Machine Learning

Matplotlib

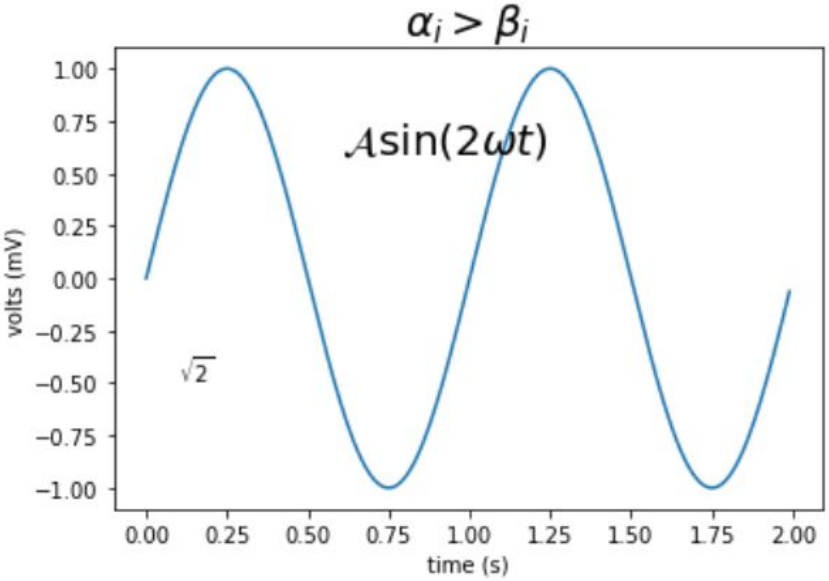
Mostafa S. Ibrahim
Teaching, Training and Coaching for more than a decade!

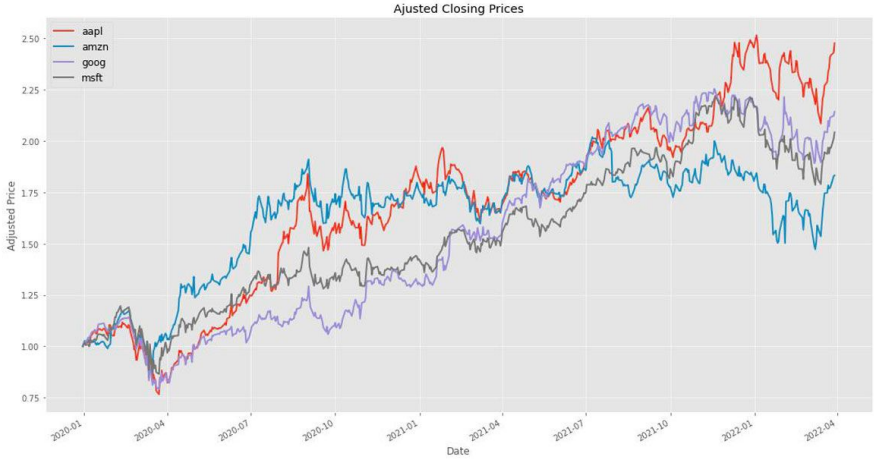
Artificial Intelligence & Computer Vision Researcher
PhD from Simon Fraser University - Canada
Bachelor / MSc from Cairo University - Egypt
Ex-(Software Engineer / ICPC World Finalist)

Matplotlib

- Matplotlib is a graph plotting library in python for **visualization**
- There is a wide diversity of **plots** that you should learn to know when to represent what
- *All pictures in this slides are somewhere from the internet not mine*

