Python for Accounting Applications

Python Programming and Data Science

1141PAA02
ACC2, NTPU (U2004) (Fall 2025)
Wed 6, 7, 8, (14:10-17:00) (9:10-12:00) (B3F10)

Min-Yuh Day, Ph.D,
Professor and Director

Institute of Information Management, National Taipei University

https://web.ntpu.edu.tw/~myday

2025-09-17

Syllabus

Week	Date	Subject/Topics
1	2025/09/10	Introduction to Python for Accounting Applications
2	2025/09/17	Python Programming and Data Science
3	2025/09/24	Foundations of Python Programming
4	2025/10/01	Data Structures
5	2025/10/08	Control Logic and Loops
6	2025/10/15	Functions and Modules; Files and Exception Handling
7	2025/10/22	Data Analytics and Visualization with Python
8	2025/10/29	Self-Learning

Syllabus

Week	Date	Subject/Topics
9	2025/11/05	Midterm Project Report
10	2025/11/12	Obtaining Data From the Web with Python
11	2025/11/19	Statistical Analysis with Python
12	2025/11/26	Machine Learning with Python
13	2025/12/03	Text Analytics with Generative AI and Python
14	2025/12/10	Applications of Accounting Data Analytics with Python
15	2025/12/17	Applications of ESG Data Analytics with Python
16	2025/12/24	Final Project Report

Python Programming and Data Science

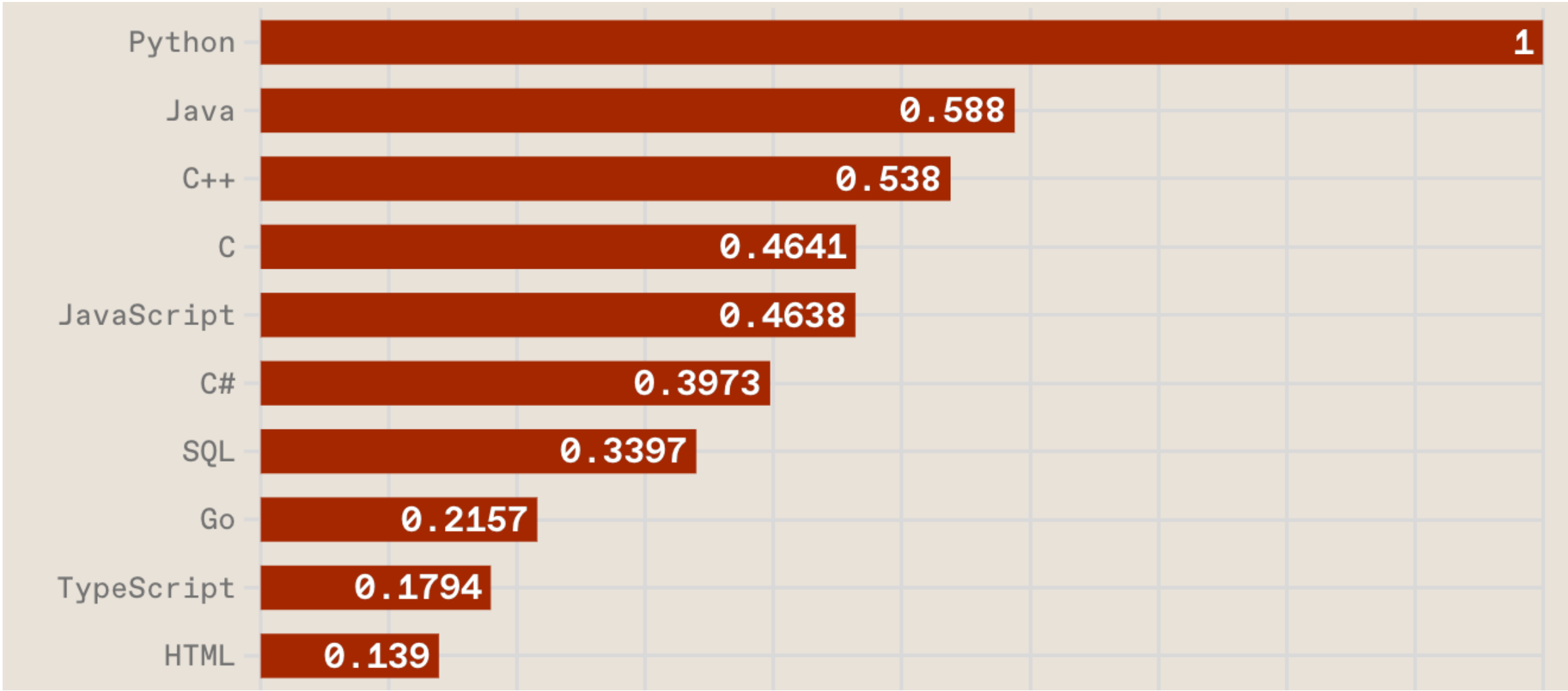
Outline

- **Python Programming**
- **Data Science**

Python

Programming

Top Programming Languages



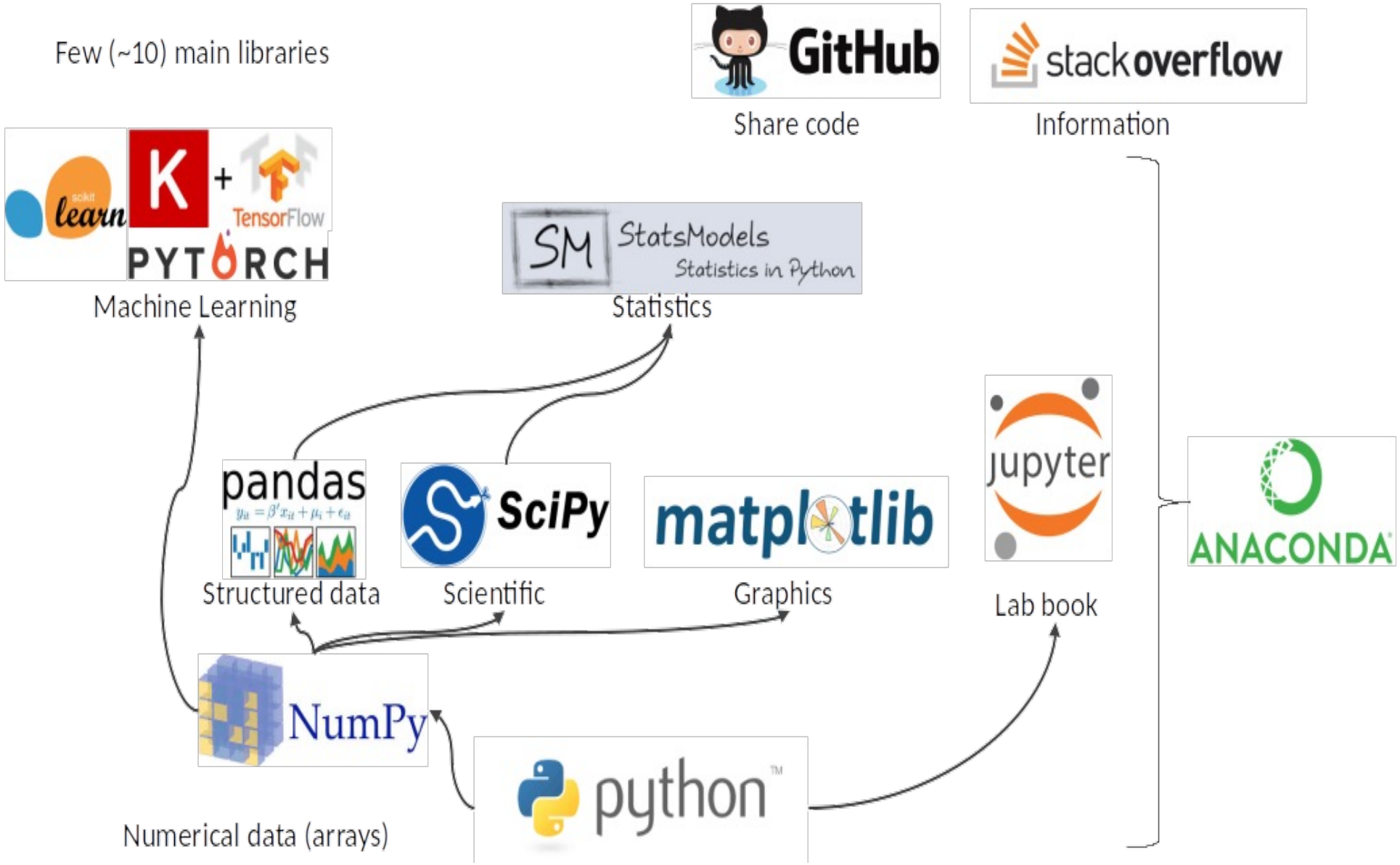
https://spectrum.ieee.org/the-top-programming-languages-2023

python™

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics.

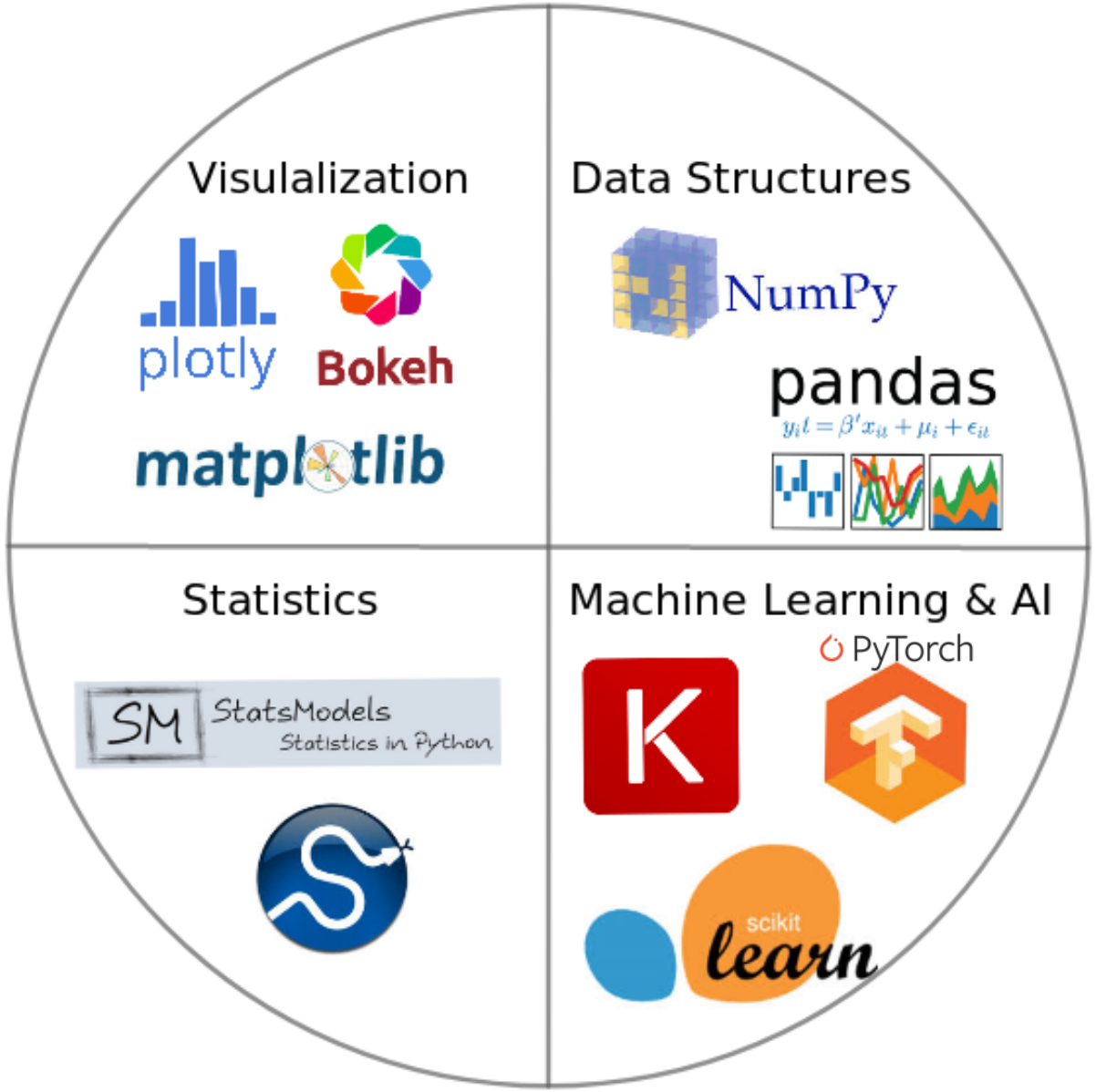
Source: https://www.python.org/doc/essays/blurb/

Python Ecosystem for Data Science



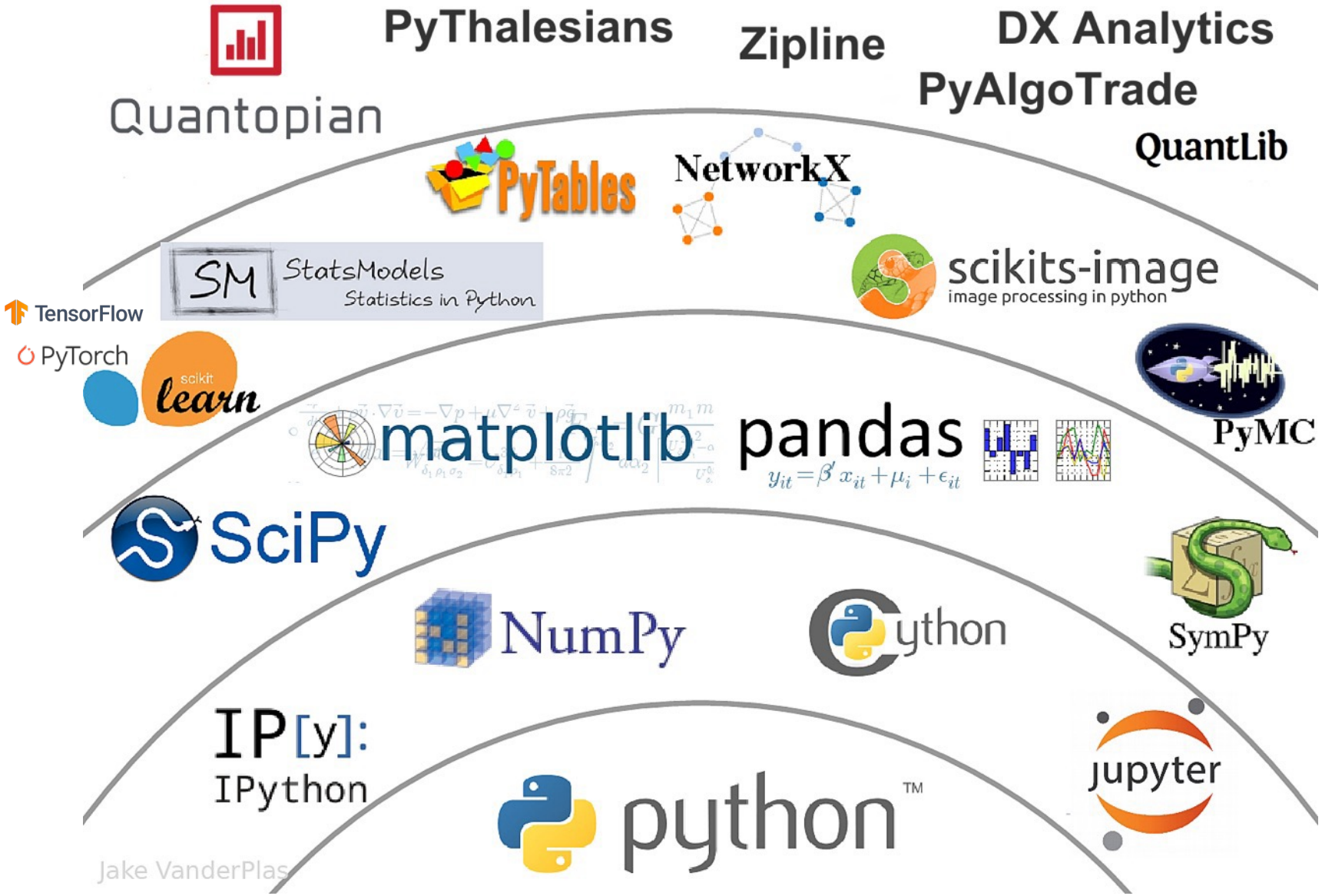
Source: https://medium.com/pyfinance/why-python-is-best-choice-for-financial-data-modeling-in-2019-c0d0d1858c45

Python Ecosystem for Data Science



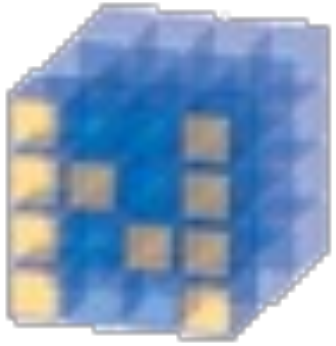
Source:https://duchesnay.github.io/pystatsml/introduction/python_ecosystem.html

The Quant Finance PyData Stack



Source: http://nbviewer.jupyter.org/format/slides/github/quantopian/pyfolio/blob/master/pyfolio/examples/overview_slides.ipynb#/5

Numpy



NumPy

Base

N-dimensional array

package

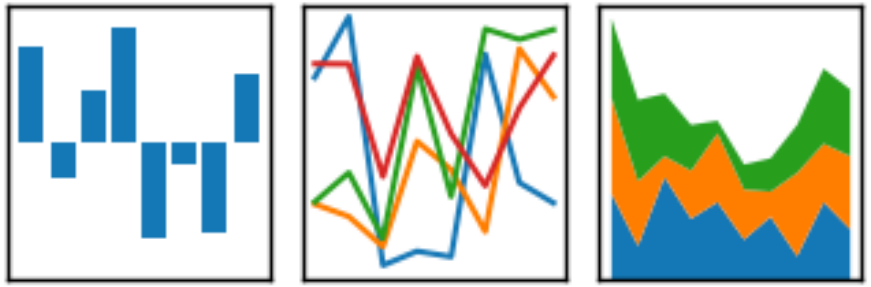
Python matplotlib

Source: https://matplotlib.org/

Python Pandas

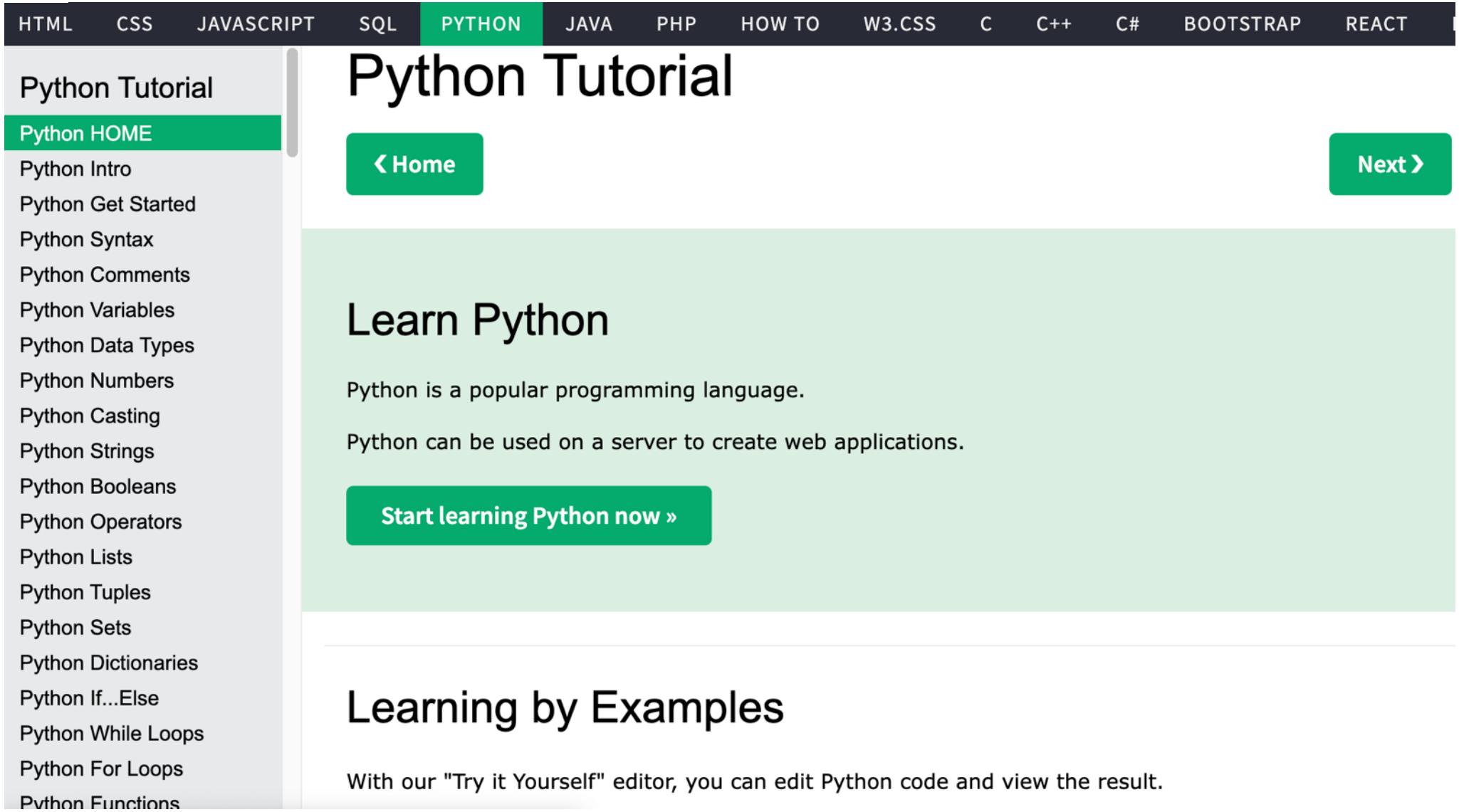
pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



http://pandas.pydata.org/

W3Schools Python

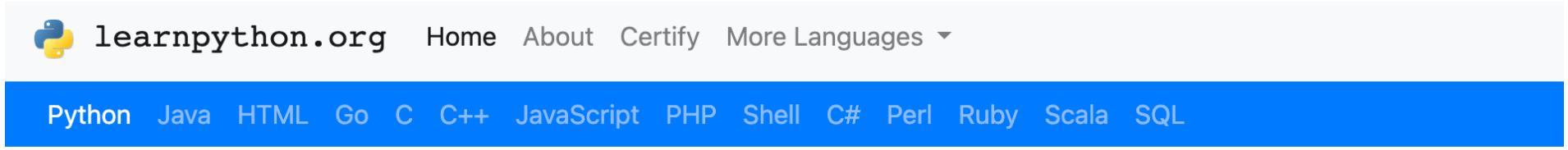


https://www.w3schools.com/python/

W3Schools Python: Try Python

https://www.w3schools.com/python/trypython.asp?filename=demo_default

LearnPython.org



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Welcome to the LearnPython.org interactive Python tutorial.

