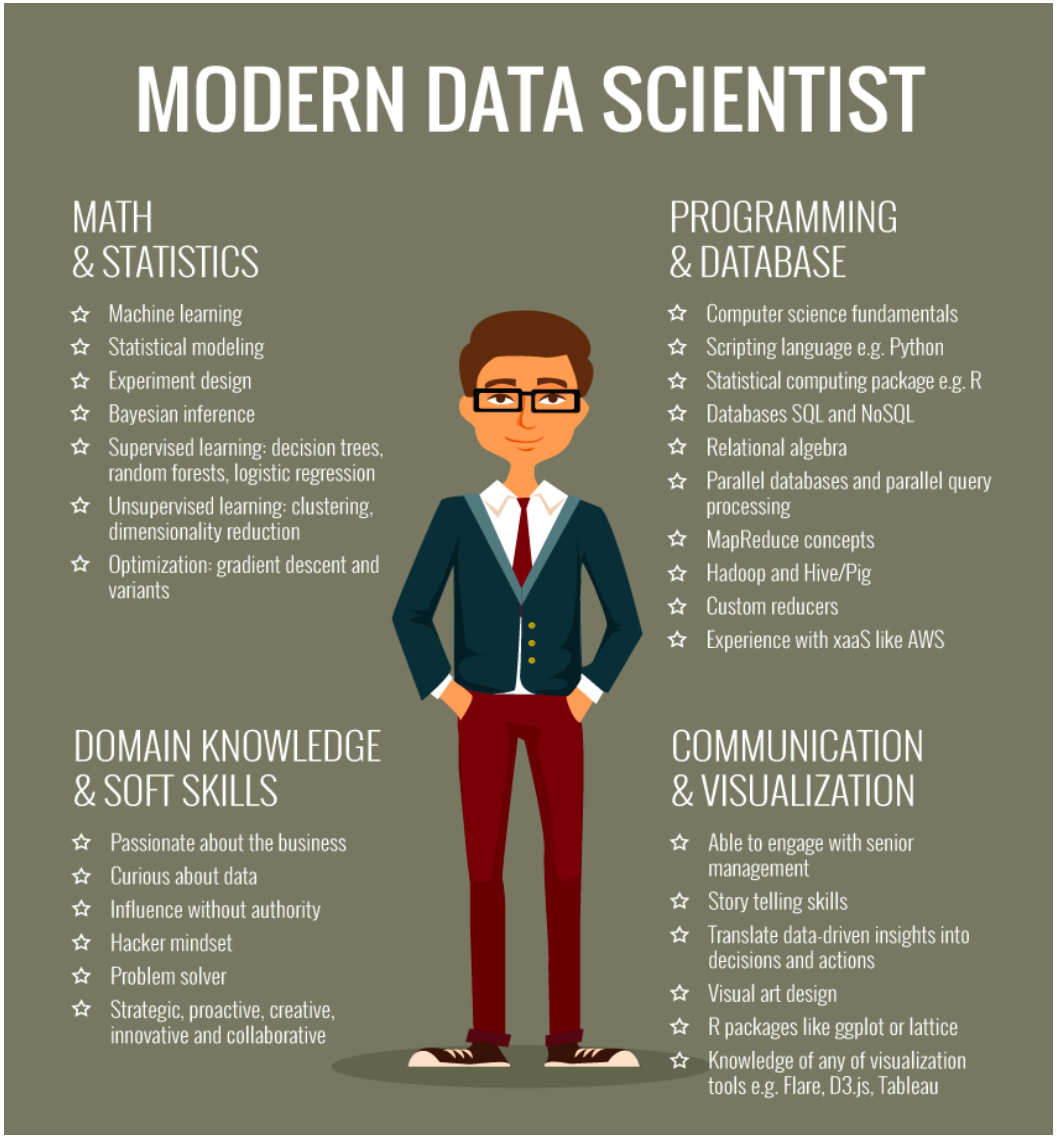
- **Part I Basics**
- General introduction
- Data pre-processing methods
- Machine Learning model development and validation
- Basic Data visualization

- **Part II Supervised Machine Learning**
- Algorithms introduction: Regression, Tree based, Boosting and Artificial Neural Networks.
- A Case study of a RecSys Conference Challenge to compare above algorithms.