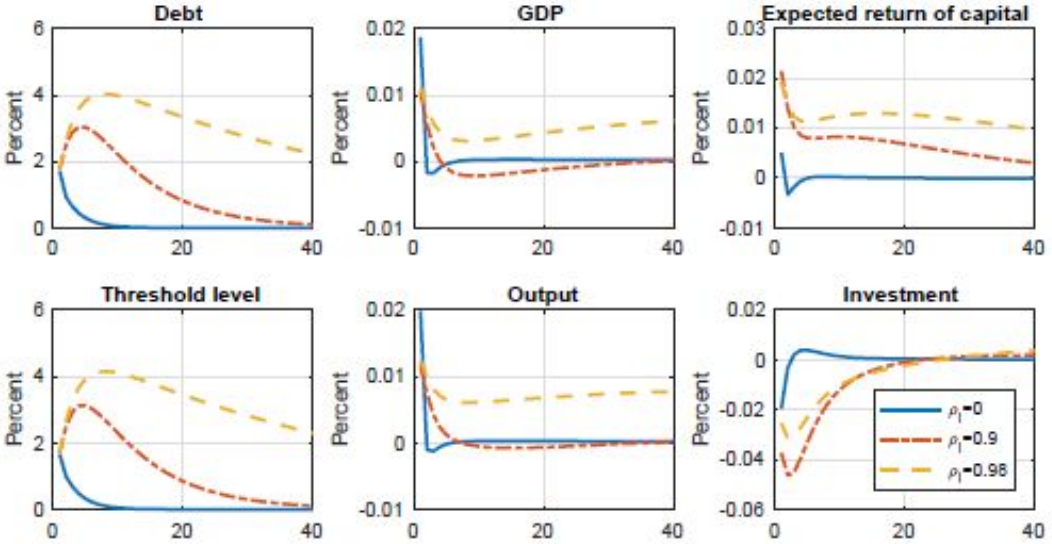
Draw curves, add text and equations





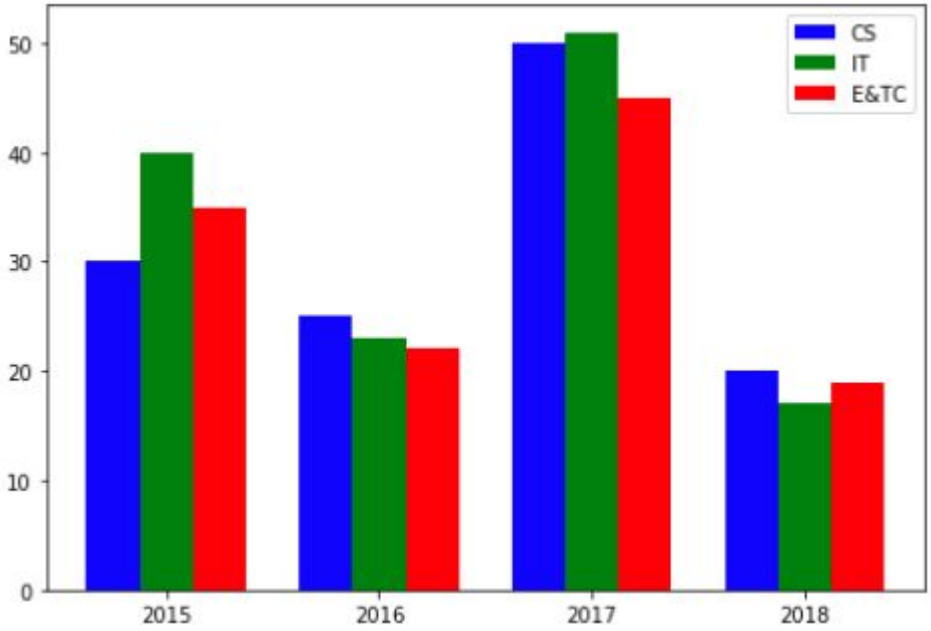
Matlab subplot

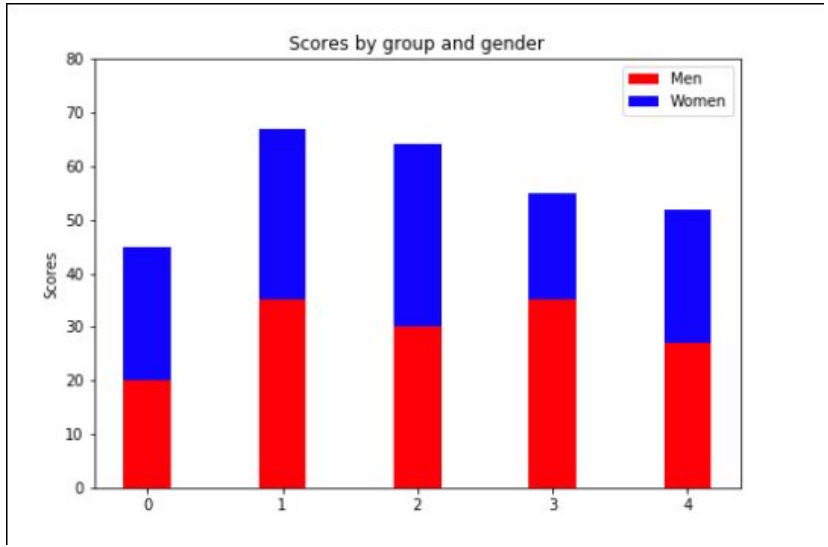
Figure 9: Impulse Responses under Credit Shocks with Different Persistence