Whether you are an experienced programmer or not, this website is intended for everyone who wishes to learn the Python programming language.

You are welcome to join our group on Facebook for questions, discussions and updates.

After you complete the tutorials, you can get certified at LearnX and add your certification to your LinkedIn profile.

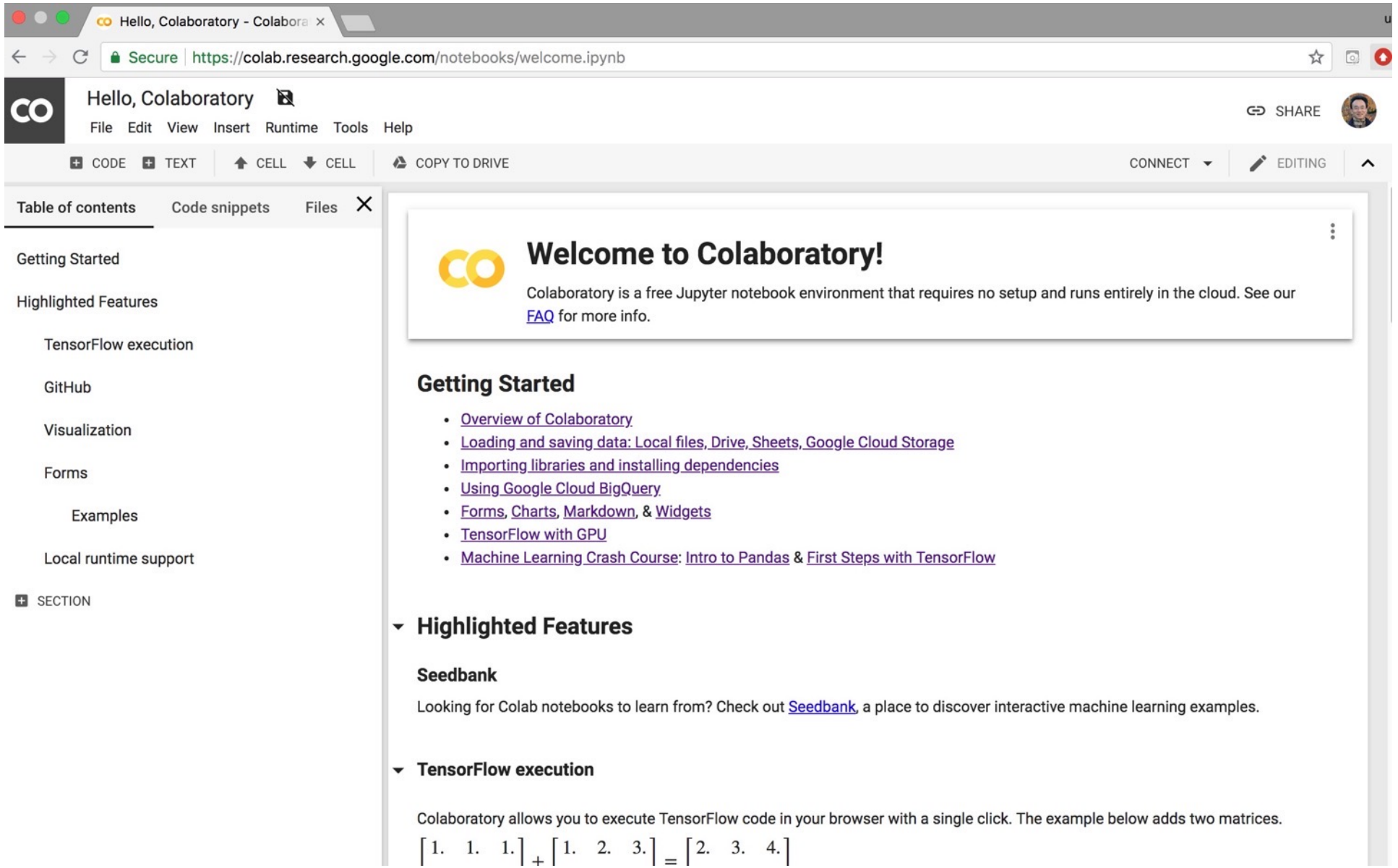
Just click on the chapter you wish to begin from, and follow the instructions. Good luck!

https://www.learnpython.org/

Google's Python Class

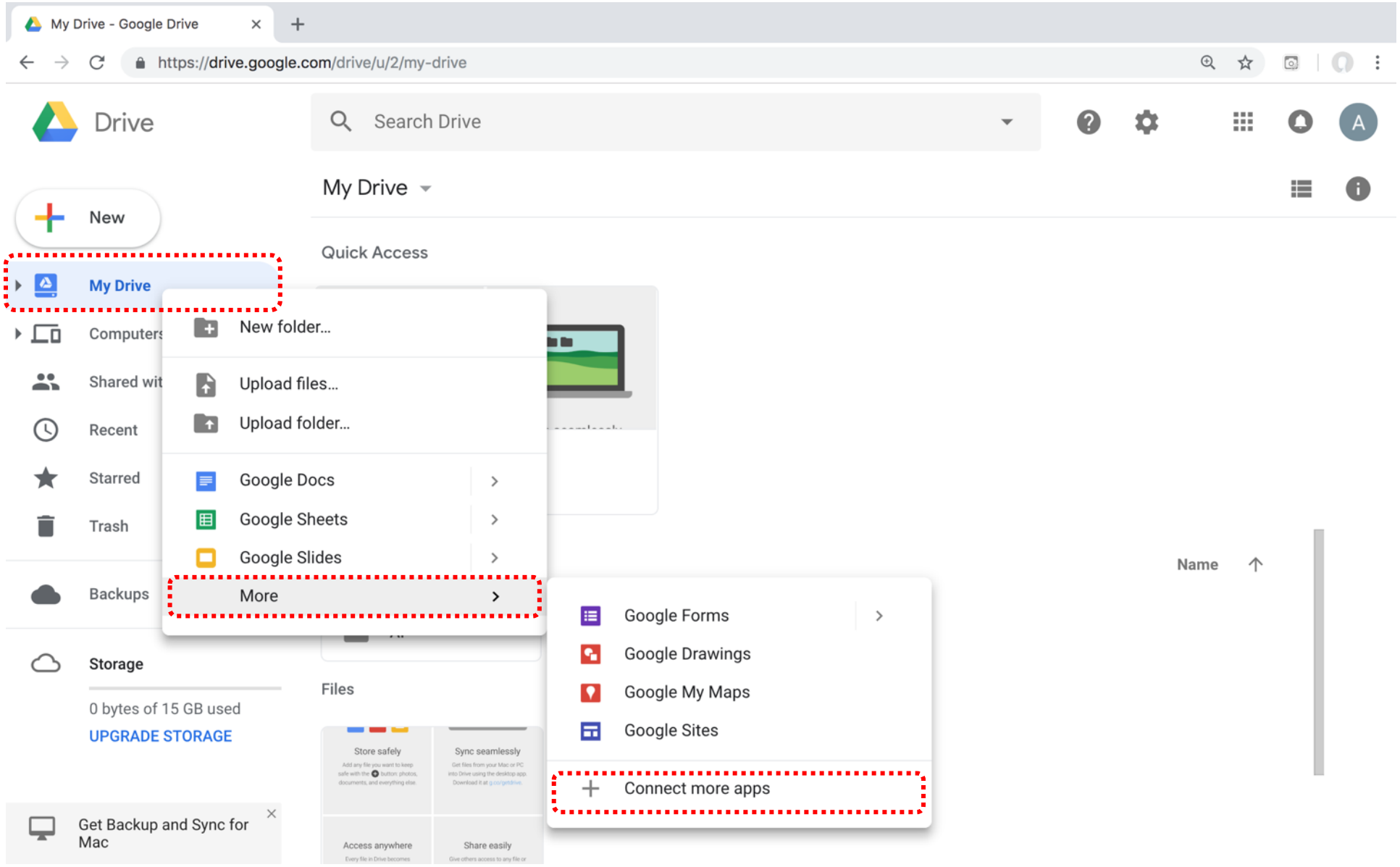
https://developers.google.com/edu/python

