Welcome to Machine Learning Module

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Educational Background

PhD, Economics, Arizona State University, 2017
Master, Economics, Simon Fraser University, 2013
MBA, Sharif University, 2012
Industrial Engineering, IUST, 2009

Biography

Pedram Jahangiry, PhD, CFA, is an assistant professor in the Economics and Finance Department of the Jon M. Huntsman School of Business at Utah State University. Prior to joining the Huntsman School in 2018, Pedram was a research associate within Financial Modeling Group at BlackRock NYC. His research is involved in machine learning applications in finance, empirical asset pricing, and factor models.

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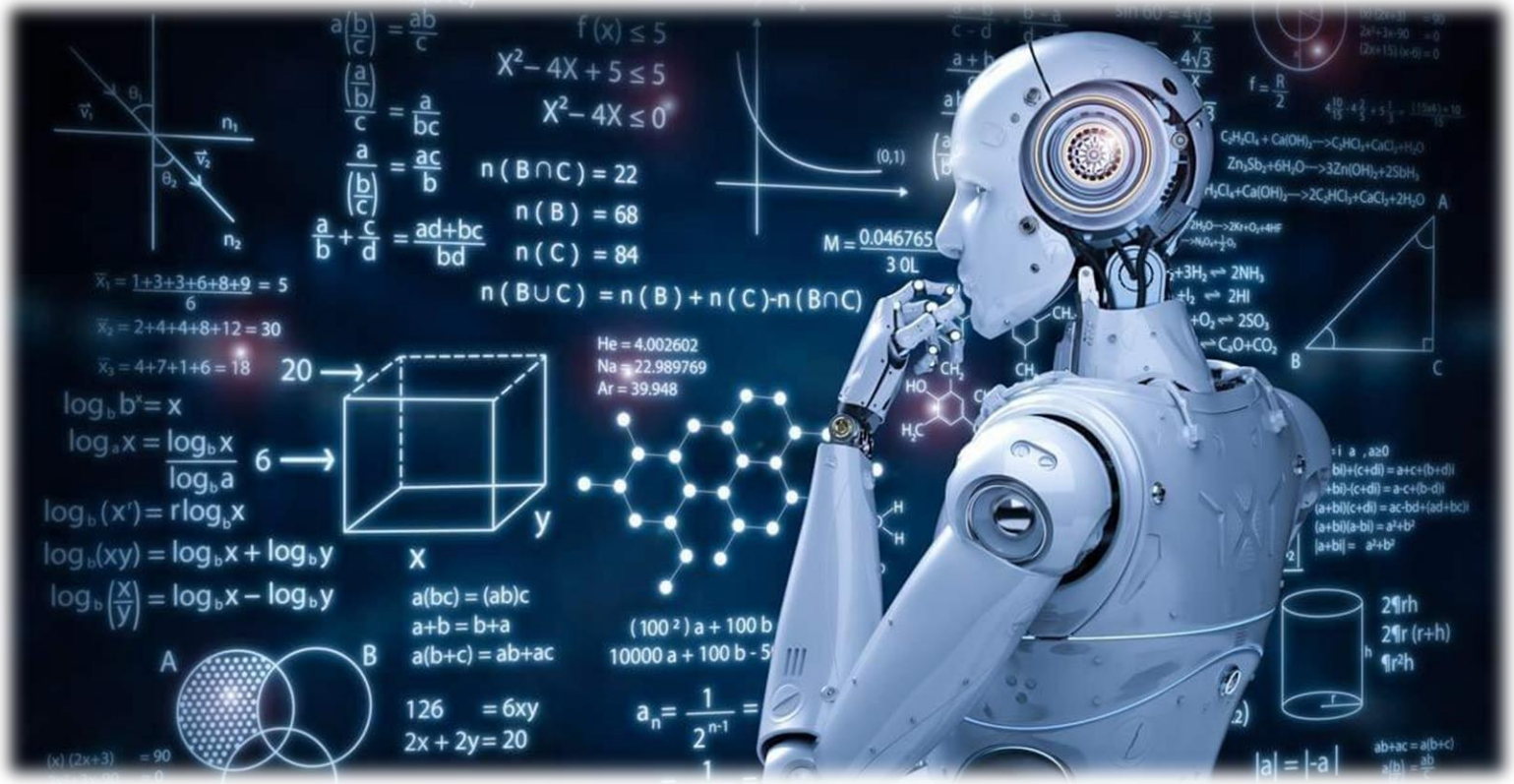
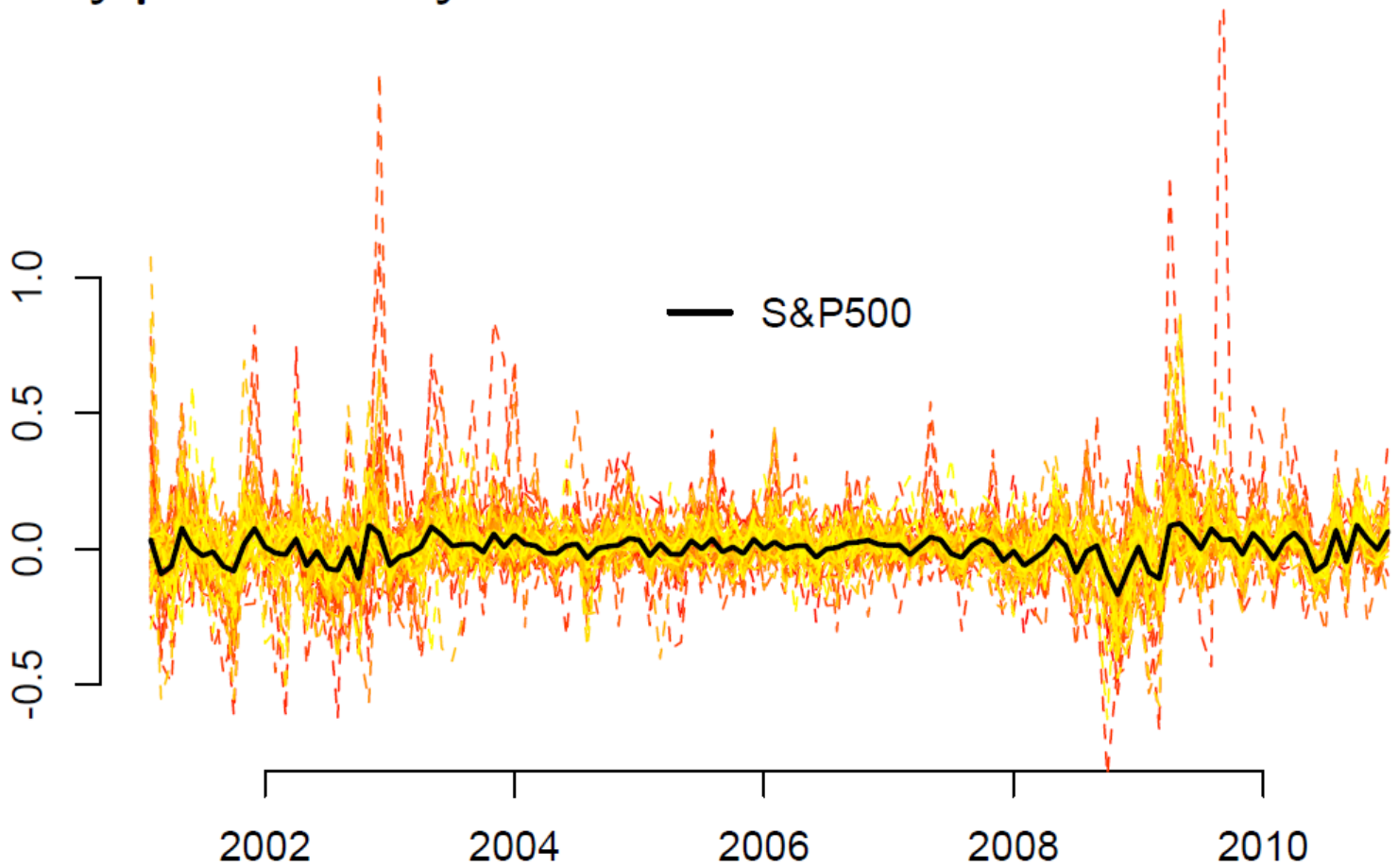
Personal Website **Curriculum Vitae**

