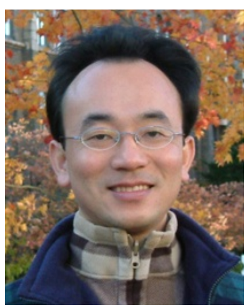
Tamkang University
淡江大學

商業智慧實務
Practices of Business Intelligence

描述性分析 I：
數據的性質、統計模型與可視化
(Descriptive Analytics I: Nature of Data, Statistical Modeling, and Visualization)

1071BI04
MI4 (M2084) (2888)
Wed, 7, 8 (14:10-16:00) (B217)



Min-Yuh Day
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2018-10-03

課程大綱 (Syllabus)

週次 (Week)　日期 (Date)　內容(Subject/Topics)

1 2018/09/12 商業智慧實務課程介紹
(Course Orientation for Practices of Business Intelligence)

2 2018/09/19 商業智慧、分析與資料科學
(Business Intelligence, Analytics, and Data Science)

3 2018/09/26 人工智慧、大數據與雲端運算
(ABC: AI, Big Data, and Cloud Computing)

4 2018/10/03 描述性分析I：數據的性質、統計模型與可視化
(Descriptive Analytics I: Nature of Data, Statistical Modeling, and Visualization)

5 2018/10/10 國慶紀念日 (放假一天) (National Day) (Day off)

6 2018/10/17 描述性分析II：商業智慧與資料倉儲
(Descriptive Analytics II: Business Intelligence and Data Warehousing)

課程大綱 (Syllabus)

週次 (Week) 日期 (Date) 內容(Subject/Topics)

7 2018/10/24 預測性分析I：資料探勘流程、方法與演算法
(Predictive Analytics I: Data Mining Process,
Methods, and Algorithms)

8 2018/10/31 預測性分析II：文本、網路與社群媒體分析
(Predictive Analytics II: Text, Web, and
Social Media Analytics)

9 2018/11/07 期中報告 (Midterm Project Report)

10 2018/11/14 期中考試 (Midterm Exam)

11 2018/11/21 處方性分析：最佳化與模擬
(Prescriptive Analytics: Optimization and Simulation)

12 2018/11/28 社會網絡分析
(Social Network Analysis)

課程大綱 (Syllabus)

週次 (Week)　日期 (Date)　內容(Subject/Topics)

13　2018/12/05　機器學習與深度學習
(Machine Learning and Deep Learning)

14　2018/12/12　自然語言處理
(Natural Language Processing)

15　2018/12/19　AI交談機器人與對話式商務
(AI Chatbots and Conversational Commerce)

16　2018/12/26　商業分析的未來趨勢、隱私與管理考量
(Future Trends, Privacy and
Managerial Considerations in Analytics)

17　2019/01/02　期末報告 (Final Project Presentation)

18　2019/01/09　期末考試 (Final Exam)

Business Intelligence (BI)

1 Introduction to BI and Data Science

2 Descriptive Analytics

3 Predictive Analytics

4 Prescriptive Analytics

5 Big Data Analytics

6 Future Trends

Descriptive Analytics I: Nature of Data, Statistical Modeling, and Visualization

Outline

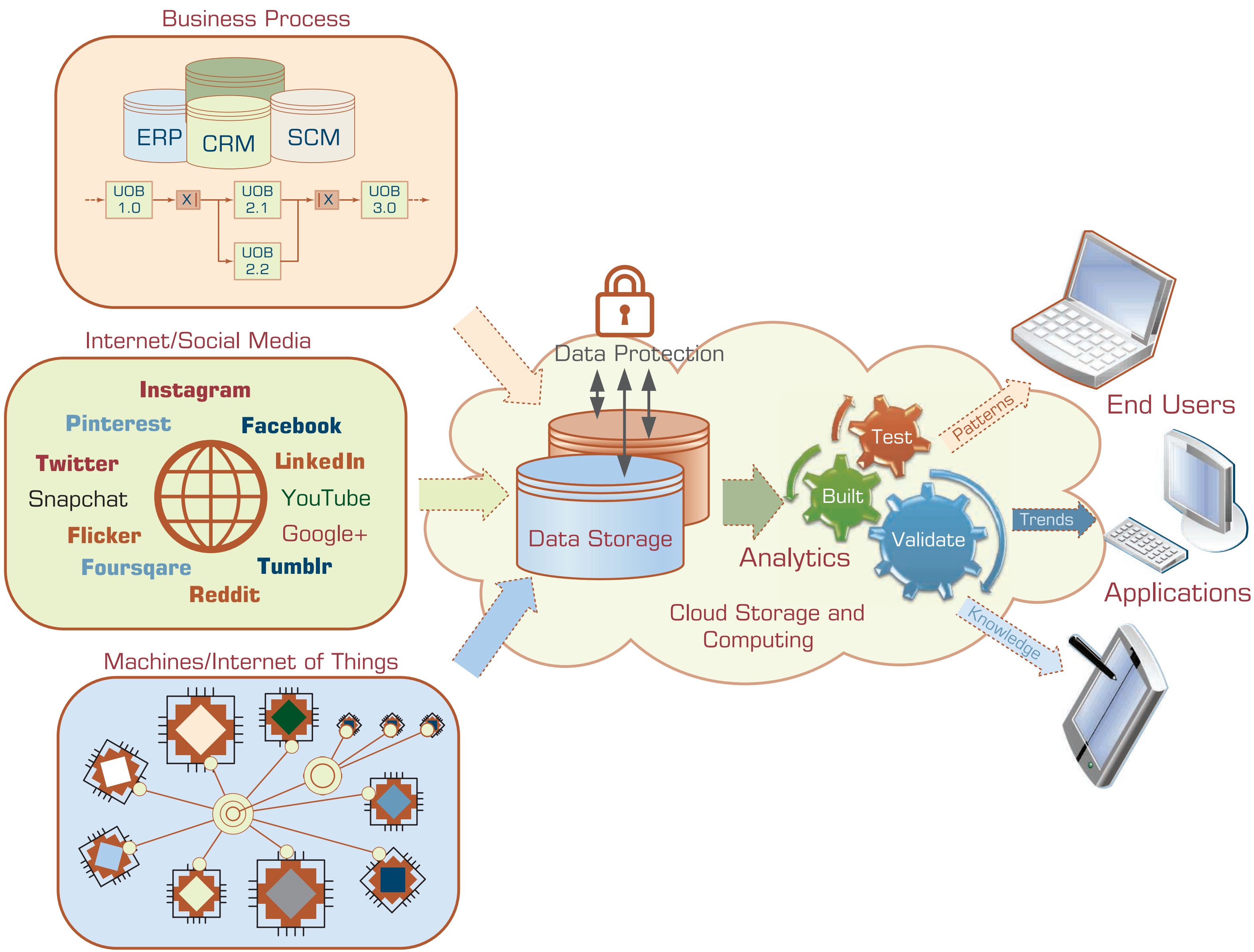
- Descriptive Analytics I
- Nature of Data
- Statistical Modeling
- Visualization

Three Types of Analytics

Business Analytics

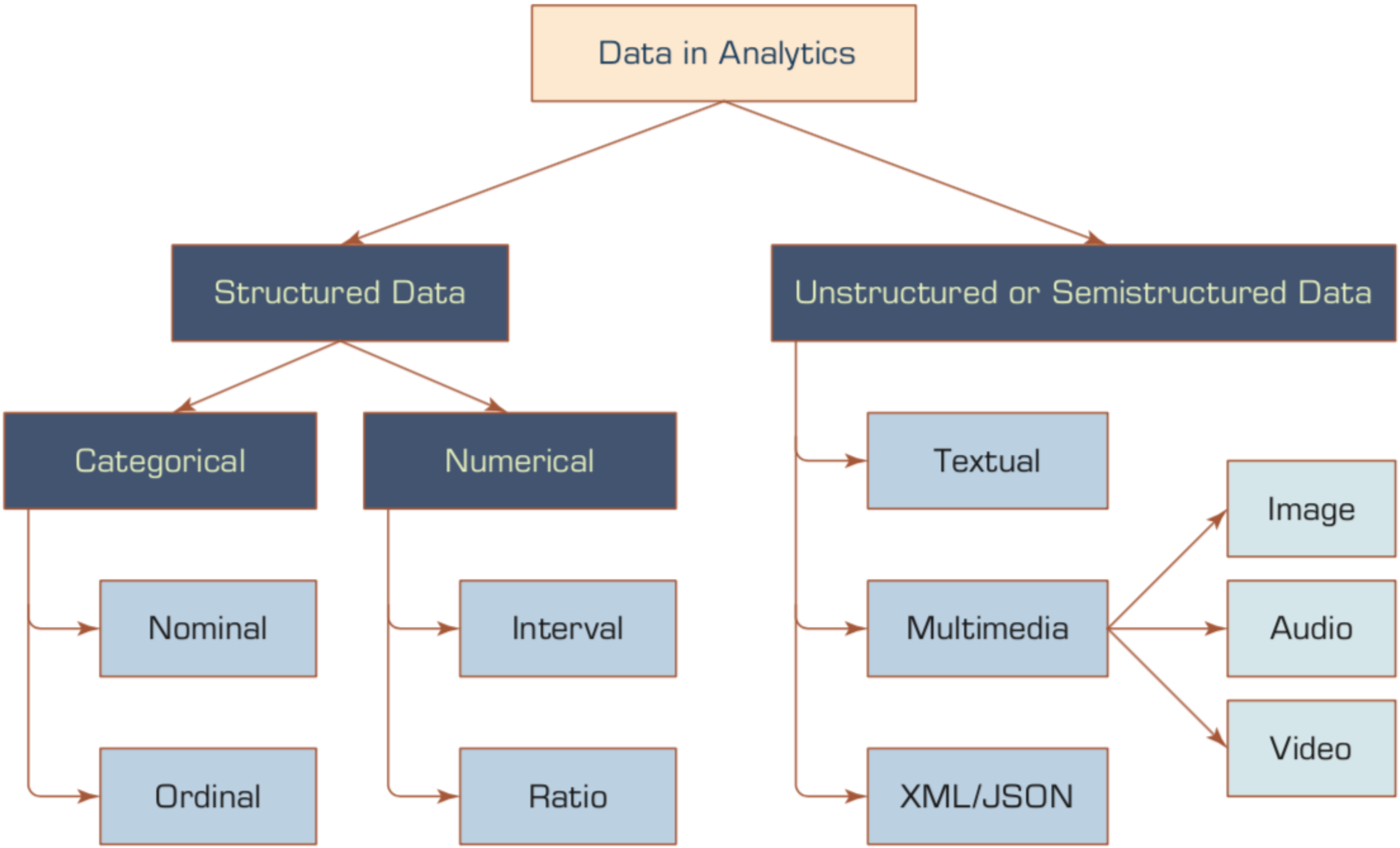
	Descriptive	Predictive	Prescriptive
Questions	What happened? What is happening?	What will happen? Why will it happen?	What should I do? Why should I do it?
Enablers	✓ Business reporting ✓ Dashboards ✓ Scorecards ✓ Data warehousing	✓ Data mining ✓ Text mining ✓ Web/media mining ✓ Forecasting	✓ Optimization ✓ Simulation ✓ Decision modeling ✓ Expert systems
Outcomes	**Well-defined business problems and opportunities**	**Accurate projections of future events and outcomes**	**Best possible business decisions and actions**

A Data to Knowledge Continuum



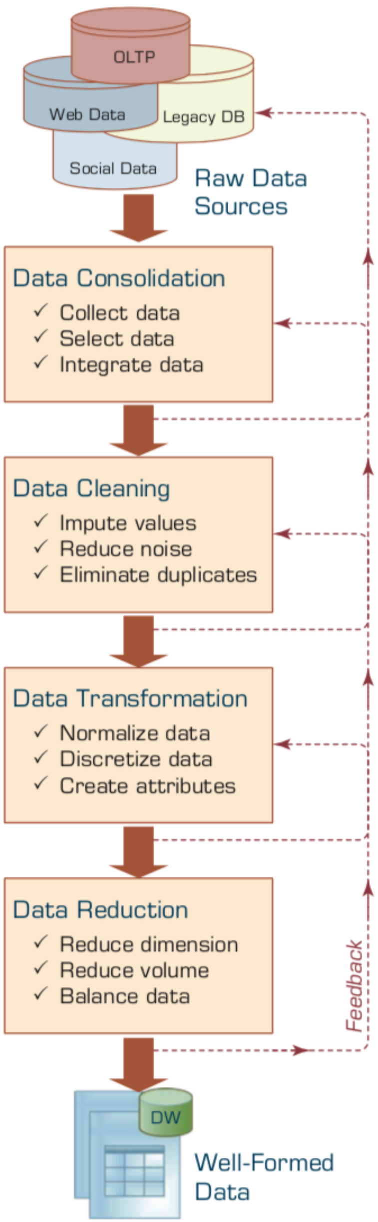
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Simple Taxonomy of Data



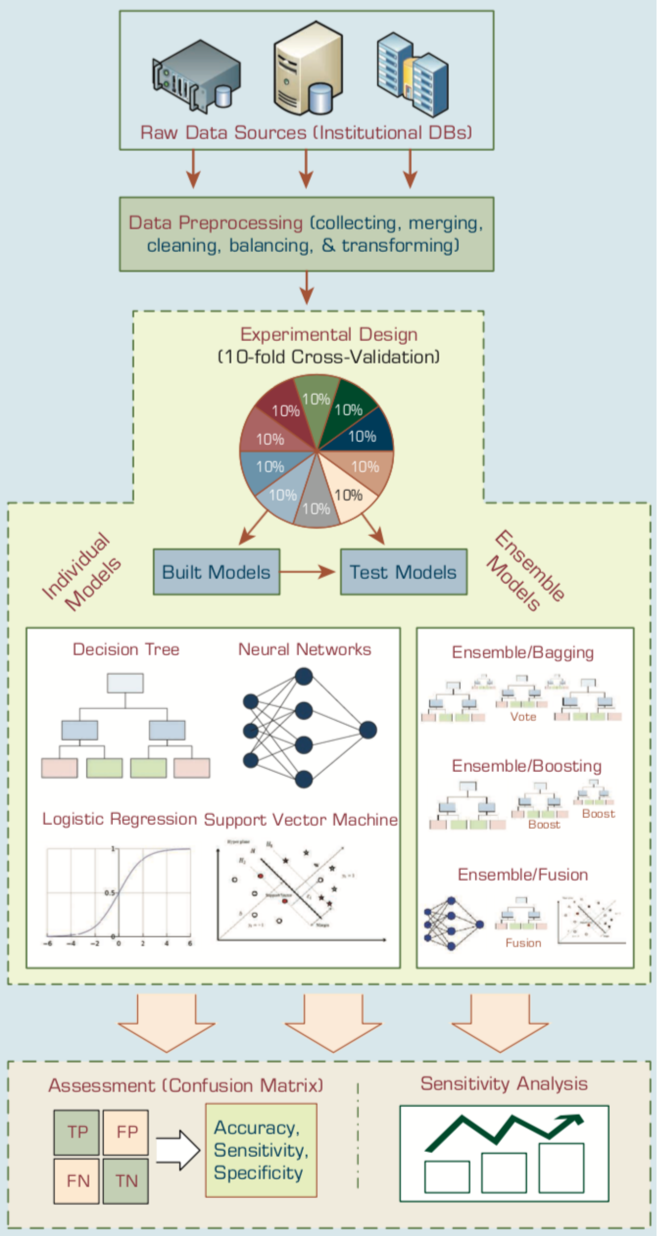
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Data Preprocessing Steps



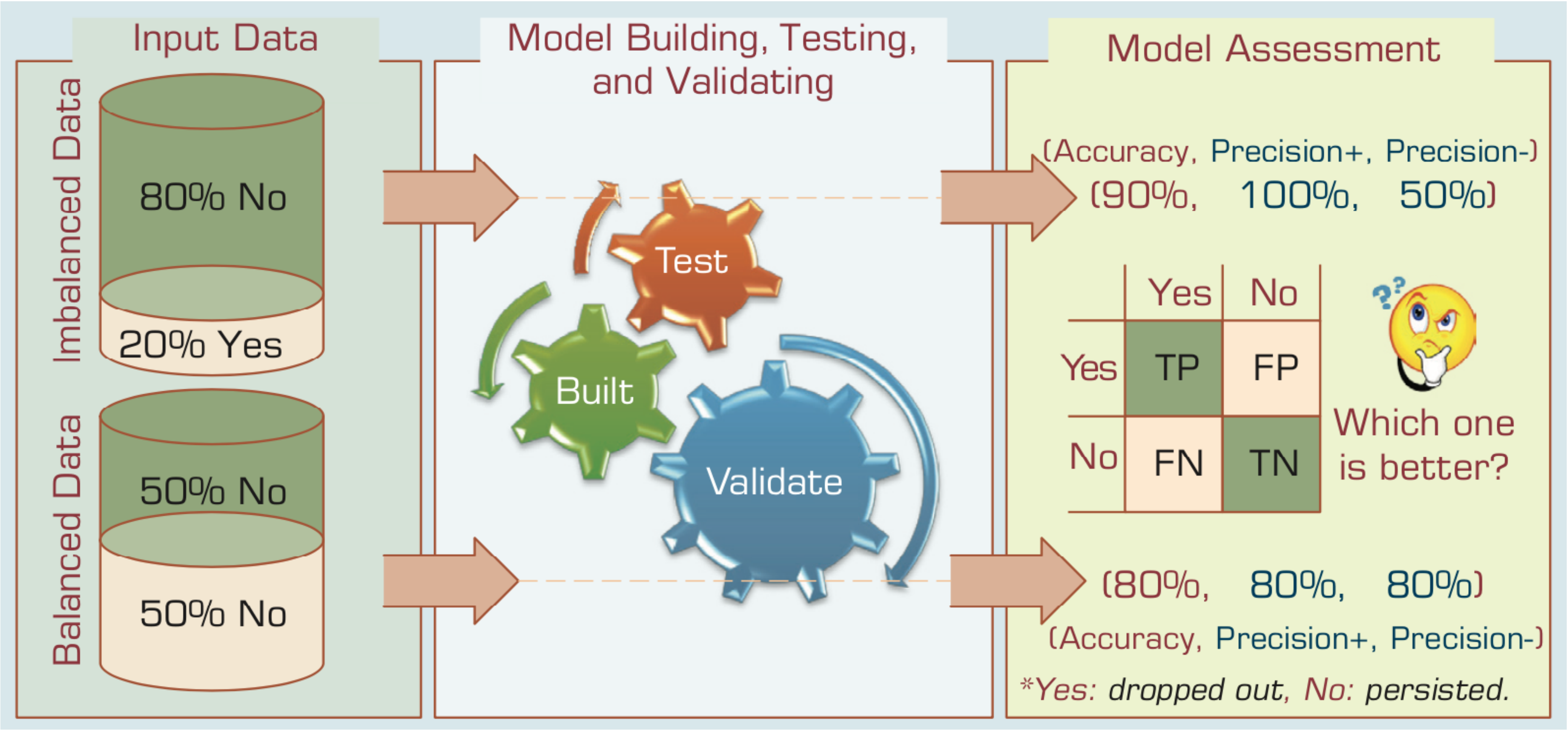
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