Google Colab

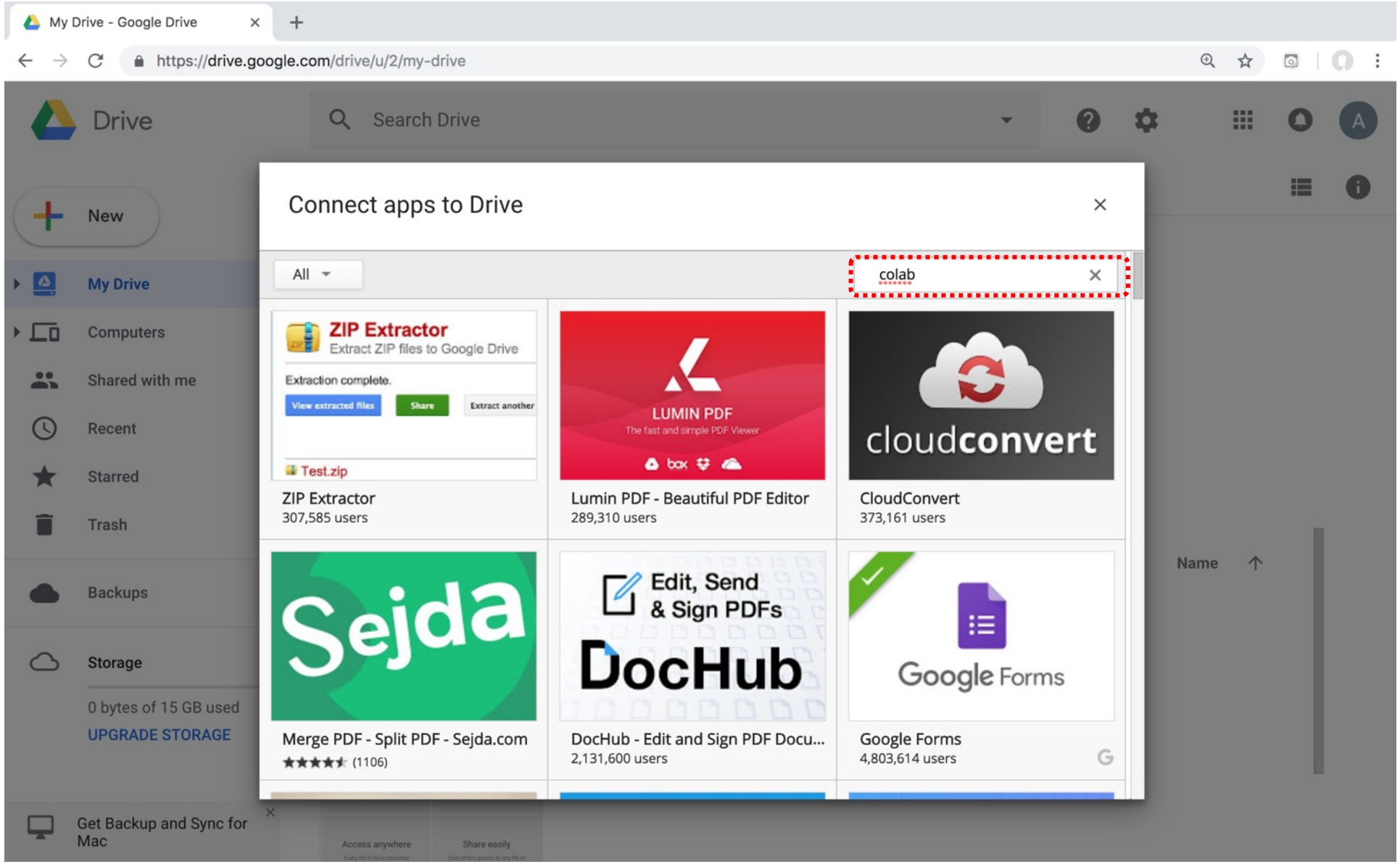


https://colab.research.google.com/notebooks/welcome.ipynb

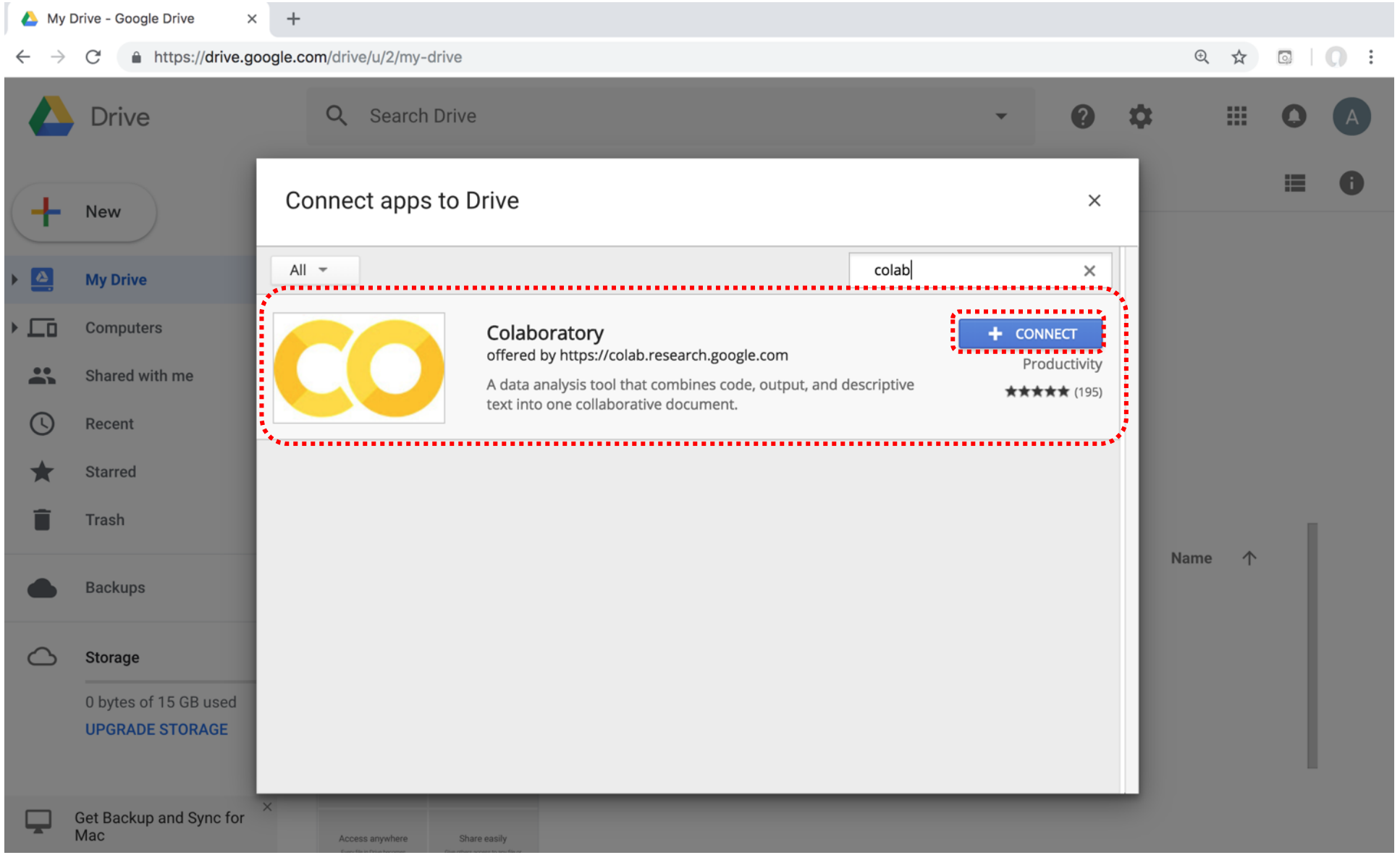
Connect Google Colab in Google Drive



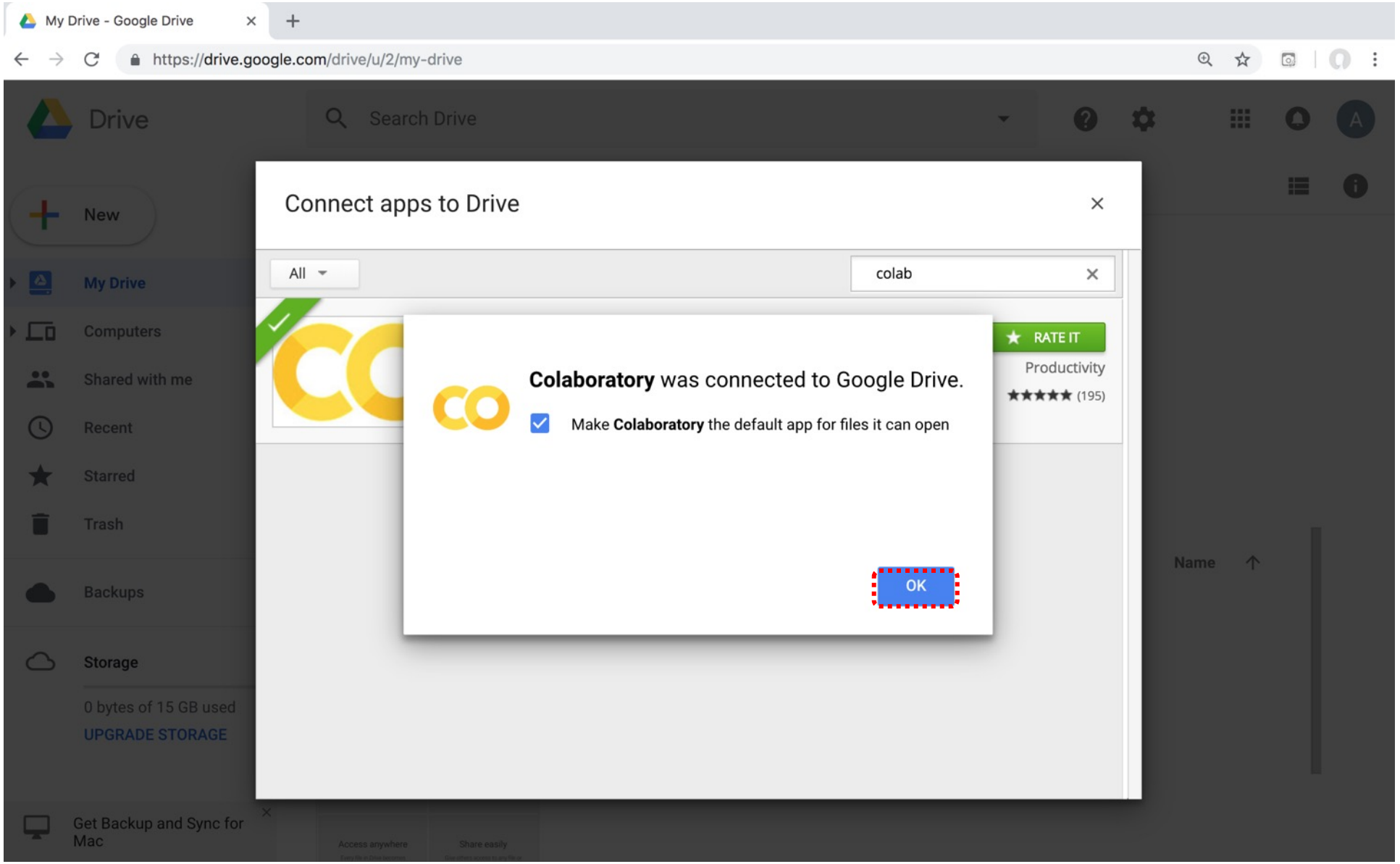
Google Colab



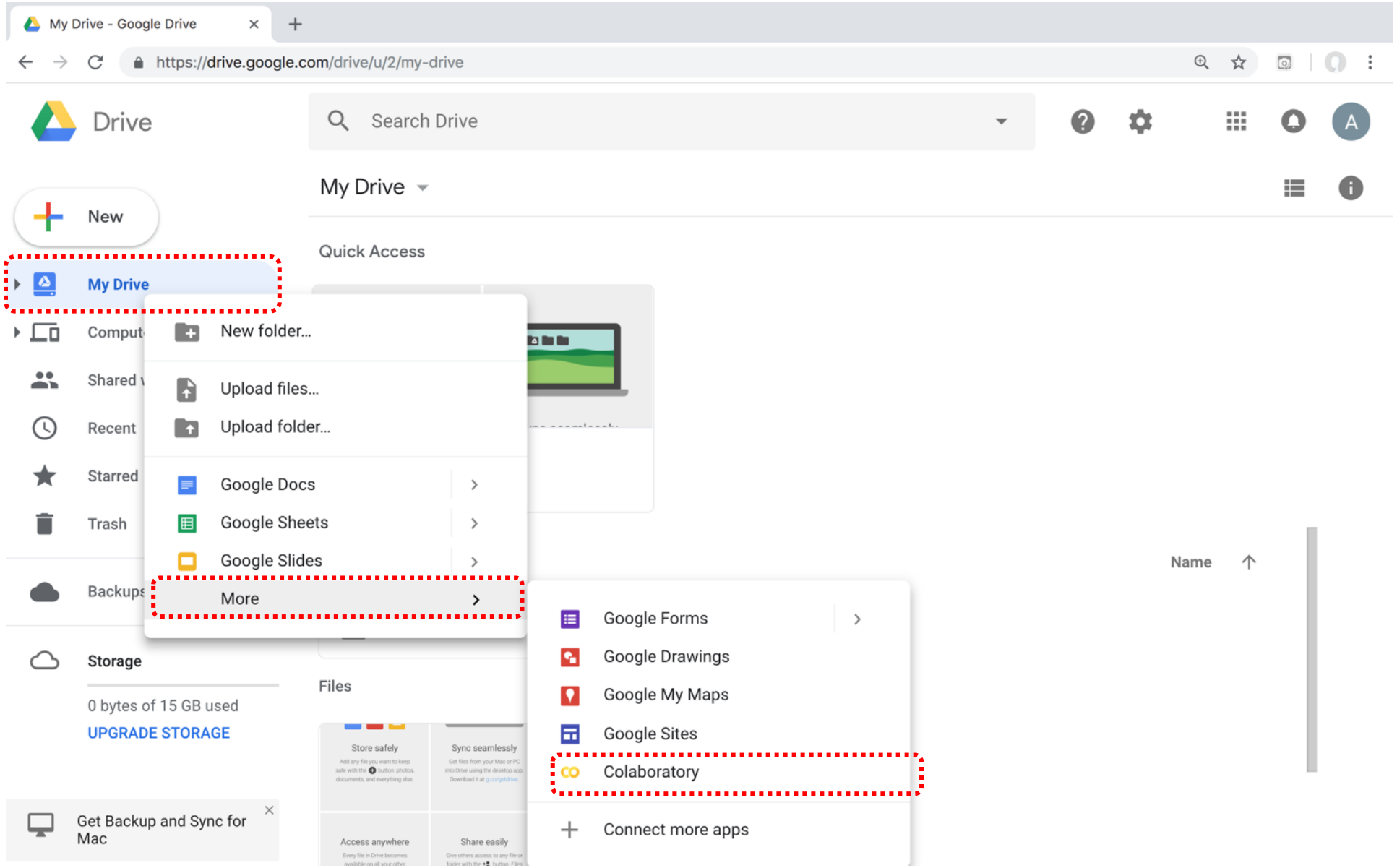
Google Colab



Connect Colaboratory to Google Drive



Google Colab



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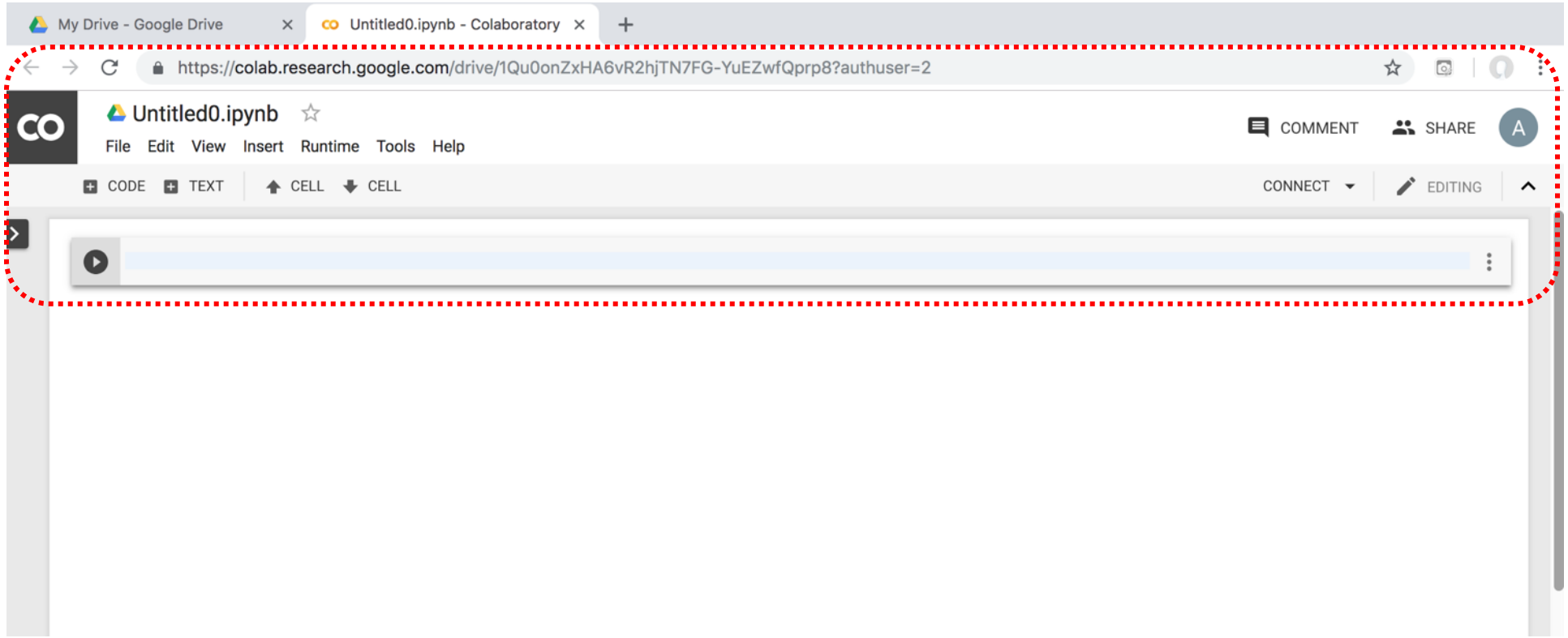
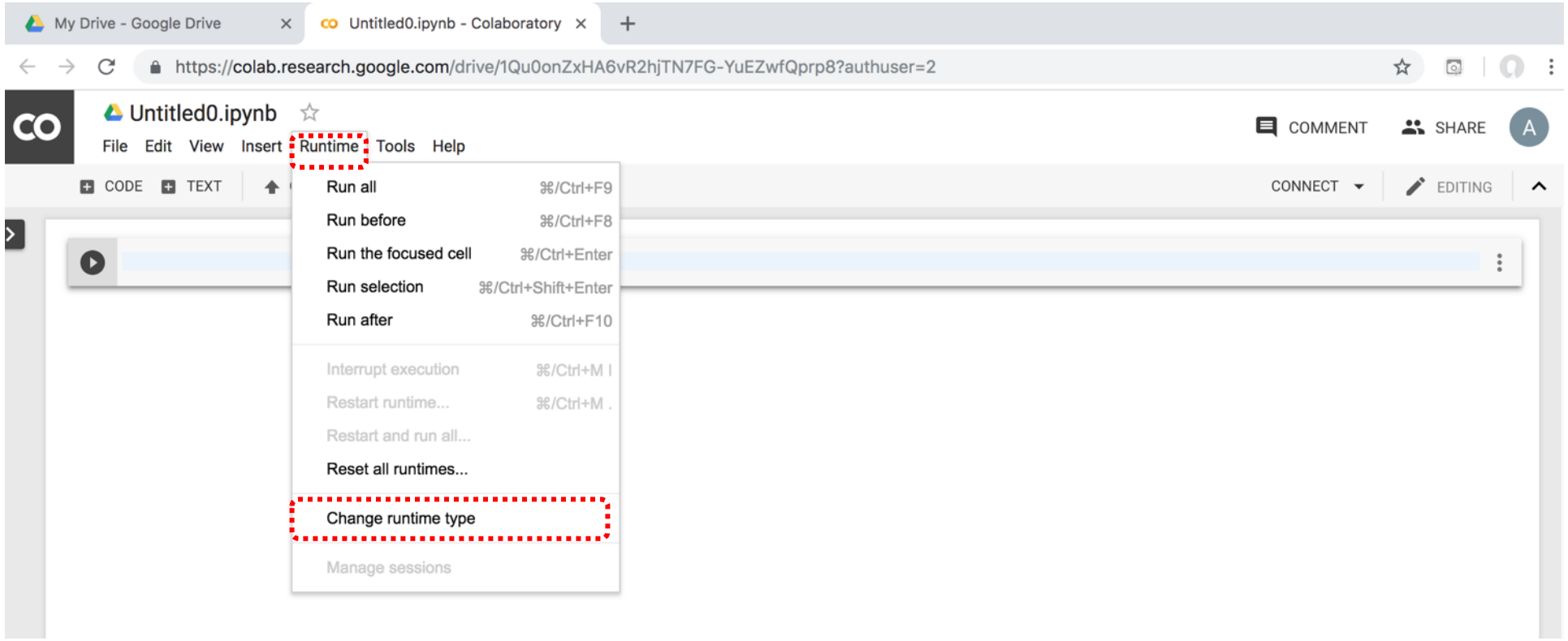
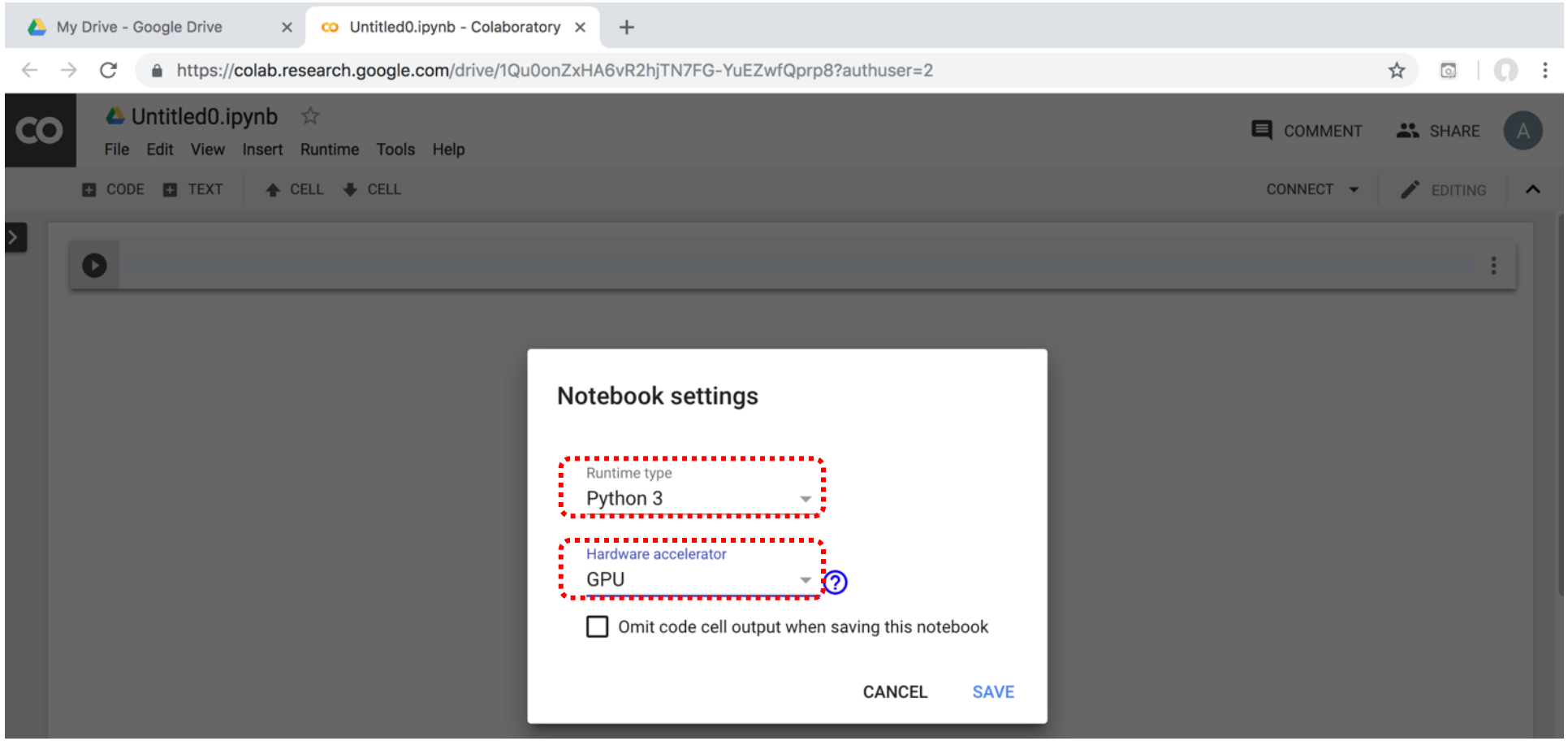


Google Colab



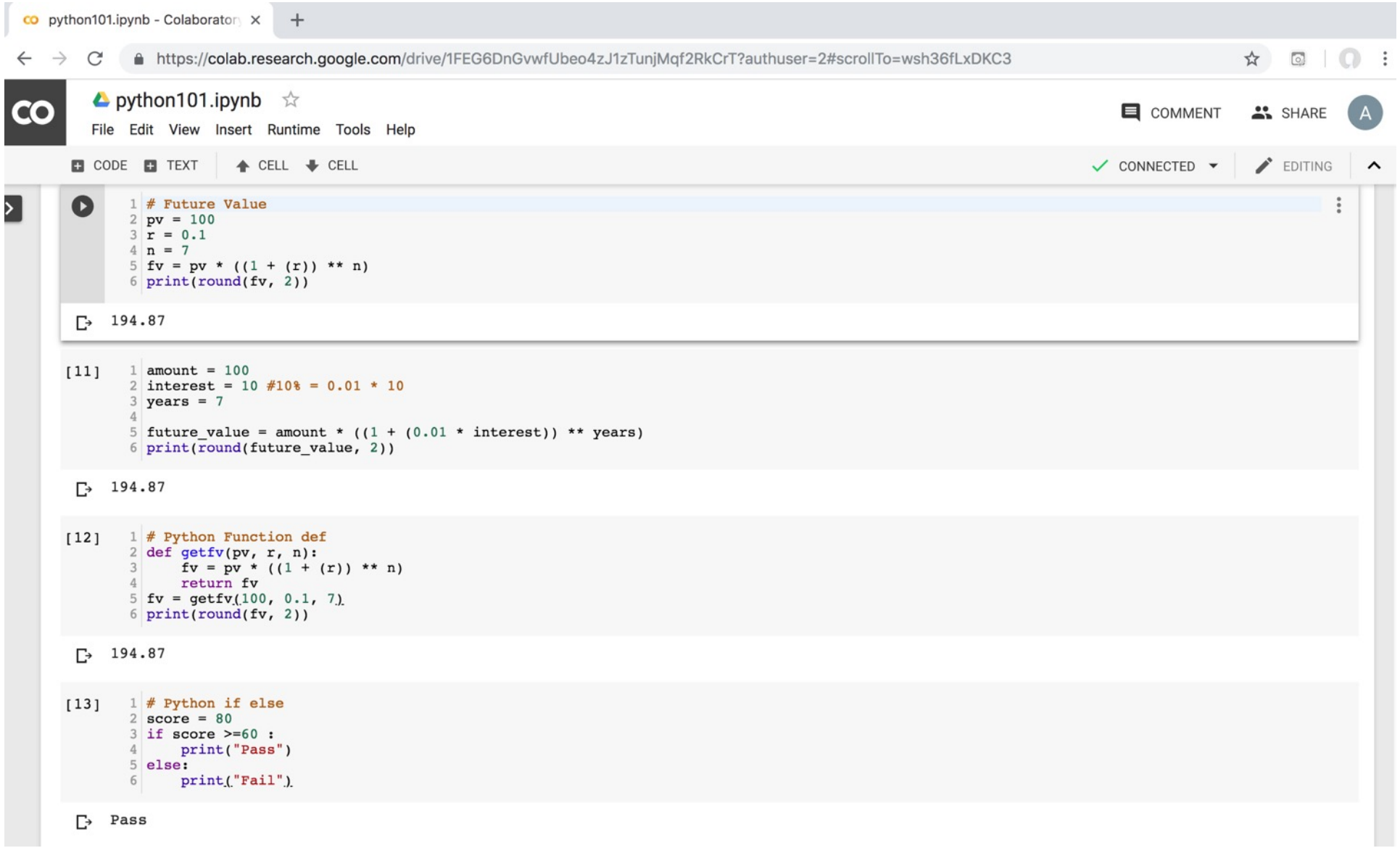
Run Jupyter Notebook
Python3 GPU
Google Colab



Google Colab Python Hello World
print('Hello World')

Python in Google Colab (Python101)