- What is Machine Learning?
- Different major types
- Applications
- Key terminology
- Applied ML



Fancy plot: monthly stock returns



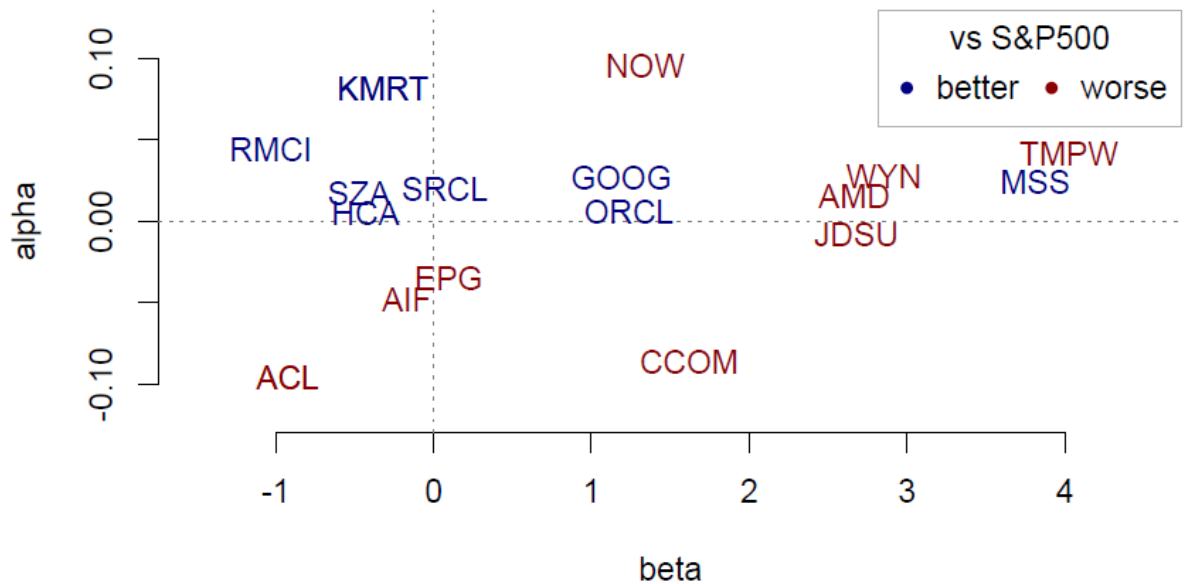
What do we learn?