- **Part III Unsupervised Machine Learning**
- Algorithms introduction: K-means and hierarchical clustering
- High-dimensional data visualization examples in Python

Part I
Machine Learning Basics

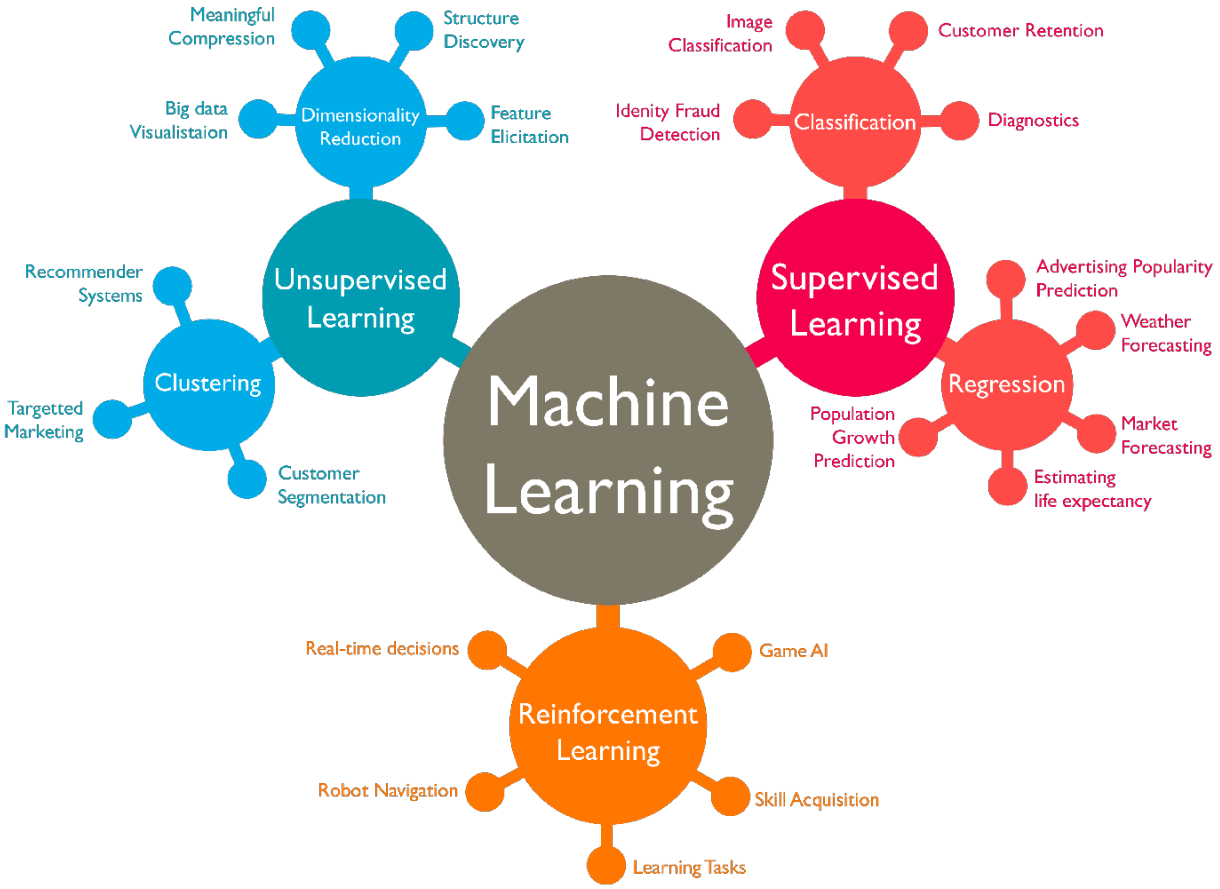
Who is Data Scientist?



