

Statistical_Data_Visualization

March 19, 2025

```
[ ]: import plotly.express as px
import pandas as pd
import numpy as np
```

```
[ ]: # Import Cancer data from the Sklearn library
cancer_df = pd.read_csv("/content/cancer.csv")
```

```
[ ]: # Check out the head of the dataframe
cancer_df.head()
```

```
[ ]:
mean radius    mean texture    mean perimeter    mean area    mean smoothness \
0      17.99      10.38      122.80      1001.0      0.11840
1      20.57      17.77      132.90      1326.0      0.08474
2      19.69      21.25      130.00      1203.0      0.10960
3      11.42      20.38       77.58       386.1      0.14250
4      20.29      14.34      135.10      1297.0      0.10030

mean compactness    mean concavity    mean concave points    mean symmetry \
0      0.27760      0.3001      0.14710      0.2419
1      0.07864      0.0869      0.07017      0.1812
2      0.15990      0.1974      0.12790      0.2069
3      0.28390      0.2414      0.10520      0.2597
4      0.13280      0.1980      0.10430      0.1809

mean fractal dimension    ...    worst texture    worst perimeter    worst area \
0      0.07871    ...      17.33      184.60      2019.0
1      0.05667    ...      23.41      158.80      1956.0
2      0.05999    ...      25.53      152.50      1709.0
3      0.09744    ...      26.50       98.87       567.7
4      0.05883    ...      16.67      152.20      1575.0

worst smoothness    worst compactness    worst concavity    worst concave points \
0      0.1622      0.6656      0.7119      0.2654
1      0.1238      0.1866      0.2416      0.1860
2      0.1444      0.4245      0.4504      0.2430
3      0.2098      0.8663      0.6869      0.2575
4      0.1374      0.2050      0.4000      0.1625
```

	worst symmetry	worst fractal dimension	target
0	0.4601	0.11890	0
1	0.2750	0.08902	0
2	0.3613	0.08758	0
3	0.6638	0.17300	0
4	0.2364	0.07678	0

[5 rows x 31 columns]

```
[ ]: # Check out the tail of the dataframe
cancer_df.tail()
```

```
[ ]:      mean radius  mean texture  mean perimeter  mean area  mean smoothness \
564          21.56         22.39         142.00      1479.0         0.11100
565          20.13         28.25         131.20      1261.0         0.09780
566          16.60         28.08         108.30       858.1         0.08455
567          20.60         29.33         140.10      1265.0         0.11780
568           7.76         24.54          47.92       181.0         0.05263
```

	mean compactness	mean concavity	mean concave points	mean symmetry	\
564	0.11590	0.24390	0.13890	0.1726	
565	0.10340	0.14400	0.09791	0.1752	
566	0.10230	0.09251	0.05302	0.1590	
567	0.27700	0.35140	0.15200	0.2397	
568	0.04362	0.00000	0.00000	0.1587	

	mean fractal dimension	...	worst texture	worst perimeter	worst area	\
564	0.05623	...	26.40	166.10	2027.0	
565	0.05533	...	38.25	155.00	1731.0	
566	0.05648	...	34.12	126.70	1124.0	
567	0.07016	...	39.42	184.60	1821.0	
568	0.05884	...	30.37	59.16	268.6	

	worst smoothness	worst compactness	worst concavity	\
564	0.14100	0.21130	0.4107	
565	0.11660	0.19220	0.3215	
566	0.11390	0.30940	0.3403	
567	0.16500	0.86810	0.9387	
568	0.08996	0.06444	0.0000	

	worst concave points	worst symmetry	worst fractal dimension	target
564	0.2216	0.2060	0.07115	0
565	0.1628	0.2572	0.06637	0
566	0.1418	0.2218	0.07820	0
567	0.2650	0.4087	0.12400	0
568	0.0000	0.2871	0.07039	1