Useful plot: market model coefficients

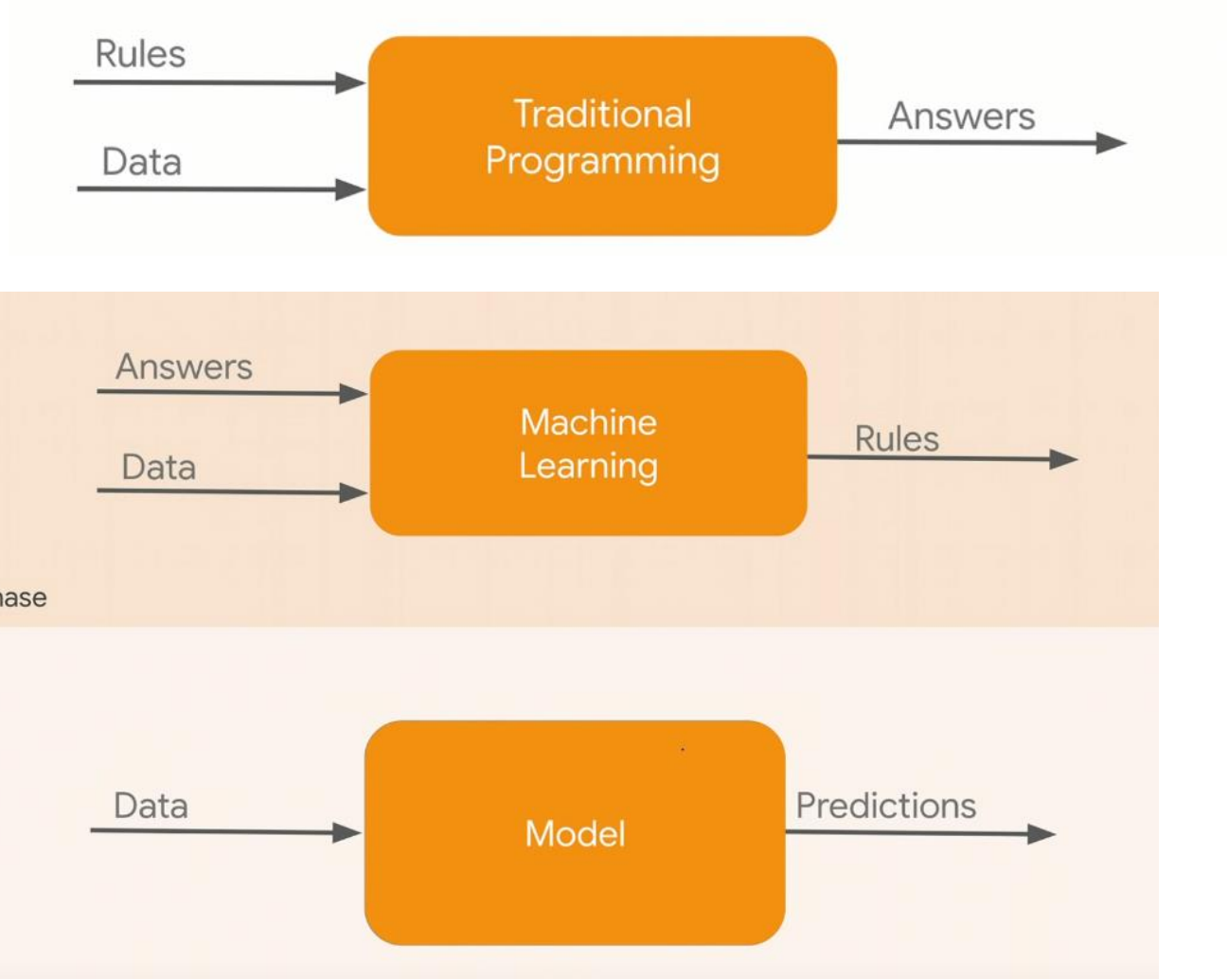
Fit a line between stock returns R_t and market returns M_t (SP).

$$R_t \approx \alpha + \beta M_t$$

α is money you make regardless of what the market does.
β is the asset's sensitivity to broad market movements.



Machine Learning vs. Traditional Programming



What is Machine Learning?

What is Machine Learning?

Machine Learning is the filed that thinks about how to **automatically** build robust **predictions** from **complex data**.

- ML is closely related to modern statistics (many ideas come from statisticians!)
- Statistics focus on model inference, ML focus on predictive performance
- The entire filed of ML is calibrated against "**out-of-sample**" experiments that evaluate how well a model **trained** on one dataset (train data) will **predict** new data (test data).
- While there is a recent push to build more transparency into machine learning, wise practitioners avoid assigning **structural** meaning to the parameters of their fitted models.
- ML models are **black boxes** whose purpose is to do a good job in **predicting** a future that follows the **same patterns** as in past data.

Why you need to learn ML?

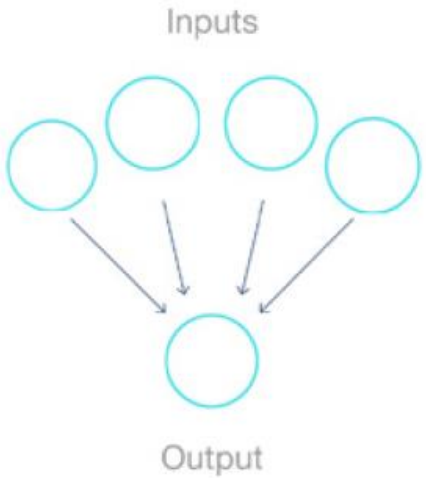
- To project the information in your data into a **low-dimensional space** that contains key insights for the decisions you need to make

- To give you the tools to quickly **turn messy data into useful information** that has direct relevance to business policy

- Big data + Machine learning = Data science
- Big data + Machine learning + Economics/Econometrics= **Business data science**