Bar Plot

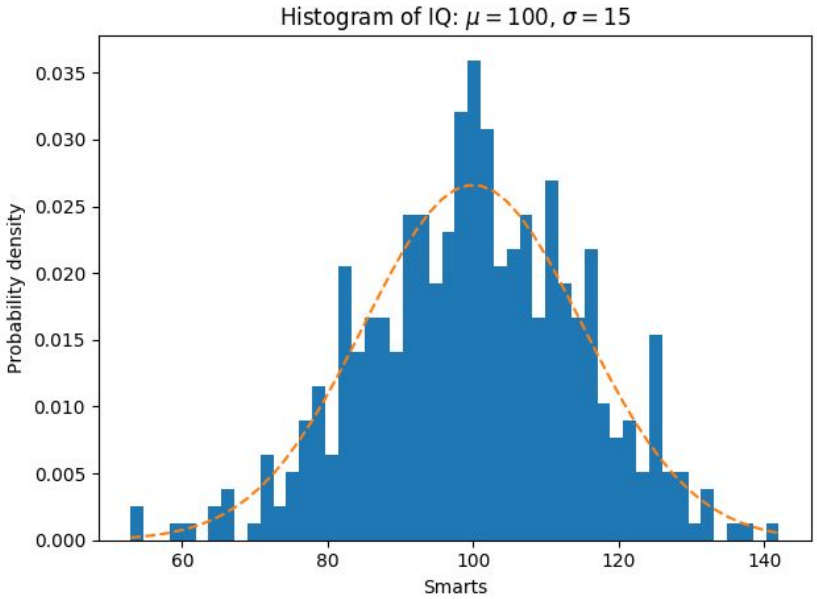
- A graph that presents categorical data with rectangular bars with **heights** or lengths **proportional** to the values that they represent.
  - The bars can be plotted vertically or horizontally.
- A bar graph shows **comparisons** among discrete **categories**.
  - One axis of the chart shows the specific categories being compared, and the other axis represents a measured value


CS
IT
E&TC
50
40
30
20
10
0
2015
2016
2017
2018


Scores by group and gender
Men
Women
Scores
80
70
60
50
40
30
20
10
0
0
1
2
3
4

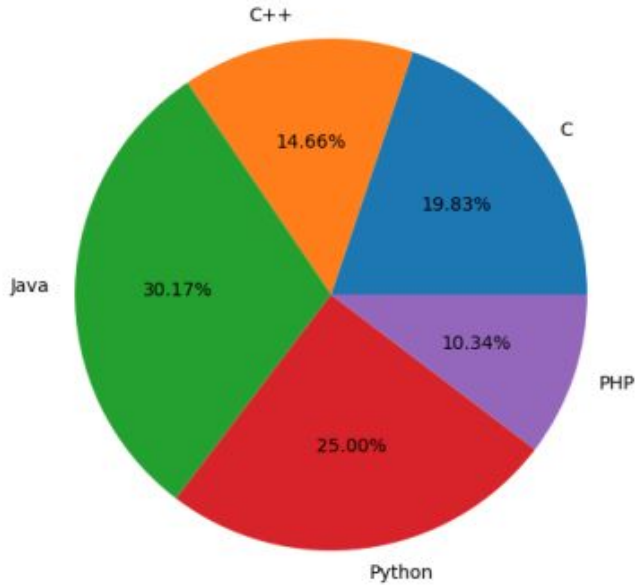
Histogram

- A bar graph that represents the **distribution** of numerical data.
  - It is an estimate of the probability distribution of a continuous variable. It is a kind of bar graph.