[5 rows x 31 columns]

```
[ ]: #Box plot
fig=px.box(cancer_df, x="target", y="mean area")
fig.show()
```

```
[ ]: #Plot the boxplot for Mean Perimeter, use points = "all"
fig = px.box(cancer_df, x = "target", y = "mean perimeter", points = "all")
fig.show()
```

```
[ ]: #A histogram is representation of the distribution of numerical data, where
    ↪the data are binned
fig = px.histogram(cancer_df, x = "mean radius", nbins = 60)
fig.show()
```

```
[ ]: #Plot the histogram for the mean perimeter for the entire dataset

fig = px.histogram(cancer_df, x = "mean perimeter", nbins = 60)
fig.show()
```

```
[ ]: #Plot the histogram for the mean perimeter for each of the class independantly
fig = px.histogram(cancer_df, x = "mean perimeter", color = 'target', nbins =
    ↪60)
fig.show()
```

```
[ ]: fig = px.histogram(cancer_df, x = "mean radius", color = 'target', nbins = 60)
fig.show()
```

```
[ ]: # With the marginal keyword, a subplot is drawn alongside the histogram,
    ↪visualizing the distribution.
fig = px.histogram(cancer_df, x = "mean radius", color = 'target', marginal =
    ↪'rug', nbins = 60)
fig.show()
```

```
[ ]: #Plot the histogram for the mean perimeter using 40 bins and explore a new
    ↪marginal plot
fig = px.histogram(cancer_df, x = "mean perimeter", color = 'target',
    ↪marginal="violin", nbins = 40, hover_data = cancer_df.columns)
fig.show()
```

```
[ ]: # A 2D histogram, also known as a density heatmap, is the 2-dimensional
    ↪generalization of a histogram which resembles a heatmap but is computed by
    ↪grouping a set of points specified by their x and y coordinates into bins,
    # and applying an aggregation function such as count or sum (if z is provided)
    ↪to compute the color of the tile representing the bin.
```

```
# This kind of visualization (and the related 2D histogram contour, or density
↳contour) is often used to manage over-plotting, or situations where showing
↳large data sets as scatter plots would result in points overlapping each
↳other and hiding patterns.
```

```
fig=px.density_heatmap(cancer_df, x="mean radius", y="mean texture")
fig.show()
```

```
[ ]: # read univeristy_admission.csv dataset
university_df=pd.read_csv("/content/university_admission.csv")
```

```
[ ]: # plot density_heatmap
fig = px.density_heatmap(university_df, x = "TOEFL Score", y = "Chance of
↳Admit")
fig.show()
```

```
[ ]: #Plot density map between GRE Score vs. Chance of admission
fig = px.density_heatmap(university_df, x = "GRE Score", y = "Chance of Admit")
fig.show()
```

```
[ ]: #Plot density map between GPA vs. Chance of admission
fig = px.density_heatmap(university_df, x = "CGPA", y = "Chance of Admit")
fig.show()
```

```
[ ]: # A scatterplot matrix is a matrix associated to n numerical arrays (data
↳variables), $X_1,X_2,...,X_n$, of the same length.
fig = px.scatter_matrix(university_df, width=1200, height=1200)
fig.show()
```

```
[ ]: #Plot the scatter matrix for cancer data, including only the following features:
↳ mean radius, mean area, mean perimeter, and mean texture
fig = px.scatter_matrix(cancer_df, dimensions = ['mean radius', 'mean area',
↳'mean perimeter', 'mean texture'])
fig.show()
```

```
[ ]: #Plot the scatter matrix for cancer data while color coding the two classes
↳ (malignant vs. benign), including only the following features: mean radius,
↳ mean area, mean perimeter, and mean texture
fig = px.scatter_matrix(cancer_df, dimensions = ['mean radius', 'mean area',
↳'mean perimeter', 'mean texture'], color="target")
fig.show()
```

```
[ ]: # A violin plot is a statistical representation of numerical data.
# It is similar to a box plot, with the addition of a rotated kernel density
↳plot on each side.
fig=px.violin(cancer_df, y='mean radius')
fig.show()
```

```
[ ]: # Show data points
fig = px.violin(cancer_df, y = "mean radius", box = True, points = "all",
    ↪hover_data = cancer_df.columns)
fig.show()
```

```
[ ]: # Show data points and box plot
fig = px.violin(cancer_df, y = "mean radius", box = True, points = "outliers",
    ↪hover_data = cancer_df.columns)
fig.show()
```

```
[ ]: # You can also plot multiple violin plots as follows:
fig = px.violin(cancer_df, y = "mean radius", box = True, points = "all",
    ↪hover_data = cancer_df.columns, color = 'target')
fig.show()
```

```
[ ]: #Plot violin plot for GRE Score in university admission dataset
fig = px.violin(university_df, y = "GRE Score", box = True, points = "all",
    ↪hover_data = university_df.columns)
fig.show()
```

```
[ ]: #Using the violin plot, what is the median value of the GRE Score?
university_df.median()
```

```
[ ]: Serial No.      250.50
GRE Score          317.00
TOEFL Score        107.00
University Rating   3.00
SOP                3.50
LOR                3.50
CGPA               8.56
Research           1.00
Chance of Admit     0.72
dtype: float64
```

```
[ ]: #Calculate the mean value for GRE score and compare it to the median
university_df.describe()
```

```
[ ]:      Serial No.  GRE Score  TOEFL Score  University Rating  SOP \
count  500.000000  500.000000  500.000000      500.000000  500.000000
mean    250.500000  316.472000  107.192000        3.114000   3.374000
std     144.481833   11.295148    6.081868        1.143512   0.991004
min       1.000000  290.000000   92.000000        1.000000   1.000000
25%     125.750000  308.000000  103.000000        2.000000   2.500000
50%     250.500000  317.000000  107.000000        3.000000   3.500000
75%     375.250000  325.000000  112.000000        4.000000   4.000000
max      500.000000  340.000000  120.000000        5.000000   5.000000
```