An Analytics Approach to Predicting Student Attrition



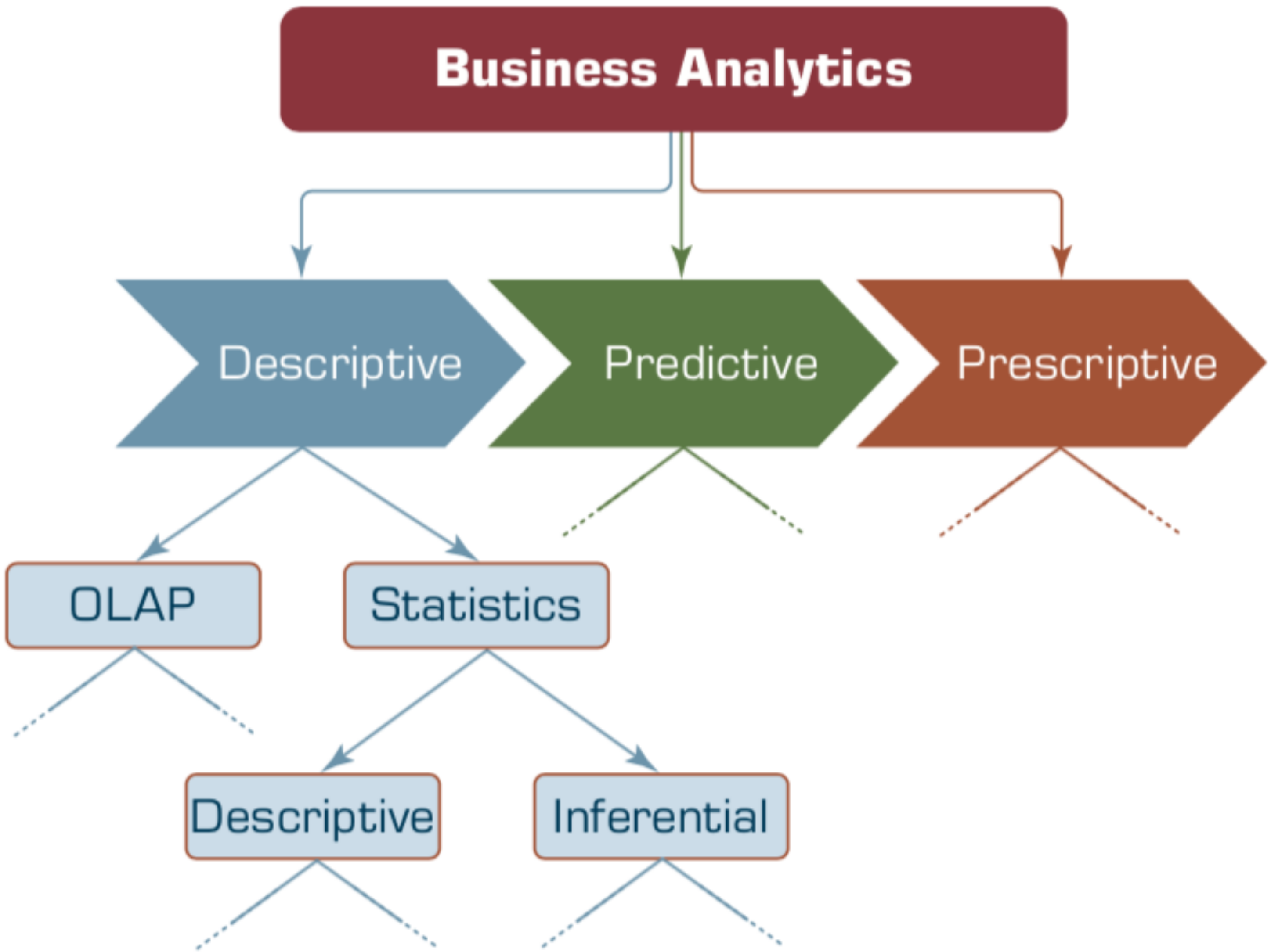
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Graphical Depiction of the Class Imbalance Problem



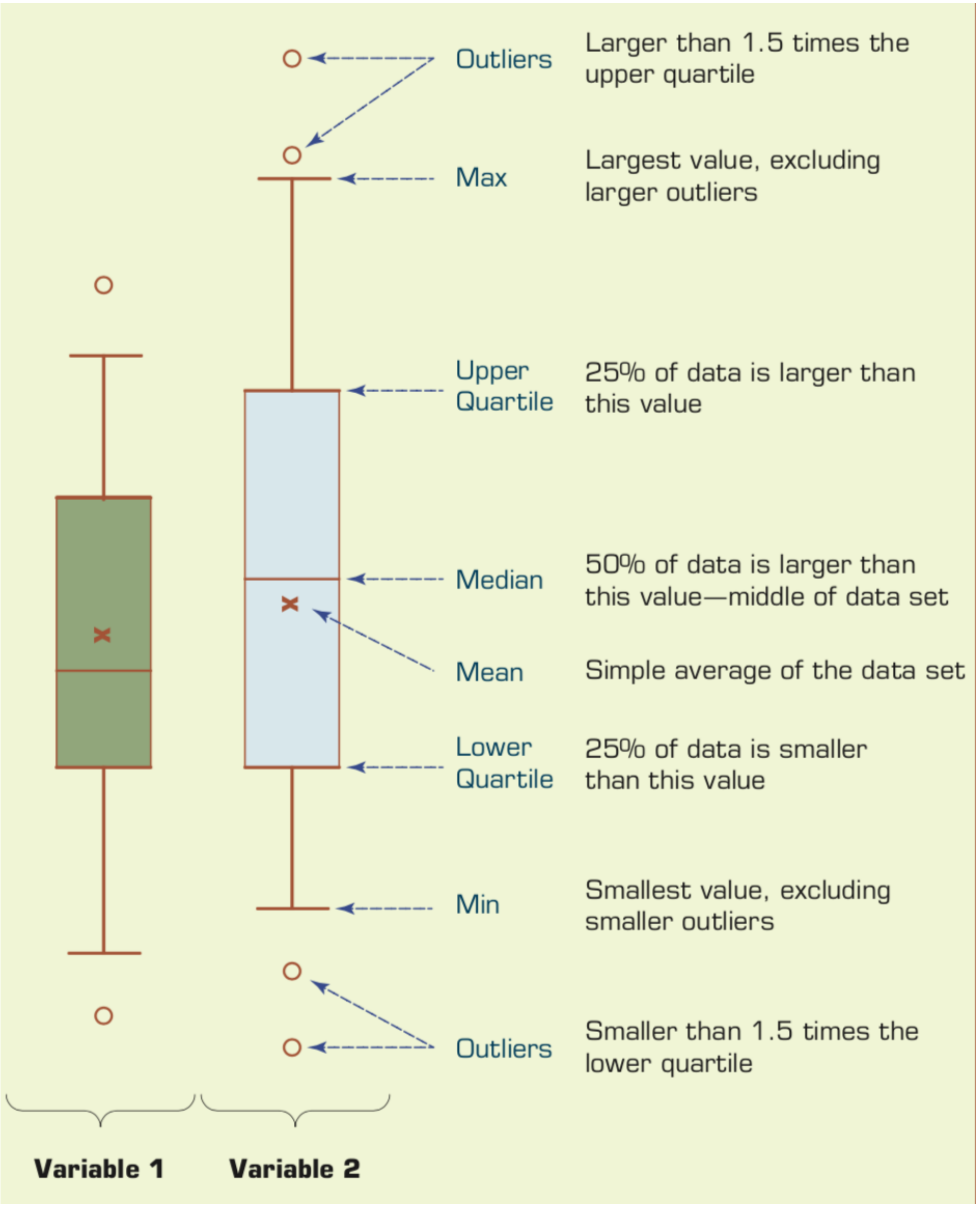
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Relationship between Statistics and Descriptive Analytics



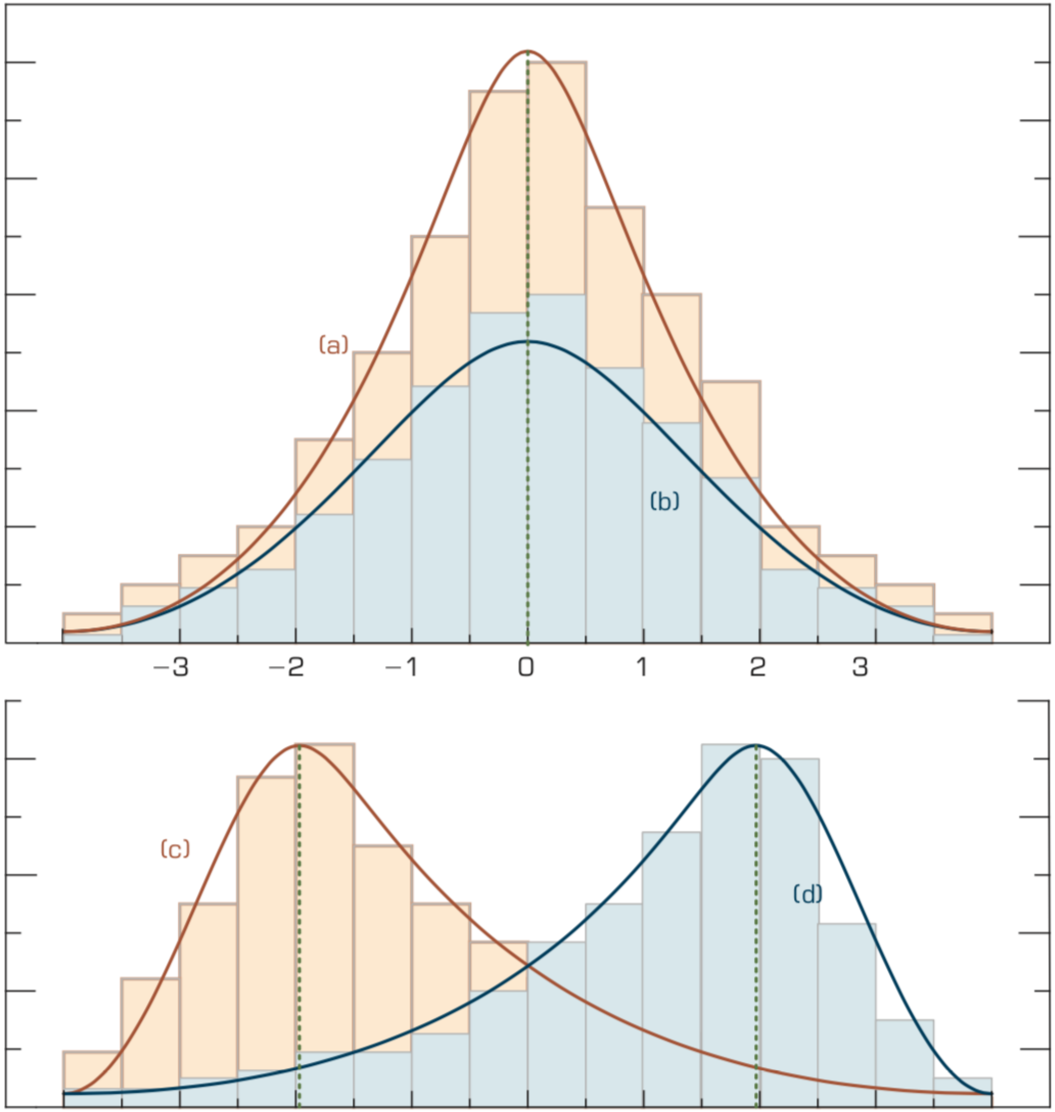
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Understanding the Specifics about Box-and-Whiskers Plots



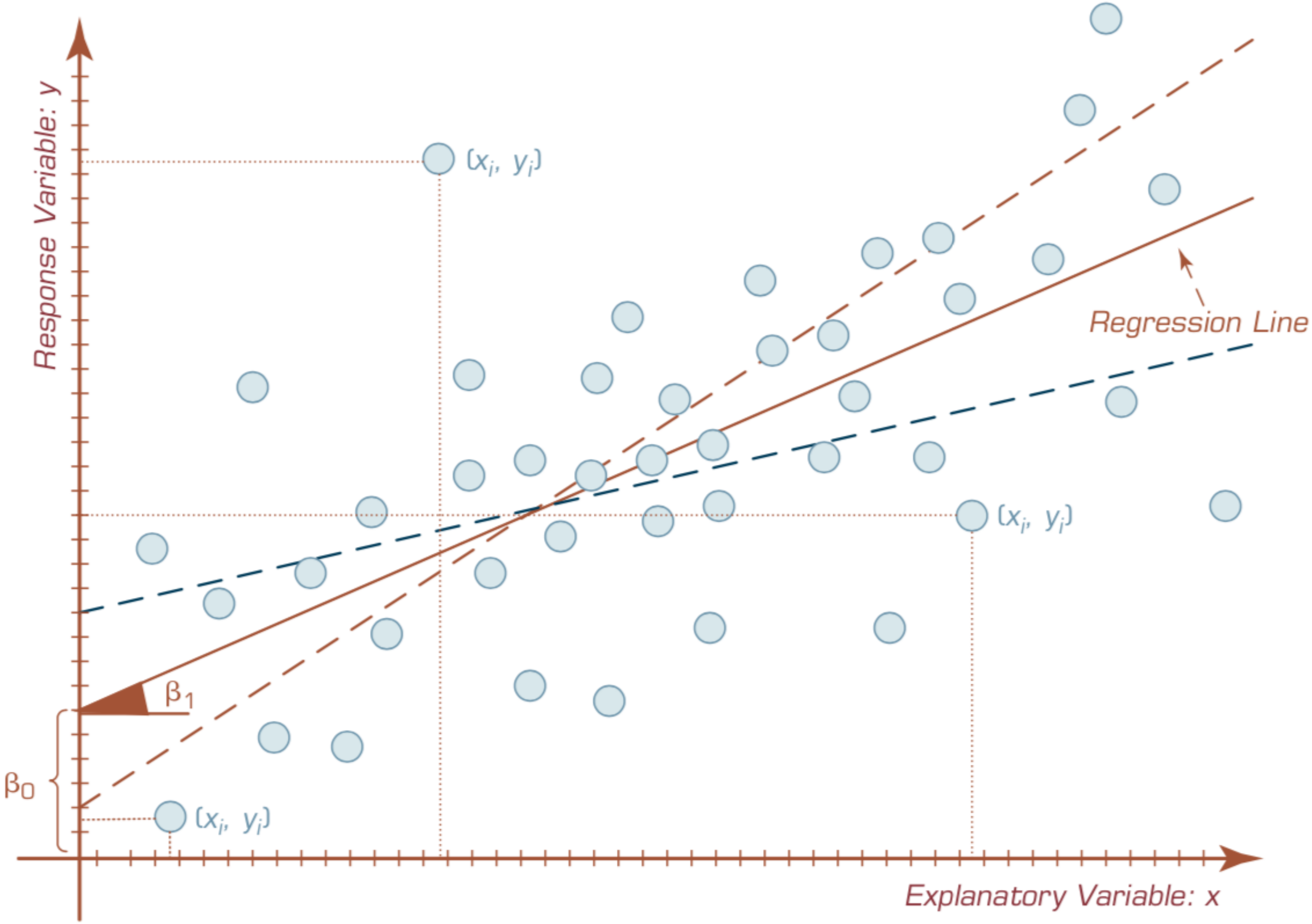
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Relationship between Dispersion and Shape Properties.



