Heart Disease Analysis

Python Data Analyst Project

Import the libraries and dataset

[24]:
```
import pandas as pd import
matplotlib.pyplot as plt
import seaborn as sns

 # Download the heart disease dataset from Kaggle (if not already
                            downloaded)
!wget https://www.kaggle.com/datasets/johnsmith88/heart-disease-
 dataset/ ↪download?version=1 -O heart.csv

# Read the CSV file into a pandas DataFrame data =
pd.read_csv("/content/drive/MyDrive/Data Analysis/Python
Project/Heart␣ ↪Disease/heart.csv")
```

```
--2024-10-27 17:35:44--
https://www.kaggle.com/datasets/johnsmith88/heartdisease-
dataset/download?version=1
Resolving www.kaggle.com (www.kaggle.com)… 35.244.233.98
Connecting to www.kaggle.com (www.kaggle.com)|35.244.233.98|:443…
connected.
HTTP request sent, awaiting response… 302 Found
Location: /account/login?titleType=dataset-
downloads&showDatasetDownloadSkip=Fal
se&messageId=datasetsWelcome&returnUrl=%2Fdatasets%2Fjohnsmith88%2Fhea
rtdisease-dataset%3Fresource%3Ddownload [following]
--2024-10-27                                                17:35:45--
https://www.kaggle.com/account/login?titleType=datasetdownloads&showD
atasetDownloadSkip=False&messageId=datasetsWelcome&returnUrl=%2Fd
atasets%2Fjohnsmith88%2Fheart-disease-dataset%3Fresource%3Ddownload
Reusing existing connection to www.kaggle.com:443.
HTTP request sent, awaiting response… 200 OK
Length: unspecified [text/html]
Saving to: 'heart.csv'

heart.csv               [ <=>                ]   4.84K --.-KB/s    in 0s

2024-10-27 17:35:45 (11.4 MB/s) - 'heart.csv' saved [4961]
```

We import the necessary libraries: pandas for data manipulation, matplotlib.pyplot for basic plotting, and seaborn for advanced visualizations. We download the heart disease dataset from Kaggle using wget

(assuming you have it installed). If you already have the dataset, replace the wget command with the path to your CSV file. *We read the CSV data into a DataFrame named data.

#Displaying Top and Last Rows

[25]:
```
print("Top 5 rows:")
data.head(5)
```

```
Top 5 rows:
```

[25]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
0	52	1	0	125	212	0	1	168	0	1.0	2	2	3	0
1	53	1	0	140	203	1	0	155	1	3.1	0	0	3	0
2	70	1	0	145	174	0	1	125	1	2.6	0	0	3	0
3	61	1	0	148	203	0	1	161	0	0.0	2	1	3	0
4	62	0	0	138	294	1	1	106	0	1.9	1	3	2	0

[26]:
```
print("\nLast 5 rows:")
data.tail(5)
```

```
Last 5 rows:
```

[26]:

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	thal	target
1020	59	1	1	140	221	0	1	164	1	0.0	2	02	1	1
1021	60	1	0	125	258	0	0	141	1	2.8	1	13	0	0
1022	47	1	0	110	275	0	0	118	1	1.0	1	12	0	0
1023	50	0	0	110	254	0	0	159	0	0.0	2	02	1	1
1024	54	1	0	120	188	0	1	113	0	1.4	1	13	0	0

- Top 5 Rows:
- This provides a glimpse into the initial data points. We can observe:
- Age: Ranging from 52 to 62.

- Sex: Primarily male (1).
- Chest Pain Type (CP): All instances are 0, indicating typical angina.
- Resting Blood Pressure (trestbps): Values between 125 and 148 mmHg.
- Cholesterol (chol): Levels ranging from 203 to 294 mg/dl.
- Fasting Blood Sugar (fbs): Most are 0, indicating fasting blood sugar is less than 120 mg/dl.
- Resting Electrocardiographic Results (restecg): Primarily 1, suggesting ST-T wave abnormality.
- Maximum Heart Rate Achieved (thalach): Values between 106 and 168 bpm.
- Exercise-Induced Angina (exang): Mostly 0, indicating no exercise-induced angina. ST Depression Induced by Exercise
- Relative to Rest (oldpeak): Values between 0 and 3.1. Slope of the Peak Exercise ST Segment (slope): Values 1 and 2.
- Number of Major Vessels (ca): Ranging from 0 to 3.
- Thalassemia (thal): Primarily 3, indicating normal.
- Target: All 0, suggesting a lower chance of heart attack.
- Last 5 Rows:
- A look at the final data points reveals:
- Sex: Both male and female are present.
- Chest Pain Type (CP): A mix of 0 and 1.
- Resting Blood Pressure (trestbps):
- Values between 110 and 140 mmHg.
- Cholesterol (chol): Levels ranging from 188 to 275 mg/dl.
- Fasting Blood Sugar (fbs): All 0.
- Resting Electrocardiographic Results (restecg): A mix of 0 and 1.
- Maximum Heart Rate Achieved (thalach):
- Values between 113 and 164 bpm.
- Exercise-Induced Angina (exang): Both 0 and 1 are present.
- ST Depression Induced by Exercise
- Relative to Rest (oldpeak): Values between 0 and 2.8. Slope of the Peak Exercise ST Segment (slope): Values 1 and 2.
- Number of Major Vessels (ca): Ranging from 0 to 1.
- Thalassemia (thal): Values 2 and 3.
- Target: A mix of 0 and 1, indicating both lower and higher chances of heart attack.