Pie Chart

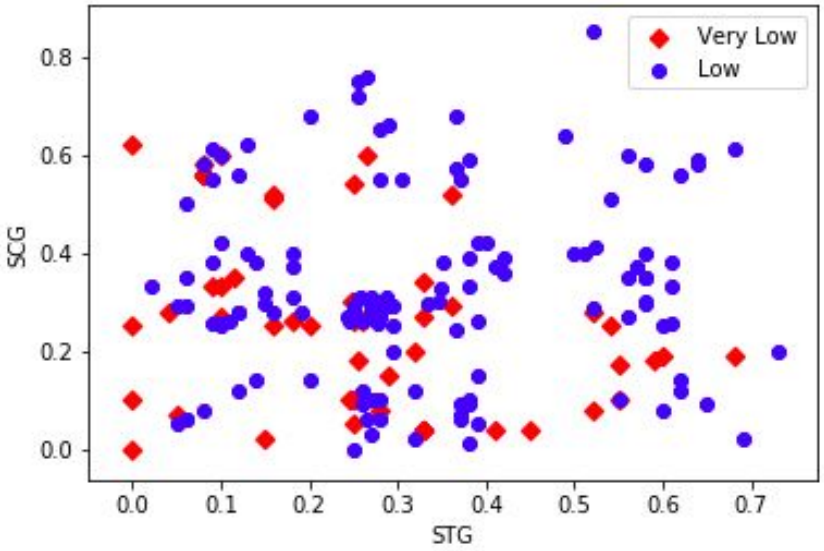
- A Pie Chart can only display one **series** of data.
- Pie charts show the size of items (called **wedge**) in one data series, **proportional** to the sum of the items.
- The data points in a pie chart are shown as a **percentage** of the whole pie.

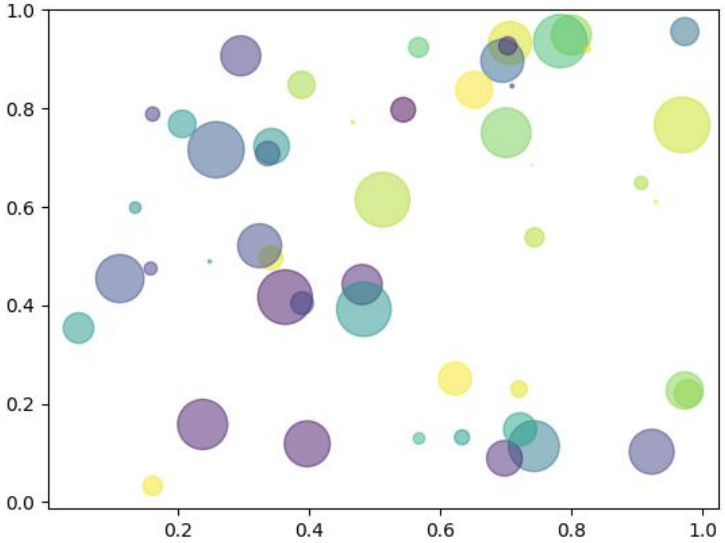


Scatter Plot

- Scatter plots are used to **plot data points** on horizontal and vertical axis in the attempt to show **how much one variable is affected by another**.
- Each row in the data table is represented by a marker the **position** depends on its values in the columns set on the X and Y axes.
- A third variable can be set to correspond to the **color or size** of the markers, thus adding yet another dimension to the plot.