New to Data Science field

- **Skill sets required for entry level analytics jobs:**
  - Query Language (Microsoft SQL, Teradata, Hadoop, Cloud Computing etc.)
  - Data Analysis and Modeling (Python, R, SAS, etc)
  - Visualization (matplotlib, ggplot, Tableau, etc)
- **Data Science mindset**
  - Data Collection
    - Data query from structured database
    - Online Data Scraping etc
  - Data Pre-Processing
    - Data Cleansing
    - Exploratory Data Analysis (Missing Data, Data Type, distribution, etc)
    - Feature Engineering or Feature Selection
  - Data Modeling
    - Statistical Algorithms (Regression, Tree, Neuronal Network, K-means etc)
  - Result Visualization

What is Machine Learning



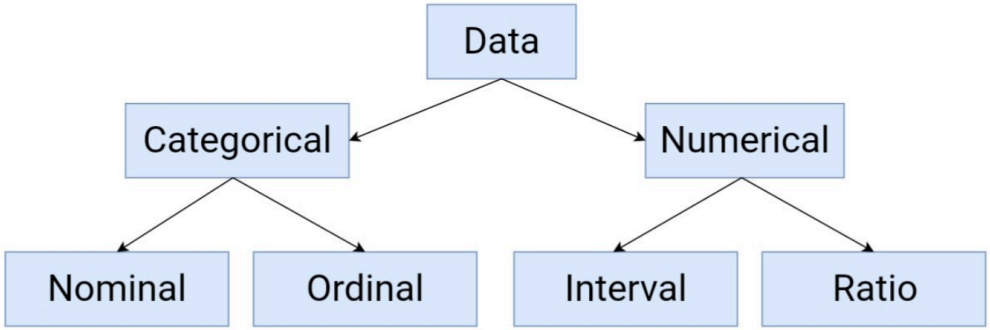
Data Science Toolkit

https://www.anaconda.com/products/individual

https://jupyterlab.readthedocs.io/en/stable/getting_started/installation.html

Data Science Basics

Structured Data Types



Data Pre-processing

- Data Quality Assessment
- Feature Aggregation
- Feature Sampling
- Dimensionality Reduction
- Feature Encoding