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT

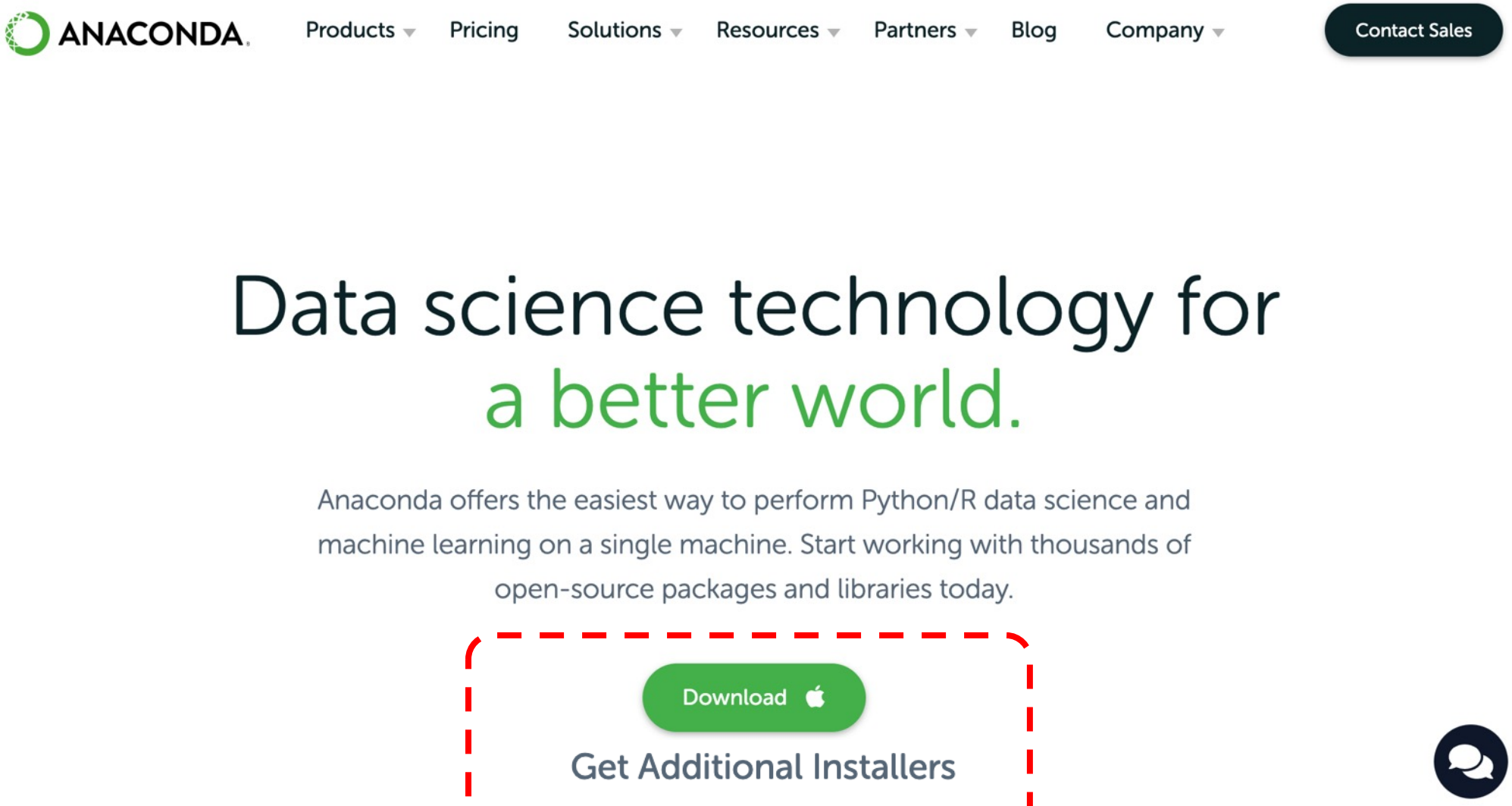


https://tinyurl.com/aintpupython101

Anaconda
The Most Popular
Python
Data Science Platform

Source: https://www.anaconda.com/

Download Anaconda

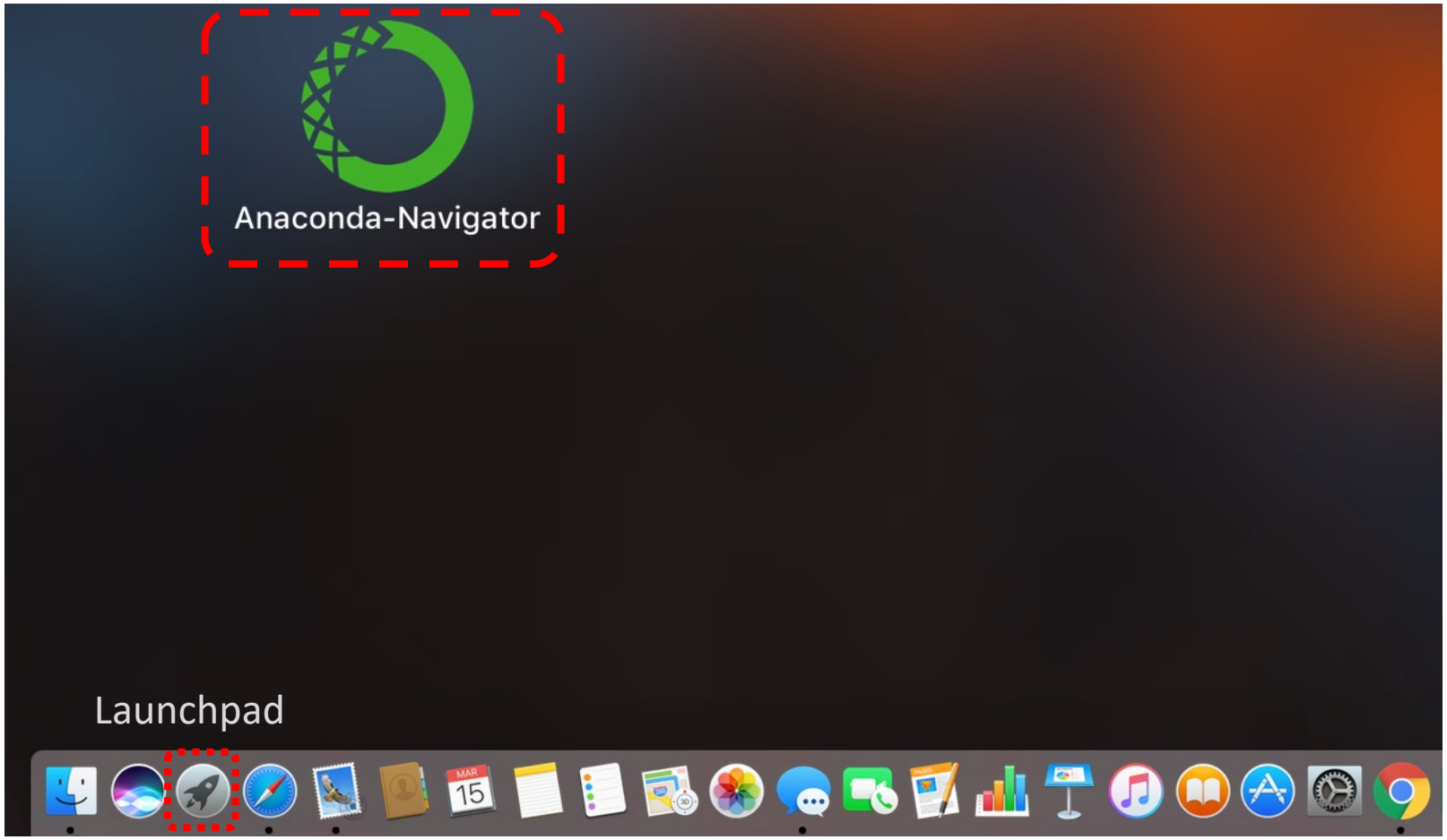


https://www.anaconda.com/download

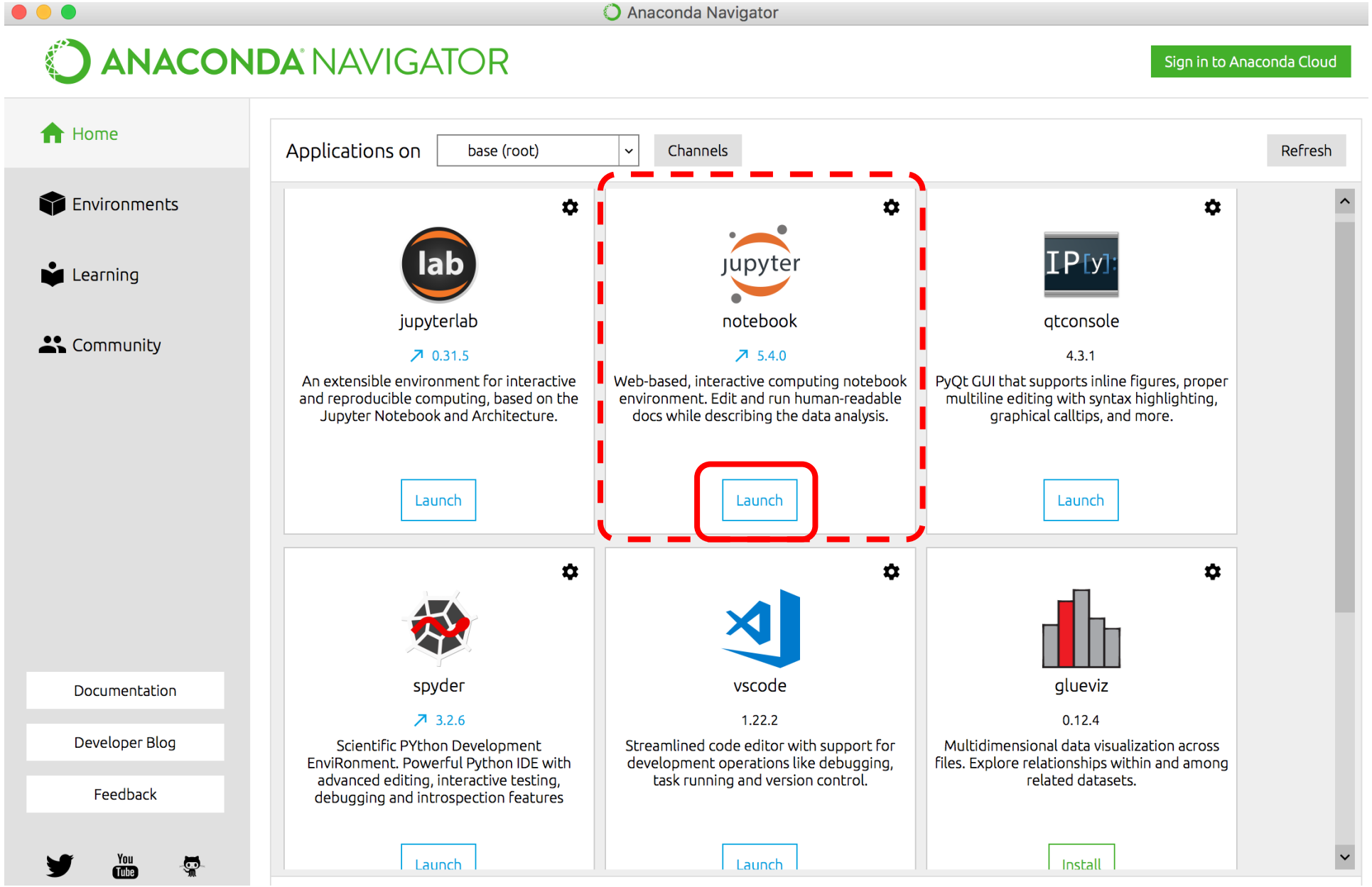
Python

HelloWorld

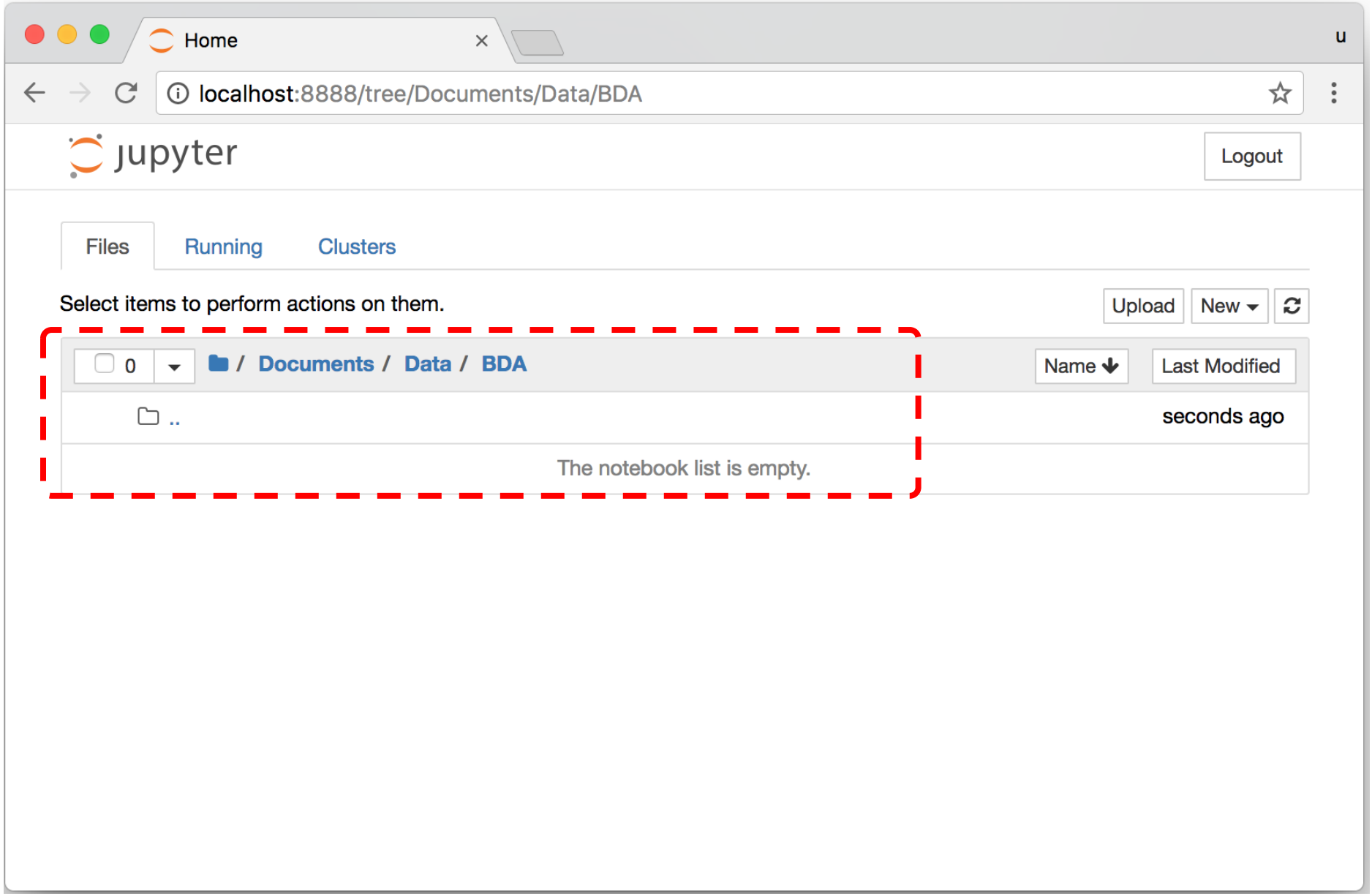
Anaconda-Navigator



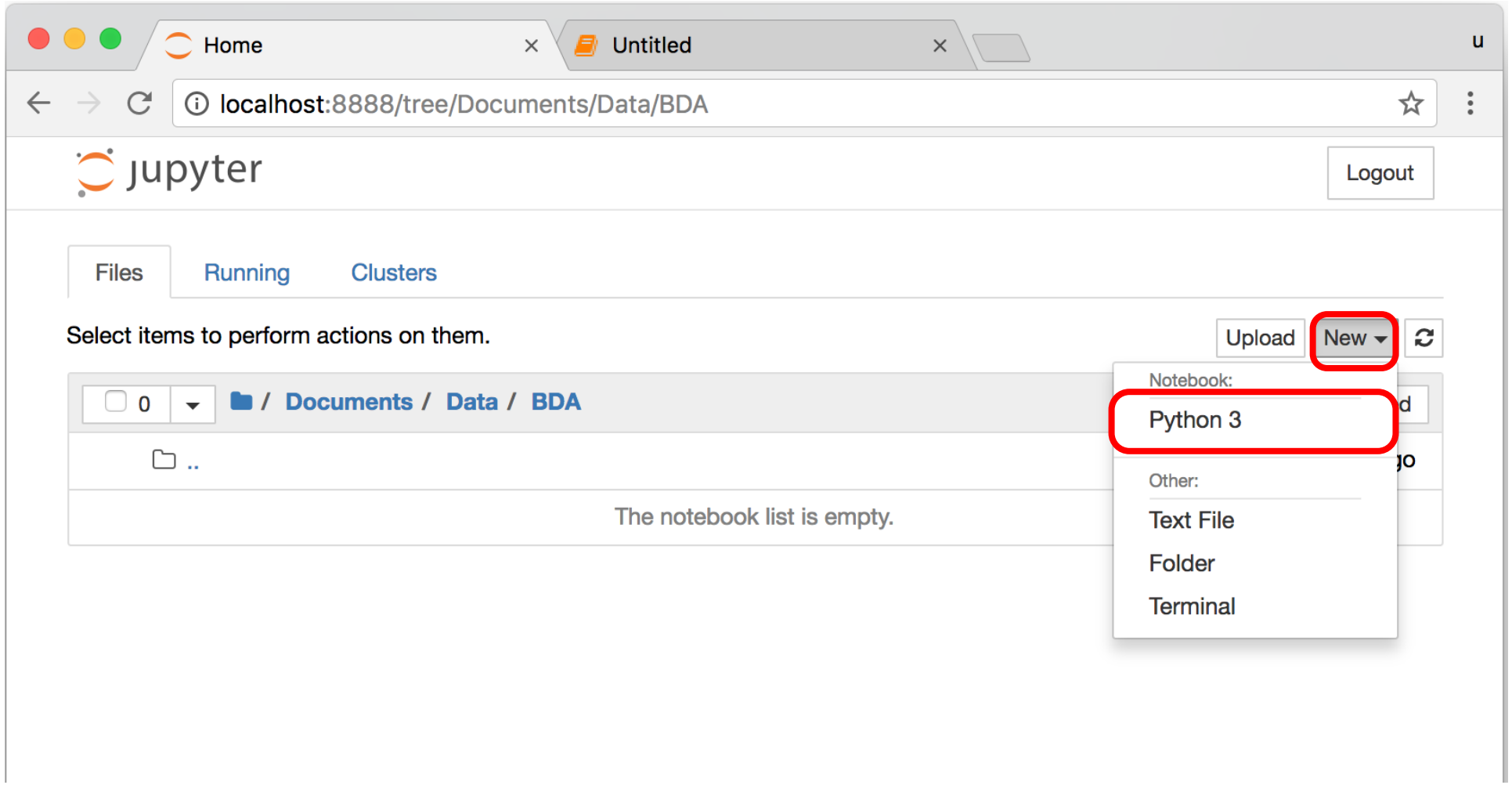
Anaconda Navigator



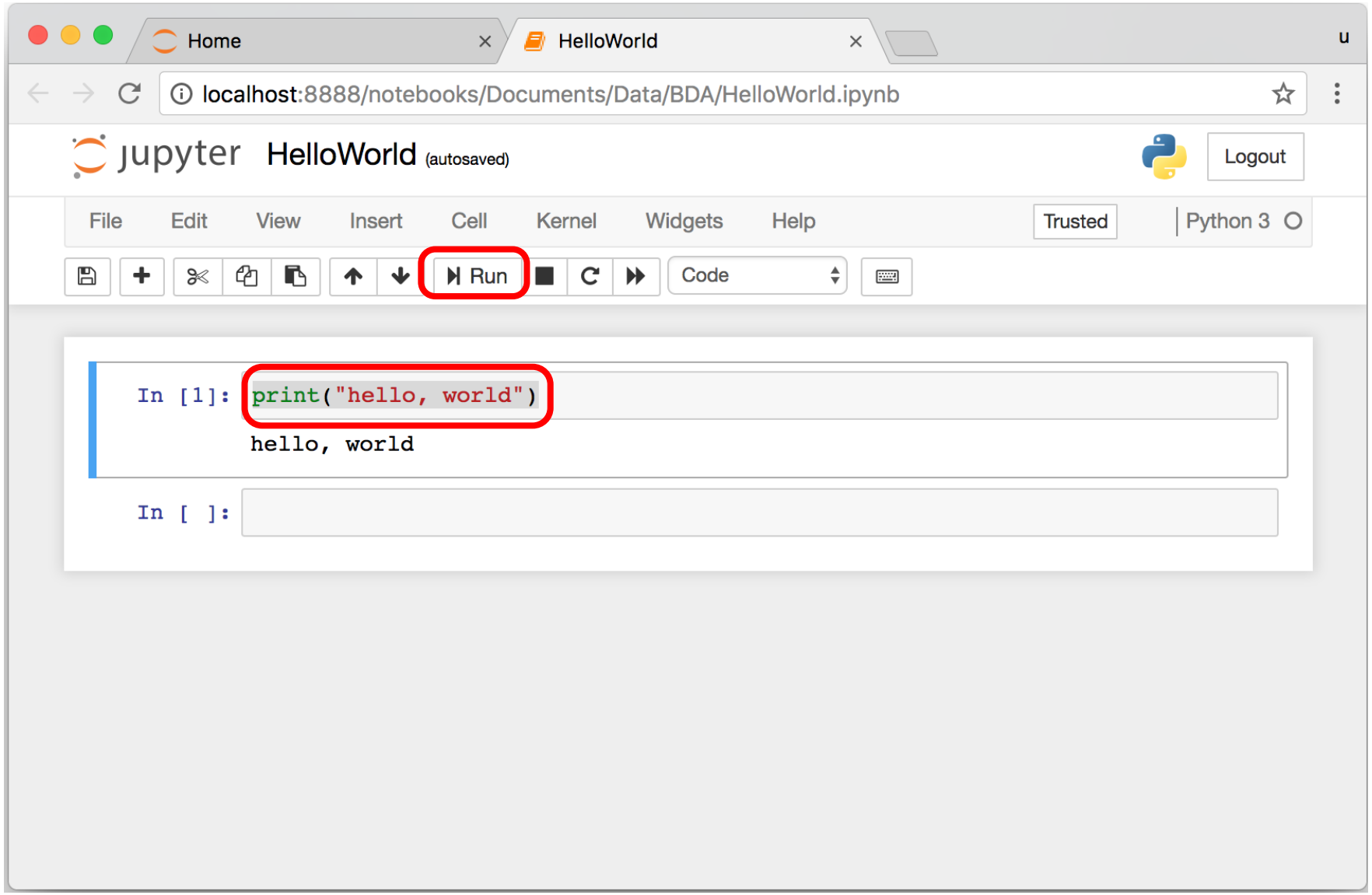
Jupyter Notebook



Jupyter Notebook
New Python 3

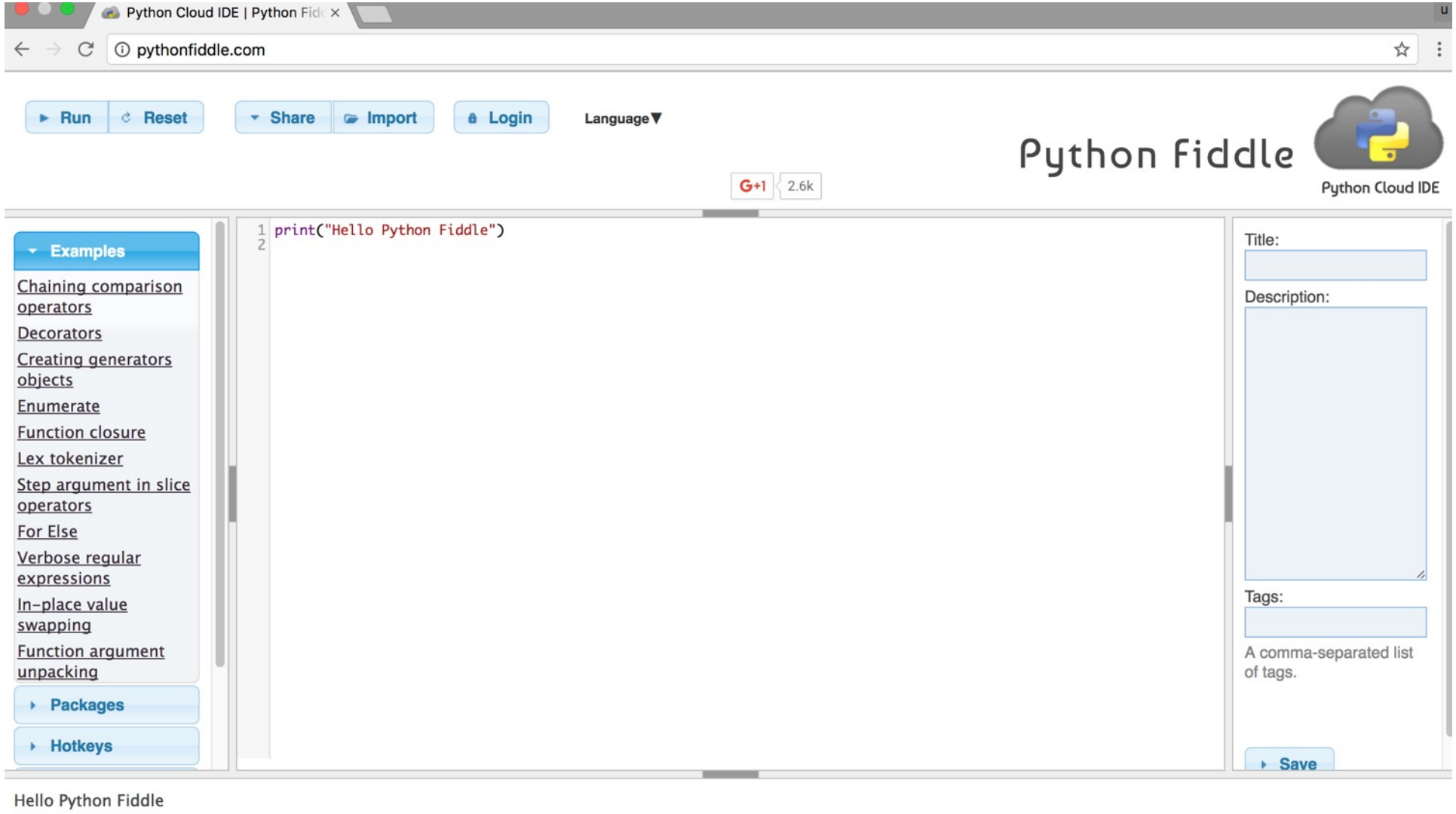


print("hello, world")



Source: https://www.python.org/community/logos/

Python Fiddle



http://pythonfiddle.com/

Text input and output

```
print("Hello World")
```

```
print("Hello World\nThis is a message")
```

```
x = 3
print(x)
```

```
x = 2
y = 3
print(x, ' ', y)
```

```
name = input("Enter a name: ")
```