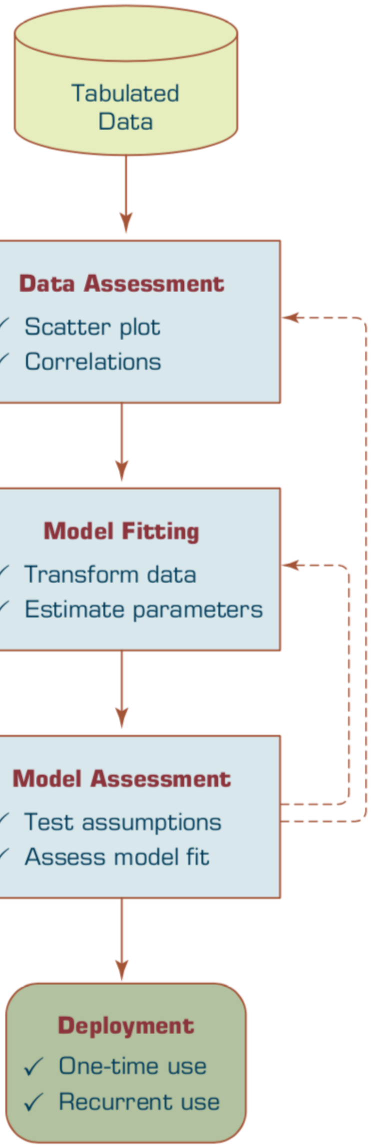
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Scatter Plot and a Linear Regression Line



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

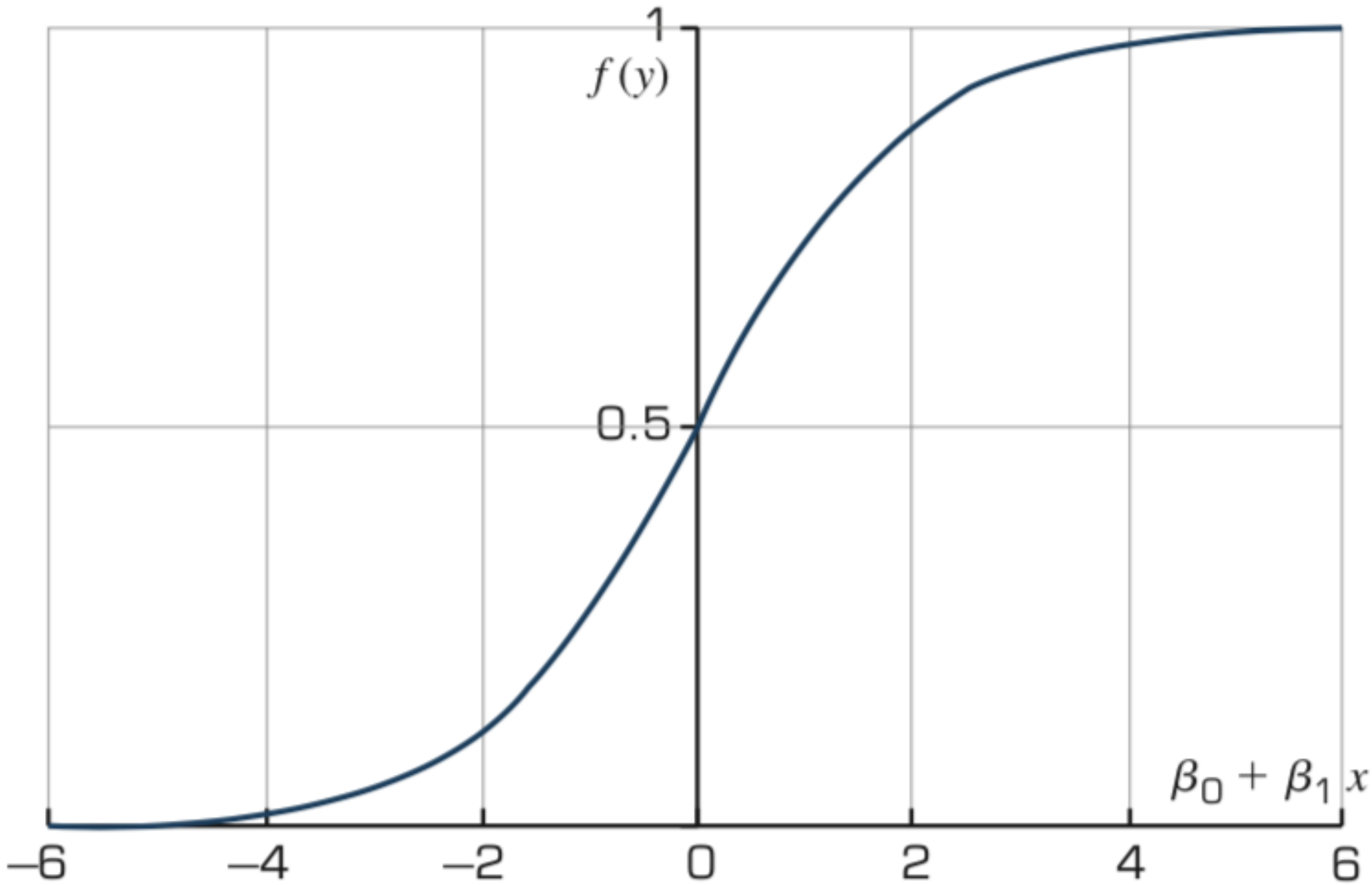
A Process Flow for Developing Regression Models.



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

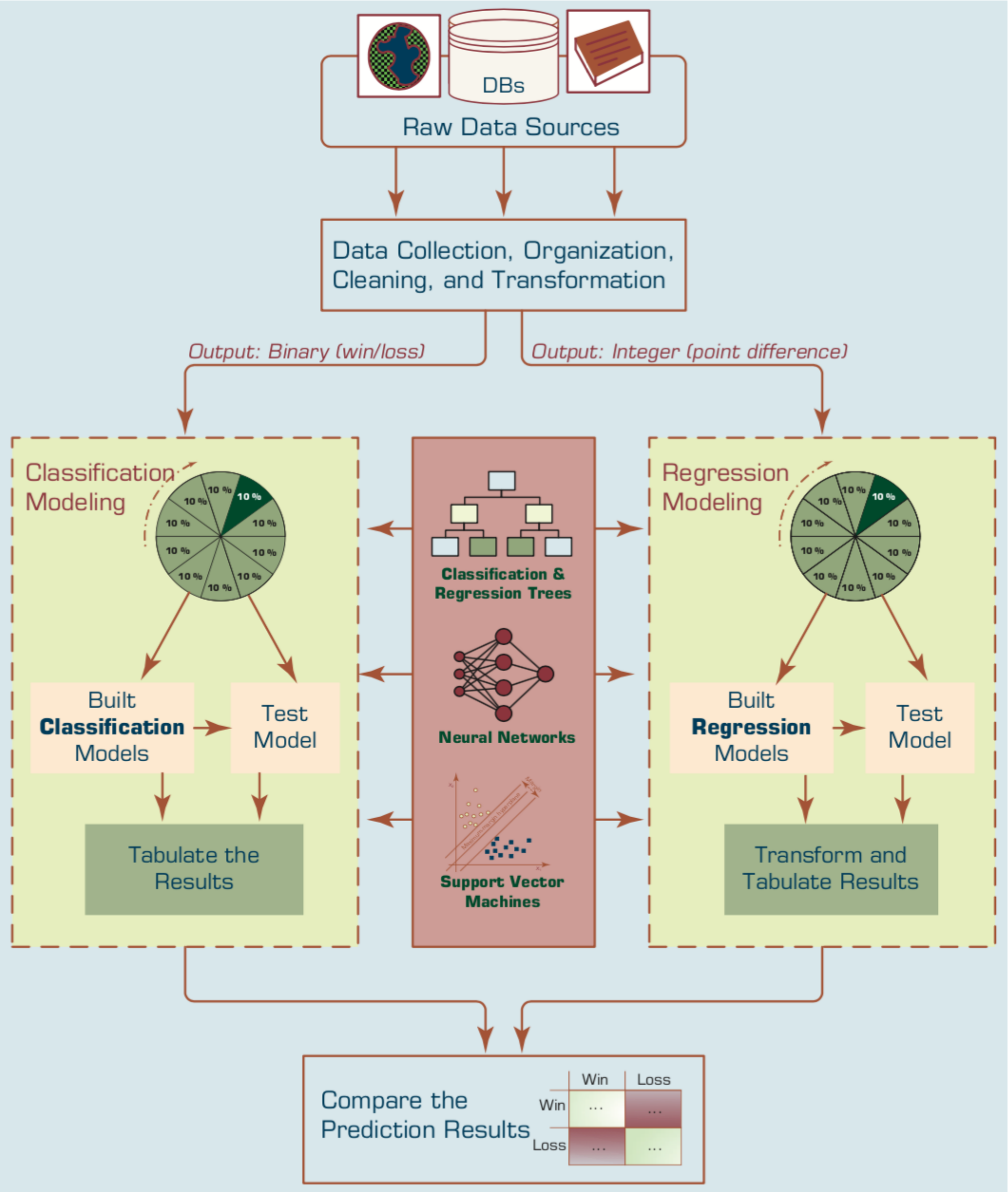
The Logistic Function

$$f(y) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x)}}$$



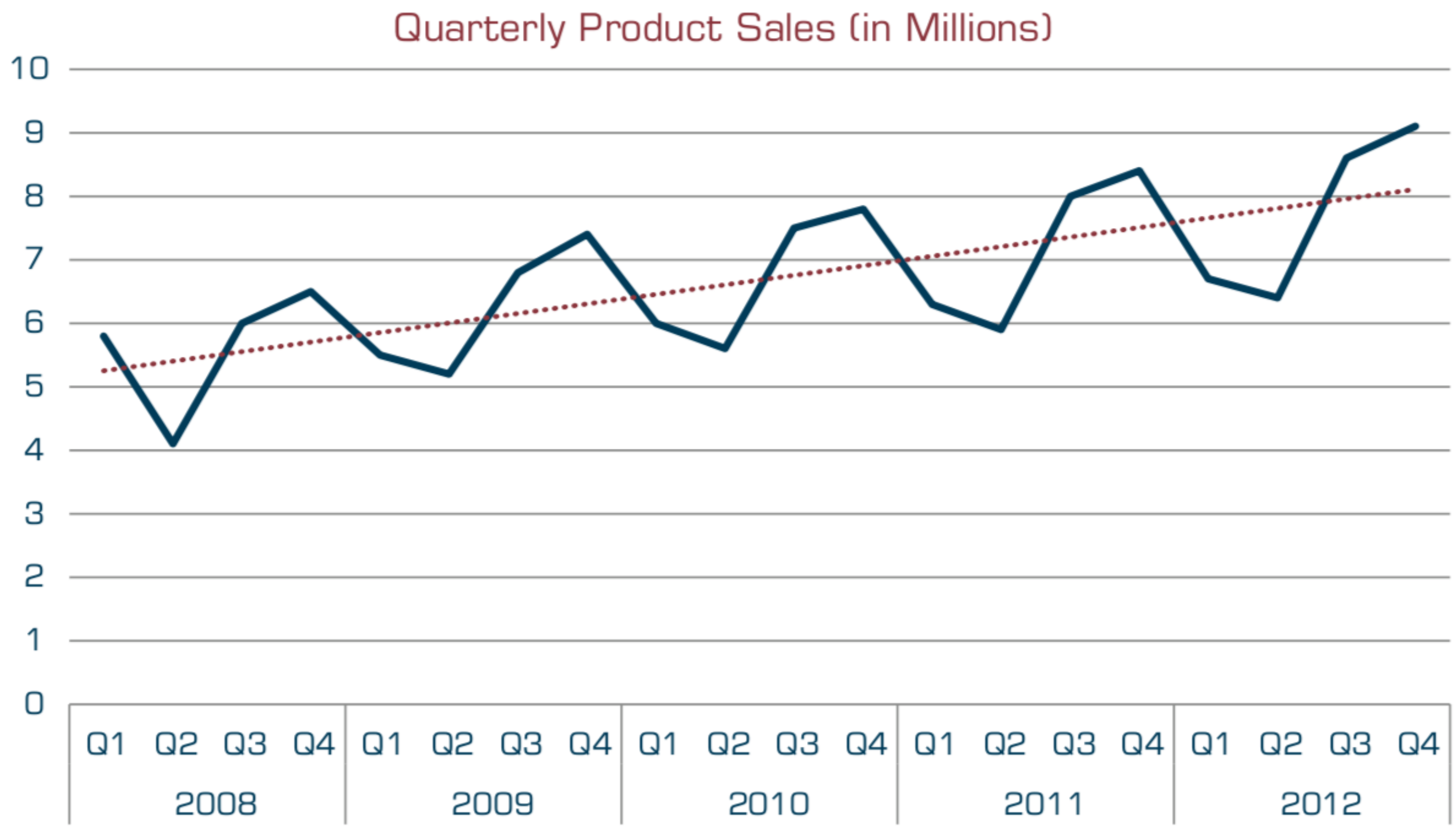
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Predicting NCAA Bowl Game Outcomes



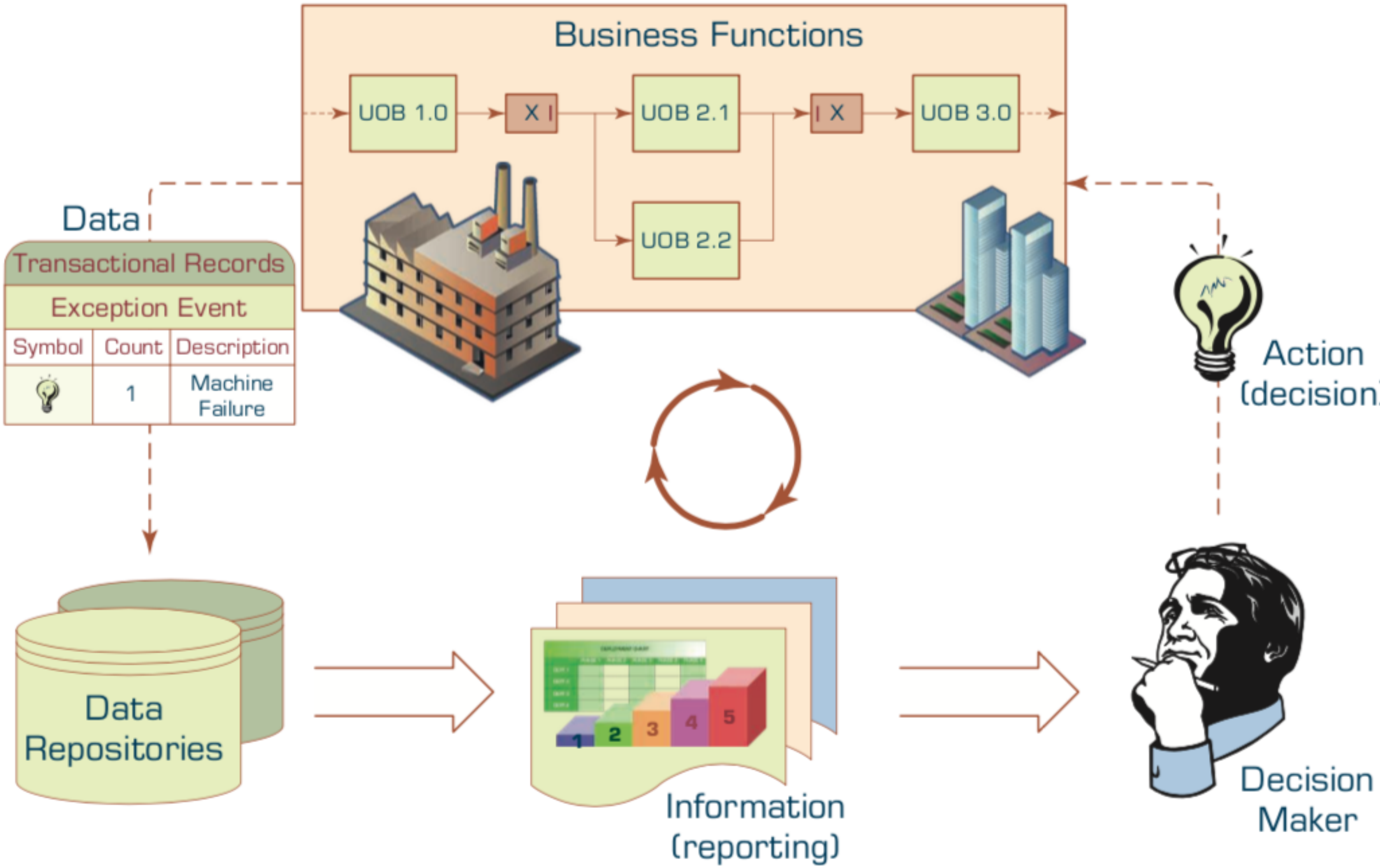
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Sample Time Series of Data on Quarterly Sales Volumes



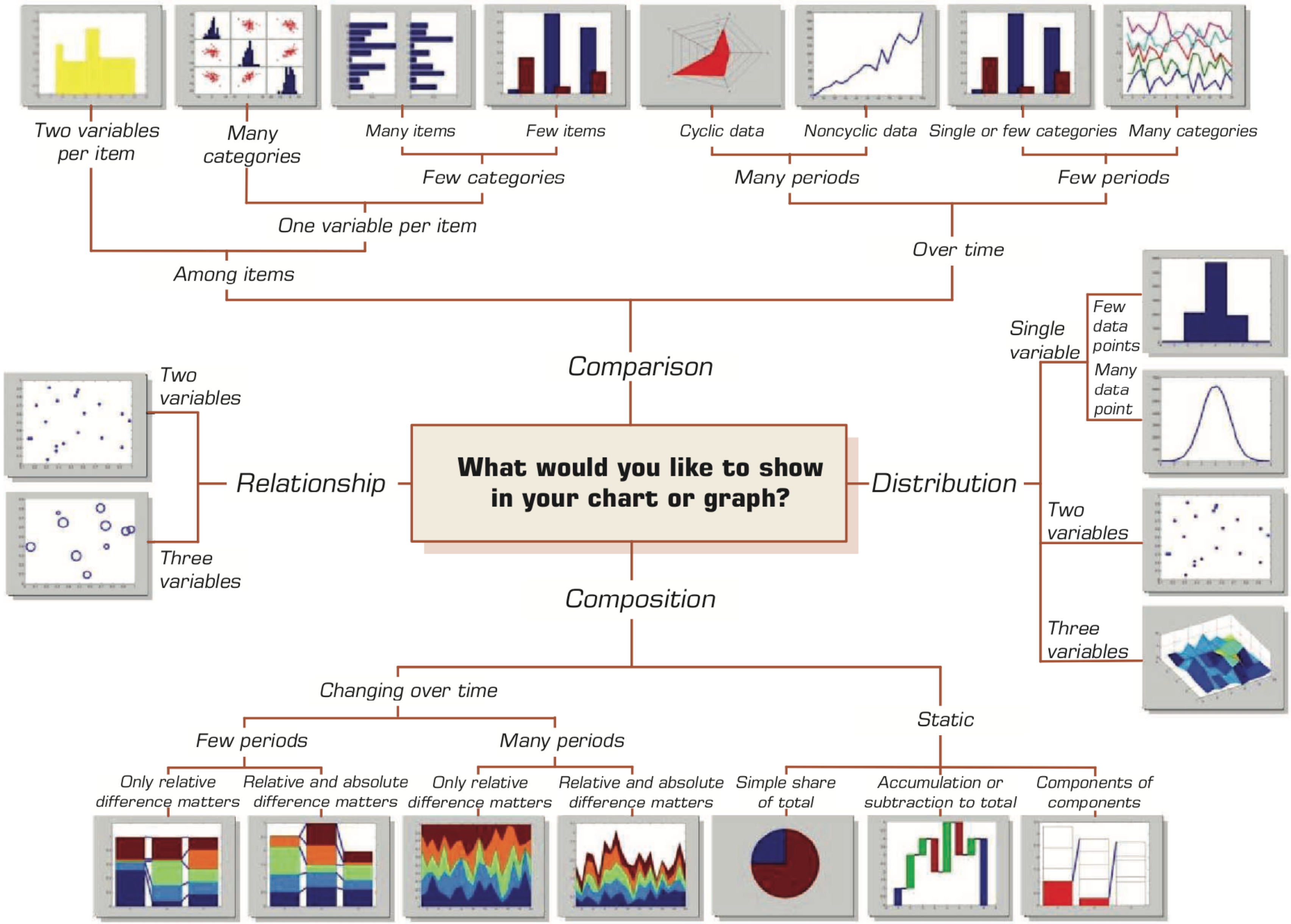
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