	LOR	CGPA	Research	Chance of Admit
count	500.00000	500.000000	500.000000	500.00000
mean	3.48400	8.576440	0.560000	0.72174
std	0.92545	0.604813	0.496884	0.14114
min	1.00000	6.800000	0.000000	0.34000
25%	3.00000	8.127500	0.000000	0.63000
50%	3.50000	8.560000	1.000000	0.72000
75%	4.00000	9.040000	1.000000	0.82000
max	5.00000	9.920000	1.000000	0.97000

```
[ ]: # A 2D histogram contour plot, also known as a density contour plot, is a
      ↪ 2-dimensional generalization of a histogram which resembles a contour plot
      ↪ but is computed by grouping a set of points specified by their x and y
      ↪ coordinates into bins,
      # and applying an aggregation function such as count or sum (if z is provided)
      ↪ to compute the value to be used to compute contours.
      # This kind of visualization (and the related 2D histogram, or density heatmap)
      ↪ is often used to manage over-plotting, or situations where showing large
      ↪ data sets as scatter plots would result in points overlapping each other and
      ↪ hiding patterns.
fig = px.density_contour(cancer_df, x = "mean radius", y = "mean texture")
fig.show()
```

```
[ ]: # Marginal plots can be added to visualize the 1-dimensional distributions of
      ↪ the two variables.
      # Here we use a marginal histogram. Other allowable values are violin, box and
      ↪ rug.
fig = px.density_contour(cancer_df, x = "mean radius", y = "mean texture",
      ↪ marginal_x='histogram', marginal_y='histogram')
fig.show()
```

```
[ ]: # Plotly Express density contours can be continuously-colored and labeled:
fig = px.density_contour(cancer_df, x = "mean radius", y = "mean texture",
      ↪ color = 'target')
fig.show()
```

```
[ ]: # Plot the density contour plot for the university admission showing GRE Score
      ↪ vs. TOEFL Score
fig = px.density_contour(university_df, x = "GRE Score", y = "TOEFL Score")
fig.show()
```

```
[ ]: # Repeat the plot to show continuously colored data
fig = px.density_contour(university_df, x = "GRE Score", y = "TOEFL Score")
fig.update_traces(contours_coloring = "fill", contours_showlabels = True)
```

```
[ ]: !sudo apt-get update
!sudo apt-get install texlive-xetex pandoc
```

```
0% [Working] Hit:1 http://archive.ubuntu.com/ubuntu jammy
InRelease
0% [Waiting for headers] [Waiting for headers] [Connected to cloud.r-project.or
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Get:3 http://security.ubuntu.com/ubuntu jammy-security InRelease [129 kB]
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Get:18 https://r2u.stat.illinois.edu/ubuntu jammy/main all Packages [8,754 kB]
Fetched 21.7 MB in 2s (8,830 kB/s)
Reading package lists... Done
W: Skipping acquire of configured file 'main/source/Sources' as repository
'https://r2u.stat.illinois.edu/ubuntu jammy InRelease' does not seem to provide
it (sources.list entry misspelt?)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
```

The following additional packages will be installed:

dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono
fonts-texgyre fonts-urw-base35 libapache-pom-java
libcmark-gfm-extensions0.29.0.gfm.3 libcmark-gfm0.29.0.gfm.3
libcommons-logging-java libcommons-parent-java libfontbox-java libfontenc1
libgs9 libgs9-common libidn12 libijs-0.35 libjbig2dec0 libkpathsea6
libpdfbox-java libptexenc1 libruby3.0 libsynchronet2 libteckit0 libtexlua53
libtexlua53 libwoff1 libzip-0-13 lmodern pandoc-data poppler-data
preview-latex-style rake ruby ruby-net-telnet ruby-rubygems ruby-webrick
ruby-xmlrpc ruby3.0 rubygems-integration t1utils teckit tex-common tex-gyre
texlive-base texlive-binaries texlive-fonts-recommended texlive-latex-base
texlive-latex-extra texlive-latex-recommended texlive-pictures
texlive-plain-generic tipa xfonts-encodings xfonts-utils