https://towardsdatascience.com/data-preprocessing-concepts-fa946d11c825

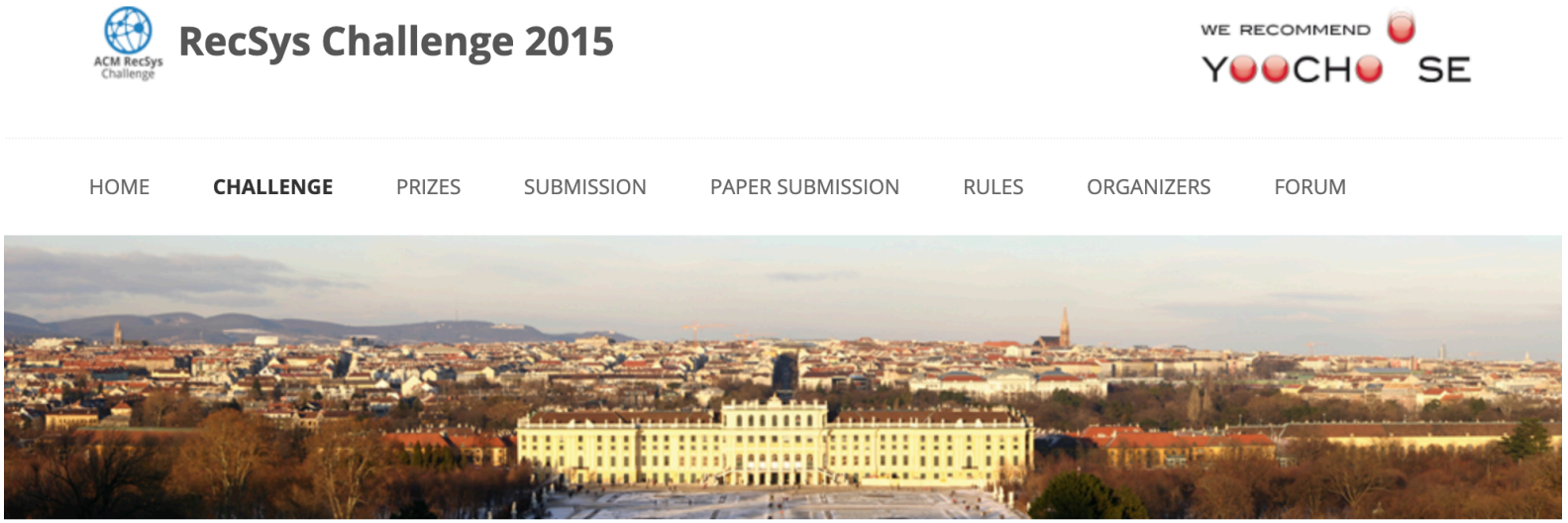
Data Science Basics

Feature preparation https://innovation.alteryx.com/feature-engineering-vs-feature-selection/

- Feature selection https://towardsdatascience.com/the-5-feature-selection-algorithms-every-data-scientist-need-to-know-3a6b566efd2

  Correlation, Feature Importance, VIF, Logistic regression or Tree based model

- Feature engineering

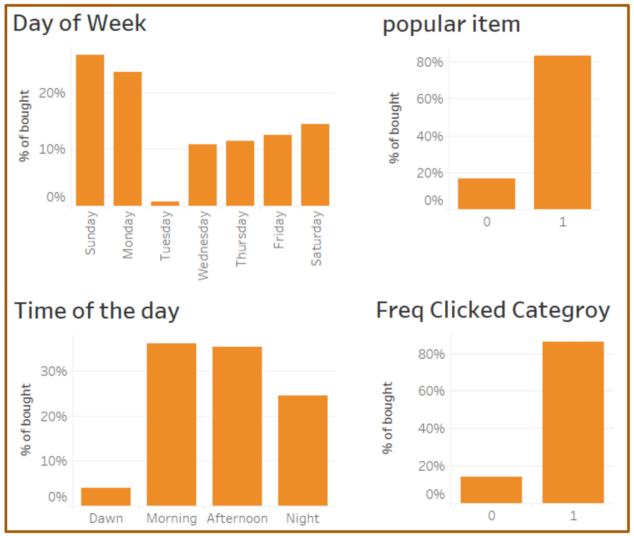


https://2015.recsyschallenge.com/challenge.html

Data Science Basics

Feature Engineering example:

Session ID
Timestamp
Item ID
Category
Price
Quantity



Model Validation

Confusion Matrix

		Actual class	
		P	**N**
Predicted class	**P**	**TP**	FP
	N	FN	**TN**

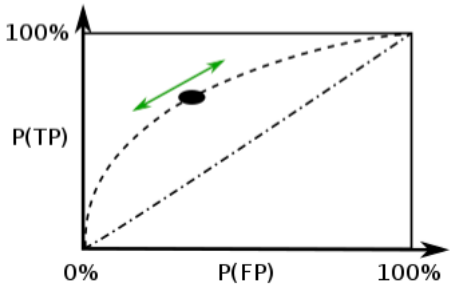
$$\text{Precision} = \frac{tp}{tp + fp}$$

$$\text{Recall} = \frac{tp}{tp + fn}$$

$$F = 2 \cdot \frac{\text{precision} \cdot \text{recall}}{\text{precision} + \text{recall}}$$