The Role of Information Reporting in Managerial Decision Making



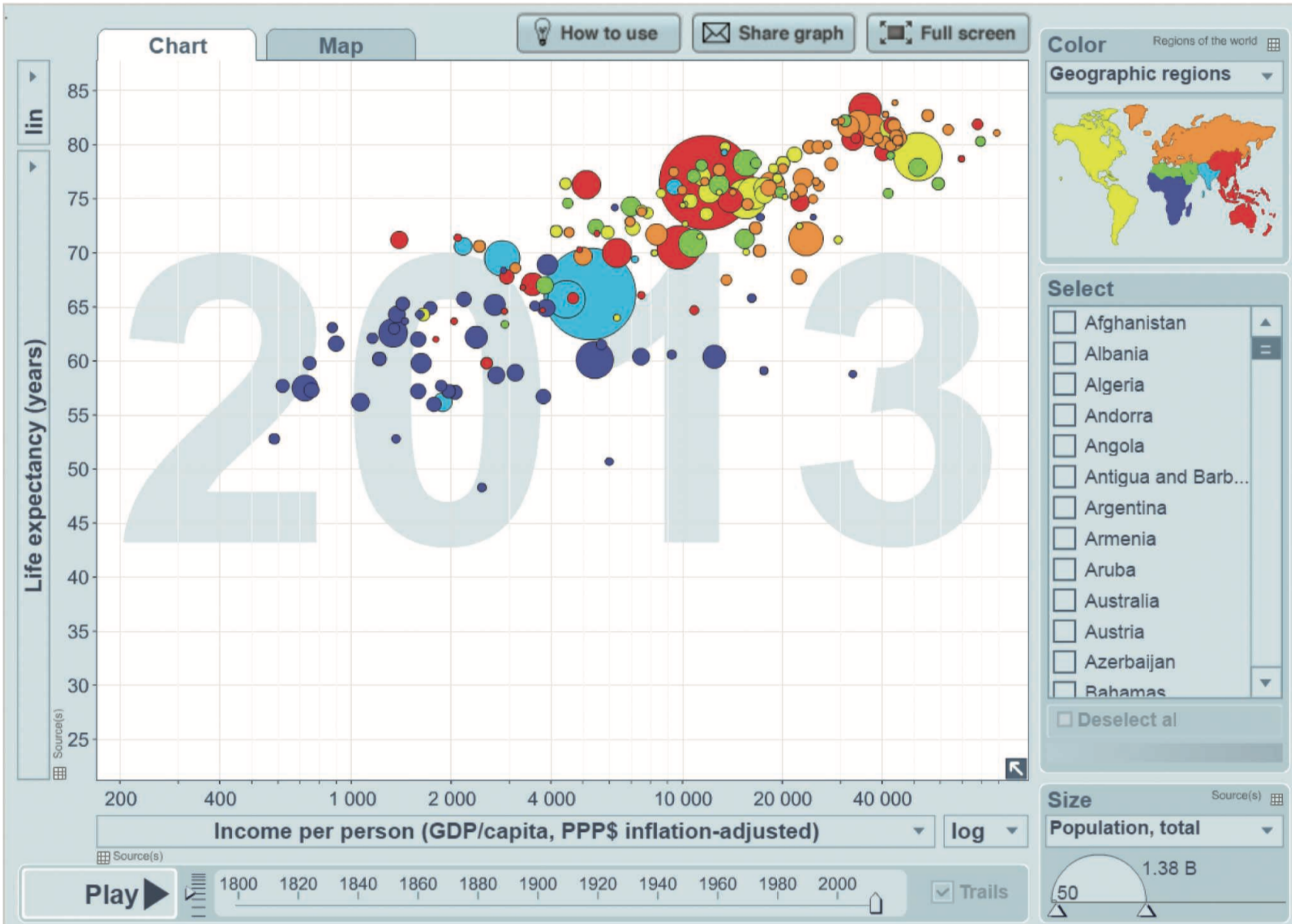
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Taxonomy of Charts and Graphs



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

A Gapminder Chart That Shows the Wealth and Health of Nations

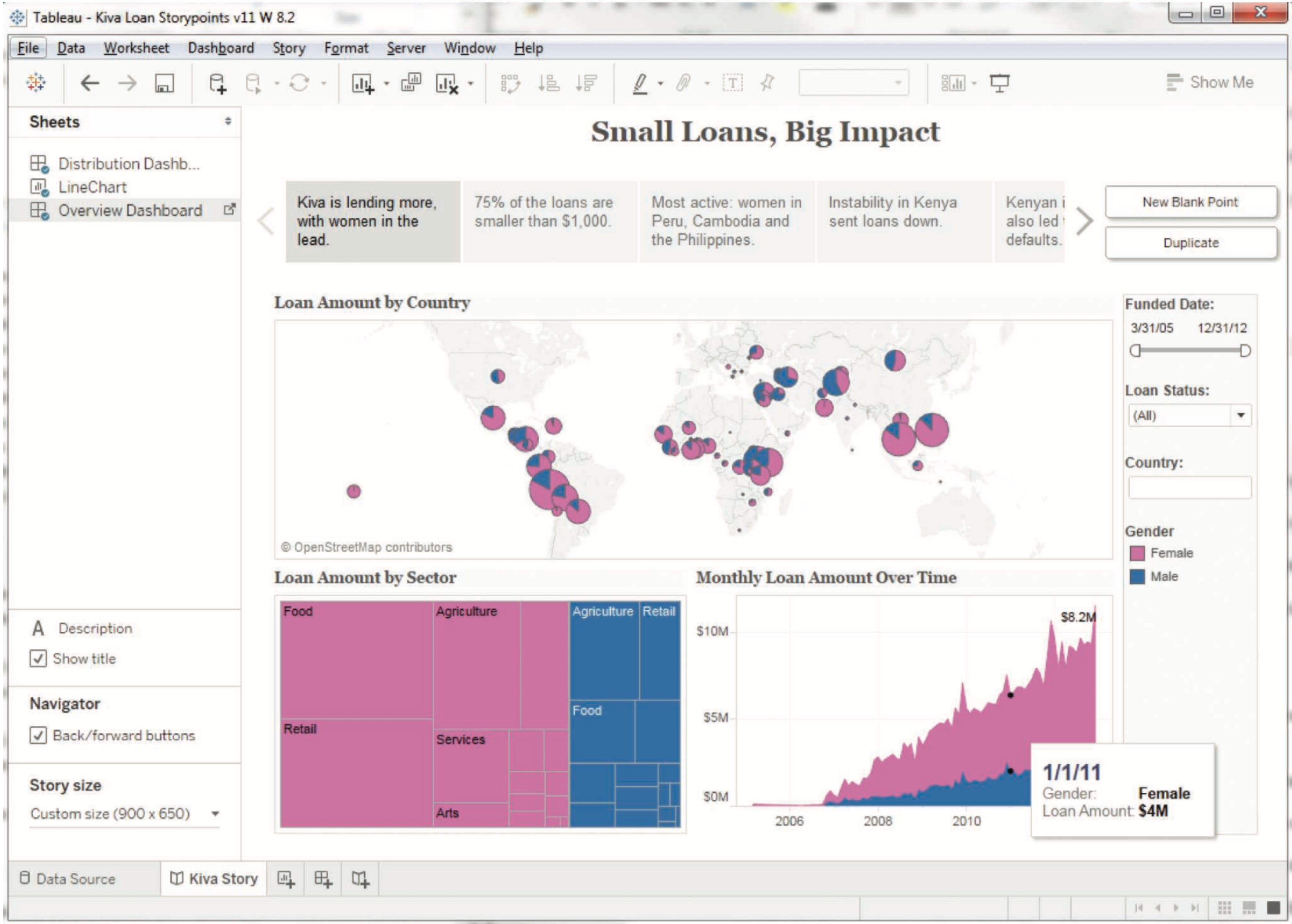


Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

Magic Quadrant for Business Intelligence and Analytics Platforms

Source: https://www.tableau.com/reports/gartner

A Storyline Visualization in Tableau Software

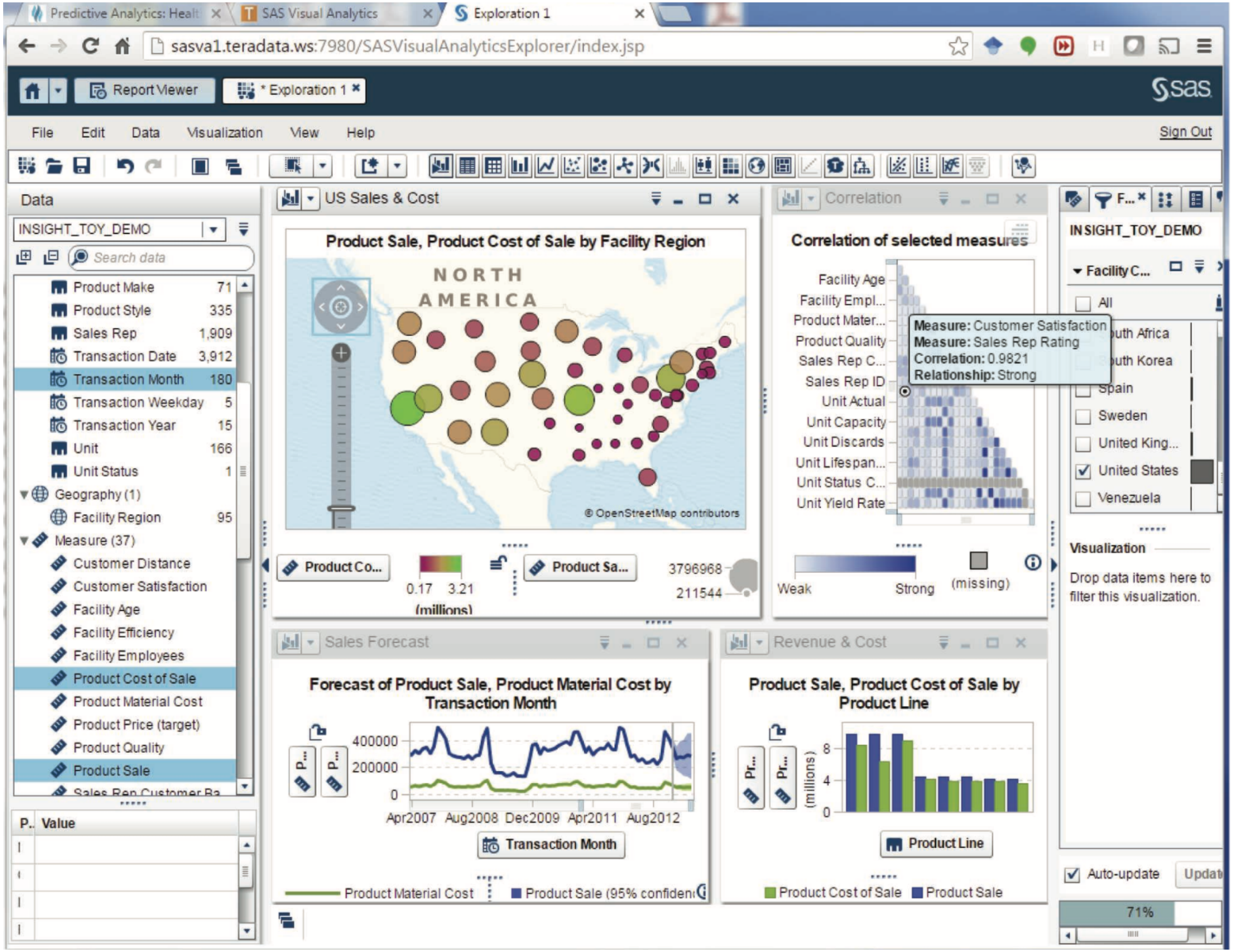


Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

An Overview of SAS Visual Analytics Architecture

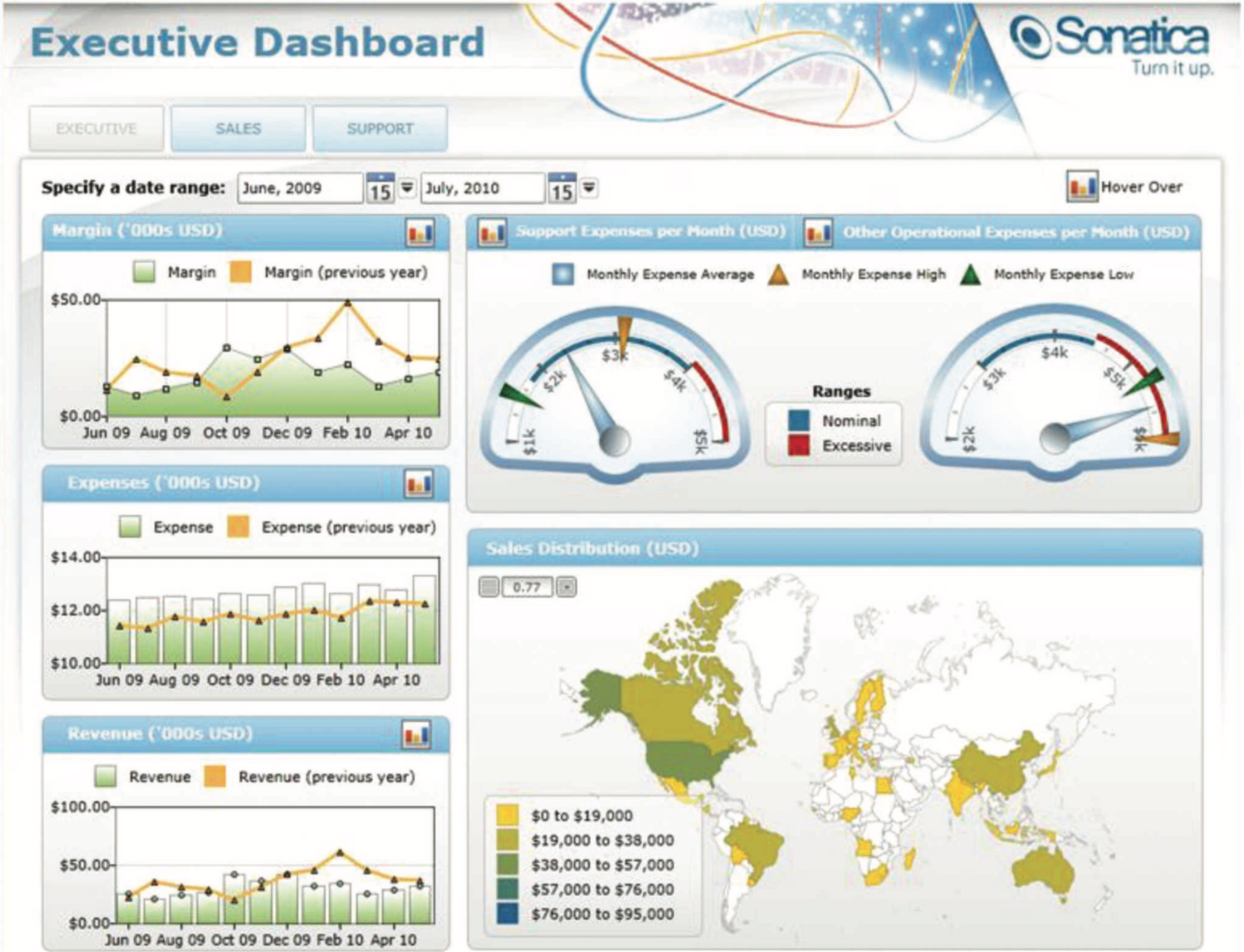
Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