Points with different color, shape and size draw at positions

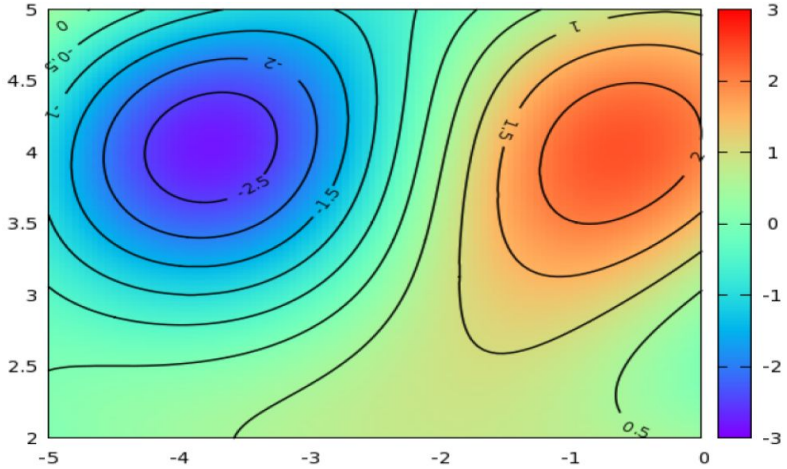


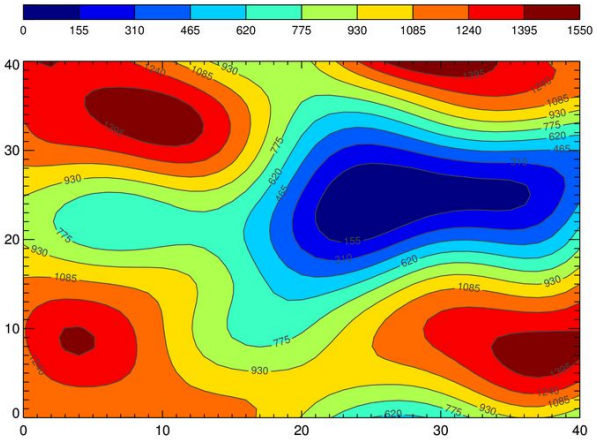


Contour Plot

- Contour plots) are a way to show a 3D surface on a 2D plane.
- It graphs two predictor variables X Y on the y-axis and a response variable Z as contours.
- These contours are sometimes called the **z-slices**. A contour plot is appropriate if you want to see how value Z changes as a function of two inputs X and Y, such that Z = f(X,Y).
- A contour line or isoline of a function of two variables is a curve along which the function has a **constant value**.

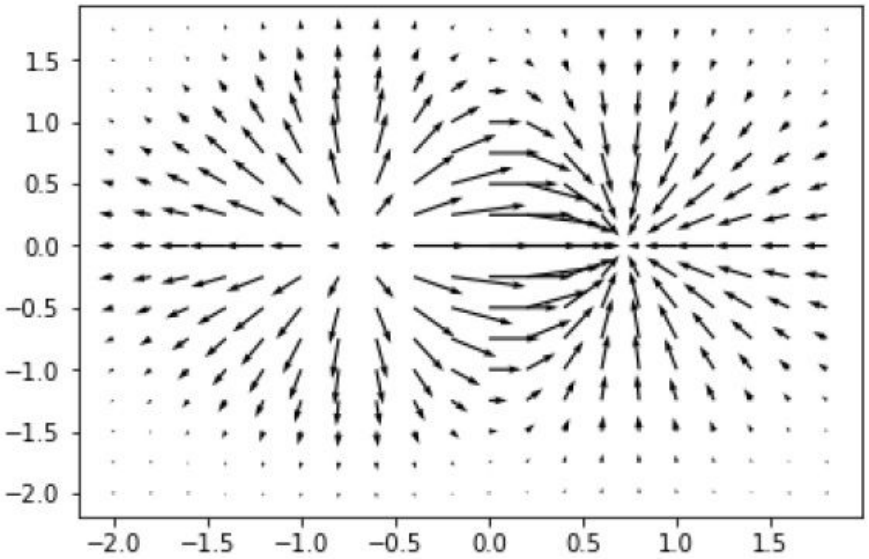

Filled Contours Plot
y (cm)
3
2
1
0
−1
−2
−3
−3
−2
−1
0
1
2
3
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
0.0