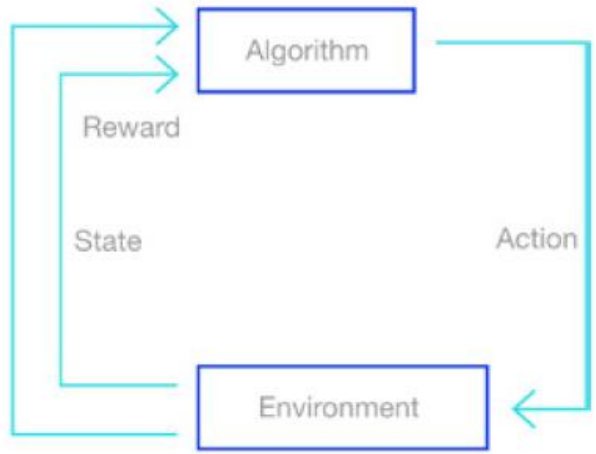
Understanding the major types of machine learning

Supervised learning



Unsupervised learning

Reinforcement learning



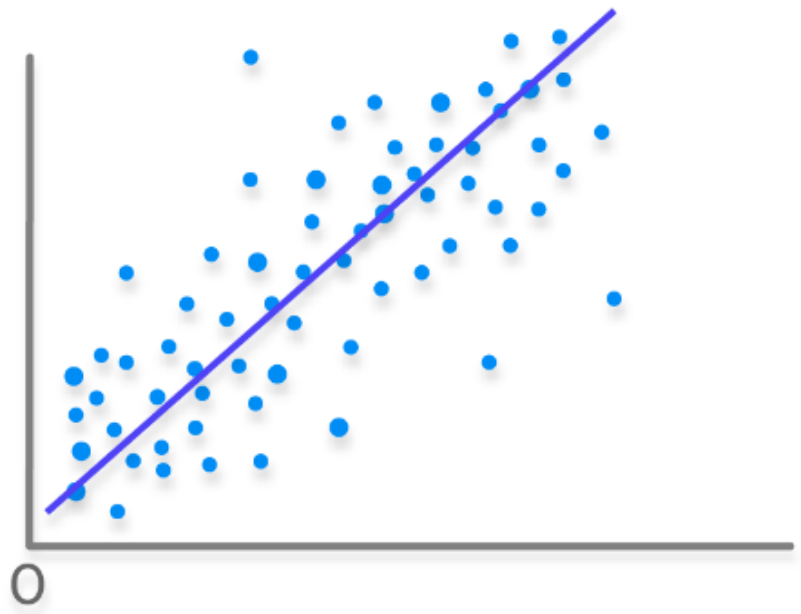
What it is

An algorithm uses training data and feedback from humans to learn the relationship of given inputs to a given output (eg, how the inputs "time of year" and "interest rates" predict housing prices)

An algorithm explores input data without being given an explicit output variable (eg, explores customer demographic data to identify patterns)

An algorithm learns to perform a task simply by trying to maximize rewards it receives for its actions (eg, maximizes points it receives for increasing returns of an investment portfolio)

Machine Learning Branches



Regression

Regression models (both linear and non-linear) are used for predicting a real value, like salary for example. If your independent variable is time, then you are forecasting future values, otherwise – your model is predicting present but unknown values. Regression techniques vary from MLR to SVR and Boosted Trees.

5 Applications Of Regression in Real world

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Future Prediction

To predict events yet to occur. For example predicting future sales, units consumed by consumer.

Process Optimization

To optimize business processes like a manager in call center would like to know how much call waiting time affects the number of complaints.

Market Forecast

Here Multivariate linear technique is used to forecast sales volumes, or market movement.

Human Resources

Linear regression in also used to predict the demographics and types of future work force in large companies . This way companies can create better hiring plans.

Study of Environment

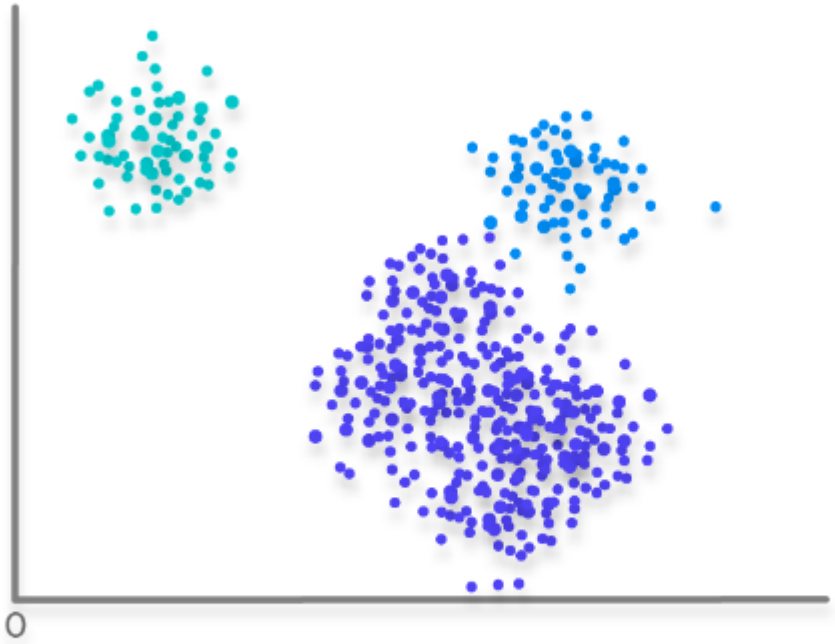
Linear Regression have a wide applications in Environment Science. For example in Canada, statistical analysis is used to measure effect of oil spills on aquatic ecosystem.

Machine Learning Branches

Unlike regression where you predict a continuous number, you use classification to predict a category. There is a wide variety of classification applications from medicine to marketing. Classification models include linear models like Logistic Regression, SVM, and nonlinear ones like K-NN, Kernel SVM and Random Forests.

Classification

Machine Learning Branches



Clustering

Clustering is similar to classification, but the basis is different – in Clustering you don't know what you are looking for. When you use clustering algorithms on your dataset, unexpected things can suddenly pop up – like structures, clusters and groupings you would have never thought of otherwise.