- Overall Observations:
- The dataset appears to contain a mix of individuals with varying heart health conditions.
- There's a range of values for key factors like age, blood pressure, cholesterol, heart rate, and exercise-induced angina.
- The target variable (heart attack risk) seems to be influenced by a combination of these factors.
- Further analysis and modeling can help identify the most significant predictors of heart disease risk.

#Finding Dataset Shape

[27]:
```
print("Dataset shape:", data.shape)
print("Number of rows:", data.shape[0])
print("Number of columns:",
data.shape[1])
```

```
Dataset shape: (1025, 14)
Number of rows: 1025
Number of columns: 14
```

#Getting Dataset Information

[28]:
```
data.info()
```

```
<class
'pandas.core.frame.DataFrame'>
RangeIndex: 1025 entries, 0 to
1024 Data columns (total 14
columns):
#   Column   Non-Null Count Dtype
--- ------   -------------- -----
0   age      1025 non-null int64
1   sex      1025 non-null int64
2   cp       1025 non-null int64
3  trestbps 1025 non-null int64
4   chol     1025 non-null int64
5   fbs      1025 non-null int64
6   restecg  1025 non-null int64
7   thalach  1025 non-null int64
8   exang    1025 non-null int64
9   oldpeak  1025 non-null float64
10 slope     1025 non-null int64
11 ca        1025 non-null int64
12 thal      1025 non-null int64
13 target    1025 non-null int64
dtypes: float64(1), int64(13)
memory usage: 112.2 KB
```

#Checking for Null Values

[29]:
```
print("Number of missing values in each column:") data.isnull().sum()

# If there are missing values, handle them (e.g., impute or drop rows)
```

```
Number of missing values in each column:
age       0
sex       0
cp        0
trestbps  0
chol      0
fbs       0
restecg   0
thalach   0
exang     0
oldpeak   0
slope     0
ca        0
thal      0
target    0
dtype: int64
```

#Checking for Duplicate Data

[30]:
```
has_duplicates = data.duplicated().any()
print("Dataset contains duplicates:", has_duplicates)

if has_duplicates:
    # Remove duplicates
    data = data.drop_duplicates()
    print("Removed duplicates. New shape:", data.shape)
```

```
Dataset contains duplicates: True
Removed duplicates. New shape: (302, 14)
```

#Calculating Descriptive Statistics

[31]:
```
data.describe()
```

[31]:

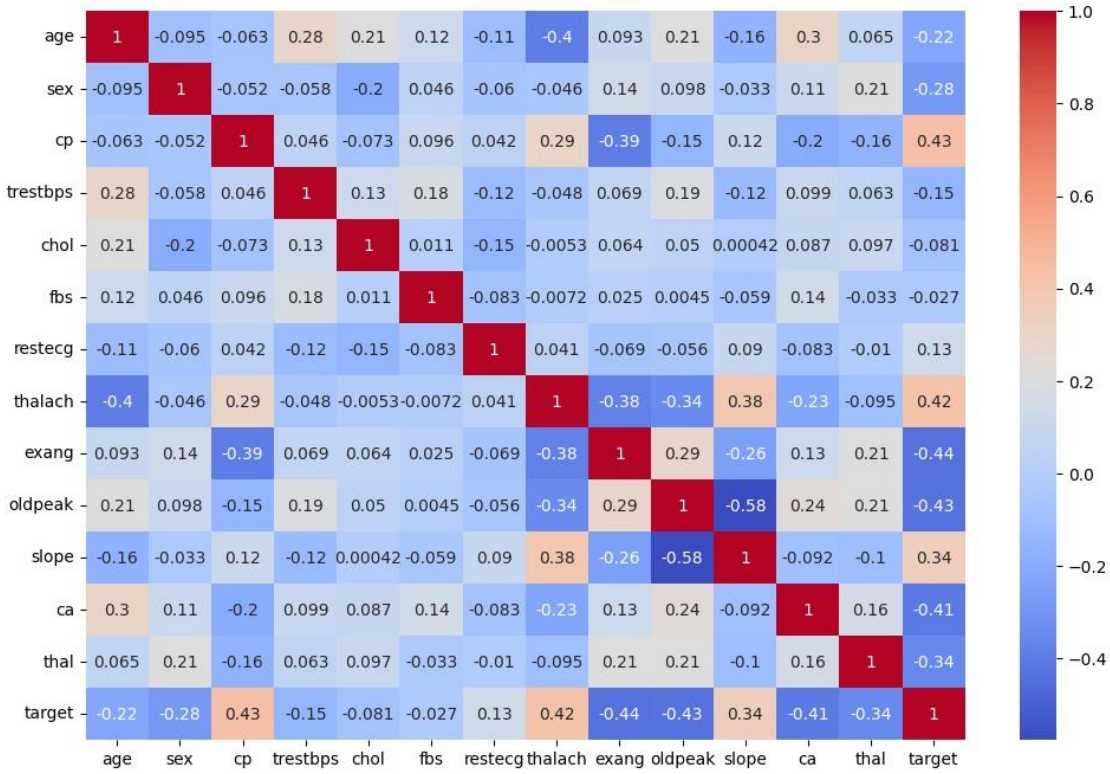
	age	sex	cp	trestbps	chol	fbs
count	302.00000	302.000000	302.000000	302.000000	302.000000	302.000000
mean	54.42053	0.682119	0.963576	131.602649	246.500000	0.149007
std	9.04797	0.466426	1.032044	17.563394	51.753489	0.356686
min	29.00000	0.000000	0.000000	94.000000	126.000000	0.000000
25%	48.00000	0.000000	0.000000	120.000000	211.000000	0.000000
50%	55.50000	1.000000	1.000000	130.000000	240.500000	0.000000
75%	61.00000	1.000000	2.000000	140.000000	274.750000	0.000000
max	77.00000	1.000000	3.000000	200.000000	564.000000	1.000000

```
         restecg  thalach    exang oldpeak    slope ca \ count 302.000000
302.000000 302.000000 302.000000 302.000000 302.000000
mean    0.526490 149.569536  0.327815  1.043046  1.397351  0.718543
std     0.526027  22.903527  0.470196  1.161452  0.616274  1.006748
min     0.000000  71.000000  0.000000  0.000000  0.000000  0.000000
25%     0.000000 133.250000  0.000000  0.000000  1.000000  0.000000
50%     1.000000 152.500000  0.000000  0.800000  1.000000  0.000000
75%     1.000000 166.000000  1.000000  1.600000  2.000000  1.000000
max     2.000000 202.000000  1.000000  6.200000  2.000000  4.000000

            thal     target
count          302.000000
302.000000  mean  2.314570
0.543046    std   0.613026
0.498970    min   0.000000
0.000000    25%   2.000000
0.000000
50%   2.000000    1.000000
75%   3.000000    1.000000
max   3.000000    1.000000
```

#Correlation Matrix

[32]:

```
sns.heatmap(data.corr(), annot=True, cmap="coolwarm")
plt.show()
plt.figure(figsize=(12, 8))
```