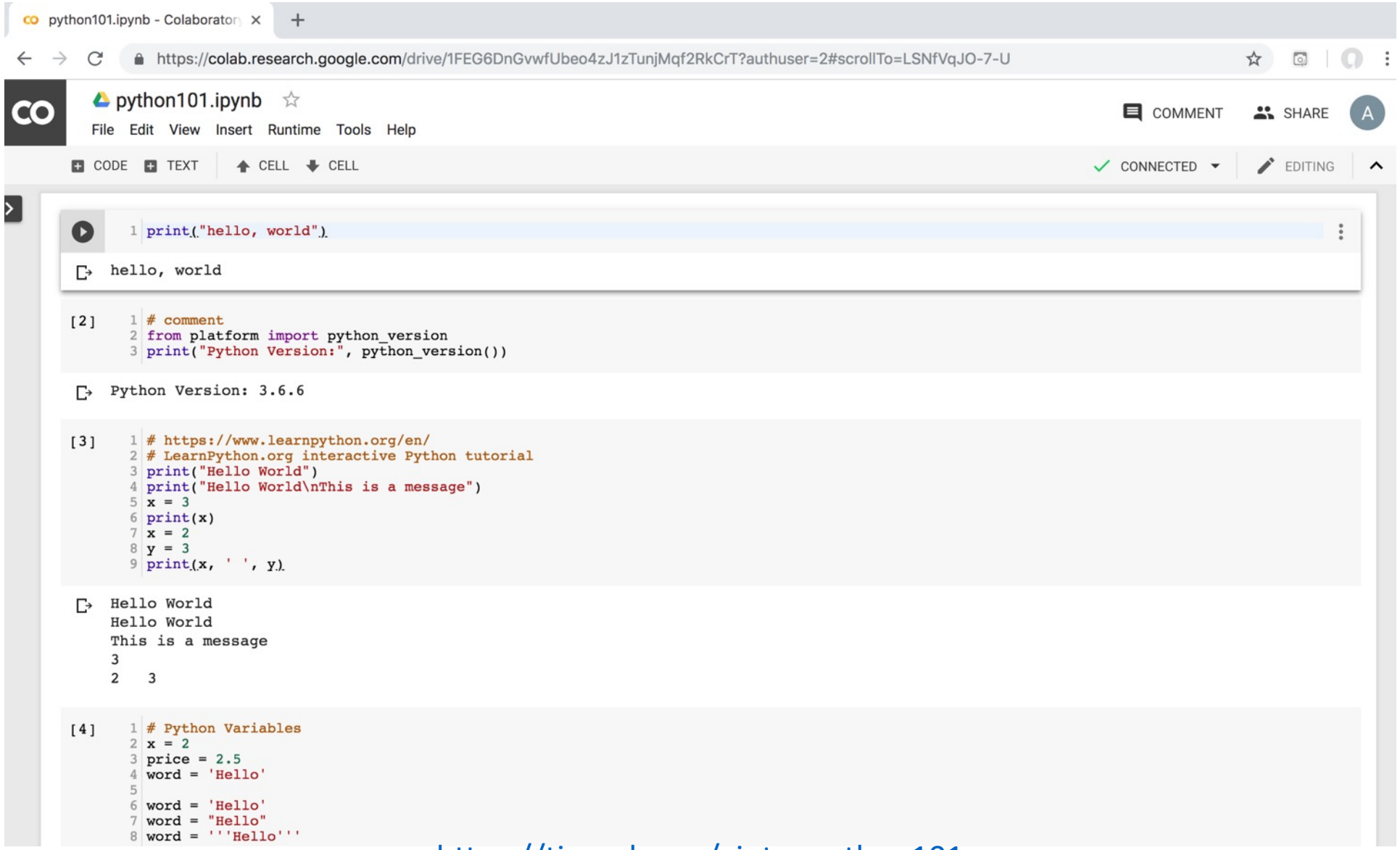
```
x = int(input("What is x? "))
```

```
x = float(input("Write a number "))
```

Source: http://pythonprogramminglanguage.com/text-input-and-output/

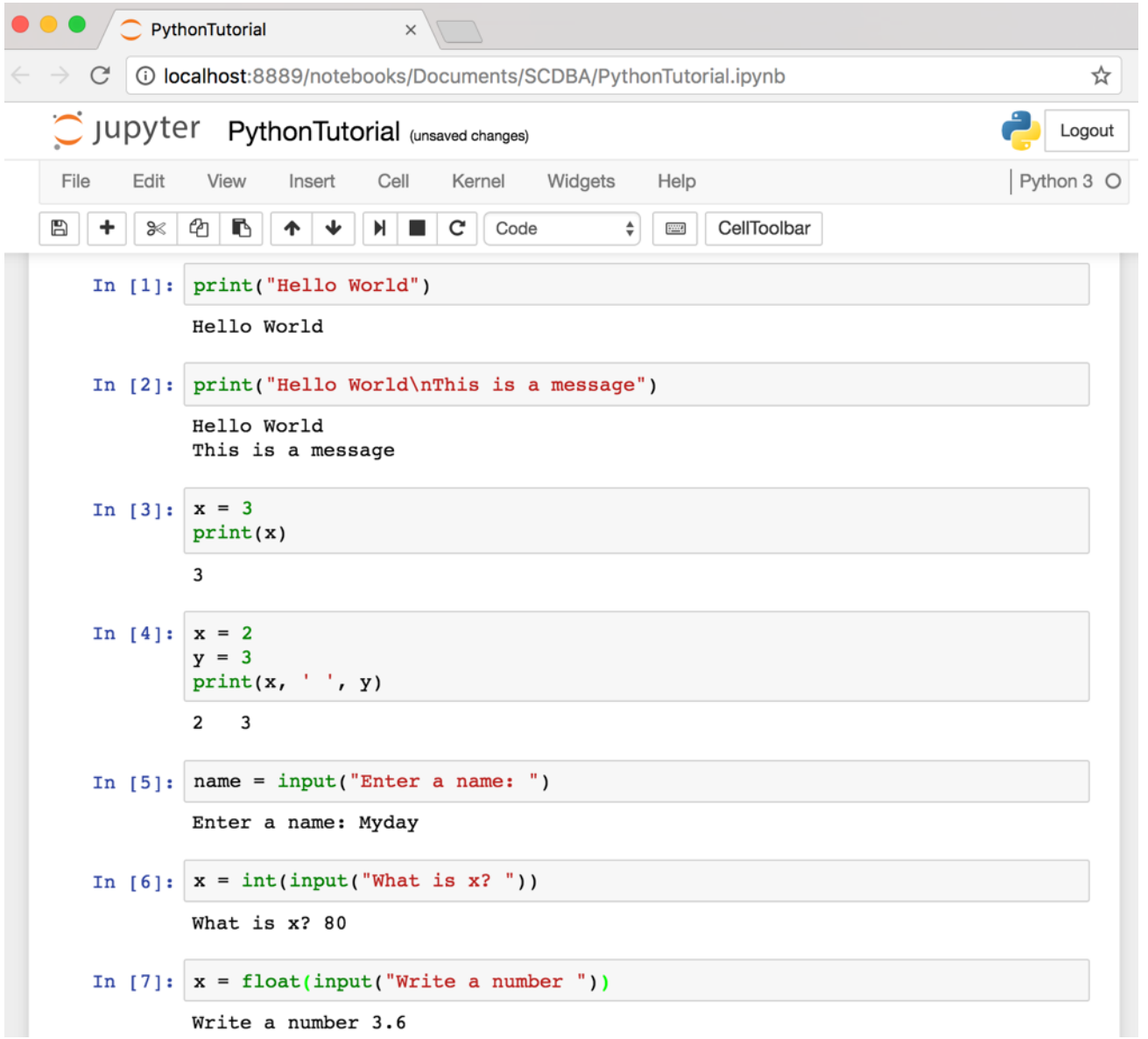
Python in Google Colab

https://colab.research.google.com/drive/1FEG6DnGvwfUbeo4zJ1zTunjMqf2RkCrT



https://tinyurl.com/aintpupython101

Text input and output

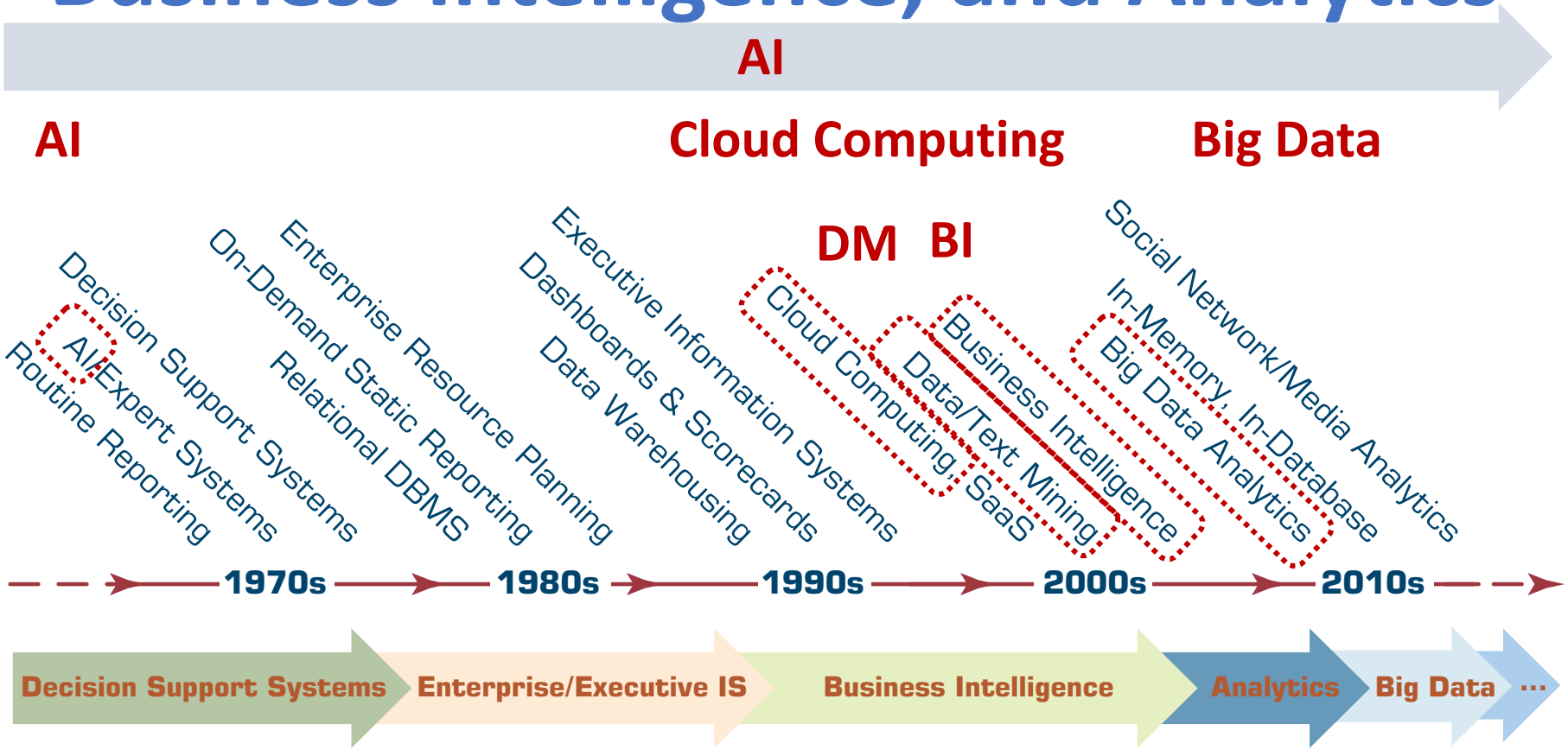


Source: http://pythonprogramminglanguage.com/text-input-and-output/

Data Science

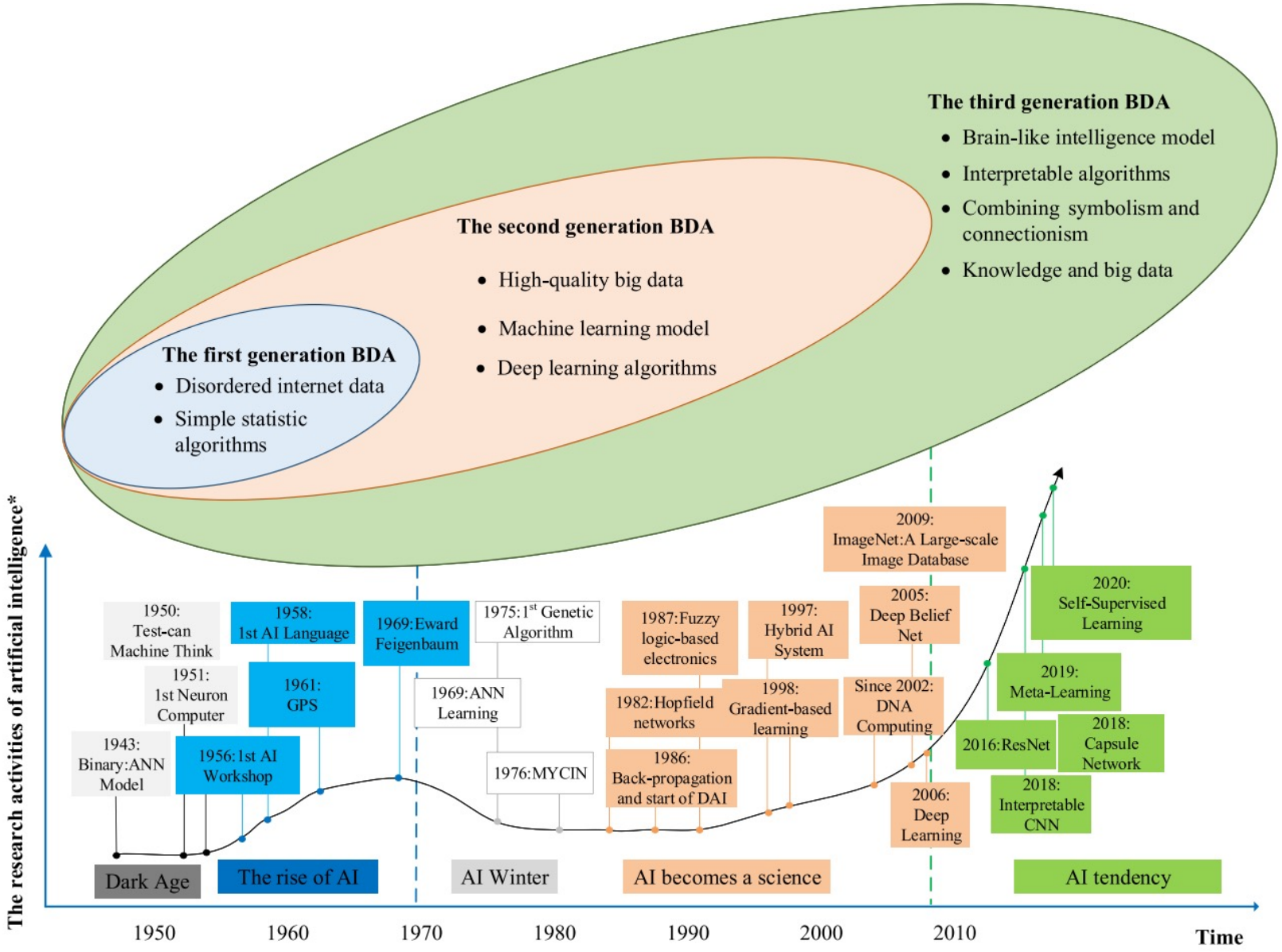
AI, Big Data, Cloud Computing

Evolution of Decision Support, Business Intelligence, and Analytics



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017),
Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

The Development of Big Data Analytics



Source: Wang, Junliang, Chuqiao Xu, Jie Zhang, and Ray Zhong (2022). "Big data analytics for intelligent manufacturing systems: A review." Journal of Manufacturing Systems 62 (2022): 738-752.

Data Analyst

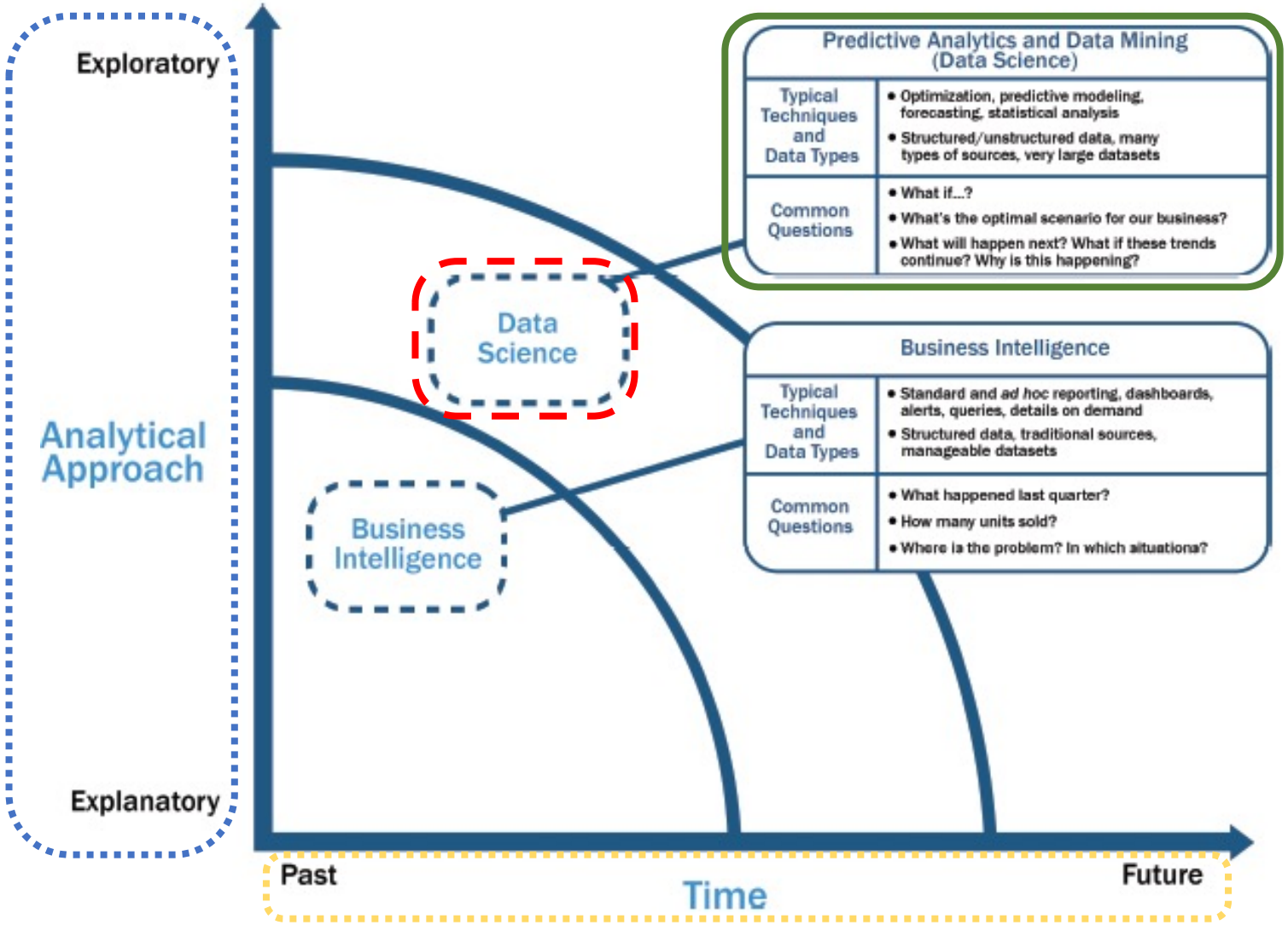
- Data analyst is just another term for professionals who were doing BI in the form of data compilation, cleaning, reporting, and perhaps some visualization.
- Their skill sets included Excel, some SQL knowledge, and reporting.
- You would recognize those capabilities as descriptive or reporting analytics.