Suggested packages:

fonts-noto fonts-freefont-otf | fonts-freefont-ttf libavalon-framework-java
libcommons-logging-java-doc libexcalibur-logkit-java liblog4j1.2-java
texlive-luatex pandoc-citeproc context wkhtmltopdf librsvg2-bin groff ghc
nodejs php python libjs-mathjax libjs-katex citation-style-language-styles
poppler-utils ghostscript fonts-japanese-mincho | fonts-ipafont-mincho
fonts-japanese-gothic | fonts-ipafont-gothic fonts-arphic-ukai
fonts-arphic-uming fonts-nanum ri ruby-dev bundler debhelper gv
| postscript-viewer perl-tk xpdf | pdf-viewer xzdec
texlive-fonts-recommended-doc texlive-latex-base-doc python3-pygments
icc-profiles libfile-which-perl libspreadsheet-parseexcel-perl
texlive-latex-extra-doc texlive-latex-recommended-doc texlive-pstricks
dot2tex prerex texlive-pictures-doc vprerex default-jre-headless tipa-doc

The following NEW packages will be installed:

dvisvgm fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono
fonts-texgyre fonts-urw-base35 libapache-pom-java
libcmark-gfm-extensions0.29.0.gfm.3 libcmark-gfm0.29.0.gfm.3
libcommons-logging-java libcommons-parent-java libfontbox-java libfontenc1
libgs9 libgs9-common libidn12 libijs-0.35 libjbig2dec0 libkpathsea6
libpdfbox-java libptexenc1 libruby3.0 libsynchronet2 libteckit0 libtexlua53
libtexlua53 libwoff1 libzip-0-13 lmodern pandoc pandoc-data poppler-data
preview-latex-style rake ruby ruby-net-telnet ruby-rubygems ruby-webrick
ruby-xmlrpc ruby3.0 rubygems-integration t1utils teckit tex-common tex-gyre
texlive-base texlive-binaries texlive-fonts-recommended texlive-latex-base
texlive-latex-extra texlive-latex-recommended texlive-pictures
texlive-plain-generic texlive-xetex tipa xfonts-encodings xfonts-utils

0 upgraded, 58 newly installed, 0 to remove and 35 not upgraded.

Need to get 202 MB of archives.

After this operation, 728 MB of additional disk space will be used.

Get:1 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-droid-fallback all
1:6.0.1r16-1.1build1 [1,805 kB]

Get:2 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-lato all 2.0-2.1
[2,696 kB]

Get:3 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 poppler-data all
0.4.11-1 [2,171 kB]

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Get:5 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-urw-base35 all 20200910-1 [6,367 kB]
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Get:15 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 fonts-noto-mono all 20201225-1build1 [397 kB]
Get:16 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 fonts-texgyre all 20180621-3.1 [10.2 MB]
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Get:18 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libcmark-gfm0.29.0.gfm.3 amd64 0.29.0.gfm.3-3 [115 kB]
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Get:32 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libruby3.0 amd64 3.0.2-7ubuntu2.8 [5,113 kB]
Get:33 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libsyntax2 amd64 2021.20210626.59705-1ubuntu0.2 [55.6 kB]
Get:34 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libteckit0 amd64 2.5.11+ds1-1 [421 kB]
Get:35 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexlua53 amd64 2021.20210626.59705-1ubuntu0.2 [120 kB]
Get:36 <http://archive.ubuntu.com/ubuntu> jammy-updates/main amd64 libtexluajit2 amd64 2021.20210626.59705-1ubuntu0.2 [267 kB]
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Get:38 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-encodings all 1:1.0.5-0ubuntu2 [578 kB]
Get:39 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 xfonts-utils amd64 1:7.7+6build2 [94.6 kB]
Get:40 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 lmodern all 2.004.5-6.1 [9,471 kB]
Get:41 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 pandoc-data all 2.9.2.1-3ubuntu2 [81.8 kB]
Get:42 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 pandoc amd64 2.9.2.1-3ubuntu2 [20.3 MB]
Get:43 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 preview-latex-style all 12.2-1ubuntu1 [185 kB]
Get:44 <http://archive.ubuntu.com/ubuntu> jammy/main amd64 t1utils amd64 1.41-4build2 [61.3 kB]
Get:45 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 teckit amd64 2.5.11+ds1-1 [699 kB]
Get:46 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 tex-gyre all 20180621-3.1 [6,209 kB]
Get:47 <http://archive.ubuntu.com/ubuntu> jammy-updates/universe amd64 texlive-binaries amd64 2021.20210626.59705-1ubuntu0.2 [9,860 kB]
Get:48 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-base all 2021.20220204-1 [21.0 MB]
Get:49 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-fonts-recommended all 2021.20220204-1 [4,972 kB]
Get:50 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 texlive-latex-base all 2021.20220204-1 [1,128 kB]
Get:51 <http://archive.ubuntu.com/ubuntu> jammy/universe amd64 libfontbox-java all 1:1.8.16-2 [207 kB]