5 Applications Of Clustering In Real World

Segmenting Customers

Used in marketing, where customers are are subdivided into segments with each segment consisting of customers with similar characteristics.

Creating Newsfeeds

To cluster articles from various sources by their similarity — it can separate documents into disjoint clusters and hence helps decision making.

Pattern Recognition

This feature is readily used in medical field these days where algorithm automatically detect for segmentation of blood cells for leukemia detection or for cancer cells detection.

Cloud Storage

To enhance performance, capacity, or reliability , clustering distributes work loads to each server, and provides access to all files from any server regardless of the physical location of the file.

Recommender System

To recommend similar items for customers. To find similar items, comparison b/w the set of users who like each item is done, if a similar set of users like two different items, then the items themselves are probably similar!

DatumGuy

Machine Learning Branches

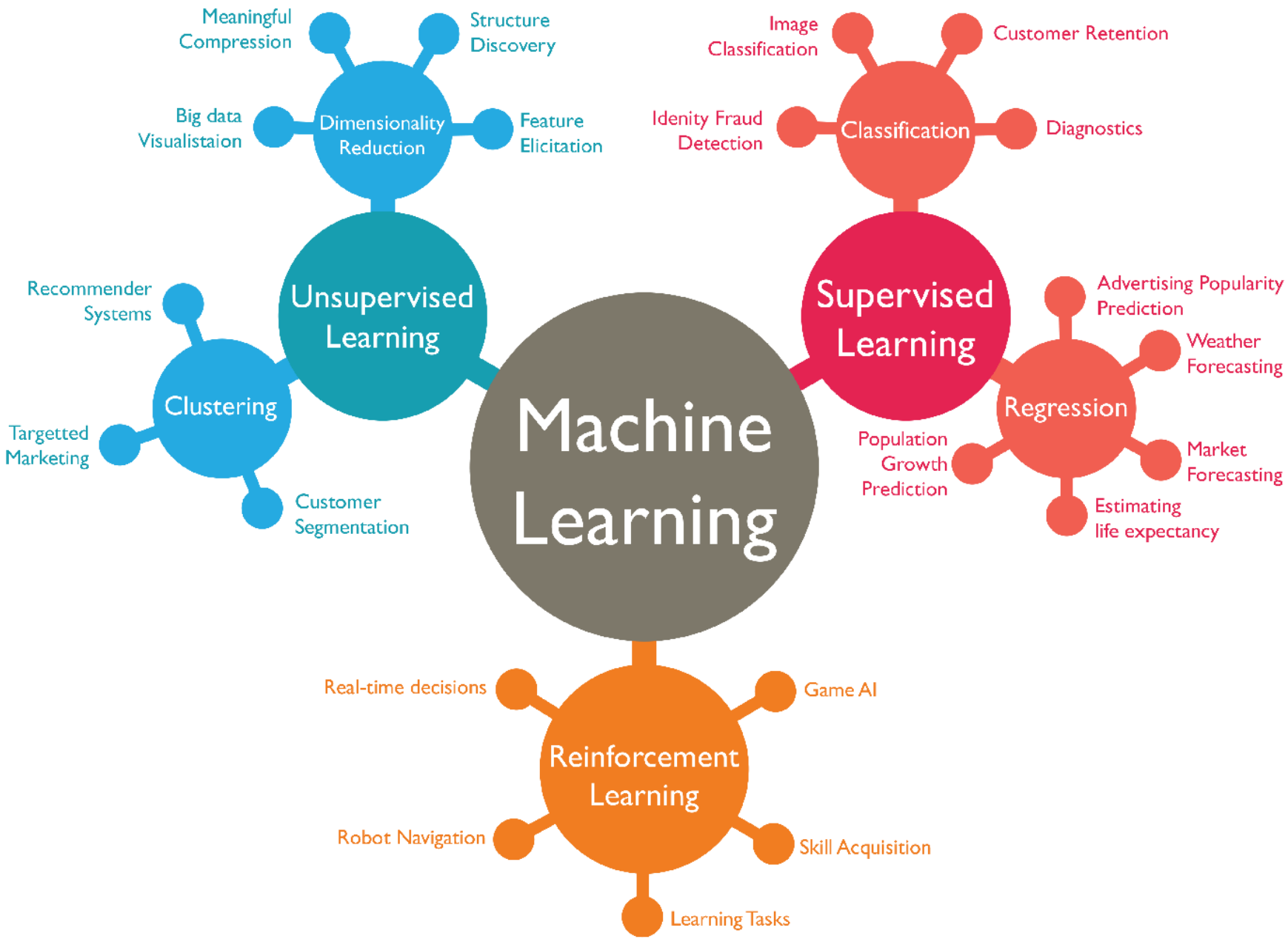
Reinforcement learning algorithms include techniques like Thompson Sampling, Upper Confidence Bound and Q-Learning. These are used a lot when training machines to perform tasks such as walking. Desired outcomes provide the AI with reward, undesired – with punishment. Machines learn through trial and error.