A Screenshot from SAS Visual Analytics



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

A Sample Executive Dashboard

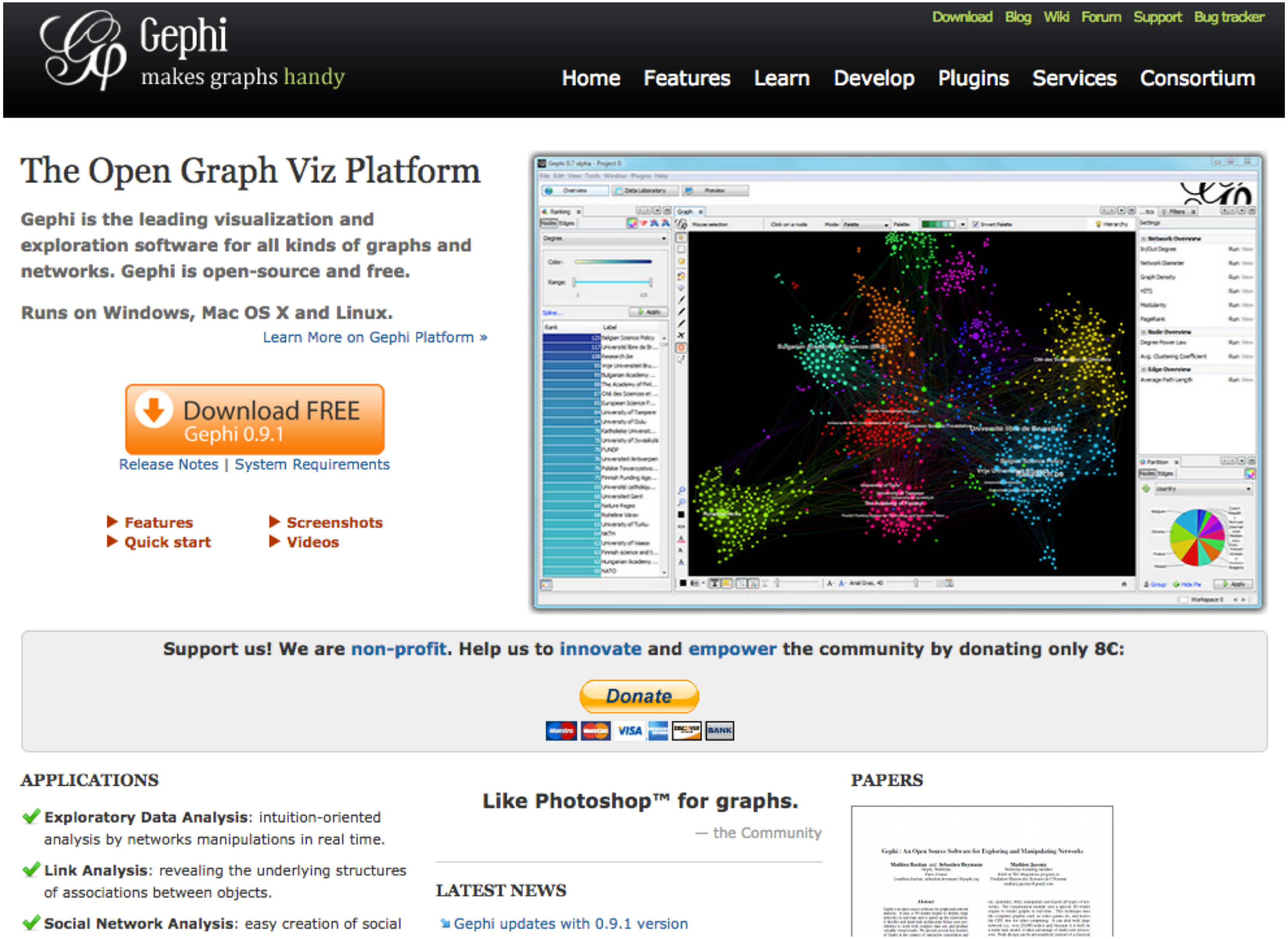


Source: Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson

igraph

http://igraph.org/redirect.html

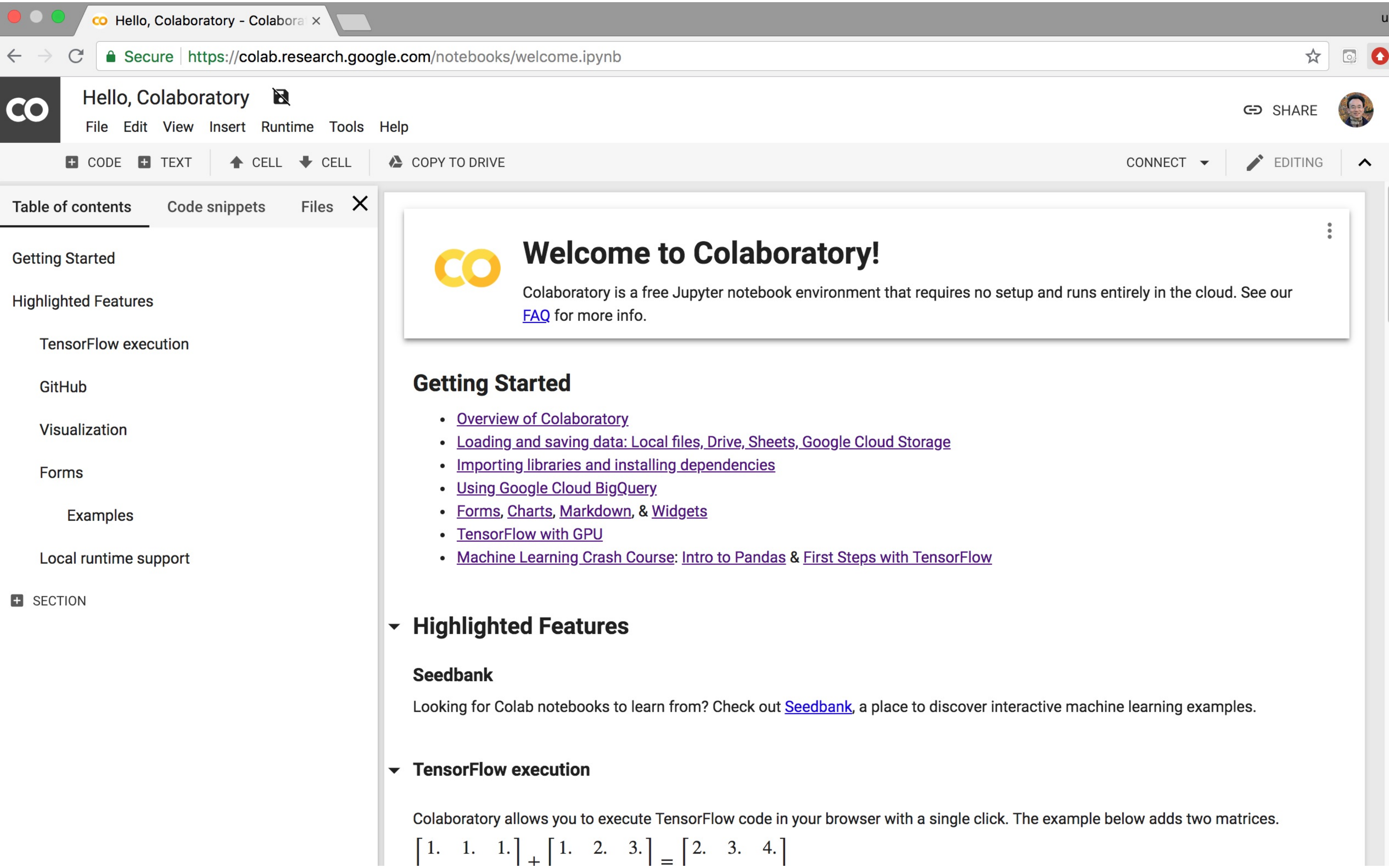
Gephi



https://gephi.org/

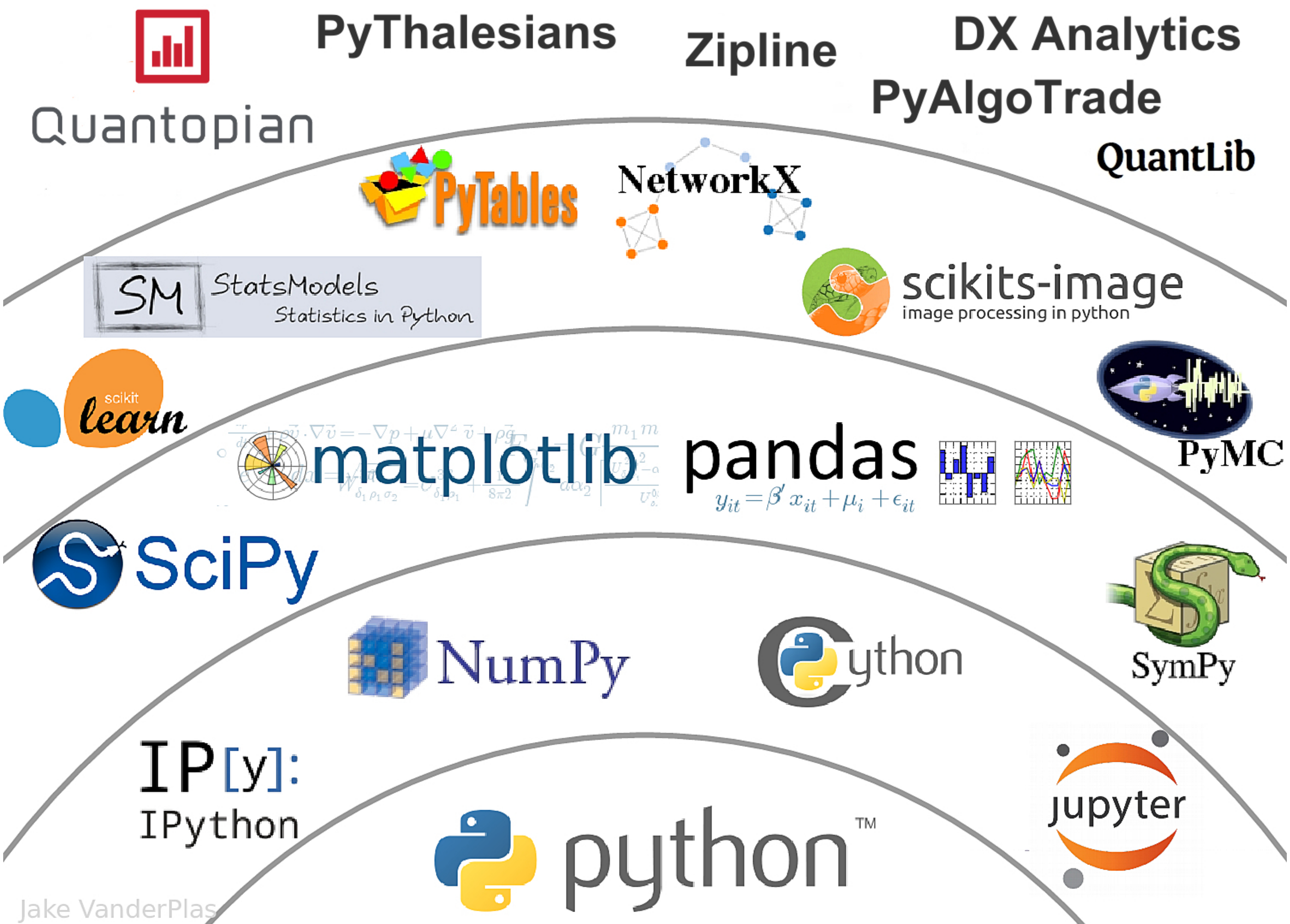
Discovering, Analyzing, Visualizing and Presenting Data with Python in Google Colab

Google Colab



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

The Quant Finance PyData Stack



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

Python matplotlib

Source: https://matplotlib.org/

Python Pandas

pandas

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

http://pandas.pydata.org/

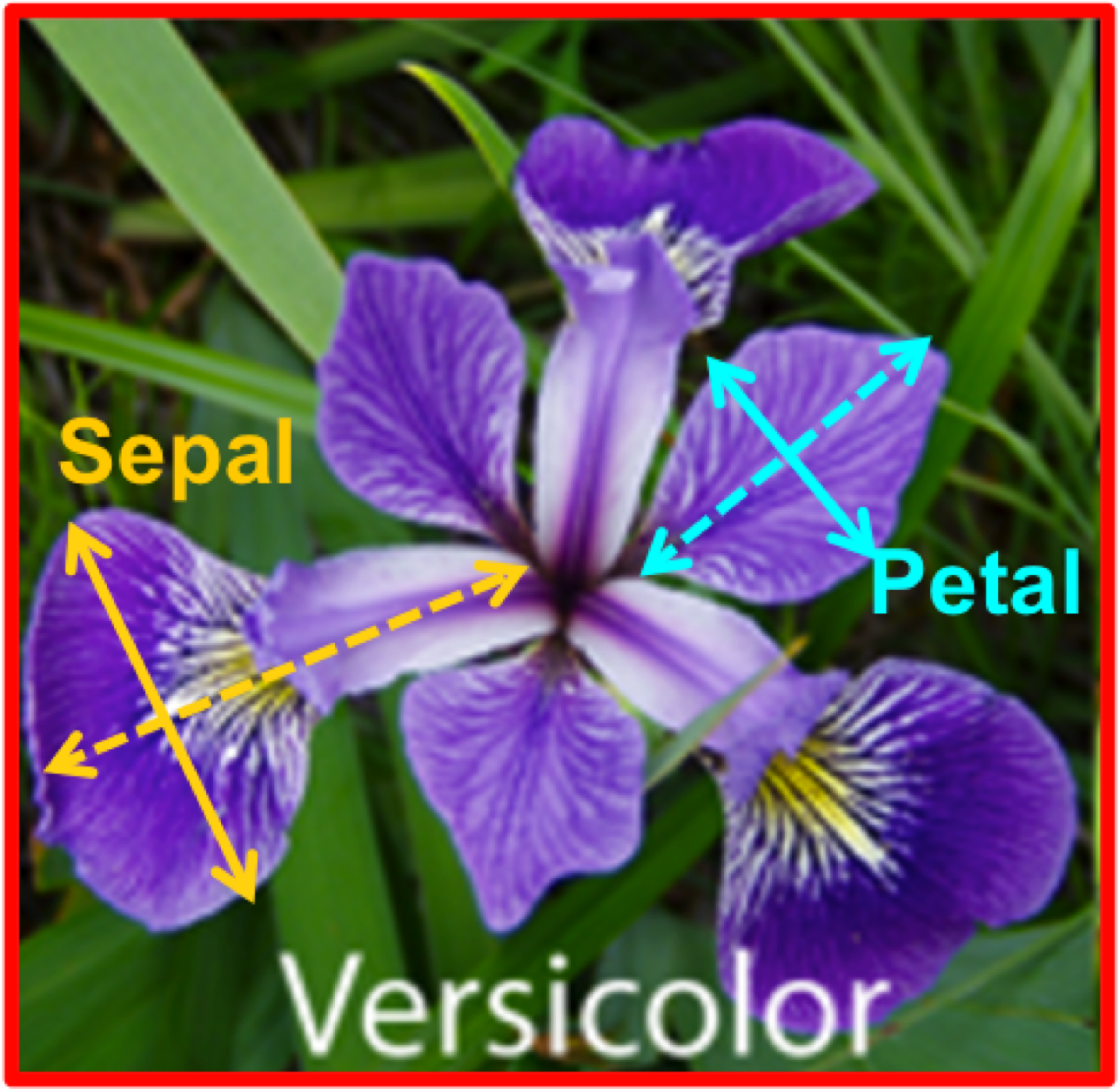
Iris flower data set

setosa **versicolor** **virginica**

Source: https://en.wikipedia.org/wiki/Iris_flower_data_set

Source: http://suruchifialoke.com/2016-10-13-machine-learning-tutorial-iris-classification/

Iris Classfication



Source: http://suruchifialoke.com/2016-10-13-machine-learning-tutorial-iris-classification/