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Get:52 http://archive.ubuntu.com/ubuntu jammy/universe amd64 libpdfbox-java all
1:1.8.16-2 [5,199 kB]
Get:53 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-
recommended all 2021.20220204-1 [14.4 MB]
Get:54 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-pictures
all 2021.20220204-1 [8,720 kB]
Get:55 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-latex-extra
all 2021.20220204-1 [13.9 MB]
Get:56 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-plain-
generic all 2021.20220204-1 [27.5 MB]
Get:57 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tipa all 2:1.3-21
[2,967 kB]
Get:58 http://archive.ubuntu.com/ubuntu jammy/universe amd64 texlive-xetex all
2021.20220204-1 [12.4 MB]
Fetched 202 MB in 4s (47.9 MB/s)
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line 78,
<> line 58.)
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (This frontend requires a controlling tty.)
debconf: falling back to frontend: Teletype
dpkg-preconfigure: unable to re-open stdin:
Selecting previously unselected package fonts-droid-fallback.
(Reading database ... 125044 files and directories currently installed.)
Preparing to unpack .../00-fonts-droid-fallback_1%3a6.0.1r16-1.1build1_all.deb
...
Unpacking fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Selecting previously unselected package fonts-lato.
Preparing to unpack .../01-fonts-lato_2.0-2.1_all.deb ...
Unpacking fonts-lato (2.0-2.1) ...
Selecting previously unselected package poppler-data.
Preparing to unpack .../02-poppler-data_0.4.11-1_all.deb ...
Unpacking poppler-data (0.4.11-1) ...
Selecting previously unselected package tex-common.
Preparing to unpack .../03-tex-common_6.17_all.deb ...
Unpacking tex-common (6.17) ...
Selecting previously unselected package fonts-urw-base35.
Preparing to unpack .../04-fonts-urw-base35_20200910-1_all.deb ...
Unpacking fonts-urw-base35 (20200910-1) ...
Selecting previously unselected package libgs9-common.
Preparing to unpack .../05-libgs9-common_9.55.0~dfsg1-0ubuntu5.10_all.deb ...
Unpacking libgs9-common (9.55.0~dfsg1-0ubuntu5.10) ...
Selecting previously unselected package libidn12:amd64.
Preparing to unpack .../06-libidn12_1.38-4ubuntu1_amd64.deb ...
Unpacking libidn12:amd64 (1.38-4ubuntu1) ...
Selecting previously unselected package libijs-0.35:amd64.

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Preparing to unpack .../07-libijs-0.35_0.35-15build2_amd64.deb ...
Unpacking libijs-0.35:amd64 (0.35-15build2) ...
Selecting previously unselected package libjbig2dec0:amd64.
Preparing to unpack .../08-libjbig2dec0_0.19-3build2_amd64.deb ...
Unpacking libjbig2dec0:amd64 (0.19-3build2) ...
Selecting previously unselected package libgs9:amd64.
Preparing to unpack .../09-libgs9_9.55.0~dfsg1-0ubuntu5.10_amd64.deb ...
Unpacking libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.10) ...
Selecting previously unselected package libkpathsea6:amd64.
Preparing to unpack .../10-libkpathsea6_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libwoff1:amd64.
Preparing to unpack .../11-libwoff1_1.0.2-1build4_amd64.deb ...
Unpacking libwoff1:amd64 (1.0.2-1build4) ...
Selecting previously unselected package dvisvgm.
Preparing to unpack .../12-dvisvgm_2.13.1-1_amd64.deb ...
Unpacking dvisvgm (2.13.1-1) ...
Selecting previously unselected package fonts-lmodern.
Preparing to unpack .../13-fonts-lmodern_2.004.5-6.1_all.deb ...
Unpacking fonts-lmodern (2.004.5-6.1) ...
Selecting previously unselected package fonts-noto-mono.
Preparing to unpack .../14-fonts-noto-mono_20201225-1build1_all.deb ...
Unpacking fonts-noto-mono (20201225-1build1) ...
Selecting previously unselected package fonts-texgyre.
Preparing to unpack .../15-fonts-texgyre_20180621-3.1_all.deb ...
Unpacking fonts-texgyre (20180621-3.1) ...
Selecting previously unselected package libapache-pom-java.
Preparing to unpack .../16-libapache-pom-java_18-1_all.deb ...
Unpacking libapache-pom-java (18-1) ...
Selecting previously unselected package libcmark-gfm0.29.0.gfm.3:amd64.
Preparing to unpack .../17-libcmark-gfm0.29.0.gfm.3_0.29.0.gfm.3-3_amd64.deb ...
Unpacking libcmark-gfm0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) ...
Selecting previously unselected package libcmark-gfm-
extensions0.29.0.gfm.3:amd64.
Preparing to unpack .../18-libcmark-gfm-
extensions0.29.0.gfm.3_0.29.0.gfm.3-3_amd64.deb ...
Unpacking libcmark-gfm-extensions0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) ...
Selecting previously unselected package libcommons-parent-java.
Preparing to unpack .../19-libcommons-parent-java_43-1_all.deb ...
Unpacking libcommons-parent-java (43-1) ...
Selecting previously unselected package libcommons-logging-java.
Preparing to unpack .../20-libcommons-logging-java_1.2-2_all.deb ...
Unpacking libcommons-logging-java (1.2-2) ...
Selecting previously unselected package libfontenc1:amd64.
Preparing to unpack .../21-libfontenc1_1%3a1.1.4-1build3_amd64.deb ...
Unpacking libfontenc1:amd64 (1:1.1.4-1build3) ...
Selecting previously unselected package libptexenc1:amd64.