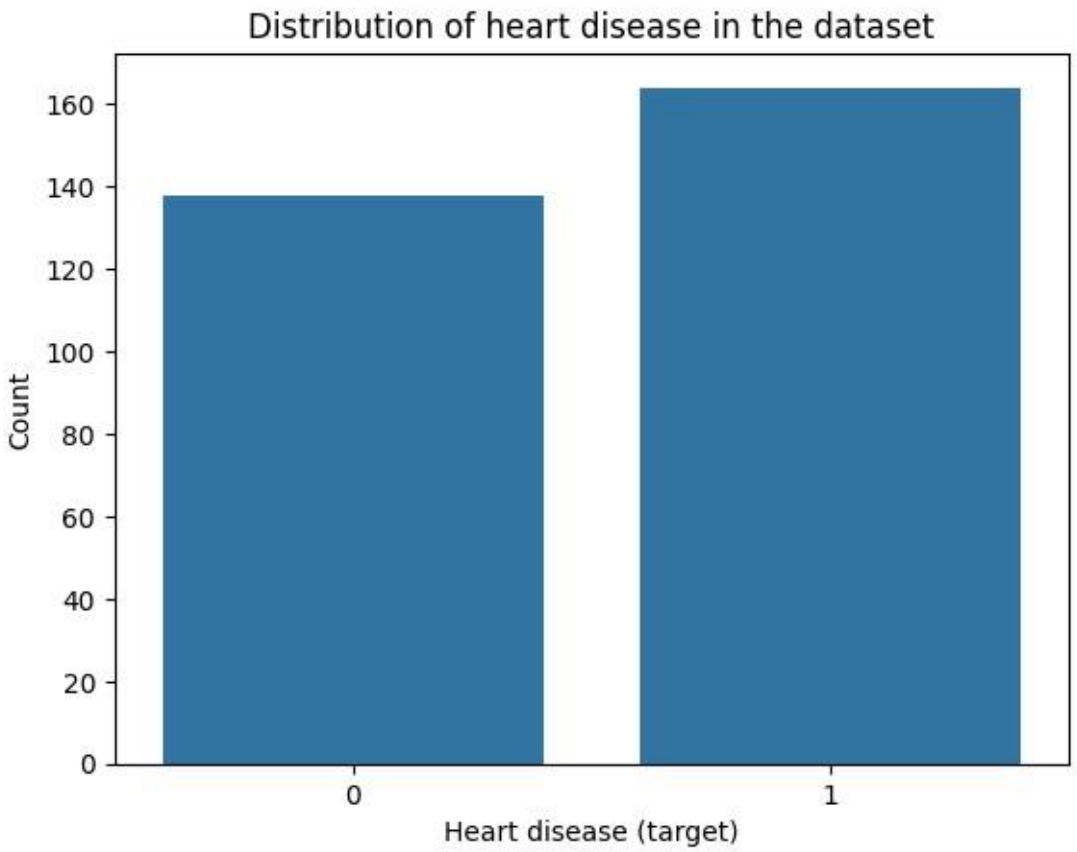


- We create a heatmap using seaborn to visualize the correlation coefficients between all numerical columns in the dataset.
- The heatmap shows the strength and direction of the relationships between variables, which can be helpful for feature selection and model building.

#Number of People with/without Heart Disease

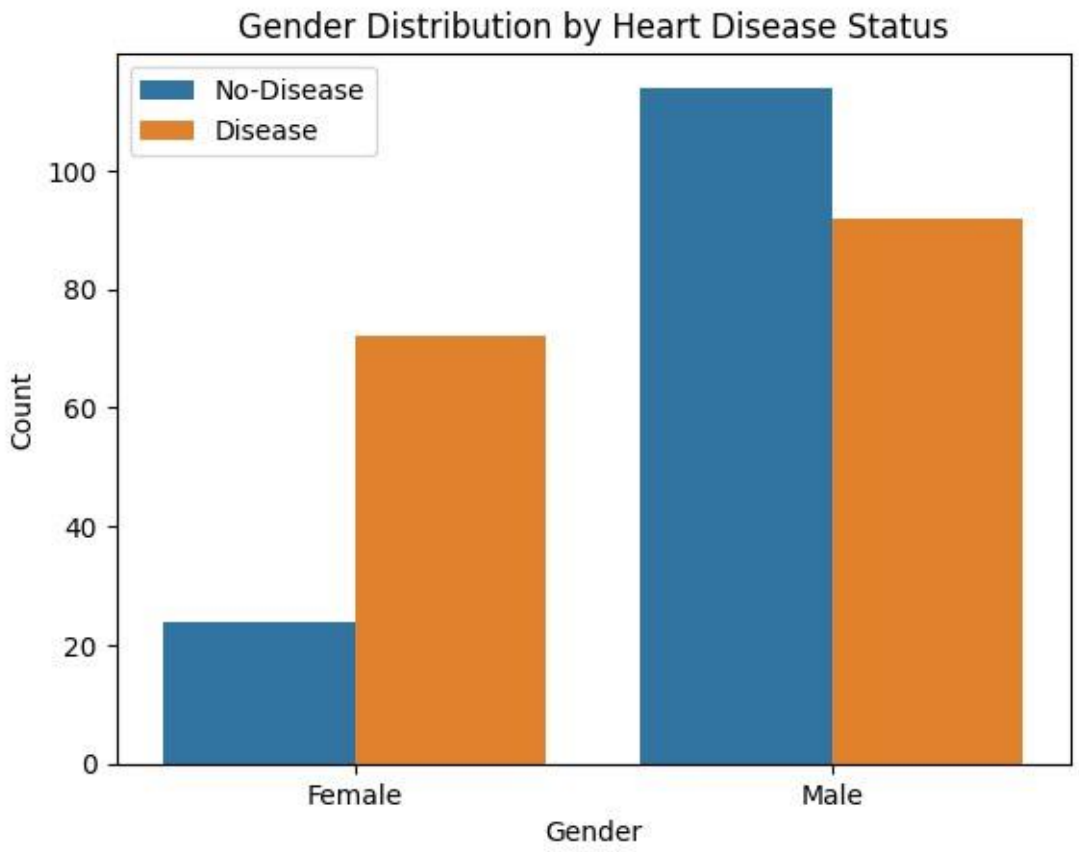
```
[40]: print("Number of people with heart disease (target=1):",
data["target"].
 ↪value_counts()[1]) print("Number of people without heart
disease (target=0):", data["target"]. ↪value_counts()[0])

# Alternatively, visualize with a count plot
sns.countplot(x="target", data=data)
plt.xlabel("Heart disease (target)")
plt.ylabel("Count") plt.title("Distribution of
heart disease in the dataset") plt.show()
```

```
Number of people with heart disease (target=1): 164
Number of people without heart disease (target=0): 138
```