iris.data

https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data

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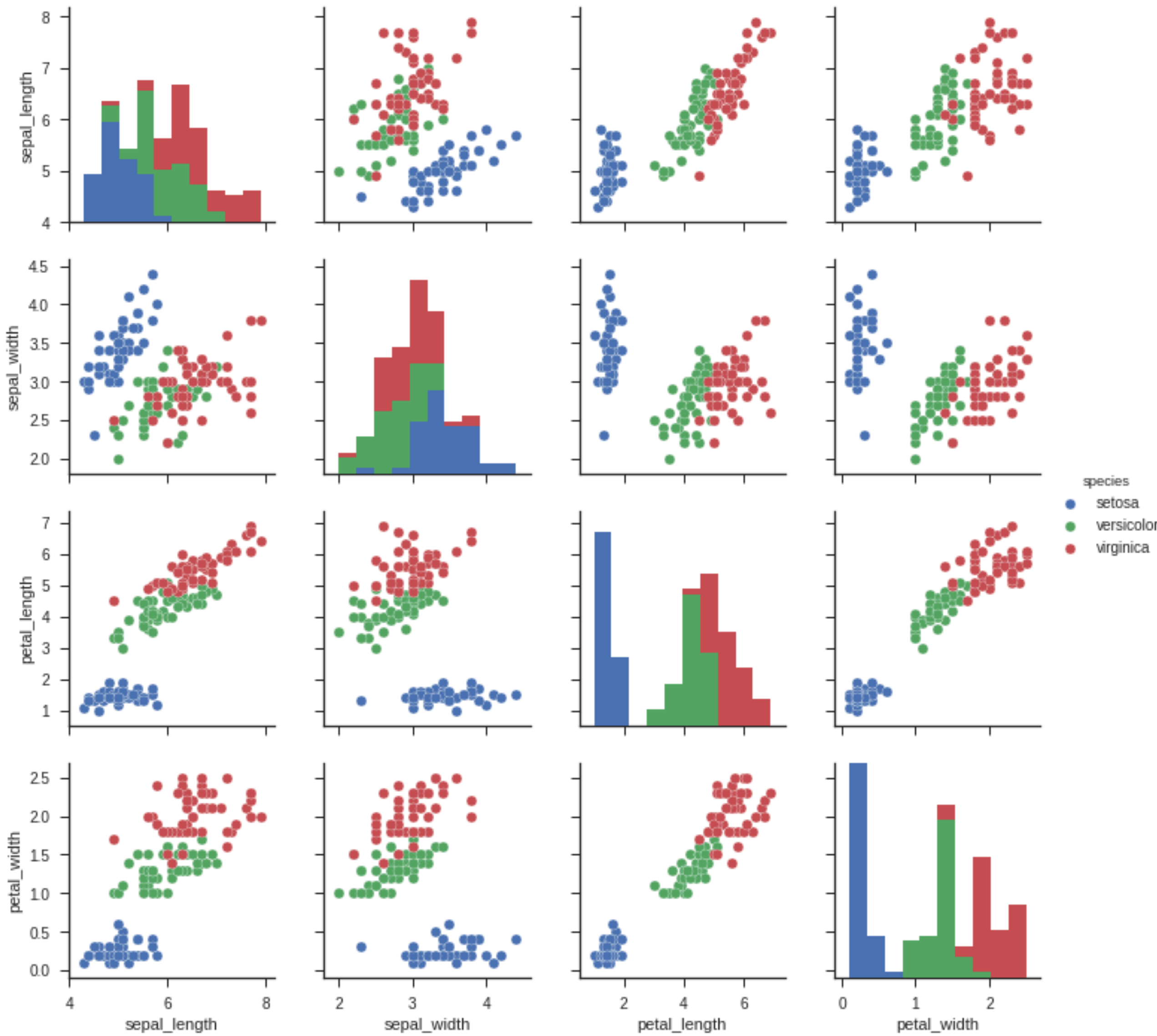
5.0,3.0,1.6,0.2,Iris-setosa
```

setosa

virginica

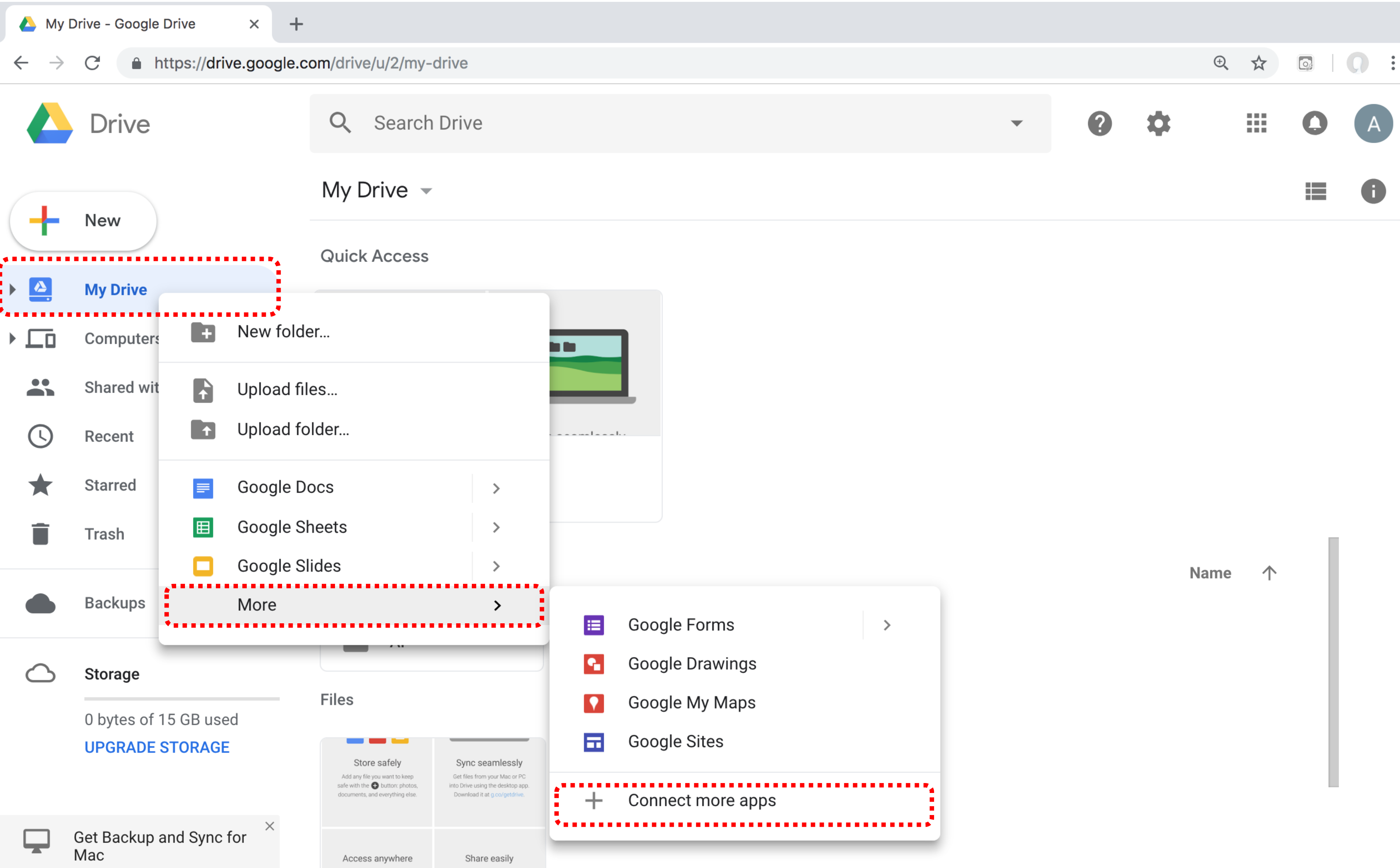
versicolor

Iris Data Visualization

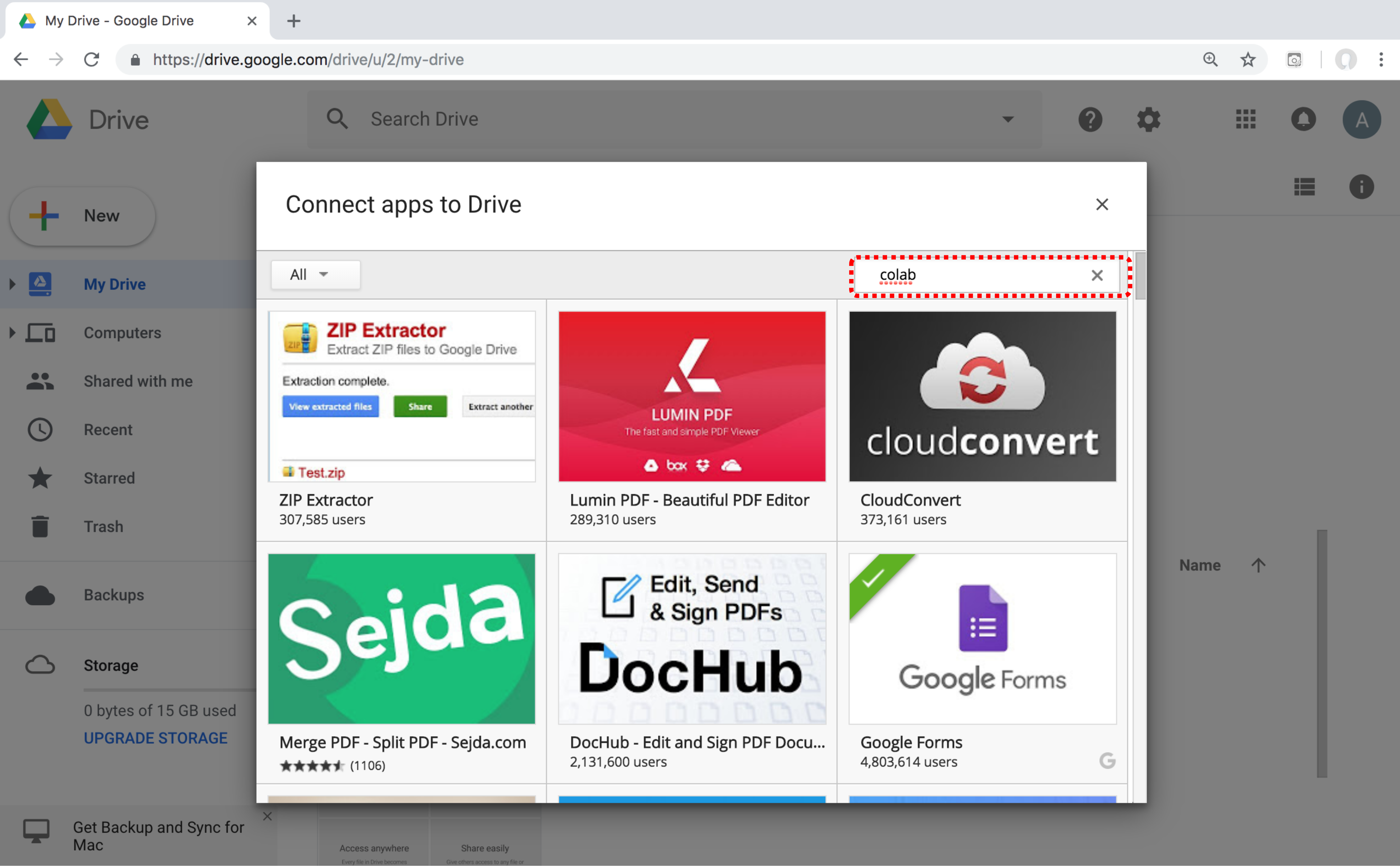


Source: https://seaborn.pydata.org/generated/seaborn.pairplot.html

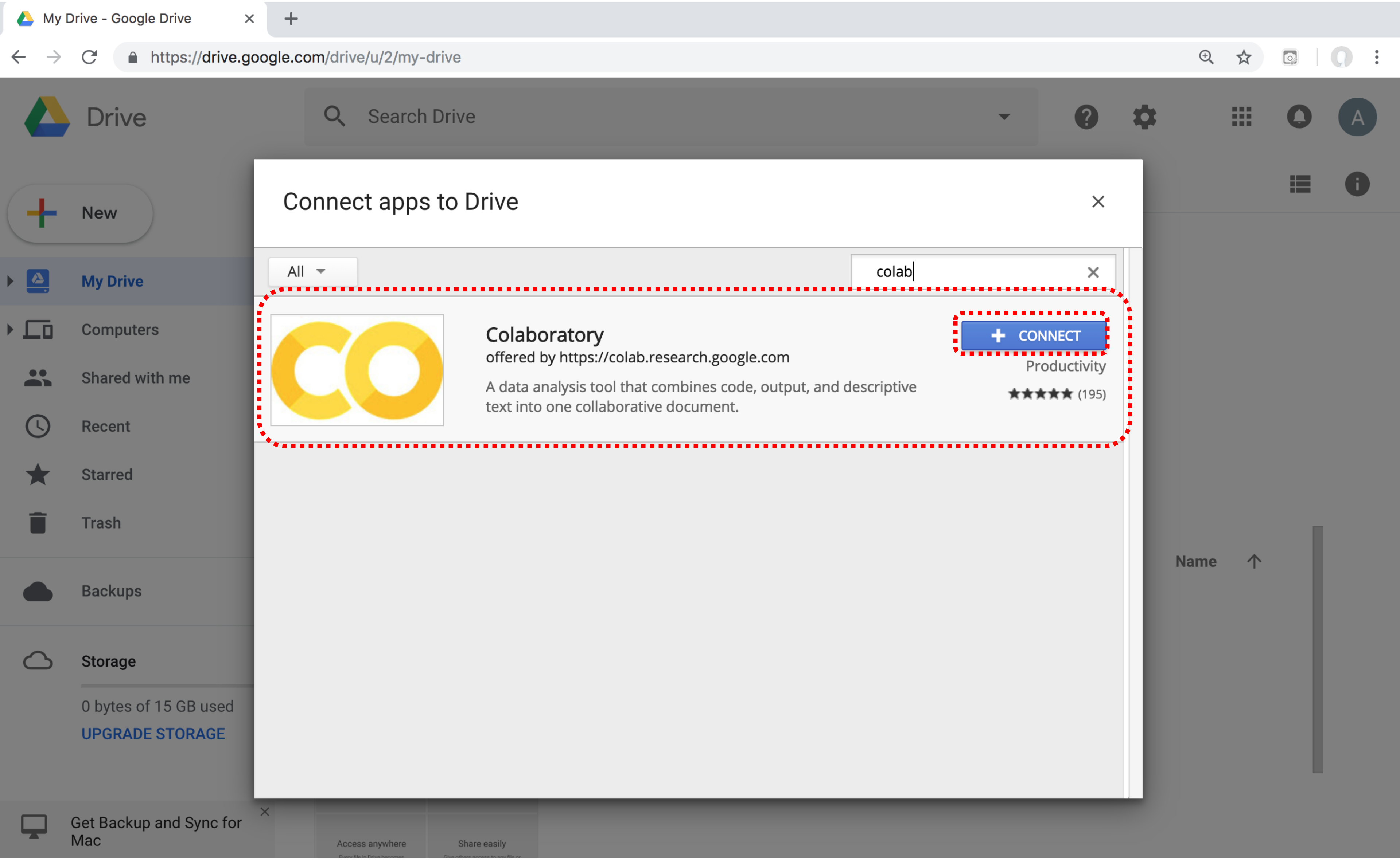
Connect Google Colab in Google Drive



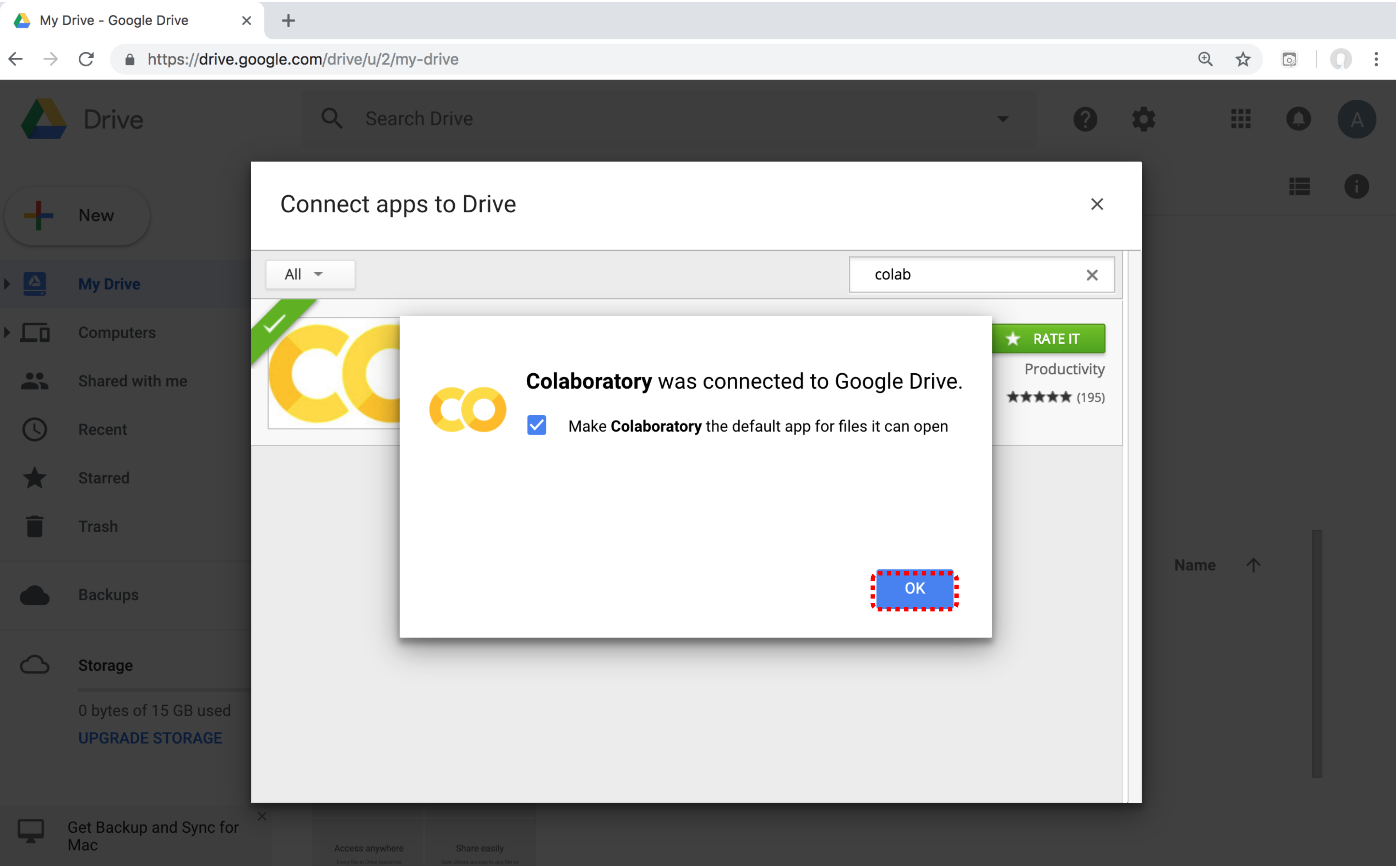
Google Colab



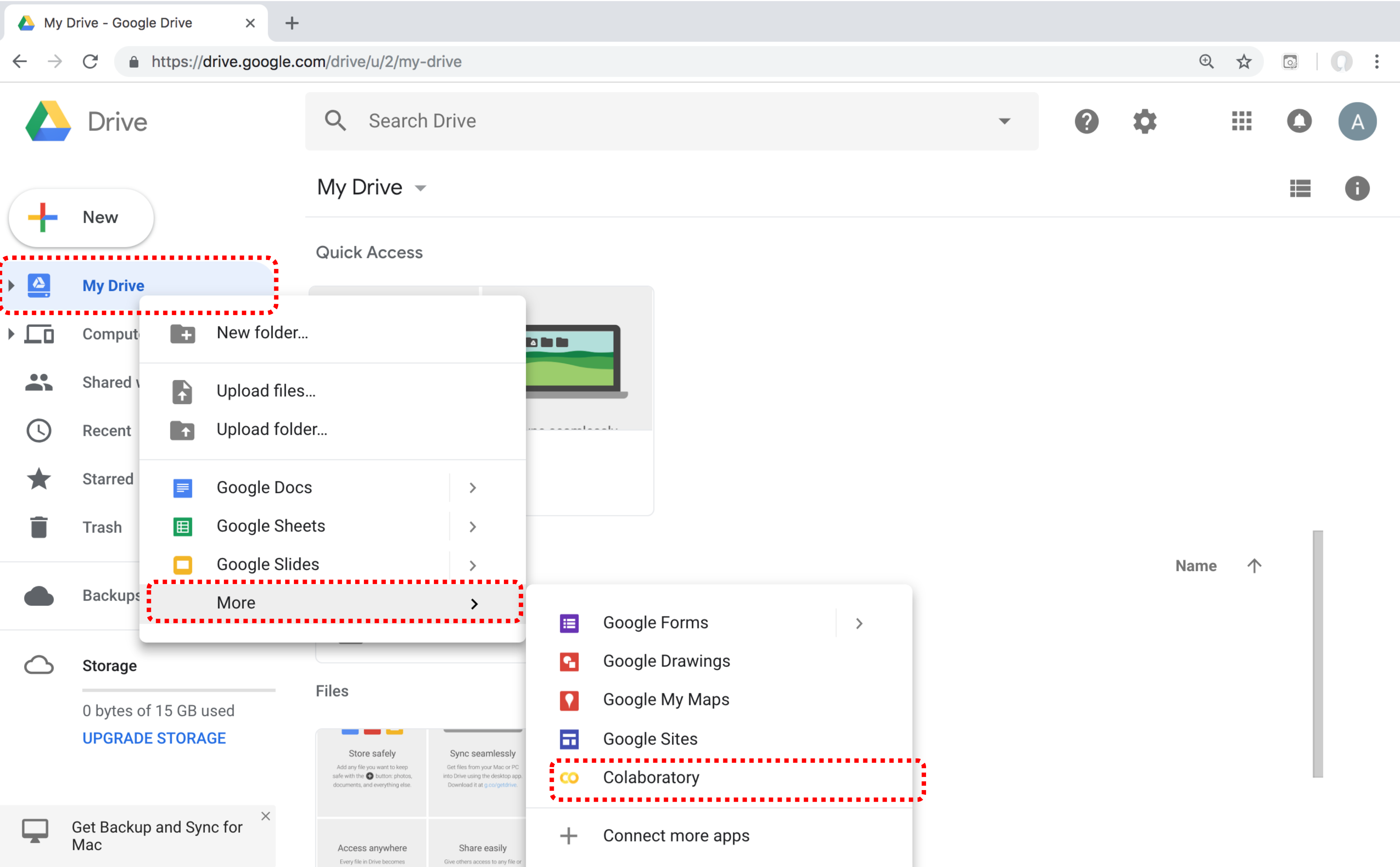
Google Colab



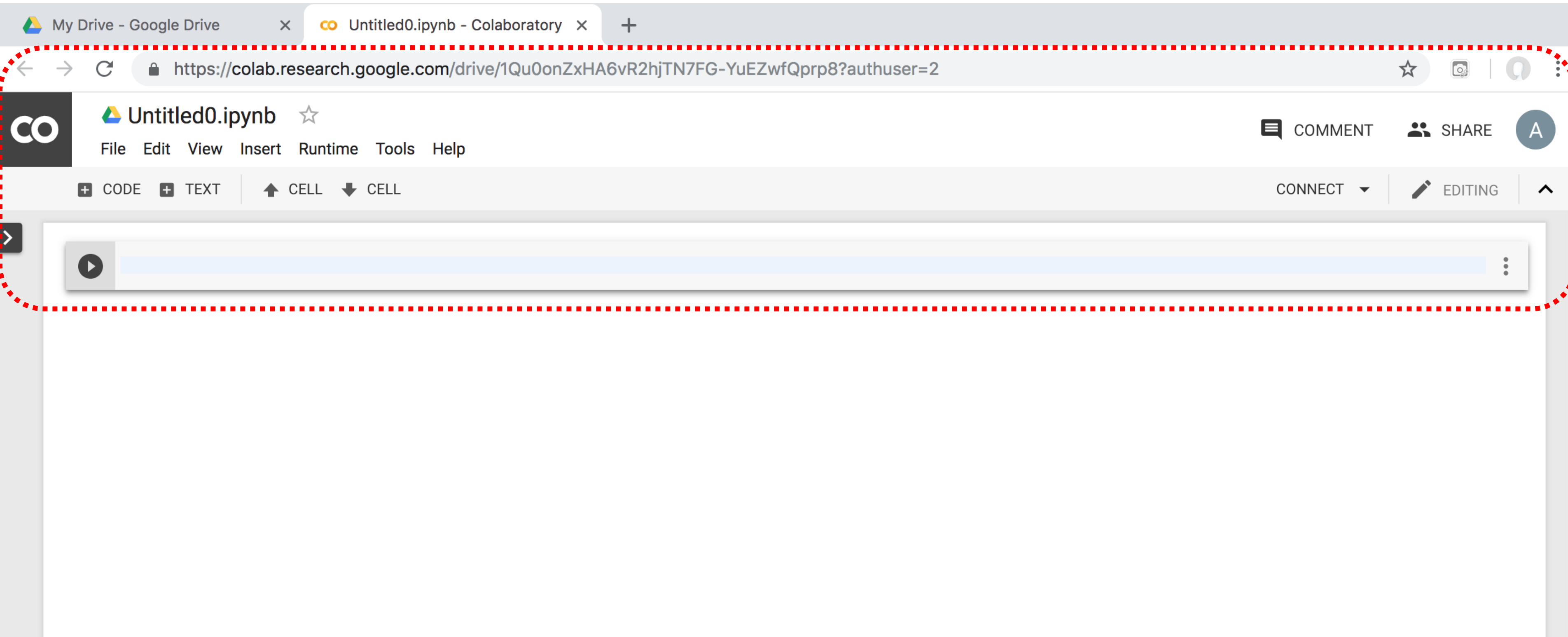
Connect Colaboratory to Google Drive



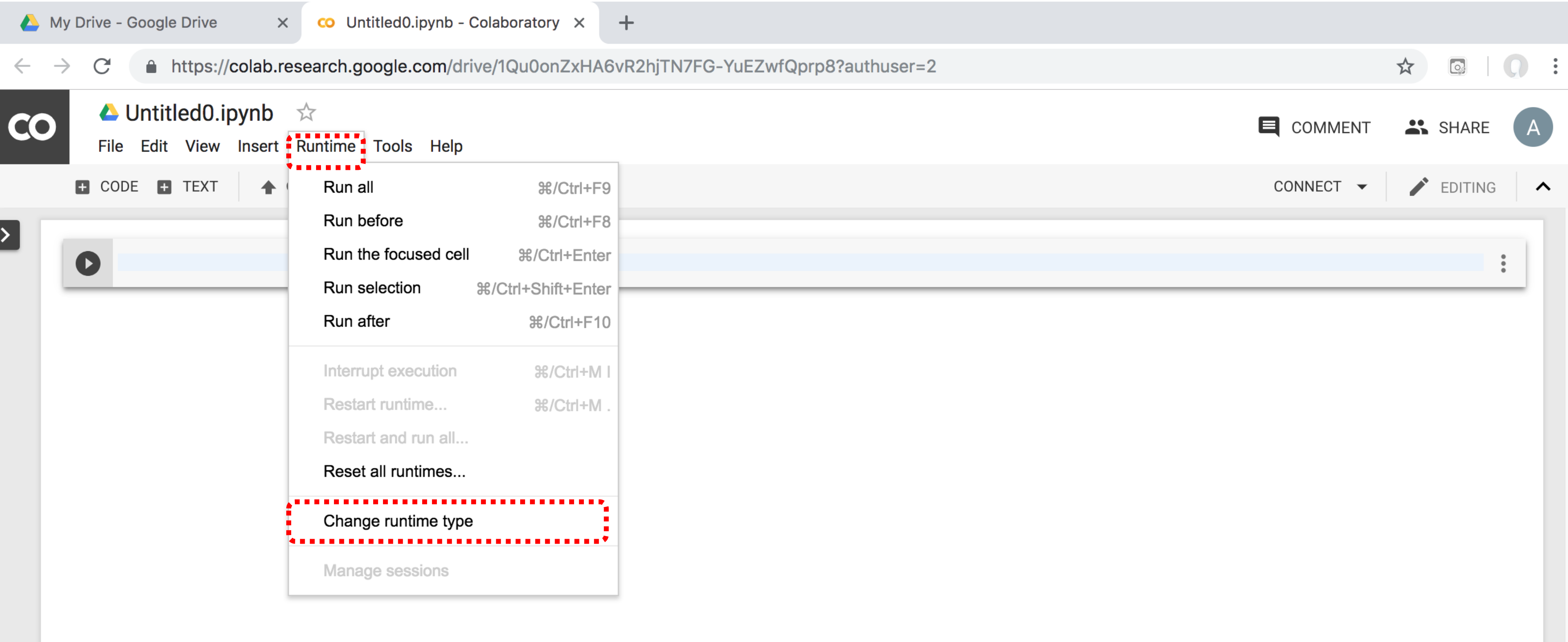
Google Colab



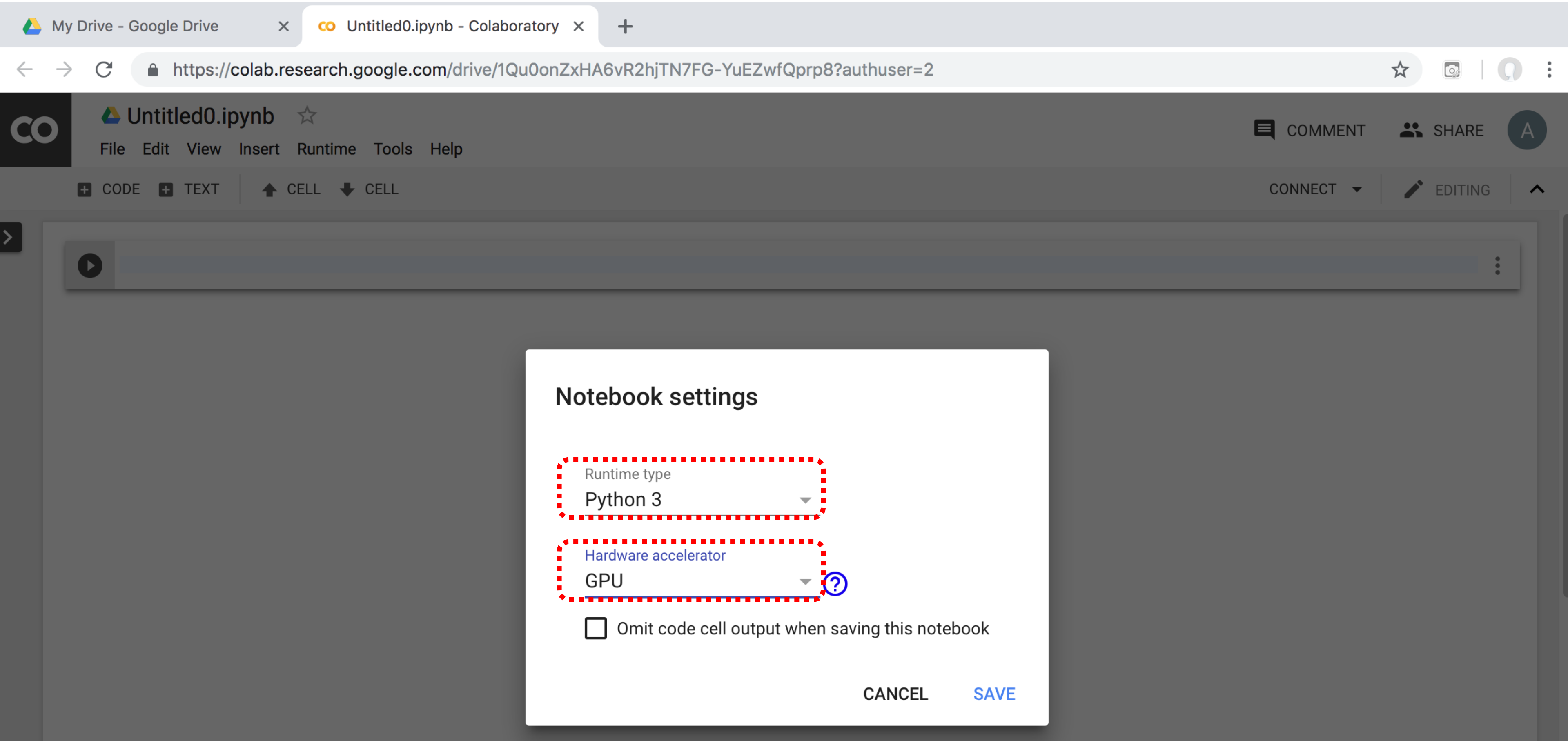
Google Colab



Google Colab

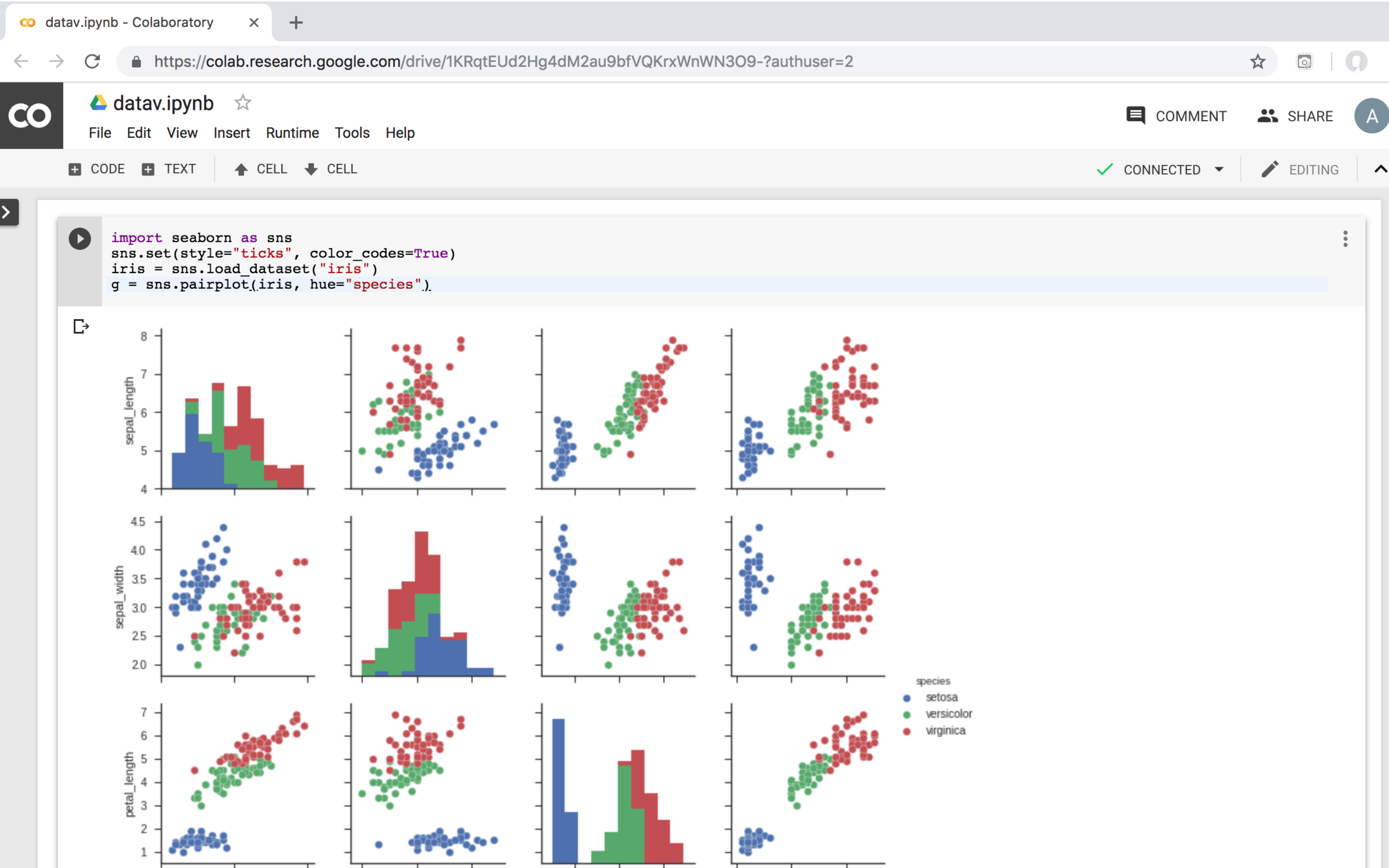


Run Jupyter Notebook Python3 GPU Google Colab



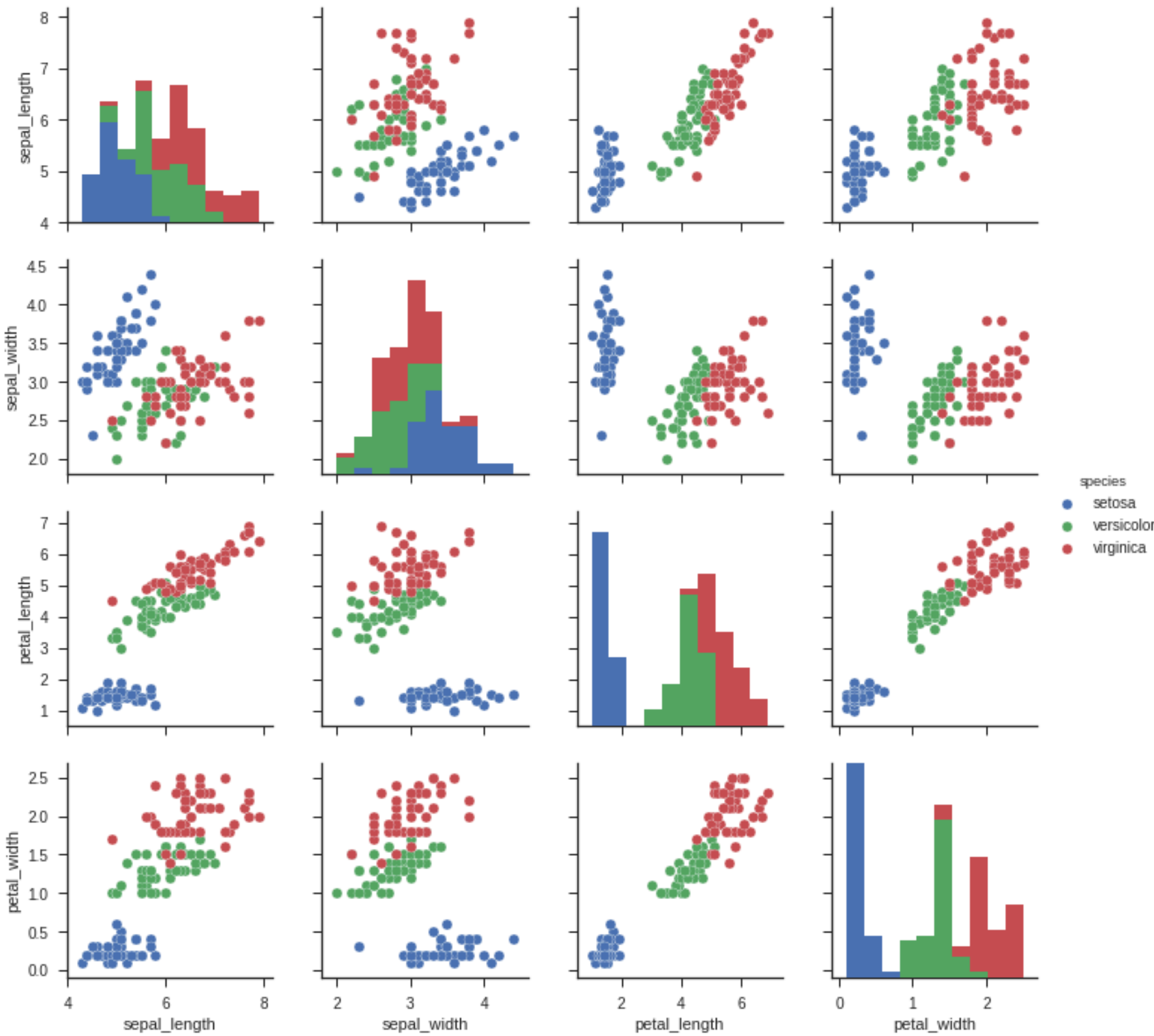
Google Colab Python Hello World
print('Hello World')

Data Visualization in Google Colab



Source: https://seaborn.pydata.org/generated/seaborn.pairplot.html