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Preparing to unpack .../22-libptexenc1_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package rubygems-integration.
Preparing to unpack .../23-rubygems-integration_1.18_all.deb ...
Unpacking rubygems-integration (1.18) ...
Selecting previously unselected package ruby3.0.
Preparing to unpack .../24-ruby3.0_3.0.2-7ubuntu2.8_amd64.deb ...
Unpacking ruby3.0 (3.0.2-7ubuntu2.8) ...
Selecting previously unselected package ruby-rubygems.
Preparing to unpack .../25-ruby-rubygems_3.3.5-2_all.deb ...
Unpacking ruby-rubygems (3.3.5-2) ...
Selecting previously unselected package ruby.
Preparing to unpack .../26-ruby_1%3a3.0~exp1_amd64.deb ...
Unpacking ruby (1:3.0~exp1) ...
Selecting previously unselected package rake.
Preparing to unpack .../27-rake_13.0.6-2_all.deb ...
Unpacking rake (13.0.6-2) ...
Selecting previously unselected package ruby-net-telnet.
Preparing to unpack .../28-ruby-net-telnet_0.1.1-2_all.deb ...
Unpacking ruby-net-telnet (0.1.1-2) ...
Selecting previously unselected package ruby-webrick.
Preparing to unpack .../29-ruby-webrick_1.7.0-3ubuntu0.1_all.deb ...
Unpacking ruby-webrick (1.7.0-3ubuntu0.1) ...
Selecting previously unselected package ruby-xmlrpc.
Preparing to unpack .../30-ruby-xmlrpc_0.3.2-1ubuntu0.1_all.deb ...
Unpacking ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Selecting previously unselected package libruby3.0:amd64.
Preparing to unpack .../31-libruby3.0_3.0.2-7ubuntu2.8_amd64.deb ...
Unpacking libruby3.0:amd64 (3.0.2-7ubuntu2.8) ...
Selecting previously unselected package libsyntax2:amd64.
Preparing to unpack .../32-libsyntax2_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libsyntax2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libteckit0:amd64.
Preparing to unpack .../33-libteckit0_2.5.11+ds1-1_amd64.deb ...
Unpacking libteckit0:amd64 (2.5.11+ds1-1) ...
Selecting previously unselected package libtexlua53:amd64.
Preparing to unpack .../34-libtexlua53_2021.20210626.59705-1ubuntu0.2_amd64.deb
...
Unpacking libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libtexluajit2:amd64.
Preparing to unpack
.../35-libtexluajit2_2021.20210626.59705-1ubuntu0.2_amd64.deb ...
Unpacking libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package libzip-0-13:amd64.
Preparing to unpack .../36-libzip-0-13_0.13.72+dfsg.1-1.1_amd64.deb ...
Unpacking libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...