Reinforcement Learning

Machine Learning Branches

Natural Language Processing

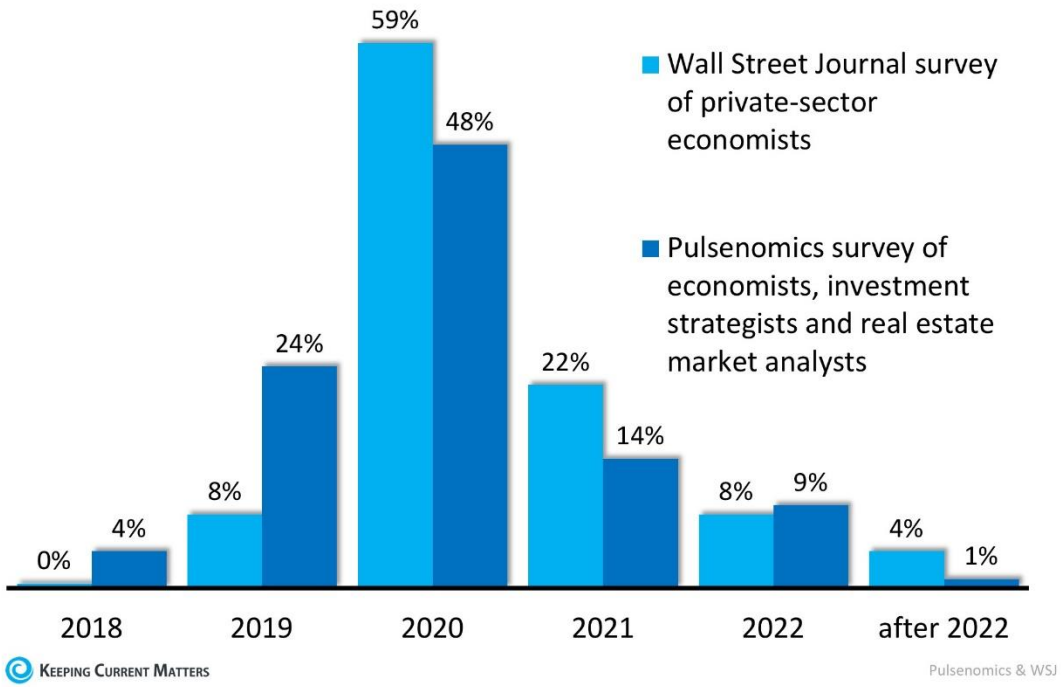
Teaching machines to understand what is said in spoken and written word is the focus of Natural Language Processing. Whenever you dictate something into your iPhone / Android device and it's converted to text – that's an NLP algorithm in action. Methods include decision trees, Markov processes, and more.


Machine Learning
Unsupervised Learning
Dimensionality Reduction
Meaningful Compression
Structure Discovery
Big data Visualistaion
Feature Elicitation
Clustering
Recommender Systems
Targetted Marketing
Customer Segmentation
Supervised Learning
Classification
Image Classification
Customer Retention
Idenity Fraud Detection
Diagnostics
Regression
Advertising Popularity Prediction
Weather Forecasting
Population Growth Prediction
Market Forecasting
Estimating life expectancy
Reinforcement Learning
Real-time decisions
Game AI
Robot Navigation
Skill Acquisition
Learning Tasks

- Familiarize you with ML terminology
- Prepare you for job interviews
- Provide cheat sheets and resources
- Help you to hedge yourself against the next recession

Hedge yourself against
the next recession!

When Will Next U.S. Recession Begin?