ROC and AUC

- Receiver Operating Characteristic
- Area Under the Curve



https://en.wikipedia.org/wiki/Confusion_matrix

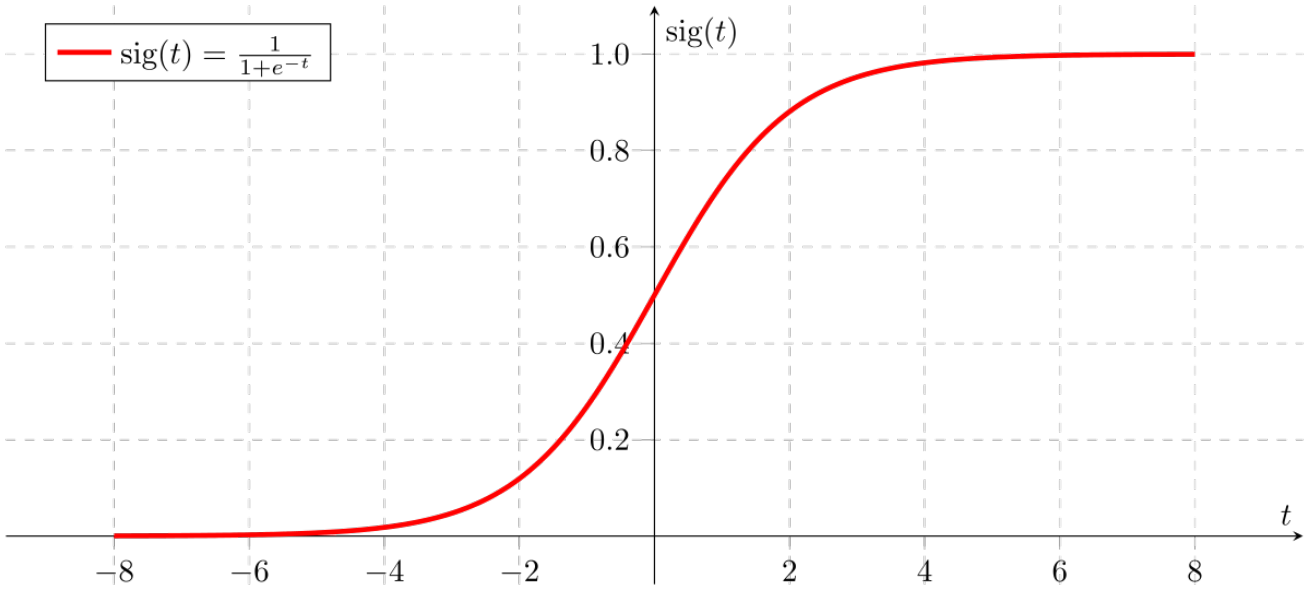
Data Visualization

- Python library Seaborn
  - Scatter plot
  - Line chart
  - Histogram
  - Bar Chart
  - Box plots
  - Heatmap
- T-SNE for high dimensional data