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Selecting previously unselected package xfonts-encodings.
Preparing to unpack .../37-xfonts-encodings_1%3a1.0.5-0ubuntu2_all.deb ...
Unpacking xfonts-encodings (1:1.0.5-0ubuntu2) ...
Selecting previously unselected package xfonts-utils.
Preparing to unpack .../38-xfonts-utils_1%3a7.7+6build2_amd64.deb ...
Unpacking xfonts-utils (1:7.7+6build2) ...
Selecting previously unselected package lmodern.
Preparing to unpack .../39-lmodern_2.004.5-6.1_all.deb ...
Unpacking lmodern (2.004.5-6.1) ...
Selecting previously unselected package pandoc-data.
Preparing to unpack .../40-pandoc-data_2.9.2.1-3ubuntu2_all.deb ...
Unpacking pandoc-data (2.9.2.1-3ubuntu2) ...
Selecting previously unselected package pandoc.
Preparing to unpack .../41-pandoc_2.9.2.1-3ubuntu2_amd64.deb ...
Unpacking pandoc (2.9.2.1-3ubuntu2) ...
Selecting previously unselected package preview-latex-style.
Preparing to unpack .../42-preview-latex-style_12.2-1ubuntu1_all.deb ...
Unpacking preview-latex-style (12.2-1ubuntu1) ...
Selecting previously unselected package t1utils.
Preparing to unpack .../43-t1utils_1.41-4build2_amd64.deb ...
Unpacking t1utils (1.41-4build2) ...
Selecting previously unselected package teckit.
Preparing to unpack .../44-teckit_2.5.11+ds1-1_amd64.deb ...
Unpacking teckit (2.5.11+ds1-1) ...
Selecting previously unselected package tex-gyre.
Preparing to unpack .../45-tex-gyre_20180621-3.1_all.deb ...
Unpacking tex-gyre (20180621-3.1) ...
Selecting previously unselected package texlive-binaries.
Preparing to unpack .../46-texlive-
binaries_2021.20210626.59705-1ubuntu0.2_amd64.deb ...
Unpacking texlive-binaries (2021.20210626.59705-1ubuntu0.2) ...
Selecting previously unselected package texlive-base.
Preparing to unpack .../47-texlive-base_2021.20220204-1_all.deb ...
Unpacking texlive-base (2021.20220204-1) ...
Selecting previously unselected package texlive-fonts-recommended.
Preparing to unpack .../48-texlive-fonts-recommended_2021.20220204-1_all.deb ...
Unpacking texlive-fonts-recommended (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-base.
Preparing to unpack .../49-texlive-latex-base_2021.20220204-1_all.deb ...
Unpacking texlive-latex-base (2021.20220204-1) ...
Selecting previously unselected package libfontbox-java.
Preparing to unpack .../50-libfontbox-java_1%3a1.8.16-2_all.deb ...
Unpacking libfontbox-java (1:1.8.16-2) ...
Selecting previously unselected package libpdfbox-java.
Preparing to unpack .../51-libpdfbox-java_1%3a1.8.16-2_all.deb ...
Unpacking libpdfbox-java (1:1.8.16-2) ...
Selecting previously unselected package texlive-latex-recommended.
Preparing to unpack .../52-texlive-latex-recommended_2021.20220204-1_all.deb ...

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Unpacking texlive-latex-recommended (2021.20220204-1) ...
Selecting previously unselected package texlive-pictures.
Preparing to unpack .../53-texlive-pictures_2021.20220204-1_all.deb ...
Unpacking texlive-pictures (2021.20220204-1) ...
Selecting previously unselected package texlive-latex-extra.
Preparing to unpack .../54-texlive-latex-extra_2021.20220204-1_all.deb ...
Unpacking texlive-latex-extra (2021.20220204-1) ...
Selecting previously unselected package texlive-plain-generic.
Preparing to unpack .../55-texlive-plain-generic_2021.20220204-1_all.deb ...
Unpacking texlive-plain-generic (2021.20220204-1) ...
Selecting previously unselected package tipa.
Preparing to unpack .../56-tipa_2%3a1.3-21_all.deb ...
Unpacking tipa (2:1.3-21) ...
Selecting previously unselected package texlive-xetex.
Preparing to unpack .../57-texlive-xetex_2021.20220204-1_all.deb ...
Unpacking texlive-xetex (2021.20220204-1) ...
Setting up fonts-lato (2.0-2.1) ...
Setting up fonts-noto-mono (20201225-1build1) ...
Setting up libwoff1:amd64 (1.0.2-1build4) ...
Setting up libtexlua53:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libijs-0.35:amd64 (0.35-15build2) ...
Setting up libtexluajit2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libfontbox-java (1:1.8.16-2) ...
Setting up rubygems-integration (1.18) ...
Setting up libzip-0-13:amd64 (0.13.72+dfsg.1-1.1) ...
Setting up fonts-urw-base35 (20200910-1) ...
Setting up poppler-data (0.4.11-1) ...
Setting up tex-common (6.17) ...
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line
78.)
debconf: falling back to frontend: Readline
update-language: texlive-base not installed and configured, doing nothing!
Setting up libfontenc1:amd64 (1:1.1.4-1build3) ...
Setting up libjbig2dec0:amd64 (0.19-3build2) ...
Setting up libteckit0:amd64 (2.5.11+ds1-1) ...
Setting up libapache-pom-java (18-1) ...
Setting up ruby-net-telnet (0.1.1-2) ...
Setting up xfonts-encodings (1:1.0.5-0ubuntu2) ...
Setting up t1utils (1.41-4build2) ...
Setting up libidn12:amd64 (1.38-4ubuntu1) ...
Setting up fonts-texgyre (20180621-3.1) ...
Setting up libkpathsea6:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up ruby-webrick (1.7.0-3ubuntu0.1) ...
Setting up libcmark-gfm0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) ...
Setting up fonts-lmodern (2.004.5-6.1) ...
Setting up libcmark-gfm-extensions0.29.0.gfm.3:amd64 (0.29.0.gfm.3-3) ...