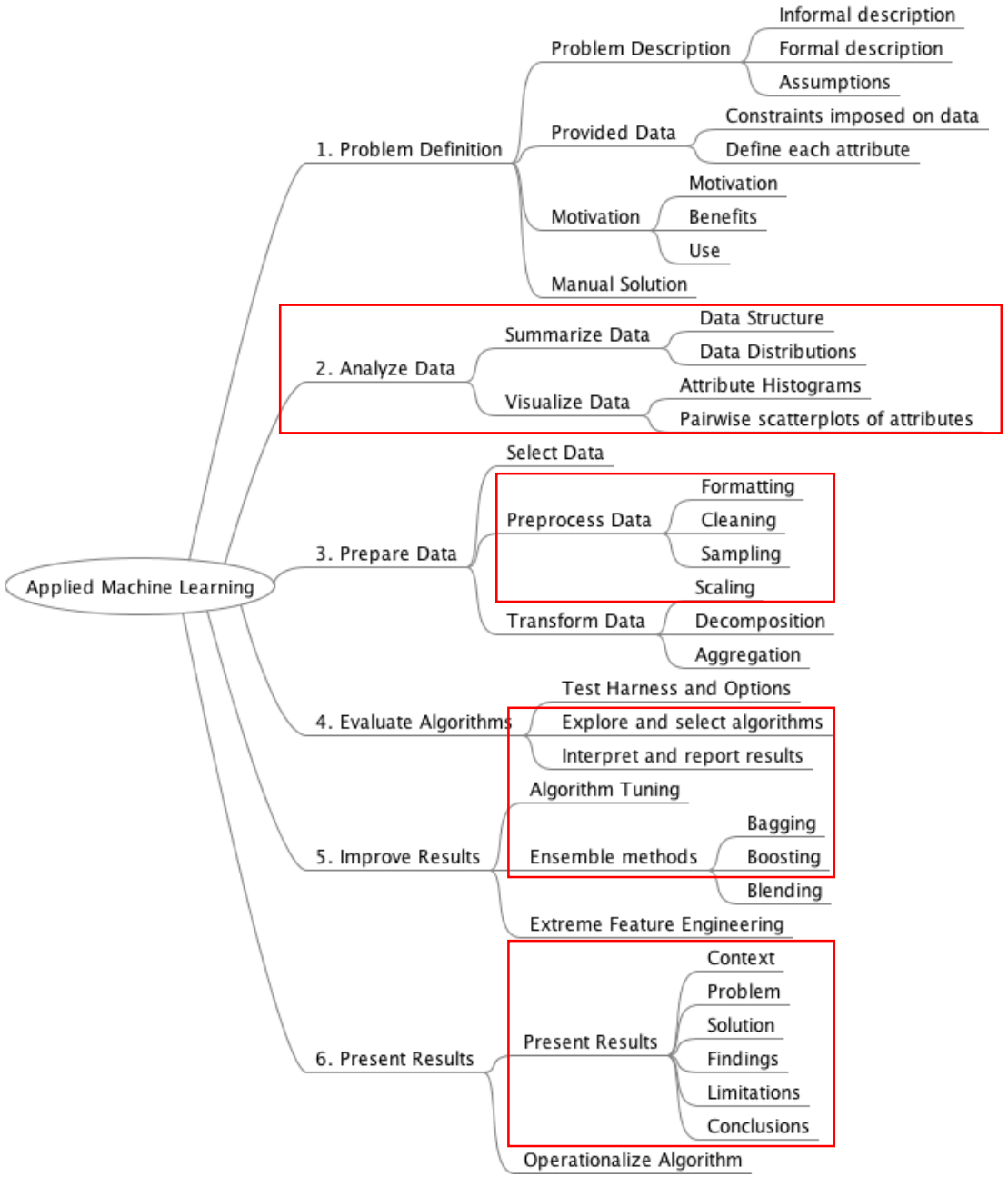
INDUSTRY

Machine Learning

Accommodation & Food	Agriculture	Banking & Insurance
Biotechnological & Life Sciences	Construction & Engineering	Education & Research
Emergency & Relief	Finance	Manufacturing
Government and Public Works	Healthcare	Media & Publishing
Justice, Law and Regulations	Miscellaneous	Accounting
Real Estate, Rental & Leasing	Utilities	Wholesale & Retail

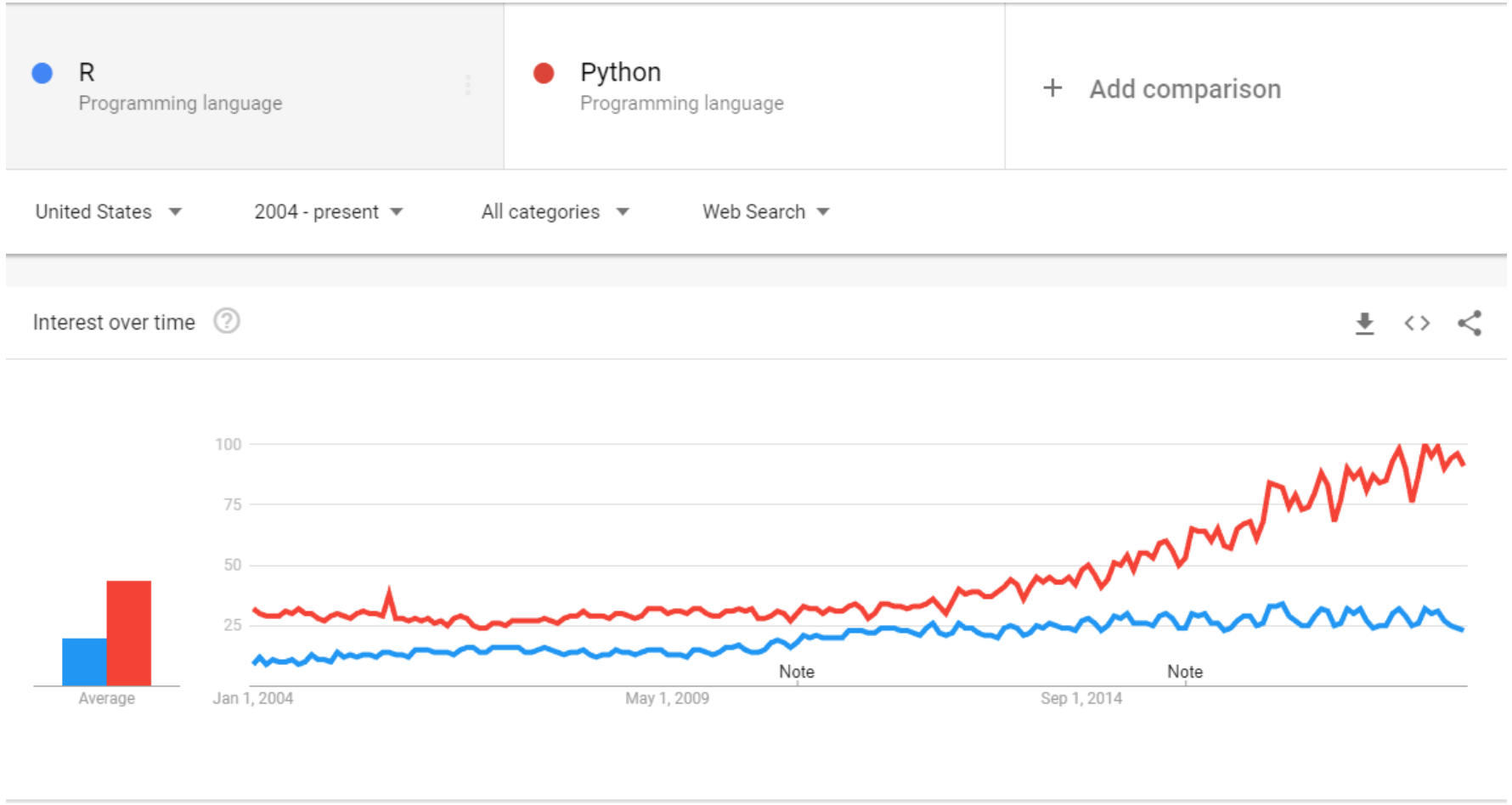
- Accommodation & Food
  - Food
  - Restaurant
  - Accommodation
- Accounting
  - Machine Learning
  - Analytics
  - Textual Analysis
  - Data
  - Research and Articles
  - Websites
  - Courses
- Agriculture
  - Economics
  - Development
- Banking & Insurance
  - Consumer Financial
  - Management and Operations
  - Valuation
  - Fraud
  - Insurance and Risk
  - Physical
- Biotechnological & Life Sciences
  - General
  - Sequencing
  - Chemoinformatics and drug discovery
  - Genomics
  - Life-sciences
- Construction & Engineering
  - Construction
  - Engineering
  - Material Science
- Economics
  - General
  - Machine Learning
  - Computational
- Education & Research
  - Student
  - School
- Emergency & Relief
  - Preventative and Reactive
  - Crime
  - Ambulance
  - Disaster Management
- Finance
  - Trading & Investment
  - Data
- Healthcare
  - General
- Justice, Law and Regulations
  - Tools
  - Policy and Regulatory
  - Judicial
- Manufacturing
  - General
  - Maintenance
  - Failure
  - Quality
- Media & Publishing
  - Marketing
- Miscellaneous
  - Art
  - Tourism
- Physics
  - General
  - Machine Learning
- Physics
  - General
  - Machine Learning
- Government and Public Works
  - Social Policies
  - Election Analysis
  - Disaster Management
  - Politics
  - Charities
- Real Estate, Rental & Leasing
  - Real Estate
  - Rental & Leasing
- Utilities
  - Electricity
  - Coal, Oil & Gas
  - Water & Pollution
  - Transportation
- Wholesale & Retail
  - Wholesale
  - Retail