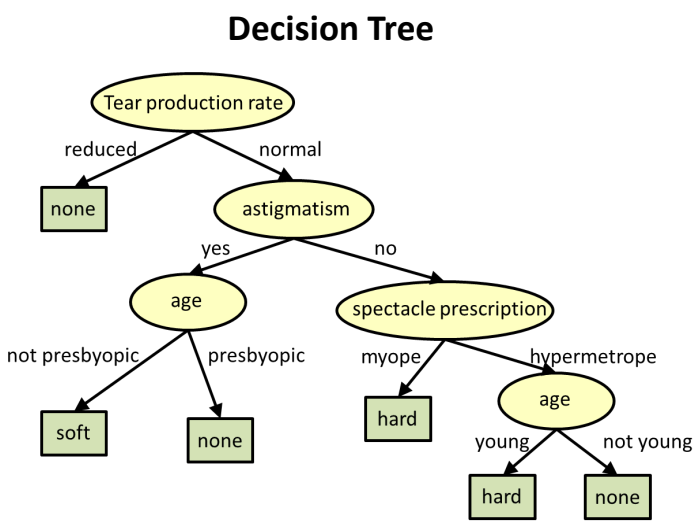
Part II
Supervised Machine Learning

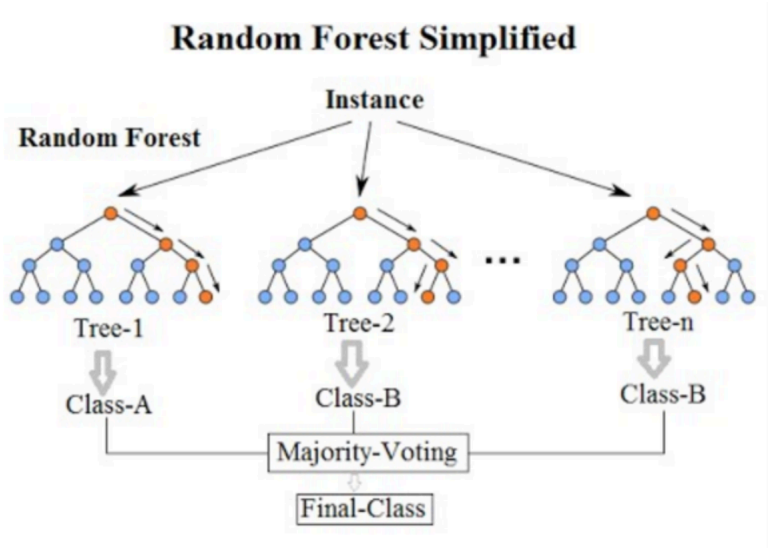
Logistic Regression

Relationship between one dependent binary variable and one or more nominal, ordinal, interval or ratio-level independent variables