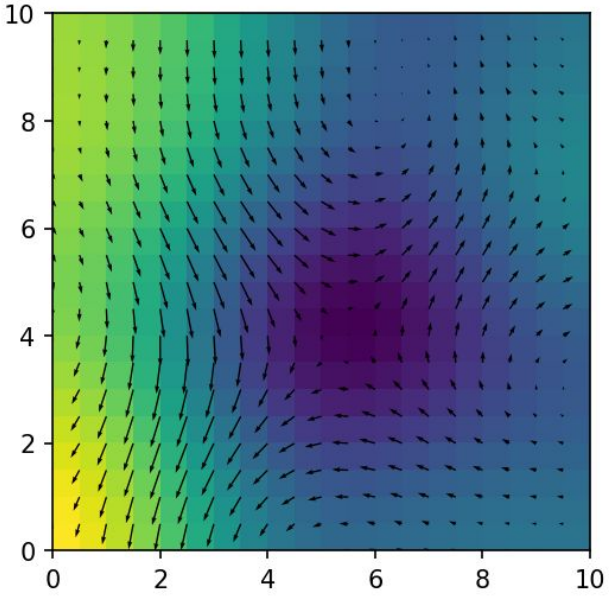

5
4.5
4
3.5
3
2.5
2
-5
-4
-3
-2
-1
0
3
2
1
0
-1
-2
-3


0
155
310
465
620
775
930
1085
1240
1395
1550
40
30
20
10
0
0
10
20
30
40

Quiver Plot

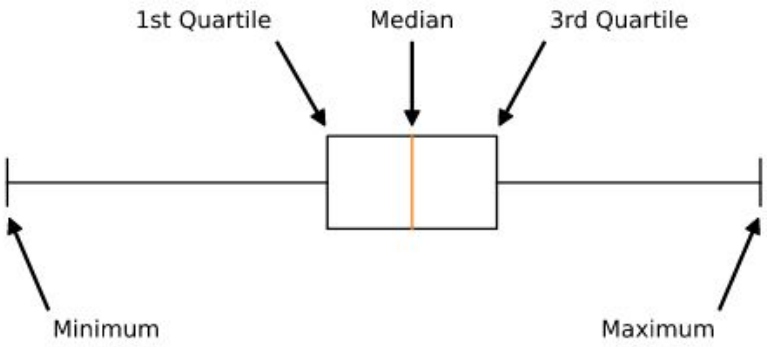
- A quiver plot displays the **velocity** vectors as arrows with components (u,v) at the points (x,y), used in computer vision (video flow)

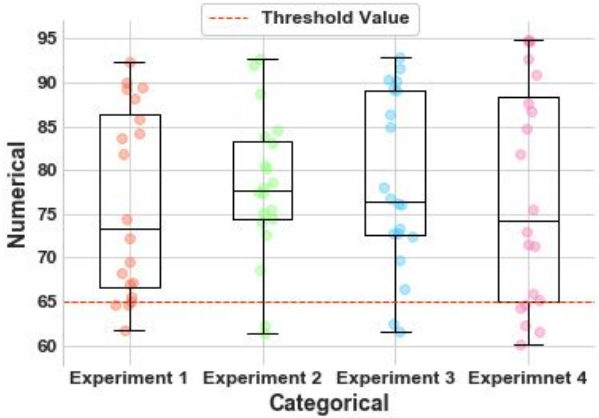




Box Plot

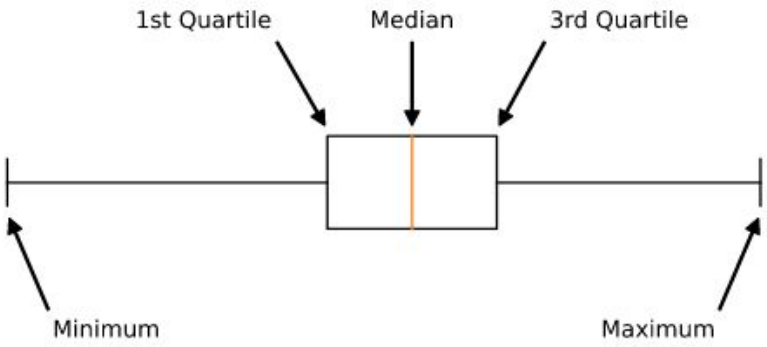
- A box plot (whisker plot) is a **summary** of a set of data containing the minimum, first quartile, median, third quartile, and maximum.
- In a box plot, we draw a box from the first quartile to the third quartile.
- A vertical line goes through the box at the median.