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Data Scientist

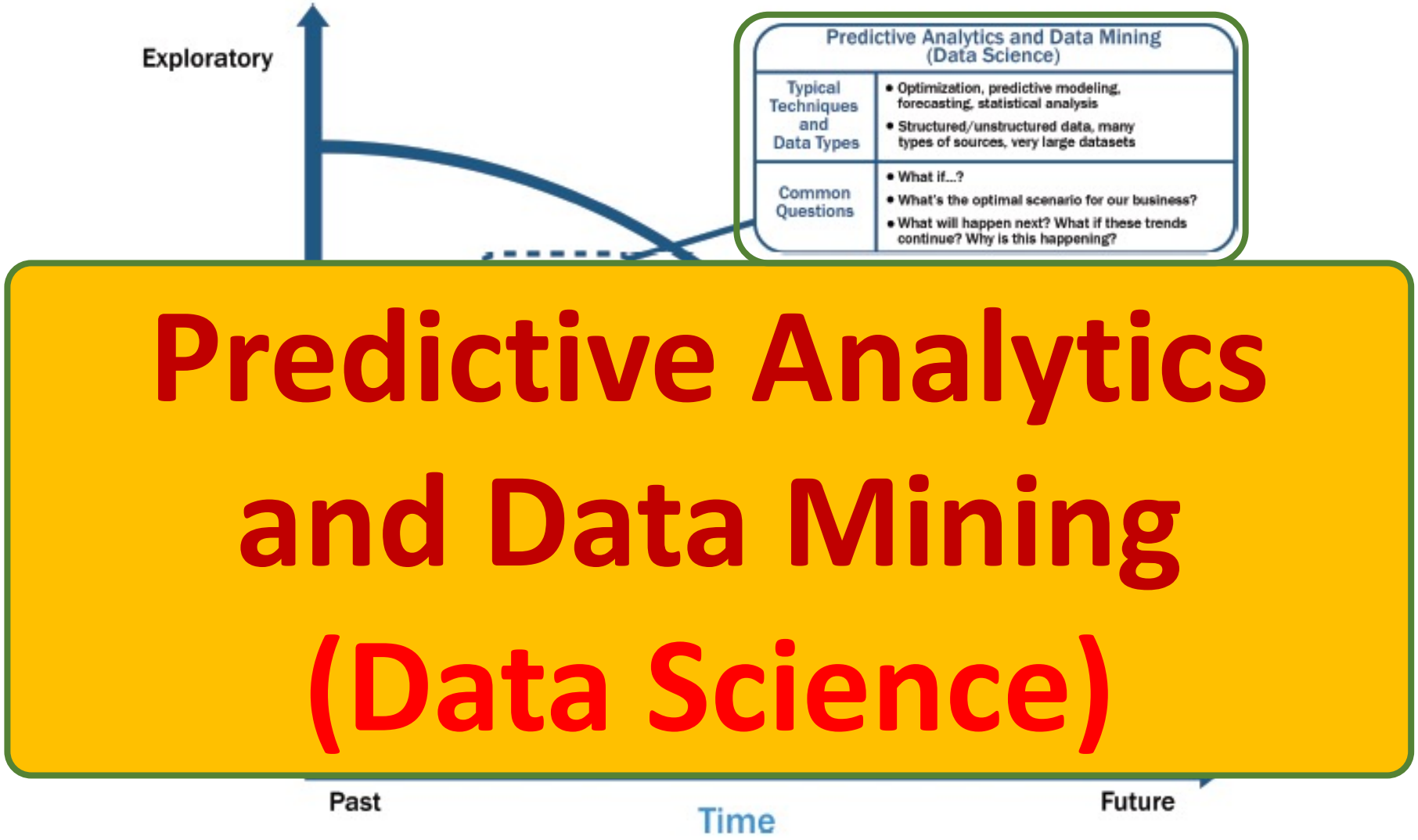
- Data scientist is responsible for predictive analysis, statistical analysis, and more advanced analytical tools and algorithms.
- They may have a deeper knowledge of algorithms and may recognize them under various labels—data mining, knowledge discovery, or machine learning.
- Some of these professionals may also need deeper programming knowledge to be able to write code for data cleaning/analysis in current Web-oriented languages such as Java or Python and statistical languages such as R.
- Many analytics professionals also need to build significant expertise in statistical modeling, experimentation, and analysis.

Data Science and Business Intelligence



Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Data Science and Business Intelligence



Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Predictive Analytics and Data Mining (Data Science)

Structured/unstructured data, many types of sources, very large datasets

Optimization, predictive modeling, forecasting statistical analysis

What if…?
What's the optimal scenario for our business?
What will happen next?
What if these trends countinue?
Why is this happening?

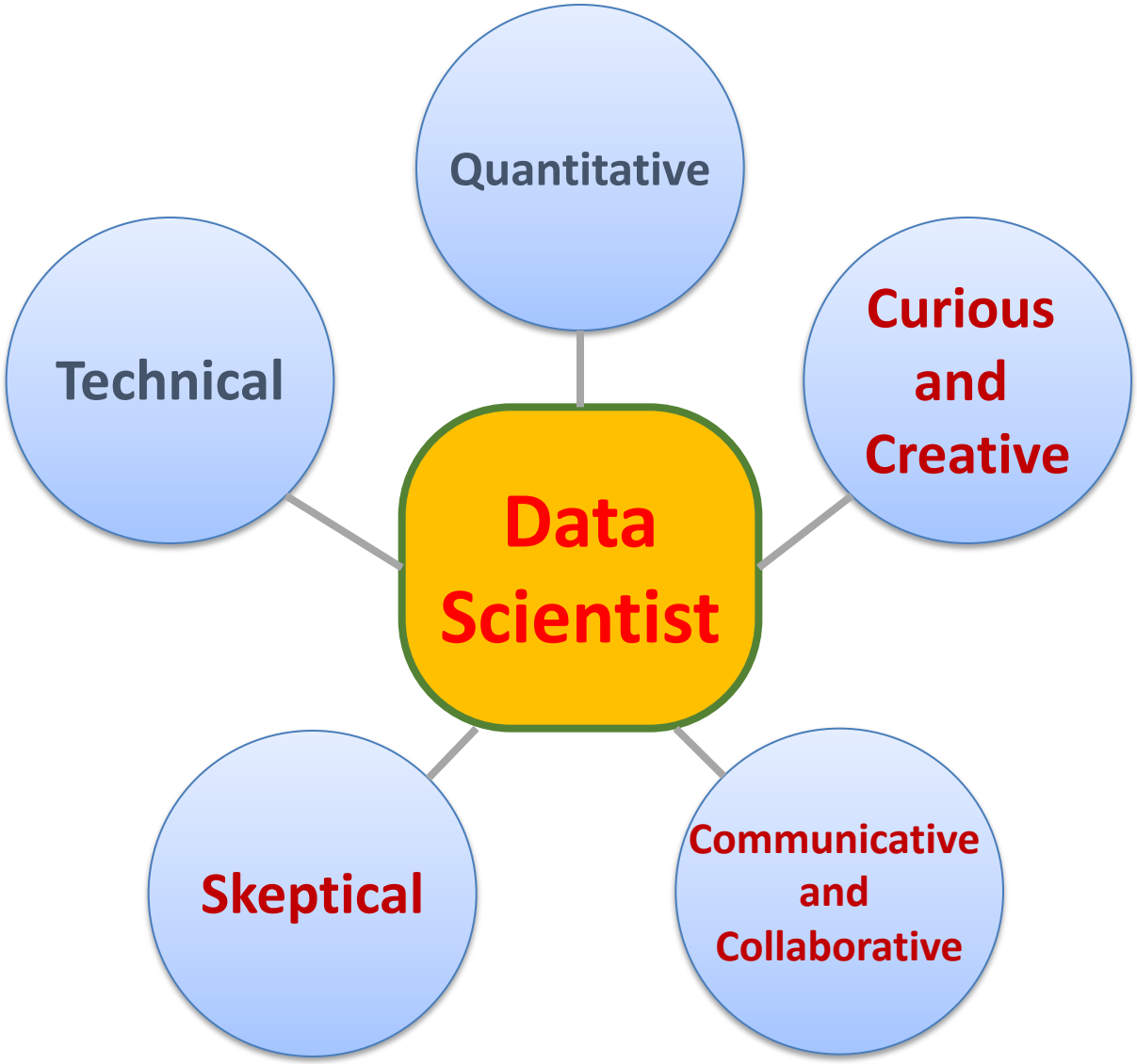
Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Profile of a Data Scientist

- **Quantitative**
  - **mathematics or statistics**
- **Technical**
  - **software engineering, machine learning, and programming skills**
- **Skeptical mind-set and critical thinking**
- **Curious and creative**
- **Communicative and collaborative**

Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

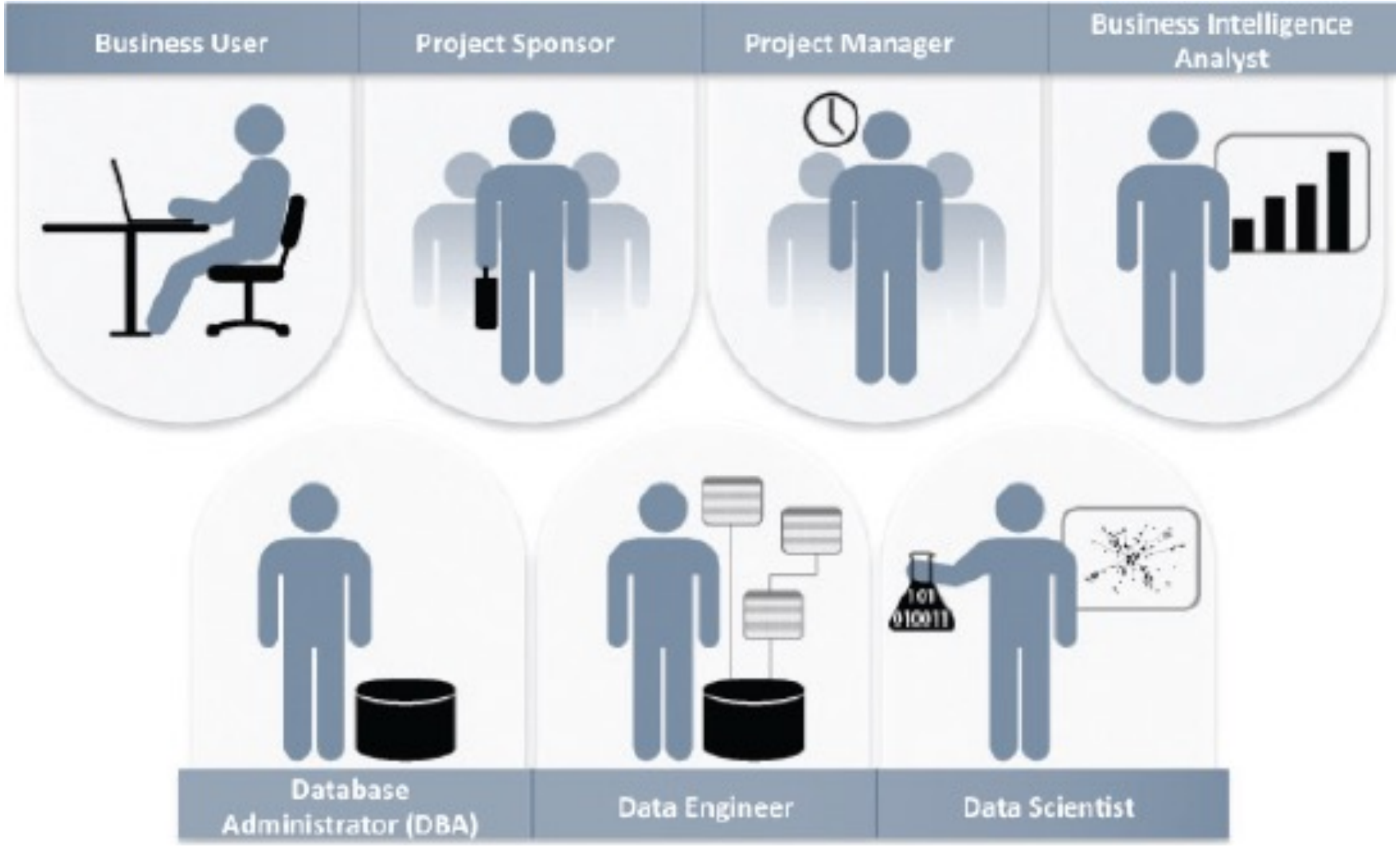
Data Scientist Profile



Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

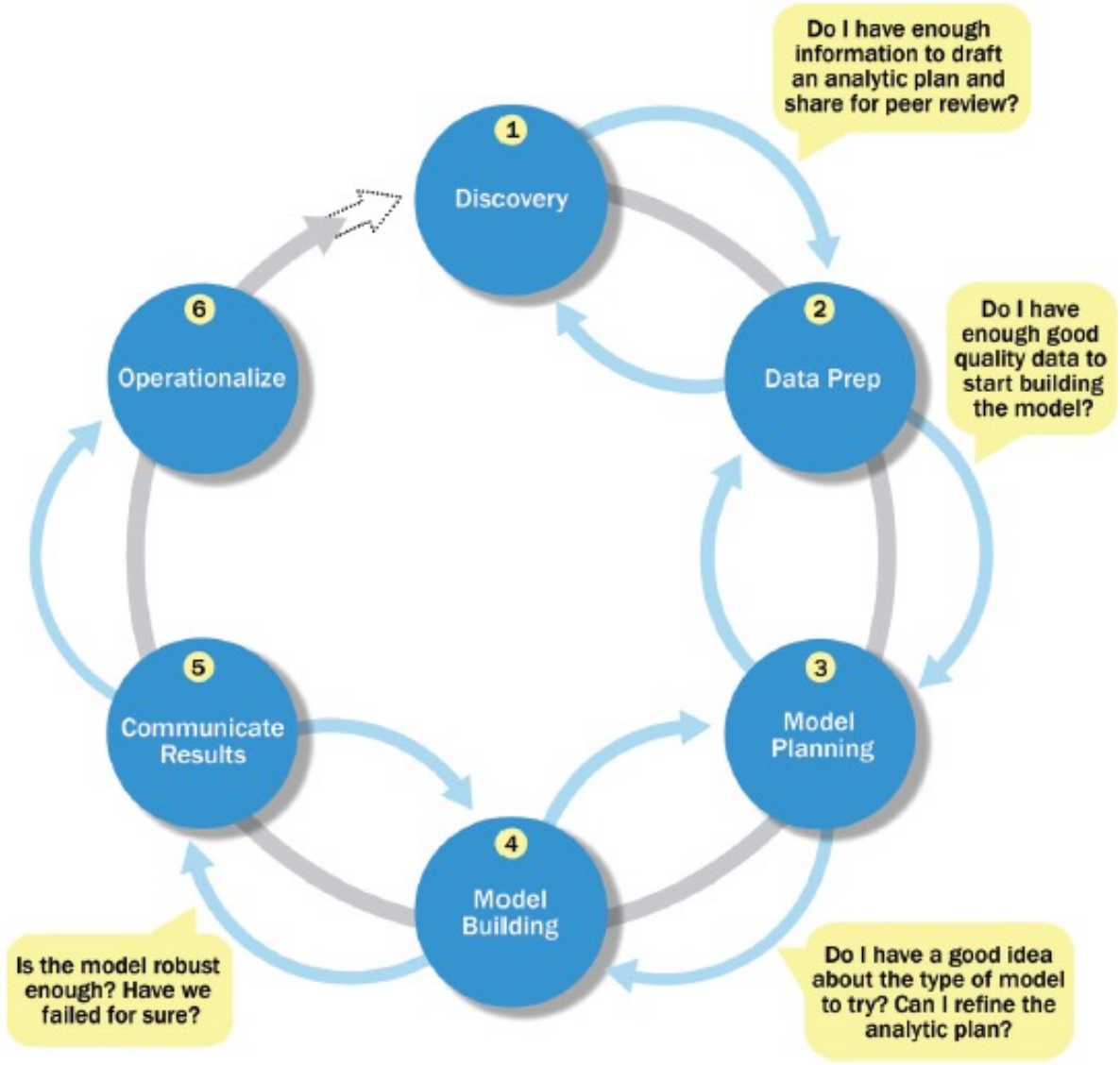
Big Data Analytics Lifecycle

Key Roles for a Successful Analytics Project



Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Overview of Data Analytics Lifecycle



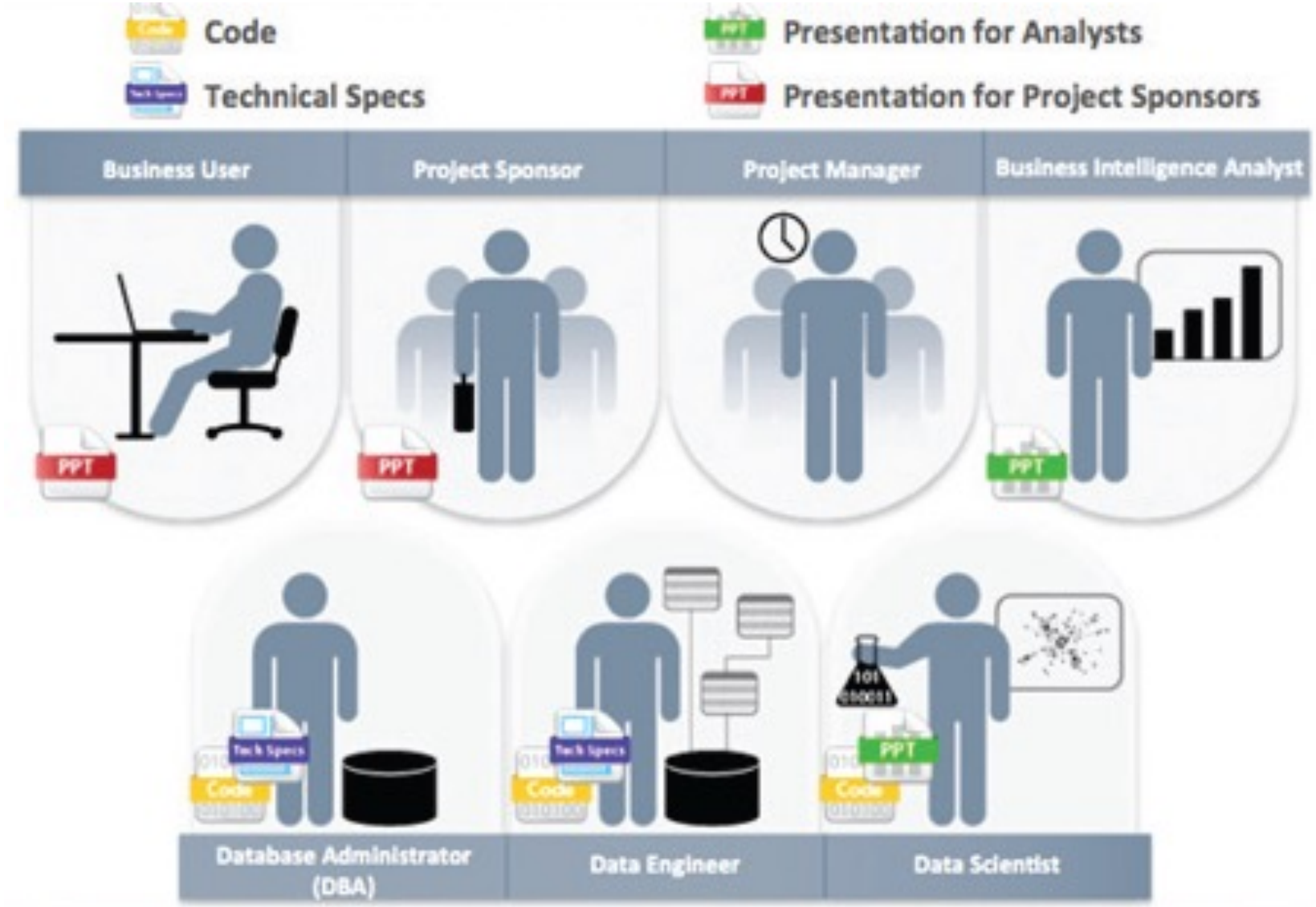
Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Overview of Data Analytics Lifecycle

1. Discovery
2. Data preparation
3. Model planning
4. Model building
5. Communicate results
6. Operationalize

Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Key Outputs from a Successful Analytics Project

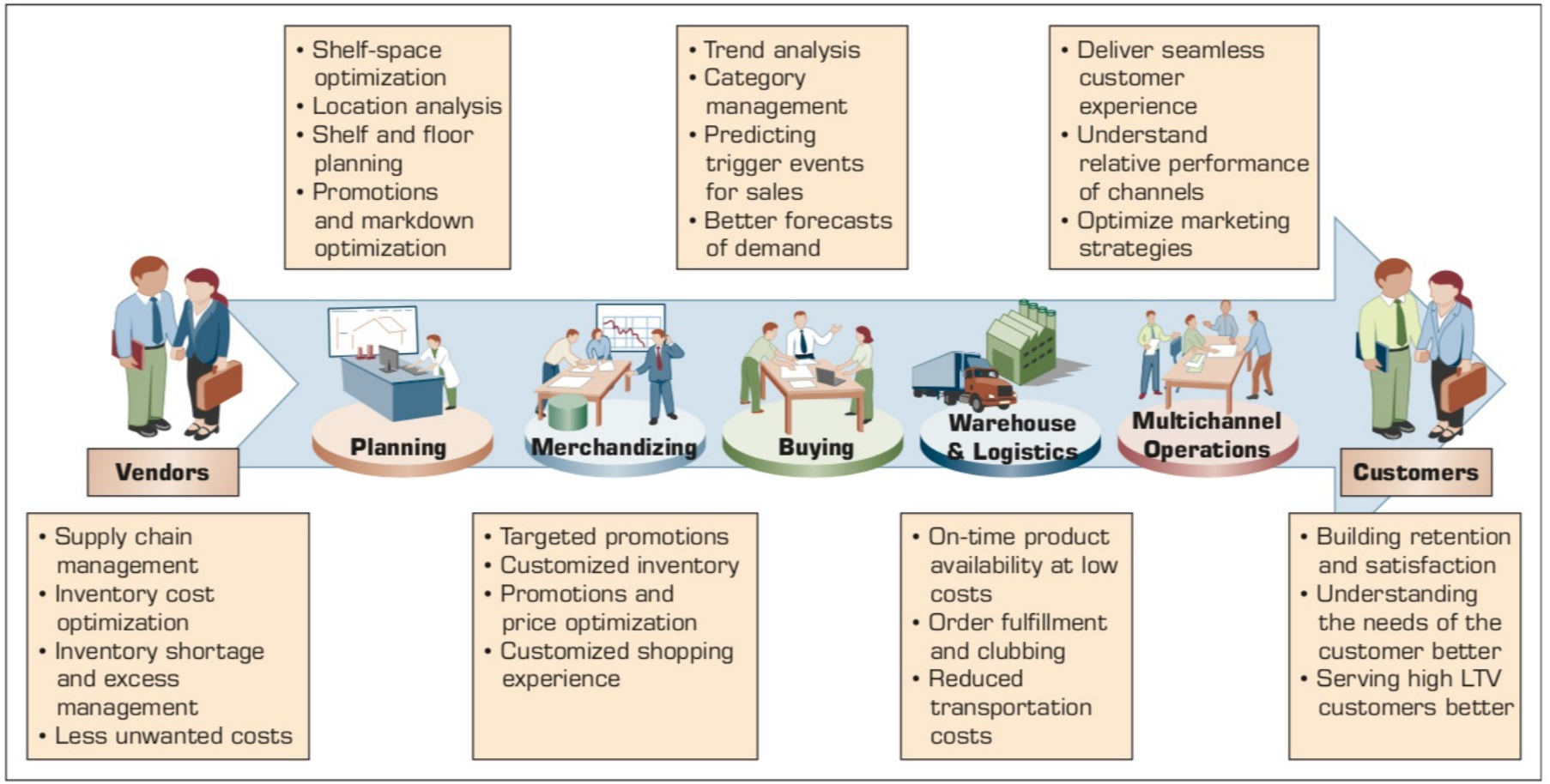


Source: EMC Education Services, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley, 2015