What we learn in this class?

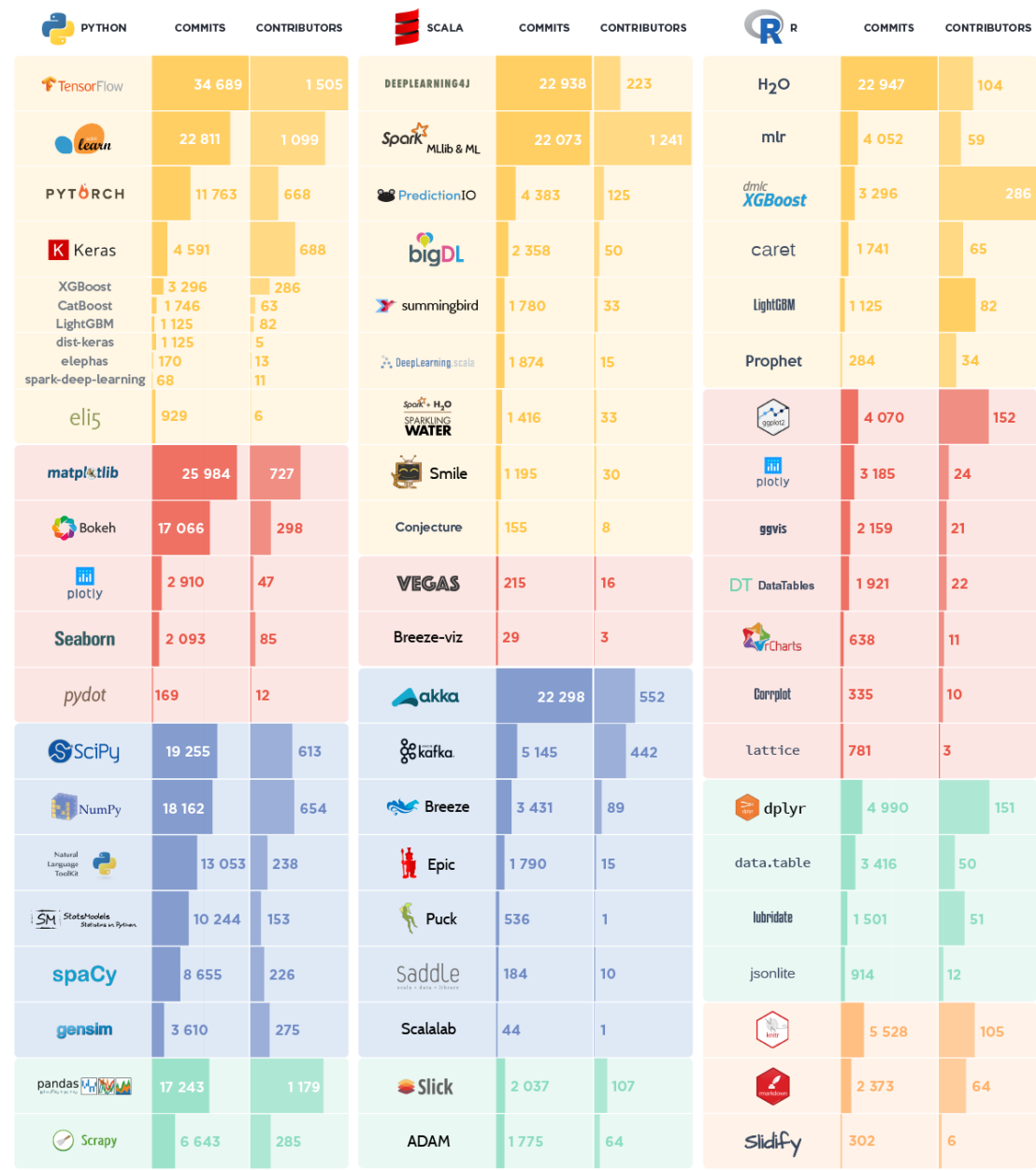


Classes and events

Why Python?


R
Programming language
Python
Programming language
+ Add comparison
United States
2004 - present
All categories
Web Search
Interest over time
100
75
50
25
Note
Note
Average
Jan 1, 2004
May 1, 2009
Sep 1, 2014

TOP PYTHON / SCALA / R LIBRARIES IN DATA SCIENCE



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Introduce your self!

What project are you working on?

The TA

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