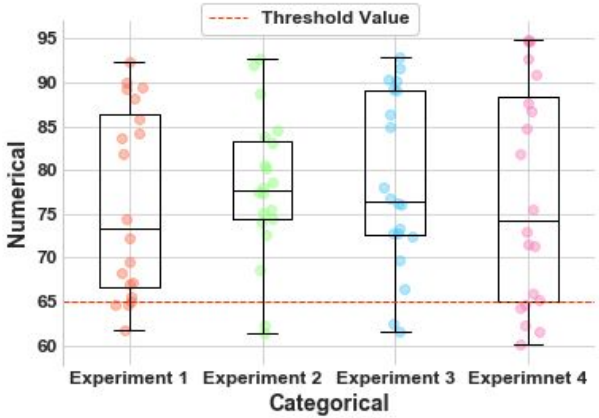




Box Plot

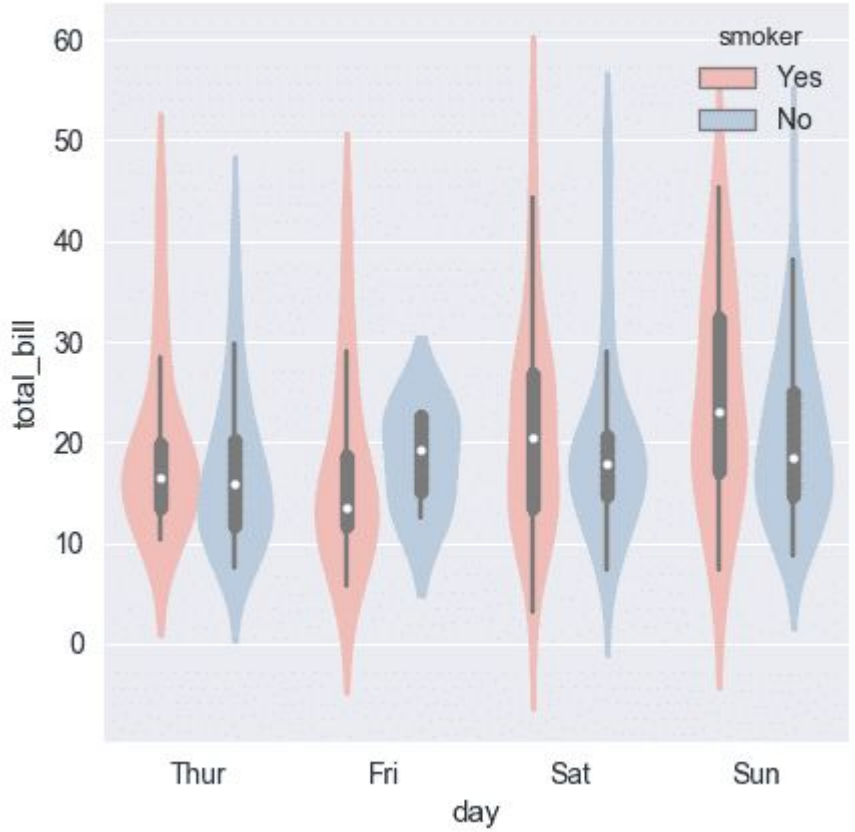
- The whiskers are the two lines outside the box, that go from the minimum to the lower quartile (the start of the box) and then from the upper quartile (the end of the box) to the maximum
- Your todo: Quartiles, Quintiles, Deciles, Percentiles