Example of Analytics Applications in a Retail Value Chain

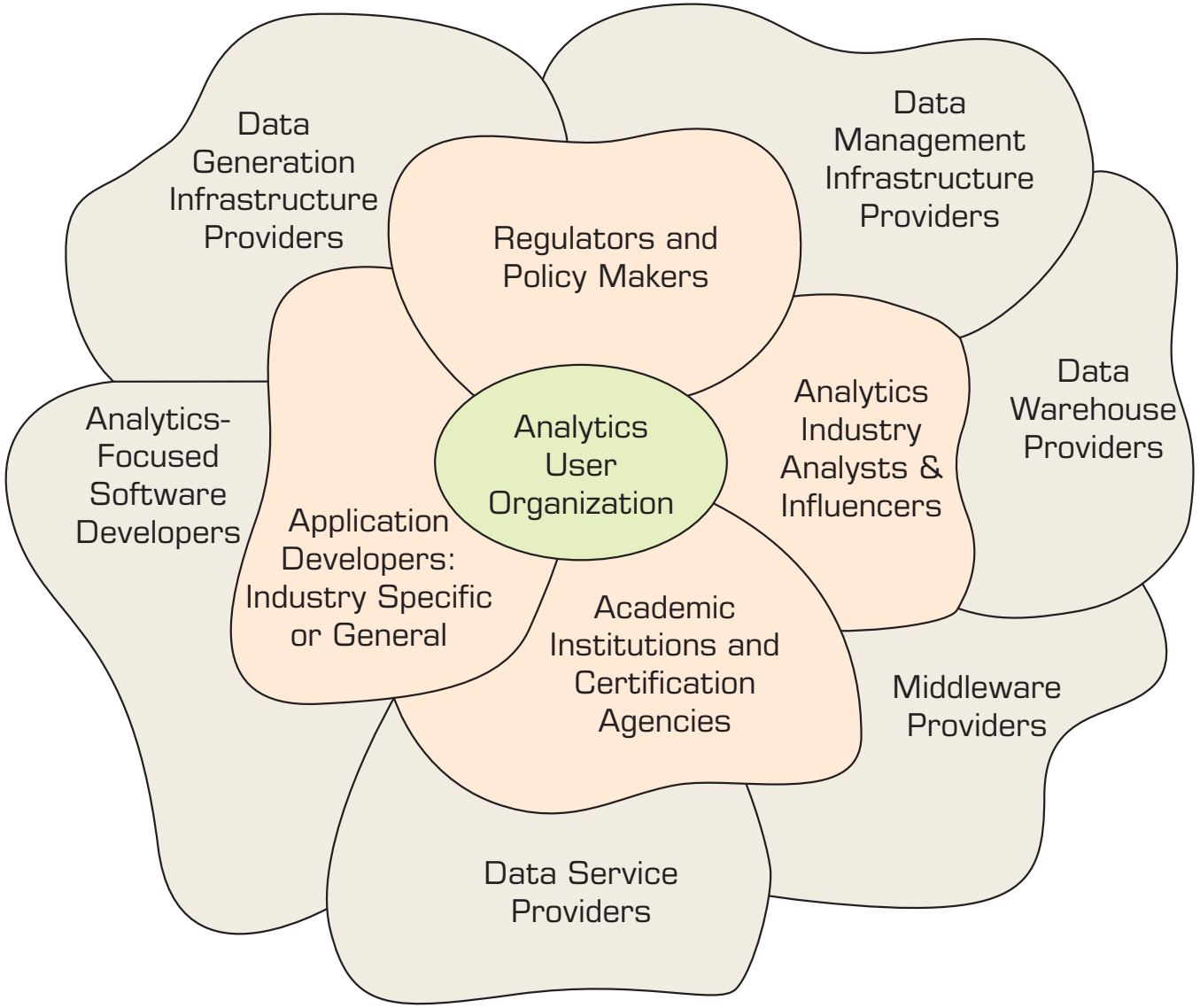
Retail Value Chain

Critical needs at every touch point of the Retail Value Chain



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Analytics Ecosystem

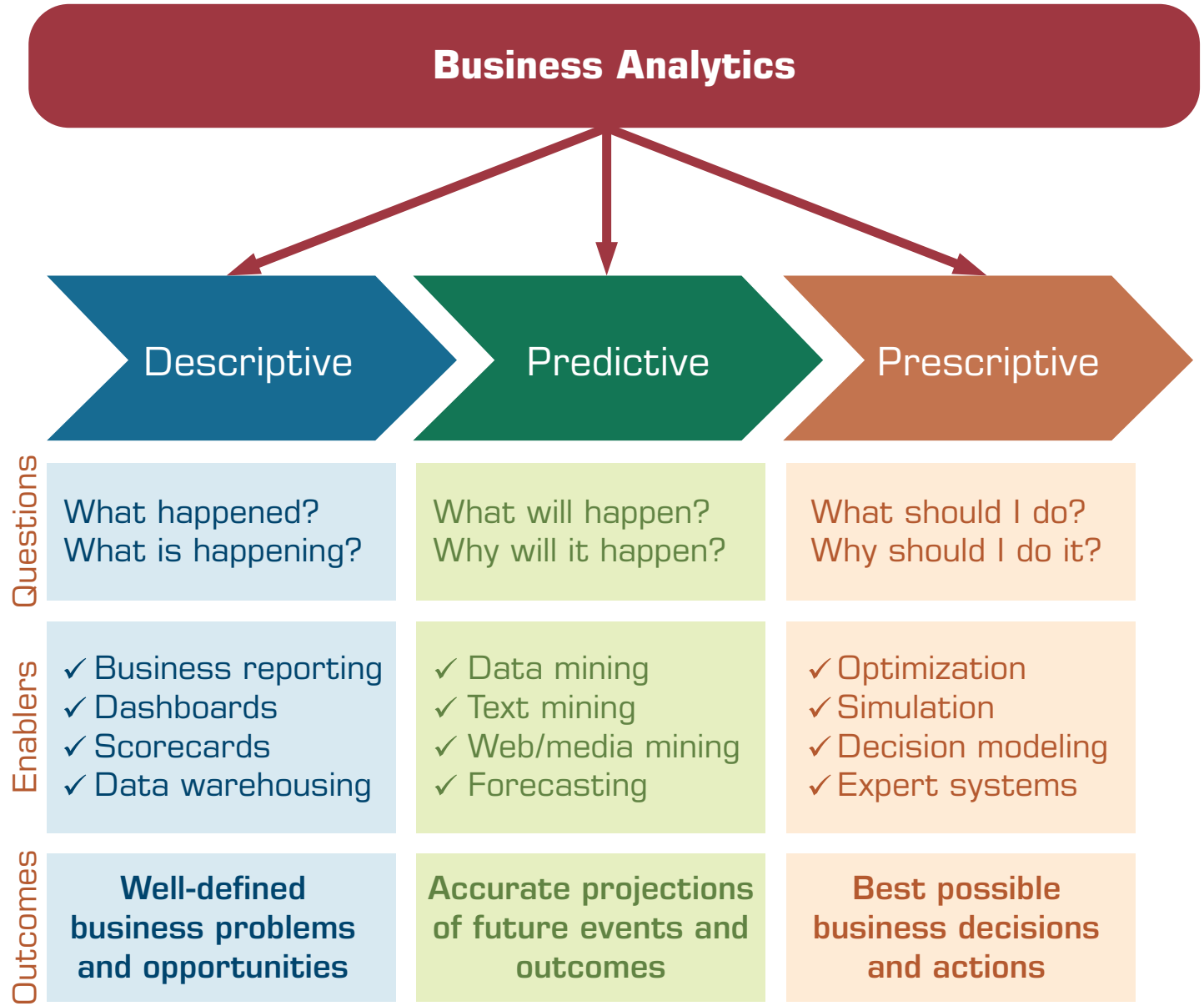


Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Job Titles of Analytics

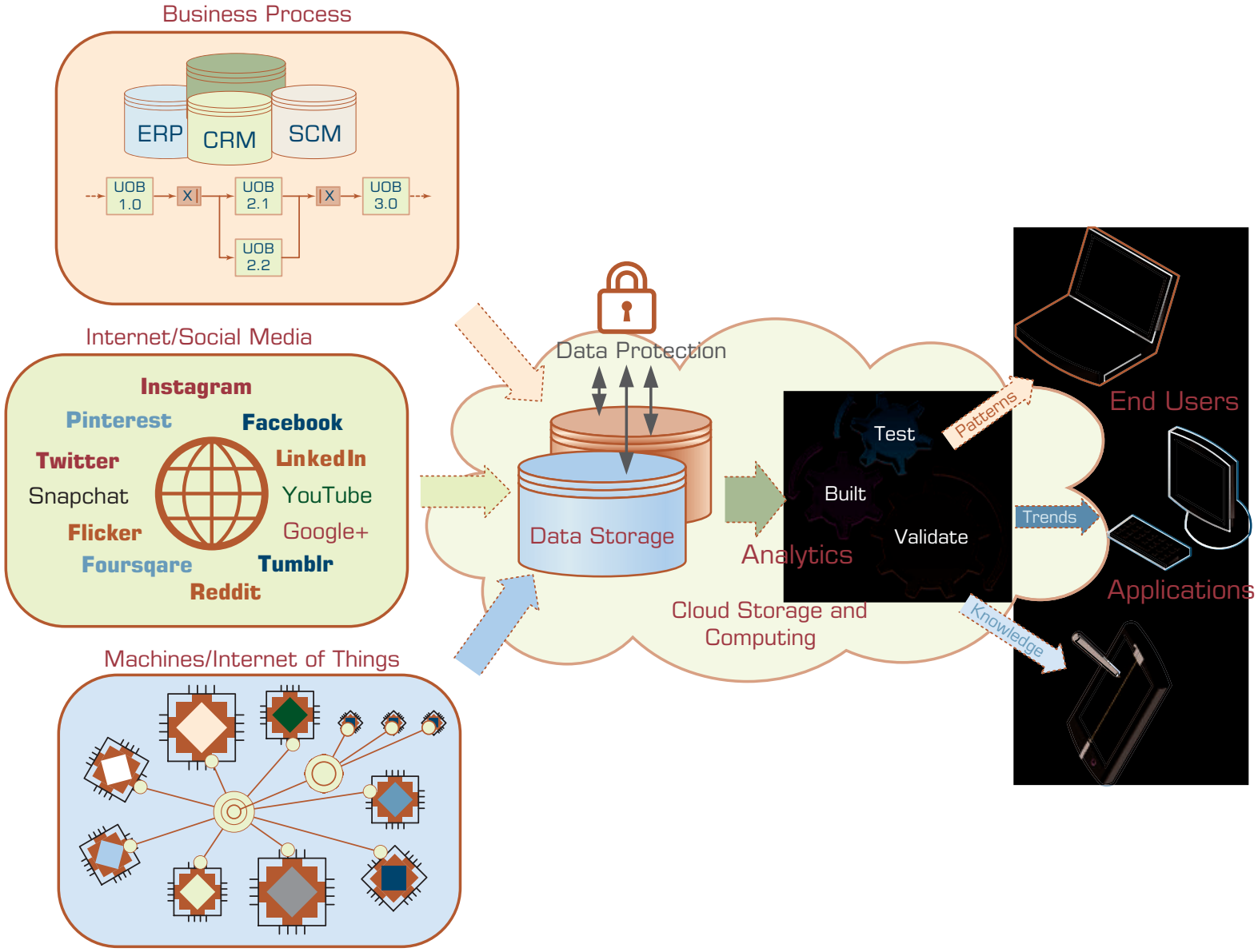
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Three Types of Analytics



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Data to Knowledge Continuum



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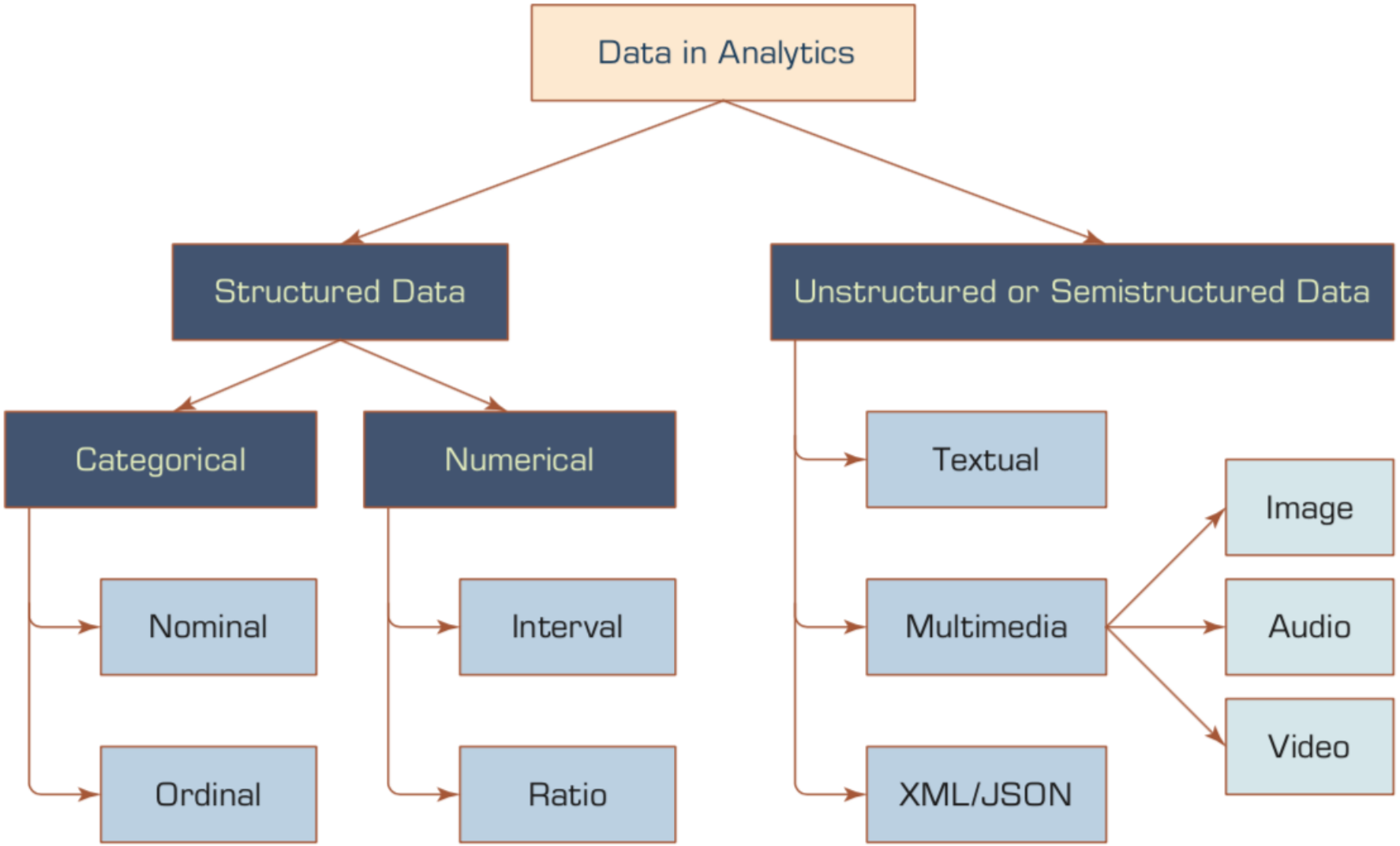
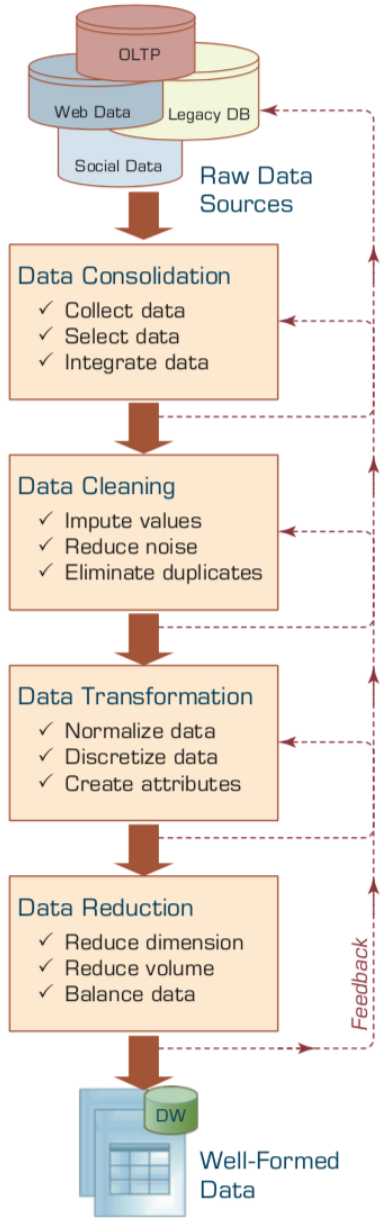
A Simple Taxonomy of Data



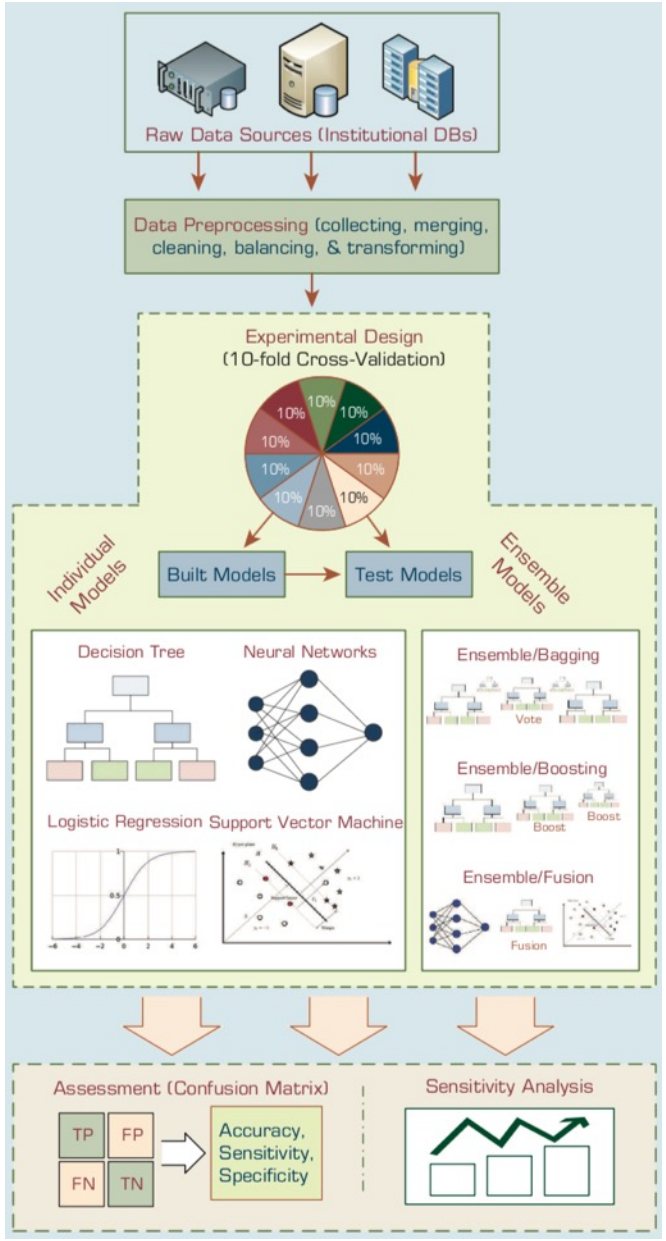
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Data Preprocessing Steps



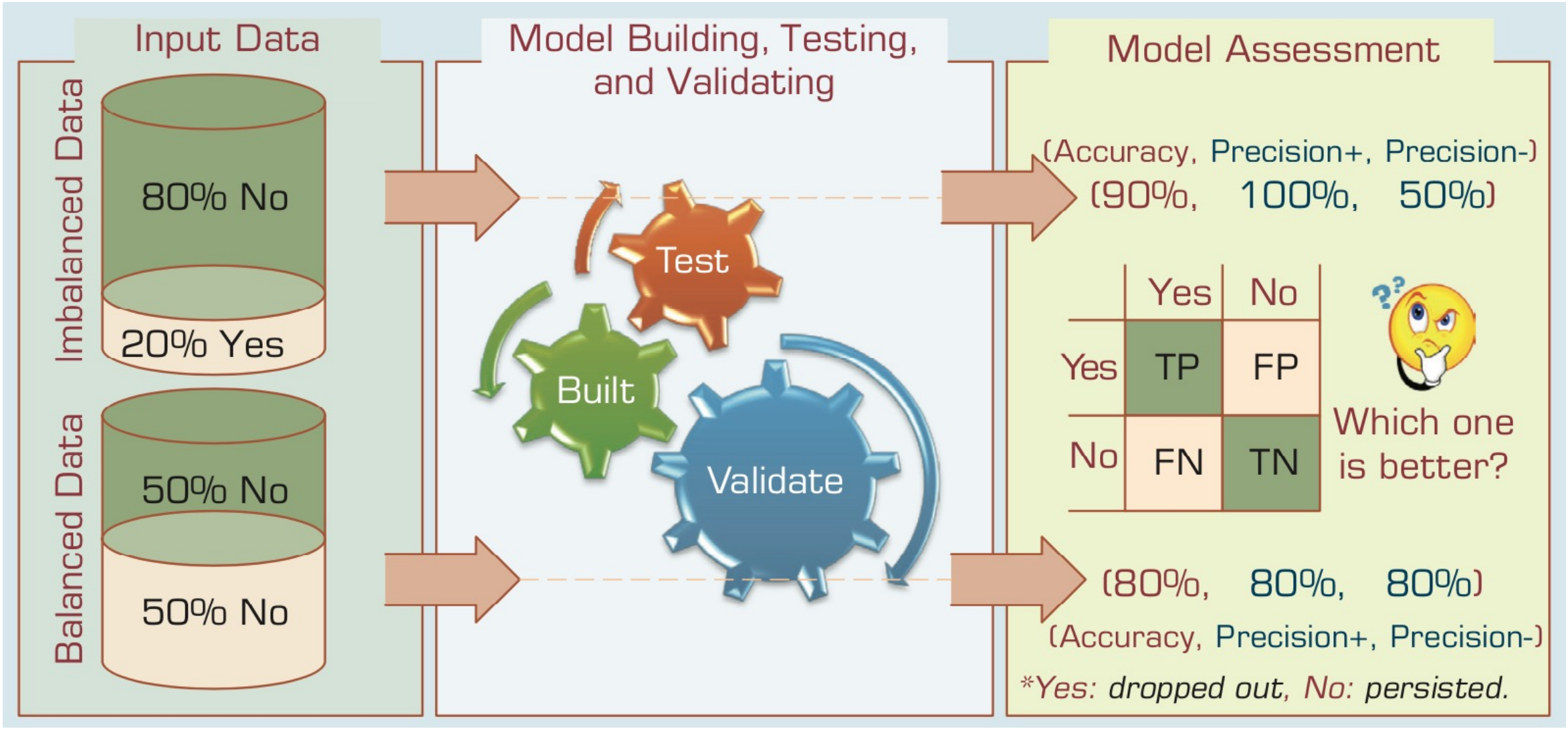
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