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Setting up fonts-droid-fallback (1:6.0.1r16-1.1build1) ...
Setting up pandoc-data (2.9.2.1-3ubuntu2) ...
Setting up ruby-xmlrpc (0.3.2-1ubuntu0.1) ...
Setting up libsyntax2:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up libgs9-common (9.55.0~dfsg1-0ubuntu5.10) ...
Setting up teckit (2.5.11+ds1-1) ...
Setting up libpdfbox-java (1:1.8.16-2) ...
Setting up libgs9:amd64 (9.55.0~dfsg1-0ubuntu5.10) ...
Setting up preview-latex-style (12.2-1ubuntu1) ...
Setting up libcommons-parent-java (43-1) ...
Setting up dvisvgm (2.13.1-1) ...
Setting up libcommons-logging-java (1.2-2) ...
Setting up xfonts-utils (1:7.7+6build2) ...
Setting up libptexenc1:amd64 (2021.20210626.59705-1ubuntu0.2) ...
Setting up pandoc (2.9.2.1-3ubuntu2) ...
Setting up texlive-binaries (2021.20210626.59705-1ubuntu0.2) ...
update-alternatives: using /usr/bin/xdvi-xaw to provide /usr/bin/xdvi.bin
(xdvi.bin) in auto mode
update-alternatives: using /usr/bin/bibtex.original to provide /usr/bin/bibtex
(bibtex) in auto mode
Setting up lmodern (2.004.5-6.1) ...
Setting up texlive-base (2021.20220204-1) ...
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
/usr/bin/ucfr
mktexlsr: Updating /var/lib/texmf/ls-R-TEXLIVEDIST...
mktexlsr: Updating /var/lib/texmf/ls-R-TEXMFMAIN...
mktexlsr: Updating /var/lib/texmf/ls-R...
mktexlsr: Done.
tl-paper: setting paper size for dvips to a4:
/var/lib/texmf/dvips/config/config-paper.ps
tl-paper: setting paper size for dvipdfmx to a4:
/var/lib/texmf/dvipdfmx/dvipdfmx-paper.cfg
tl-paper: setting paper size for xdvi to a4: /var/lib/texmf/xdvi/XDvi-paper
tl-paper: setting paper size for pdftex to a4: /var/lib/texmf/tex/generic/tex-
ini-files/pdftexconfig.tex
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line
78.)
debconf: falling back to frontend: Readline
Setting up tex-gyre (20180621-3.1) ...
Setting up texlive-plain-generic (2021.20220204-1) ...
Setting up texlive-latex-base (2021.20220204-1) ...
Setting up texlive-latex-recommended (2021.20220204-1) ...
Setting up texlive-pictures (2021.20220204-1) ...
Setting up texlive-fonts-recommended (2021.20220204-1) ...

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Setting up tipa (2:1.3-21) ...
Setting up texlive-latex-extra (2021.20220204-1) ...
Setting up texlive-xetex (2021.20220204-1) ...
Setting up rake (13.0.6-2) ...
Setting up libruby3.0:amd64 (3.0.2-7ubuntu2.8) ...
Setting up ruby3.0 (3.0.2-7ubuntu2.8) ...
Setting up ruby (1:3.0~exp1) ...
Setting up ruby-rubygems (3.3.5-2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for mailcap (3.70+nmulubuntu1) ...
Processing triggers for fontconfig (2.13.1-4.2ubuntu5) ...
Processing triggers for libc-bin (2.35-0ubuntu3.8) ...
/sbin/ldconfig.real: /usr/local/lib/libtbb.so.12 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_5.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_opencl.so.0 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libtbbbind_2_0.so.3 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc.so.2 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libumf.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libur_loader.so.0 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libhwloc.so.15 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtcm_debug.so.1 is not a symbolic link

/sbin/ldconfig.real: /usr/local/lib/libtbbmalloc_proxy.so.2 is not a symbolic
link

/sbin/ldconfig.real: /usr/local/lib/libur_adapter_level_zero.so.0 is not a
symbolic link

Processing triggers for tex-common (6.17) ...
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based
frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd/Dialog.pm line
78.)
debconf: falling back to frontend: Readline
Running upmap-sys. This may take some time... done.

```

```
Running mktexlsr /var/lib/texmf ... done.  
Building format(s) --all.  
    This may take some time...
```

```
[ ]: !jupyter nbconvert --to pdf "/content/drive/MyDrive/Colab_Notebooks/Projects/  
↪Statistical_Data_Visualization.ipynb"
```