```
import seaborn as sns
sns.set(style="ticks", color_codes=True)
iris = sns.load_dataset("iris")
g = sns.pairplot(iris, hue="species")
```



Source: https://seaborn.pydata.org/generated/seaborn.pairplot.html

https://colab.research.google.com/drive/1KRqtEUd2Hg4dM2au9bfVQKrxWnWN3O9-

```
import numpy as np
import pandas as pd
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns
from pandas.plotting import scatter_matrix

# Load dataset
url = "https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data"
names = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'class']
df = pd.read_csv(url, names=names)

print(df.head(10))
print(df.tail(10))
print(df.describe())
print(df.info())
print(df.shape)
print(df.groupby('class').size())

plt.rcParams["figure.figsize"] = (10,8)
df.plot(kind='box', subplots=True, layout=(2,2), sharex=False, sharey=False)
plt.show()

df.hist()
plt.show()

scatter_matrix(df)
plt.show()

sns.pairplot(df, hue="class", size=2)
```

Source: https://machinelearningmastery.com/machine-learning-in-python-step-by-step/

```
import numpy as np
import pandas as pd
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns
from pandas.plotting import scatter_matrix
```

```
# Import Libraries
import numpy as np
import pandas as pd
%matplotlib inline
import matplotlib.pyplot as plt
import seaborn as sns
from pandas.plotting import scatter_matrix
print('imported')
```

```
imported
```

```
url = "https://archive.ics.uci.edu/ml/machine-learning-databases/iris/iris.data"
names = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'class']
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names = ['sepal-length', 'sepal-width', 'petal-length', 'petal-width', 'class']
df = pd.read_csv(url, names=names)
print(df.head(10))
```