An Analytics Approach to Predicting Student Attrition



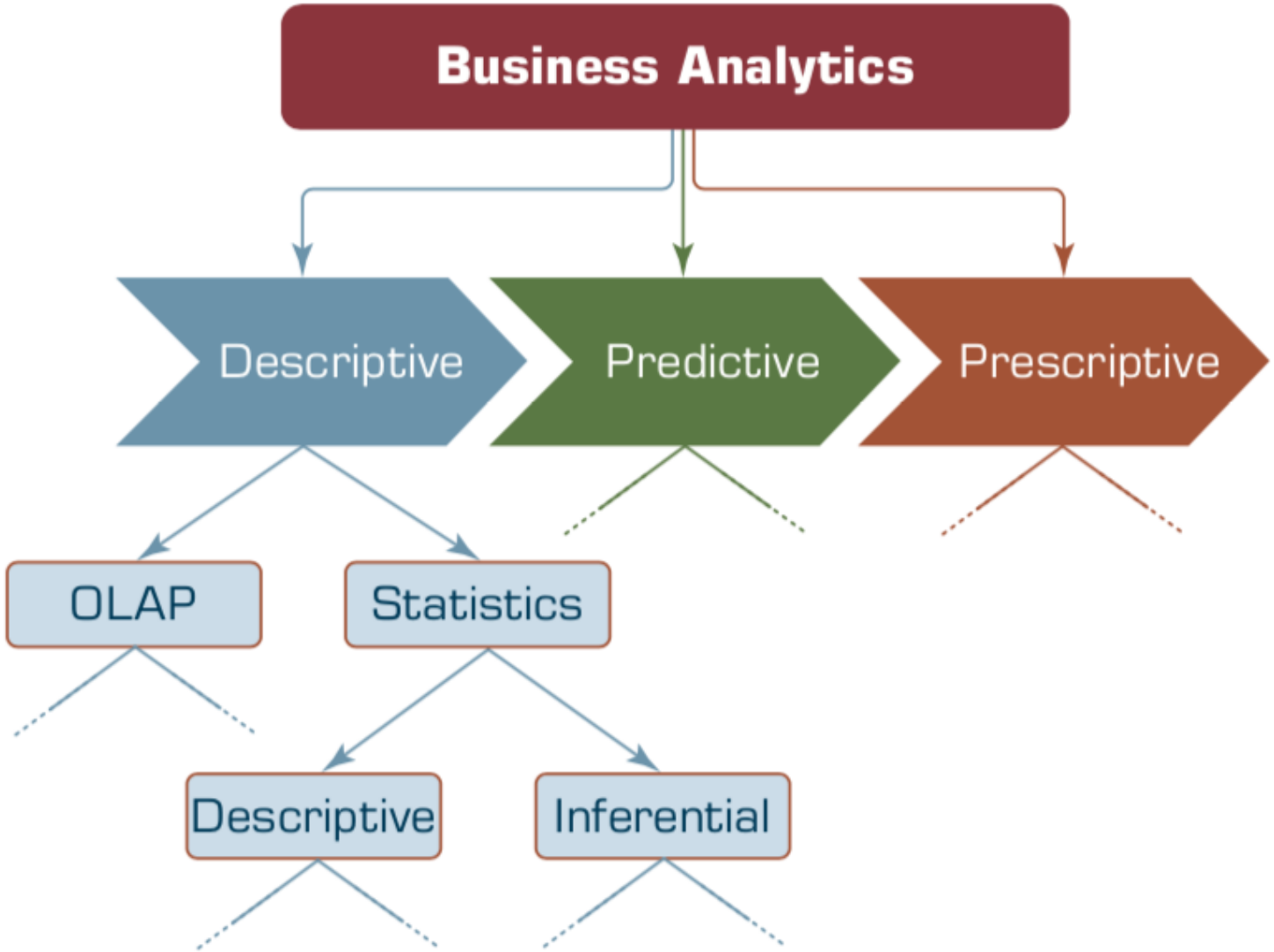
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Graphical Depiction of the Class Imbalance Problem



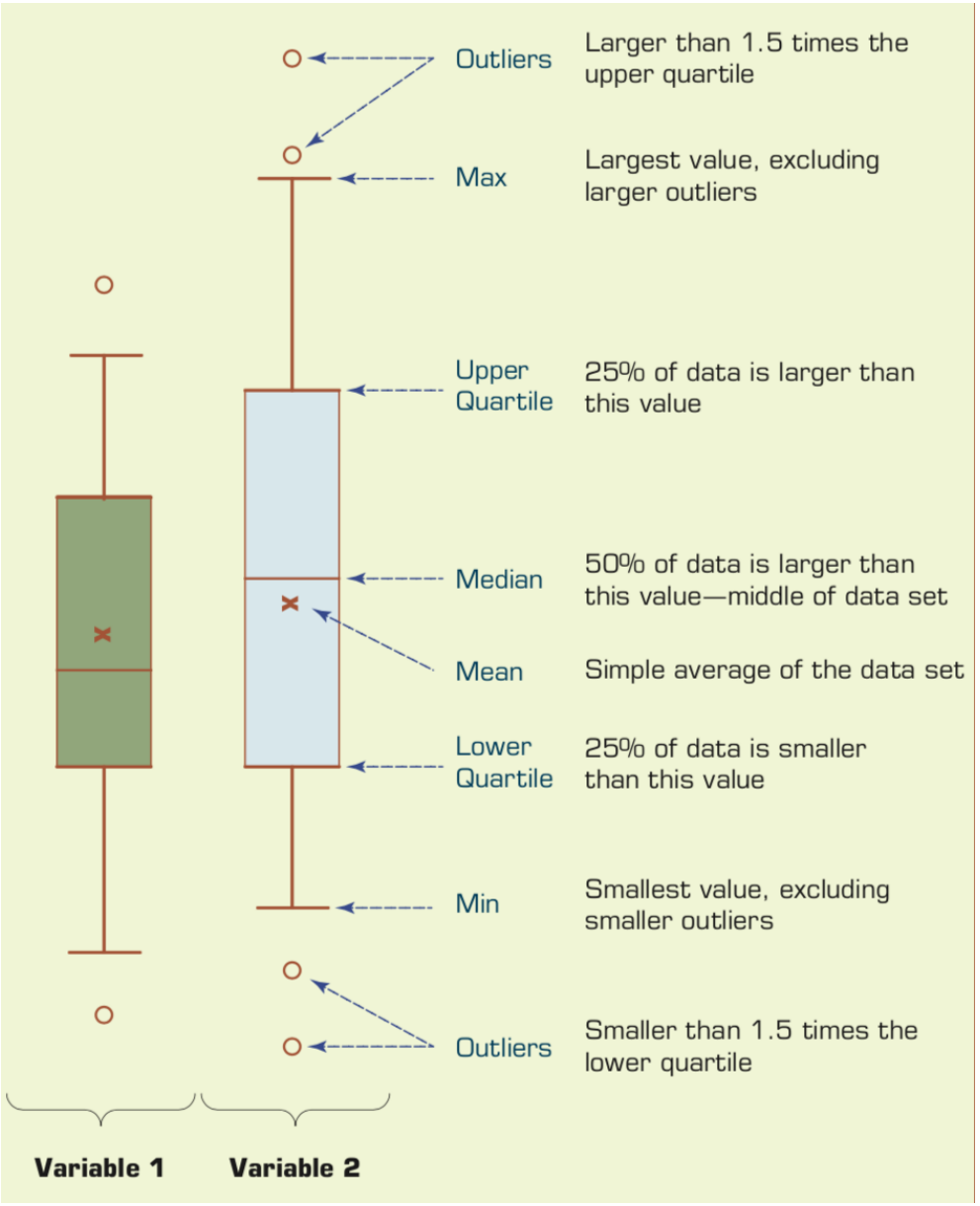
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Relationship between Statistics and Descriptive Analytics



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

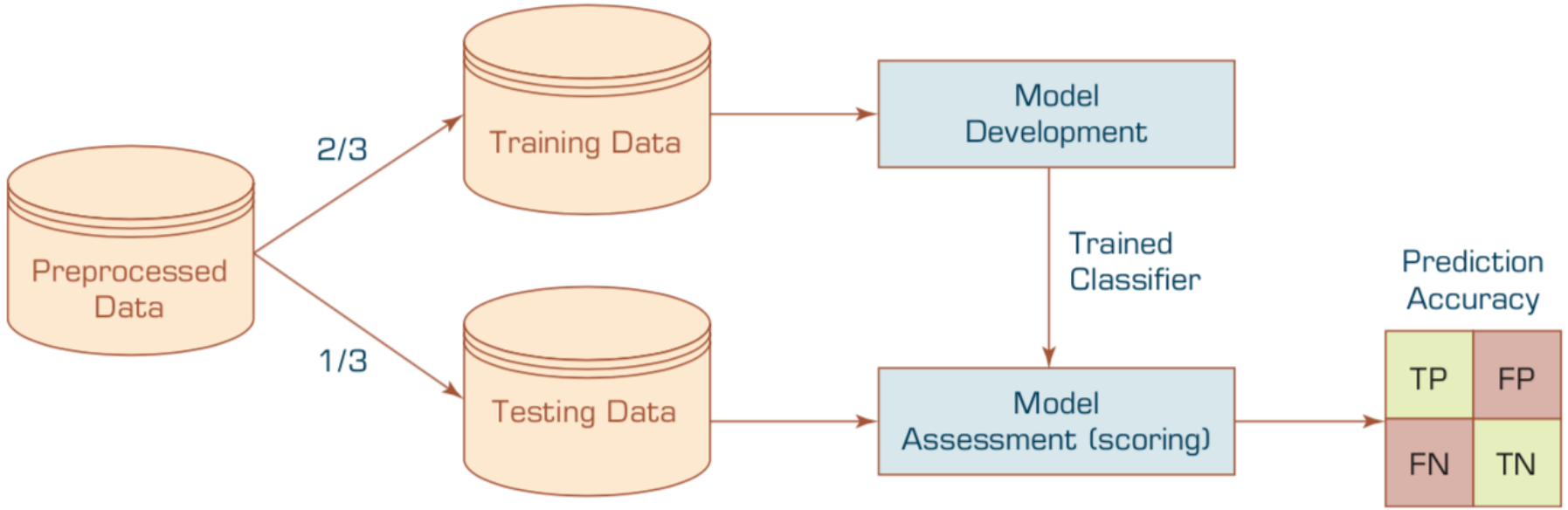
Understanding the Specifics about Box-and-Whiskers Plots



Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Estimation Methodologies for Machine Learning Classification Tasks

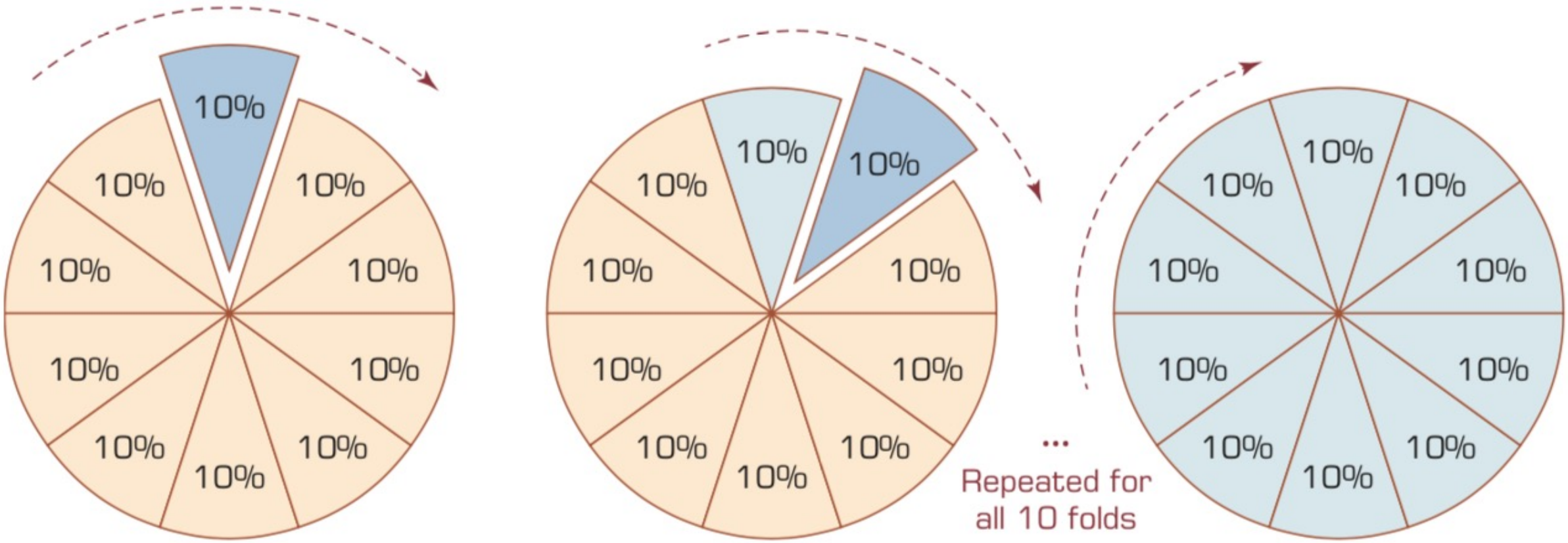
- **Simple split (or holdout or test sample estimation)**
  - **Split the data into 2 mutually exclusive sets training (~70%) and testing (30%)**



  - **For ANN, the data is split into three sub-sets (training [~60%], validation [~20%], testing [~20%])**

Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

k-Fold Cross-Validation:
Machine Learning Data Splitting and Model Assessment



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Data Science for Sustainability and ESG

Data Science for Sustainability and ESG

- **Data Science and Sustainability**
- **Data Collection and Analysis for Sustainability**
- **Implementing Data-Driven Sustainability Strategies**

Fundamentals of Data Science

- **Definition of Data Science:**
  - **Interdisciplinary field using scientific methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured data.**
- **Key components:**
  - **Statistics, Machine Learning, Data Engineering**

Data Science Process

1. Business Understanding
2. Data Understanding
3. Data Preparation
4. Modeling
5. Evaluation
6. Deployment

Sustainability and ESG

- **Sustainability: Meeting present needs without compromising future generations**
- **ESG: Environmental, Social, and Governance**
  - **Environmental: Climate change, resource depletion, waste, pollution, deforestation**
  - **Social: Human rights, labor standards, workplace safety, community relations**
  - **Governance: Board diversity, executive compensation, ethics, transparency**

Sustainability and ESG: Business case

- **Risk management**
- **Cost savings**
- **Innovation**
- **Brand value**
- **Investor attraction**

Intersection of Data Science with Sustainability and ESG

- **Data-driven decision making for sustainability initiatives**
- **Predictive analytics for environmental impact**
- **Machine learning for optimizing resource usage**
- **Big data analysis for social impact assessment**
- **AI-powered governance risk management**

The Interconnectedness of Data, Sustainability & ESG

- **Sustainability encompasses environmental, social, and governance concerns.**
- **ESG provides a framework for measuring and reporting sustainability performance.**
- **Data science offers the tools to collect, analyze, and use ESG data for decision-making.**

ESG:

Environmental

Social

Governance

Sustainable Development Goals (SDGs)

Source: https://sdgs.un.org/goals

Sustainable Development Goals (SDGs) and 5P

Partnership

Peace

Prosperity

People

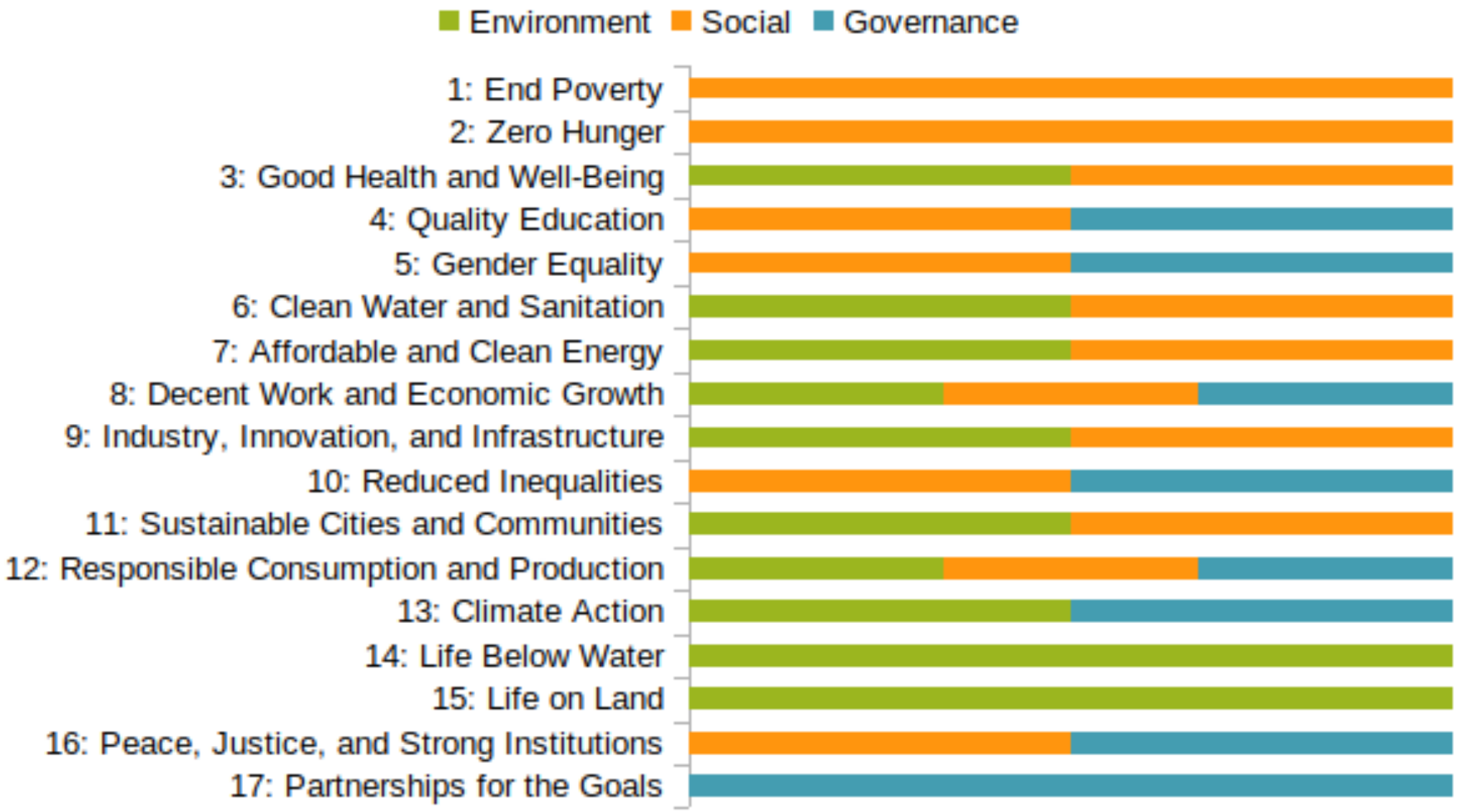
Planet

Source: Folke, Carl, Reinette Biggs, Albert V. Norström, Belinda Reyers, and Johan Rockström. "Social-ecological resilience and biosphere-based sustainability science."Ecology and Society 21, no. 3 (2016).

ESG to 17 SDGs

Source: Henrik Skaug Sætra (2021) "A Framework for Evaluating and Disclosing the ESG Related Impacts of AI with the SDGs." Sustainability 13, no. 15 (2021): 8503.

ESG to 17 SDGs



Source: https://sustainometric.com/esg-to-sdgs-connected-paths-to-a-sustainable-future/

ESG Reporting Frameworks and Standards

1. **GRI (Global Report Initiative):** https://www.globalreporting.org/
2. **CDP (Carbon Disclosure Project):** https://www.cdp.net/
3. **SASB (Sustainability Accounting Standards Board):** https://sasb.org/
4. **ISSB (International Sustainability Standards Board):** https://www.ifrs.org/groups/international-sustainability-standards-board/
5. **TCFD (Task Force on Climate-related Financial Disclosures):** https://www.fsb-tcfd.org/

Summary

- **Python Programming**
- **Data Science**

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- Google's Python Class, https://developers.google.com/edu/python
- Min-Yuh Day (2025), Python 101, https://tinyurl.com/aintpupython101