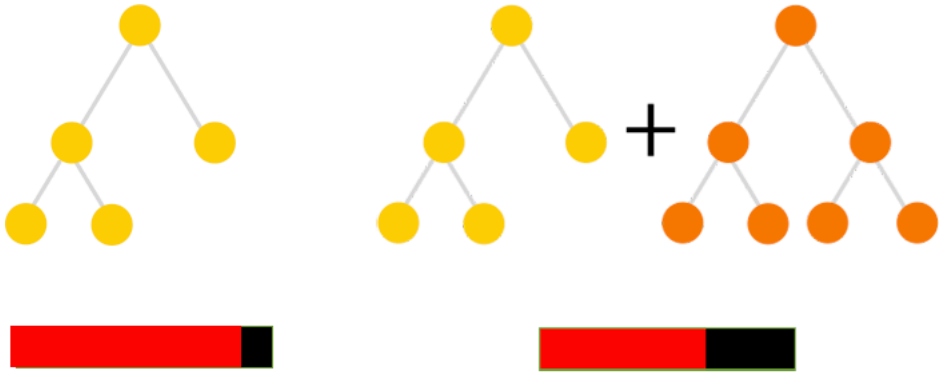


Decision Tree and Random Forest



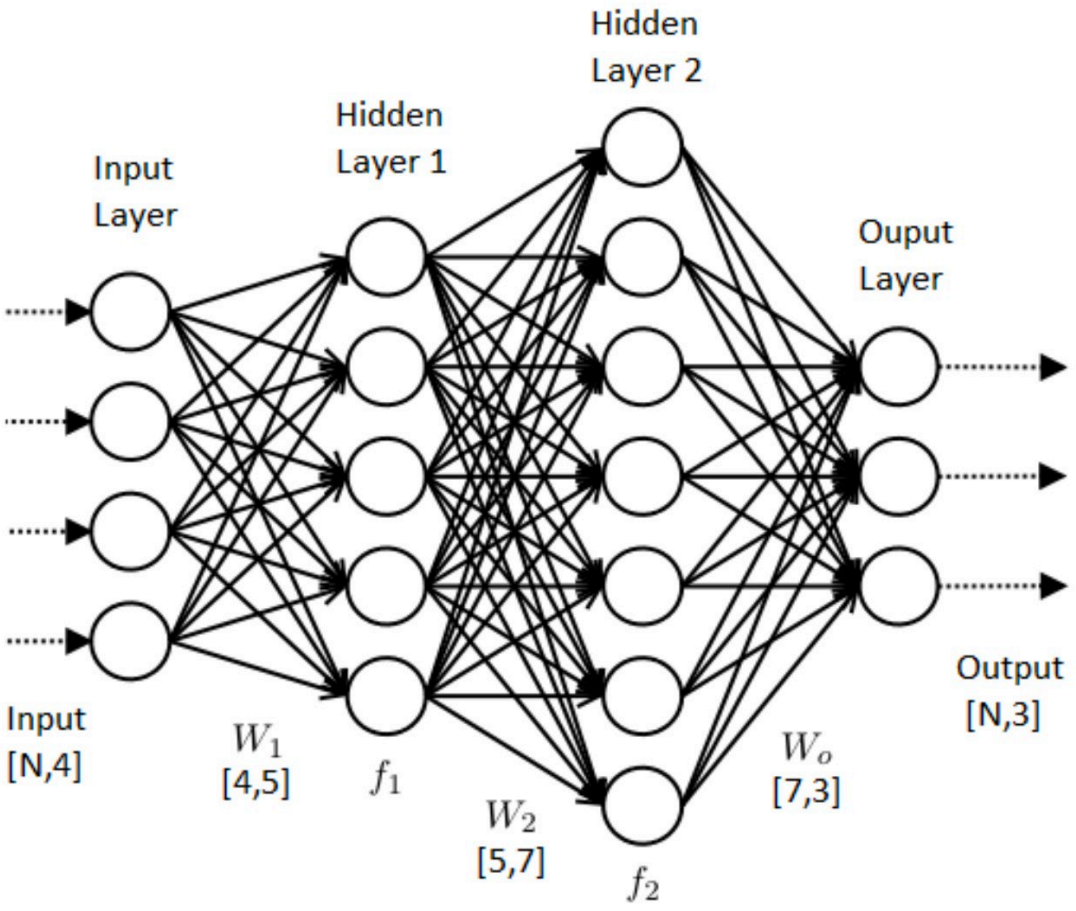


Yandex
CatBoost



https://catboost.ai/news/catboost-enables-fast-gradient-boosting-on-decision-trees-using-gpus

Artificial Neural Network

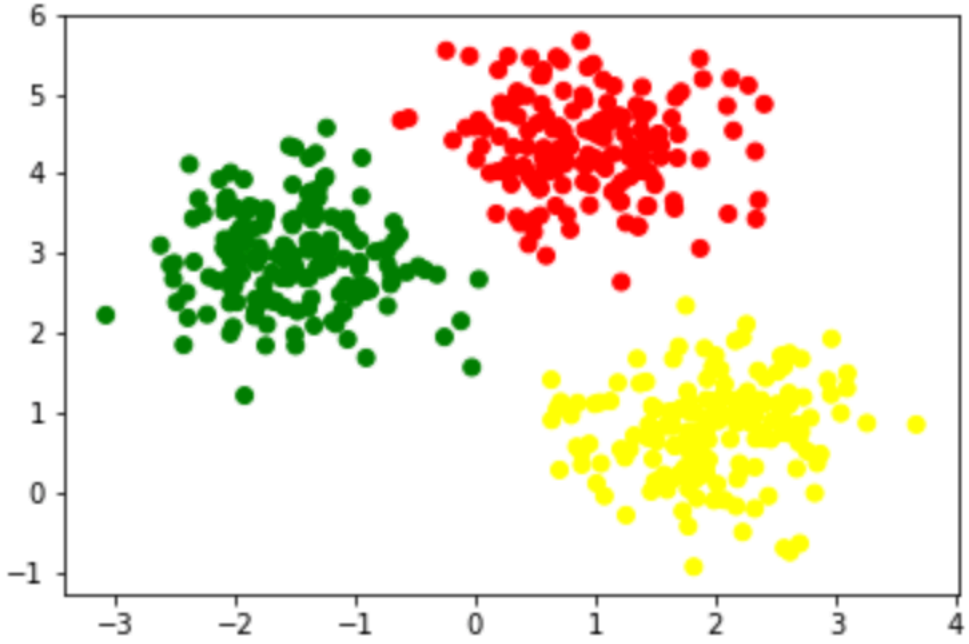


Algorithm Comparison

	ROC AUC Score	
Algorithm	Train	Validation
MatrixNet(Regressor)	74.62%	75.56%
MatrixNet(Classifier)	69.13%	69.48%
Random Forest	67.20%	67.51%
Decision Tree	99.78%	65.43%
Logistic Regression	61.18%	62.84%
Neural Network	54.08%	50%