```
   sepal-length  sepal-width  petal-length  petal-width        class
0           5.1          3.5           1.4          0.2  Iris-setosa
1           4.9          3.0           1.4          0.2  Iris-setosa
2           4.7          3.2           1.3          0.2  Iris-setosa
3           4.6          3.1           1.5          0.2  Iris-setosa
4           5.0          3.6           1.4          0.2  Iris-setosa
5           5.4          3.9           1.7          0.4  Iris-setosa
6           4.6          3.4           1.4          0.3  Iris-setosa
7           5.0          3.4           1.5          0.2  Iris-setosa
8           4.4          2.9           1.4          0.2  Iris-setosa
9           4.9          3.1           1.5          0.1  Iris-setosa
```

df.tail(10)

```python
print(df.tail(10))
```

	sepal-length	sepal-width	petal-length	petal-width	class
140	6.7	3.1	5.6	2.4	Iris-virginica
141	6.9	3.1	5.1	2.3	Iris-virginica
142	5.8	2.7	5.1	1.9	Iris-virginica
143	6.8	3.2	5.9	2.3	Iris-virginica
144	6.7	3.3	5.7	2.5	Iris-virginica
145	6.7	3.0	5.2	2.3	Iris-virginica
146	6.3	2.5	5.0	1.9	Iris-virginica
147	6.5	3.0	5.2	2.0	Iris-virginica
148	6.2	3.4	5.4	2.3	Iris-virginica
149	5.9	3.0	5.1	1.8	Iris-virginica

df.describe()

```
print(df.describe())
```

	sepal-length	sepal-width	petal-length	petal-width
count	150.000000	150.000000	150.000000	150.000000
mean	5.843333	3.054000	3.758667	1.198667
std	0.828066	0.433594	1.764420	0.763161
min	4.300000	2.000000	1.000000	0.100000
25%	5.100000	2.800000	1.600000	0.300000
50%	5.800000	3.000000	4.350000	1.300000
75%	6.400000	3.300000	5.100000	1.800000
max	7.900000	4.400000	6.900000	2.500000

```
print(df.info())
print(df.shape)
```

```
print(df.info())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 5 columns):
sepal-length    150 non-null float64
sepal-width     150 non-null float64
petal-length    150 non-null float64
petal-width     150 non-null float64
class           150 non-null object
dtypes: float64(4), object(1)
memory usage: 5.9+ KB
None
```

```
print(df.shape)
```

```
(150, 5)
```

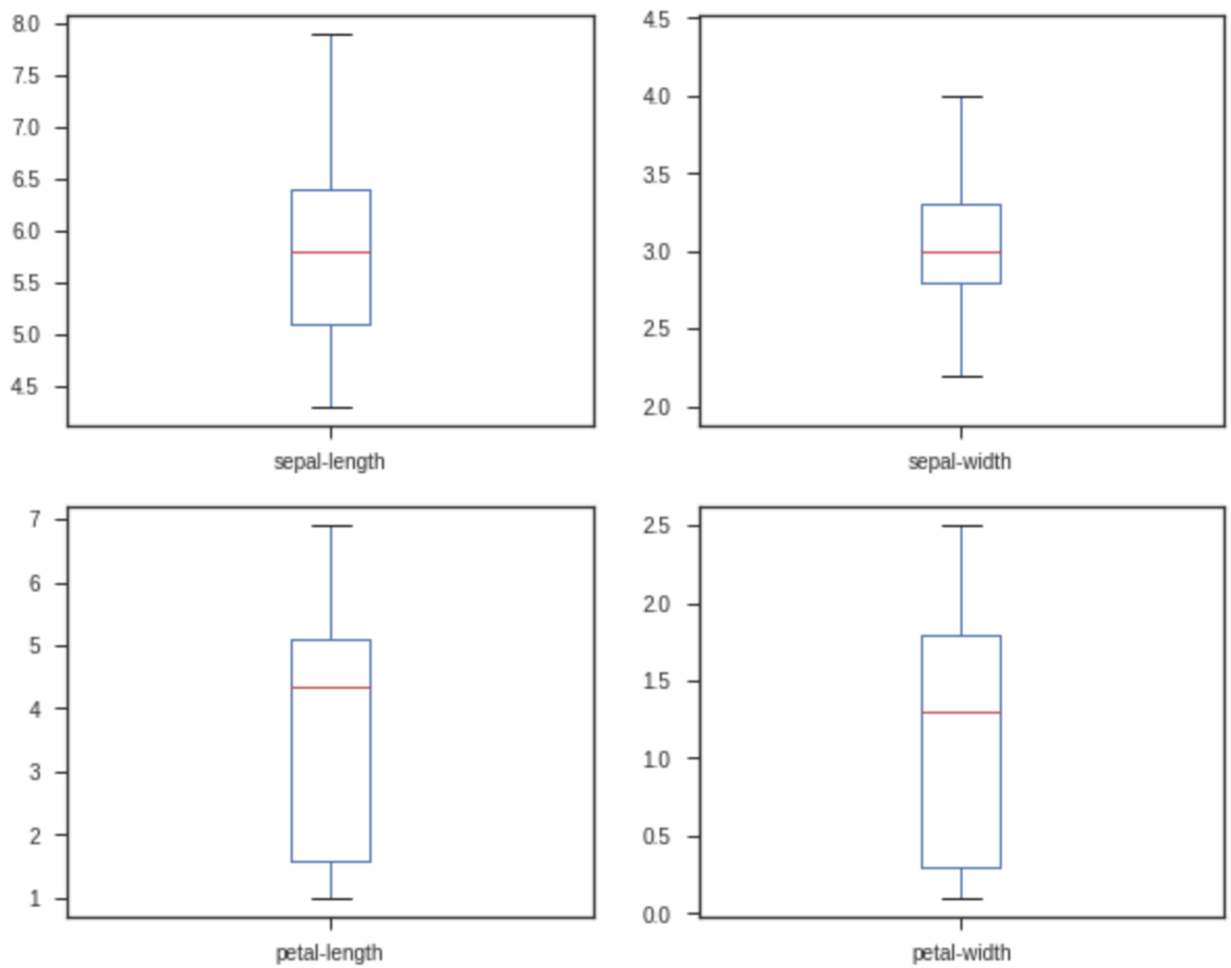
df.groupby('class').size()

```
print(df.groupby('class').size())
```

```
class
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
dtype: int64
```

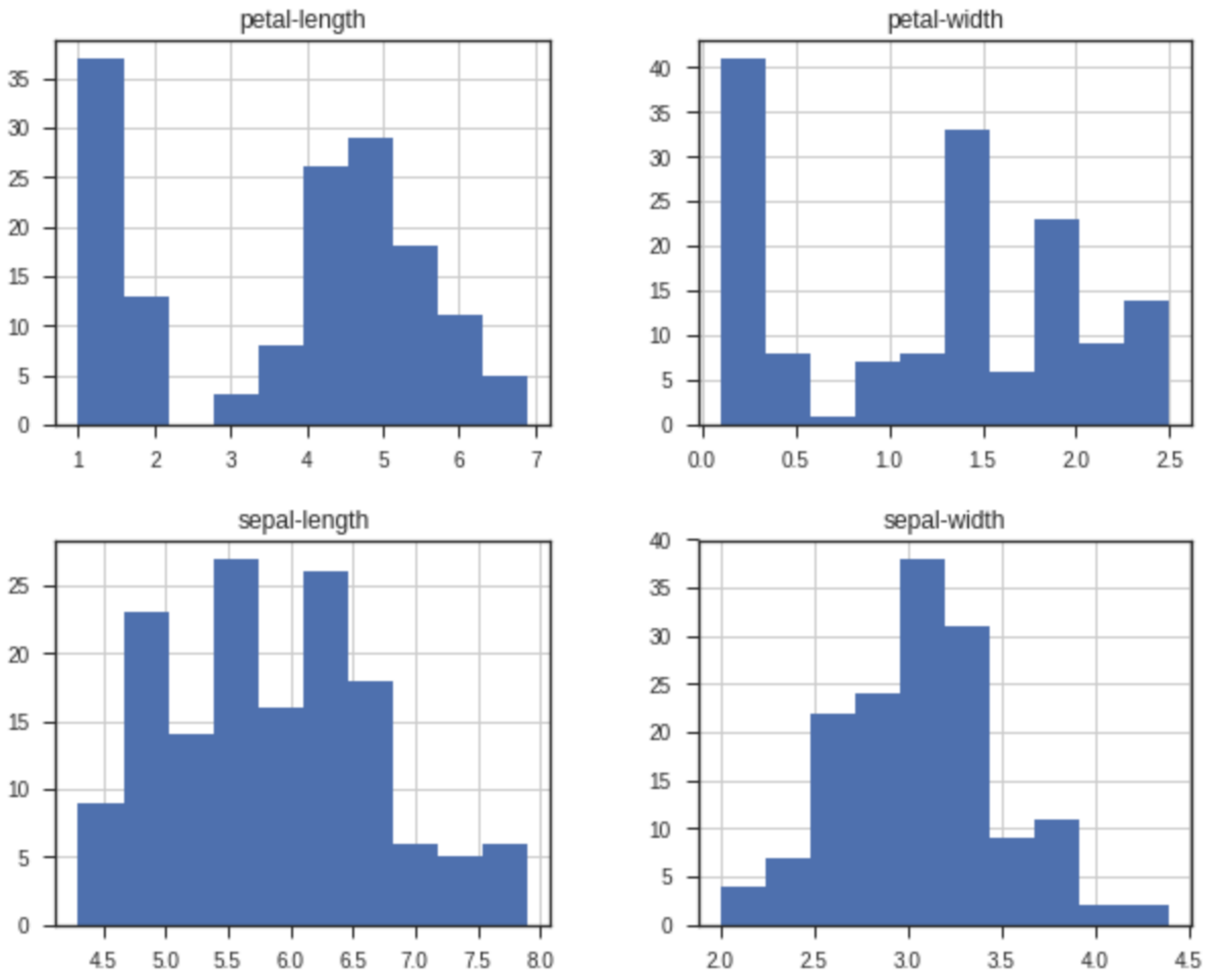
```
plt.rcParams["figure.figsize"] = (10,8)
df.plot(kind='box', subplots=True, layout=(2,2), sharex=False, sharey=False)
plt.show()
```


```
plt.rcParams["figure.figsize"] = (10,8)
df.plot(kind='box', subplots=True, layout=(2,2), sharex=False, sharey=False)
plt.show()
```

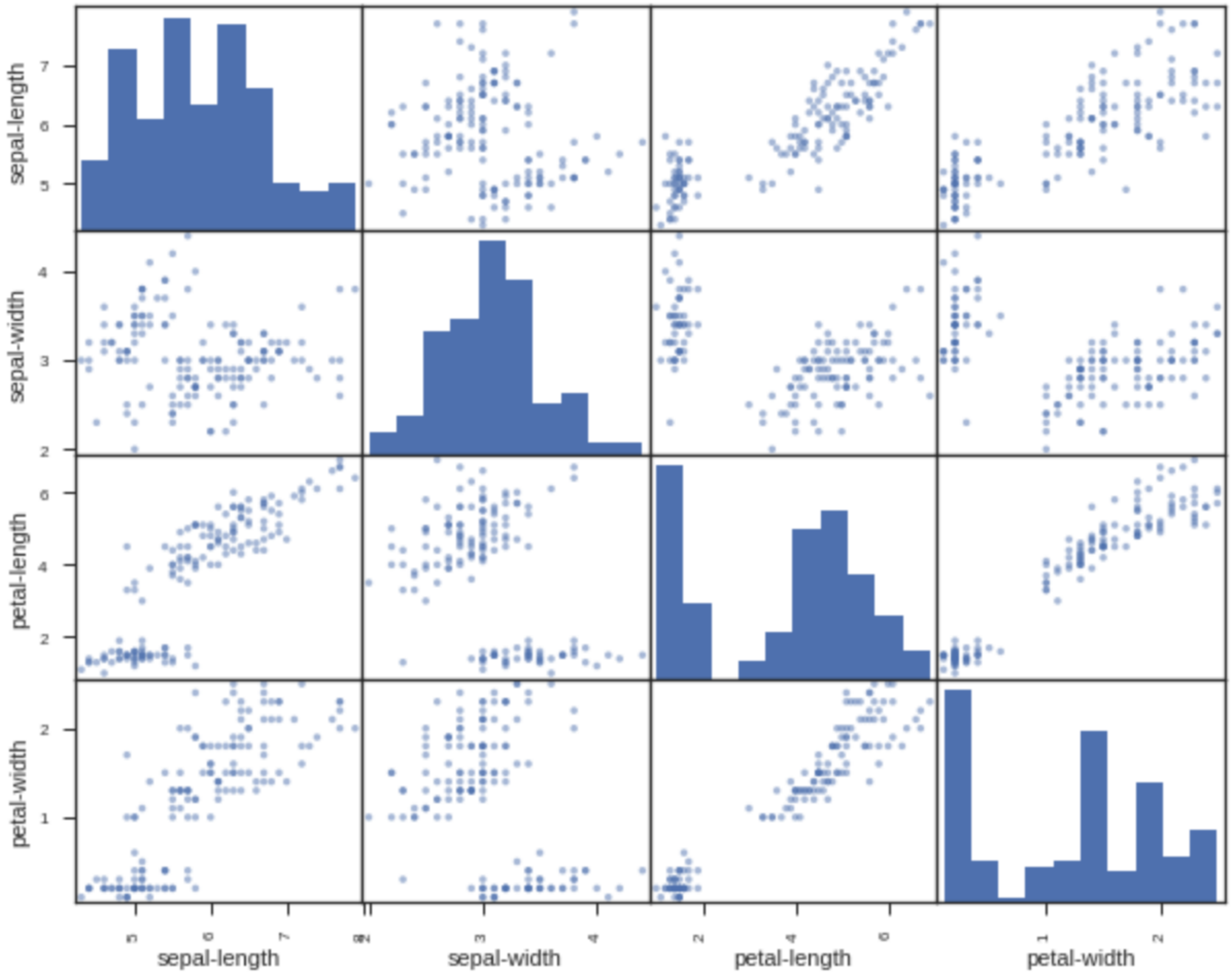
```
df.hist()
plt.show()
```

```
df.hist()
plt.show()
```



```
scatter_matrix(df)
plt.show()
```

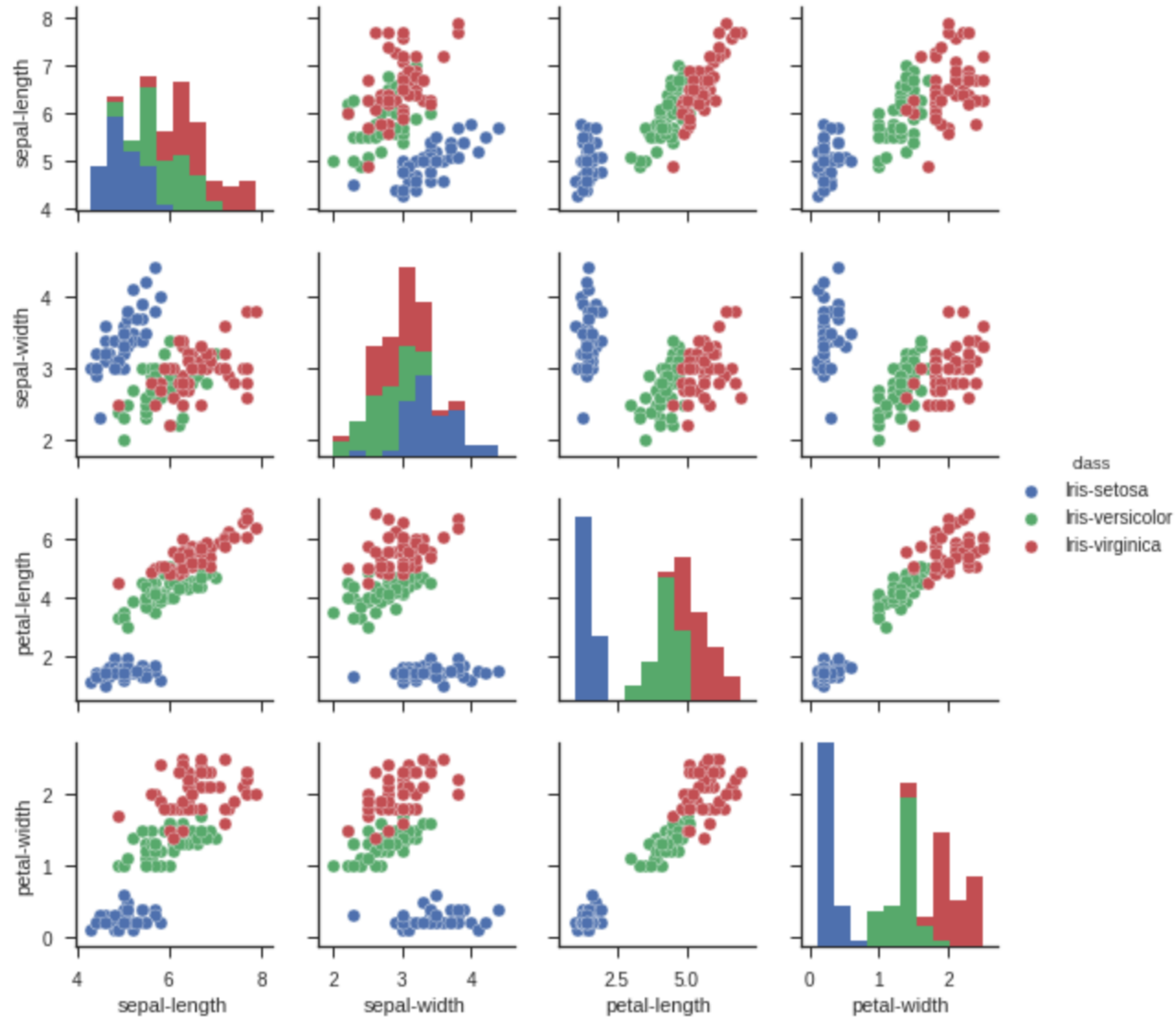
```
scatter_matrix(df)
plt.show()
```



sns.pairplot(df, hue="class", size=2)

```
sns.pairplot(df, hue="class", size=2)
```

<seaborn.axisgrid.PairGrid at 0x7f1d21267390>



Summary

- Descriptive Analytics I
- Nature of Data
- Statistical Modeling
- Visualization

References

- Ramesh Sharda, Dursun Delen, and Efraim Turban (2017), Business Intelligence, Analytics, and Data Science: A Managerial Perspective, 4th Edition, Pearson.
- EMC Education Services (2015), Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, Wiley