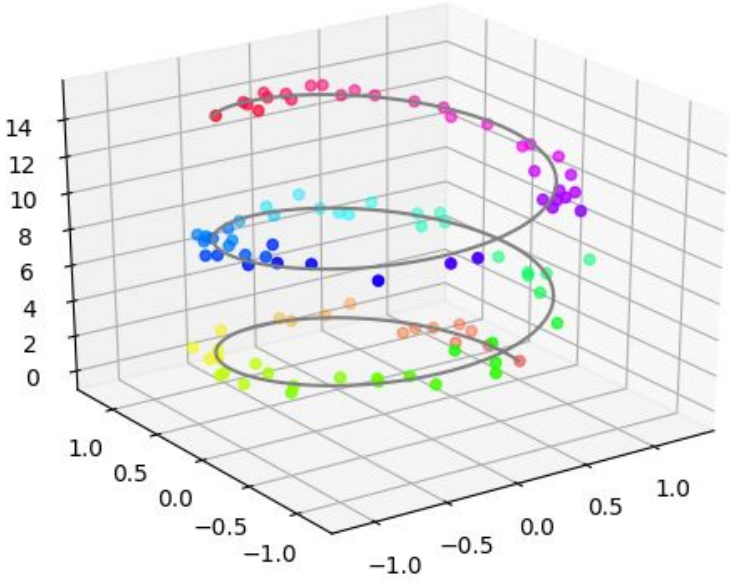


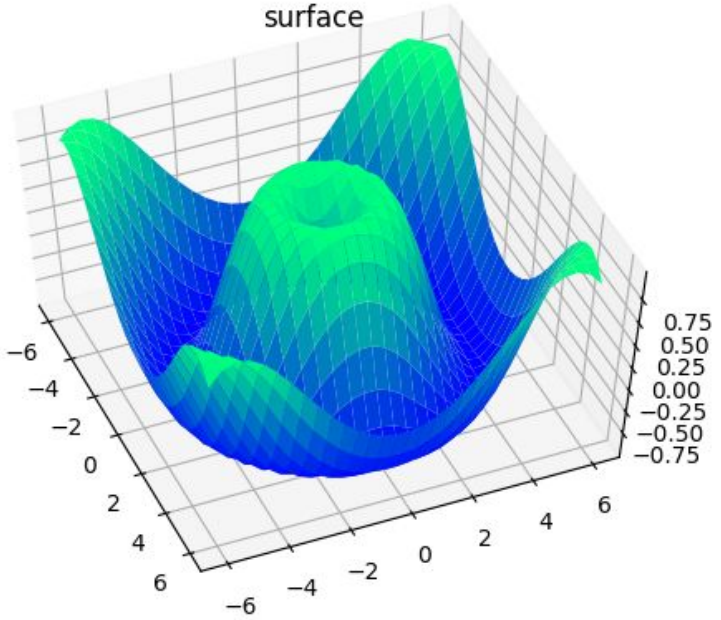
Violin Plot

- Enhanced box plot with the **probability** density of the data at different values

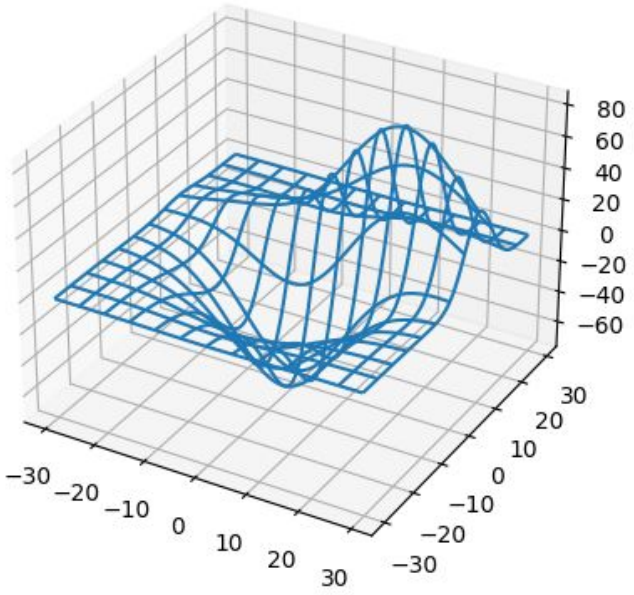


Three-dimensional Plotting





Wire plot

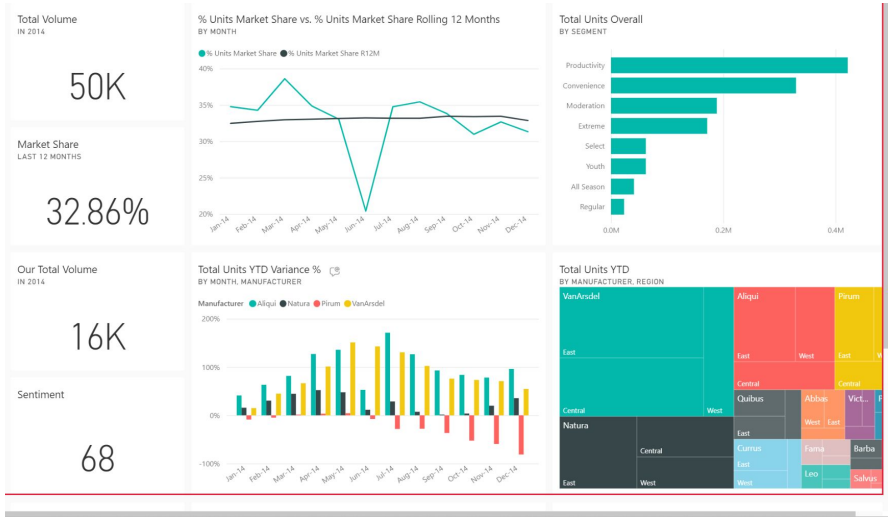


Learning Strategy

- Observe that we knew what is there to plot but we didn’t learn how
  - What vs how
- Don’t be the person who no nothing about the libraries
- Don’t be the person who tries to know everything
  - You will end up knowing very little and missing the big picture
- Be the person who know what is there and hence can find its details when you need it. This is an important skill
  - In general, not about this tool

Available Tools

- So far, we were showing how to use code to visualize information
- Business analysis and data science can also use strong dashboards
  - A **dashboard** is a way of displaying various types of visual data in one place
- Popular tools: Tableau, Power bi and Excel



Relevant Materials

- Text: link link link

"Acquire knowledge and impart it to the people."

"Seek knowledge from the Cradle to the Grave."