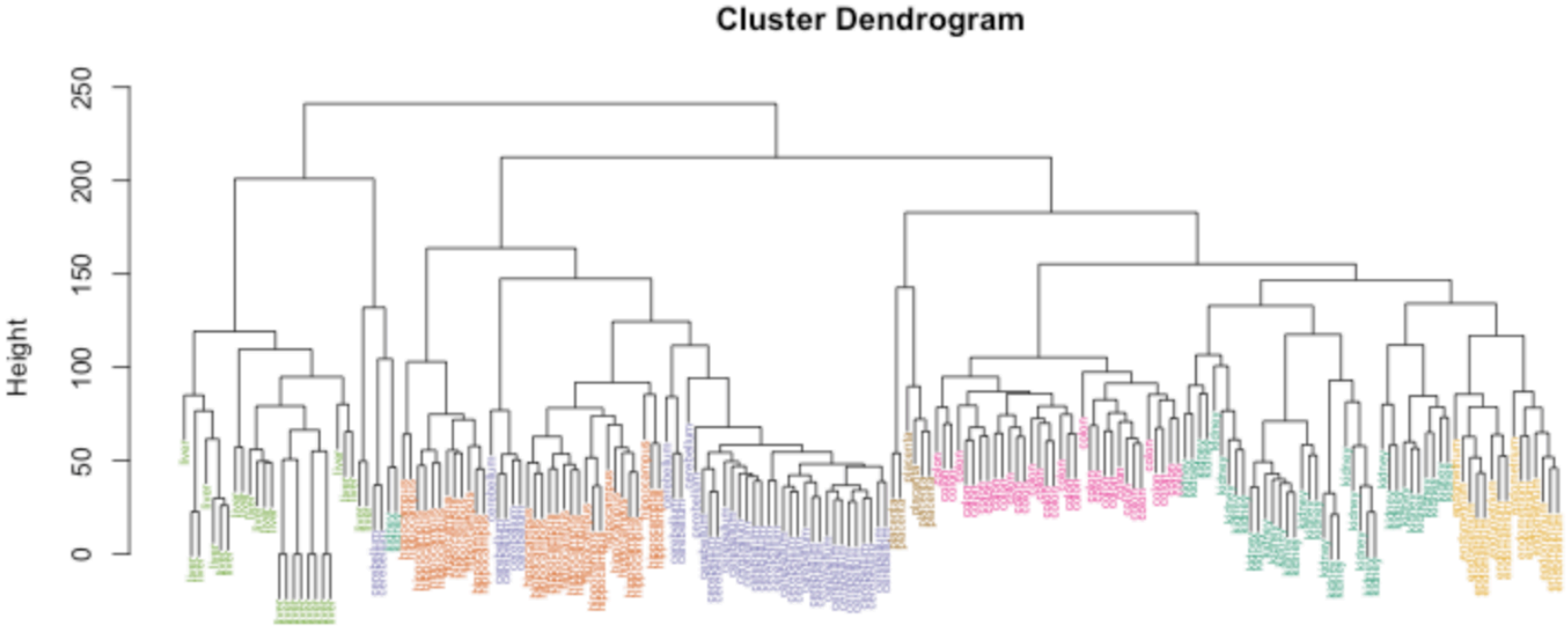
Part III
Unsupervised Machine Learning

K-means Clustering



https://cmdlinetips.com/2019/05/k-means-clustering-in-python/

Hierarchical Clustering



https://genomicsclass.github.io/book/pages/clustering_and_heatmaps.html

Thank you !