#Find Gender Distribution According to The Target Variable

[34]:
```
sns.countplot(x='sex', hue='target', data=data)
plt.xticks([1, 0], ['Male', 'Female'])
plt.legend(labels=['No-Disease', 'Disease'])
plt.xlabel("Gender") plt.ylabel("Count")
plt.title("Gender Distribution by Heart Disease
Status") plt.show()
```

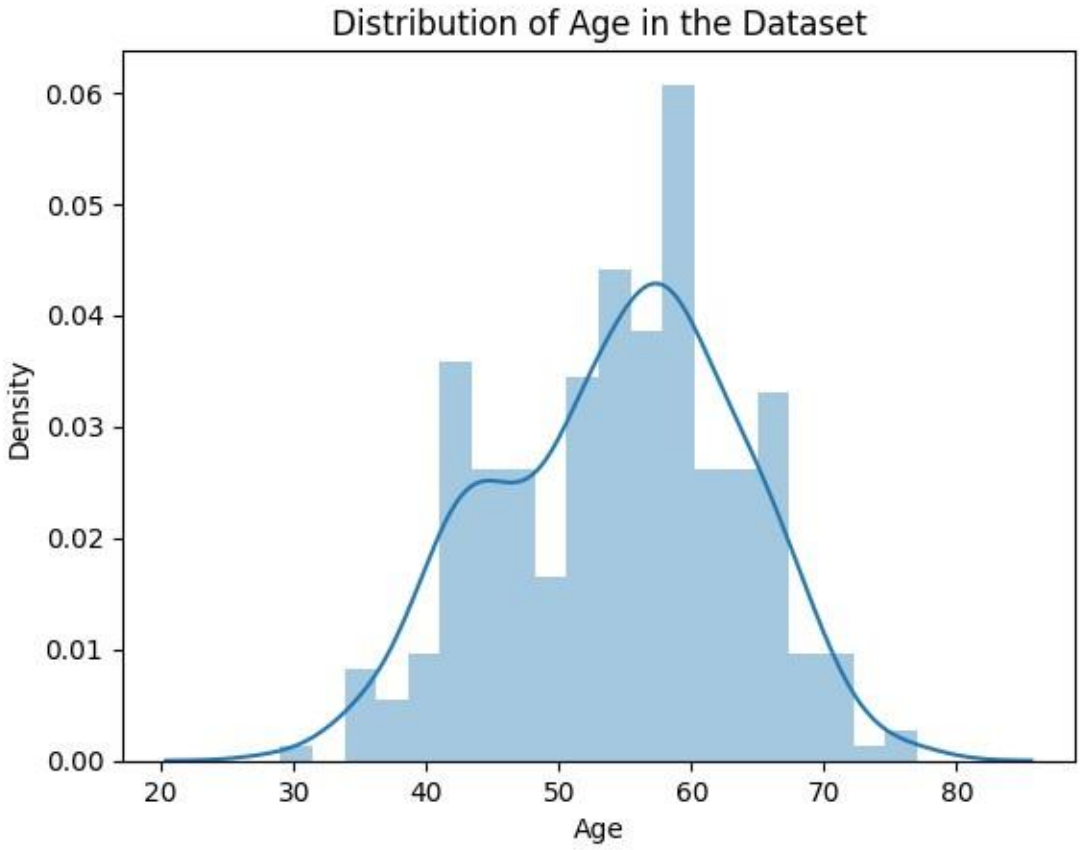


#Check Age Distribution In The Dataset

[41]:
```
sns.distplot(data['age'], bins=20)
plt.xlabel("Age")
plt.ylabel("Density")
plt.title("Distribution of Age in the Dataset ")
plt.show()
```

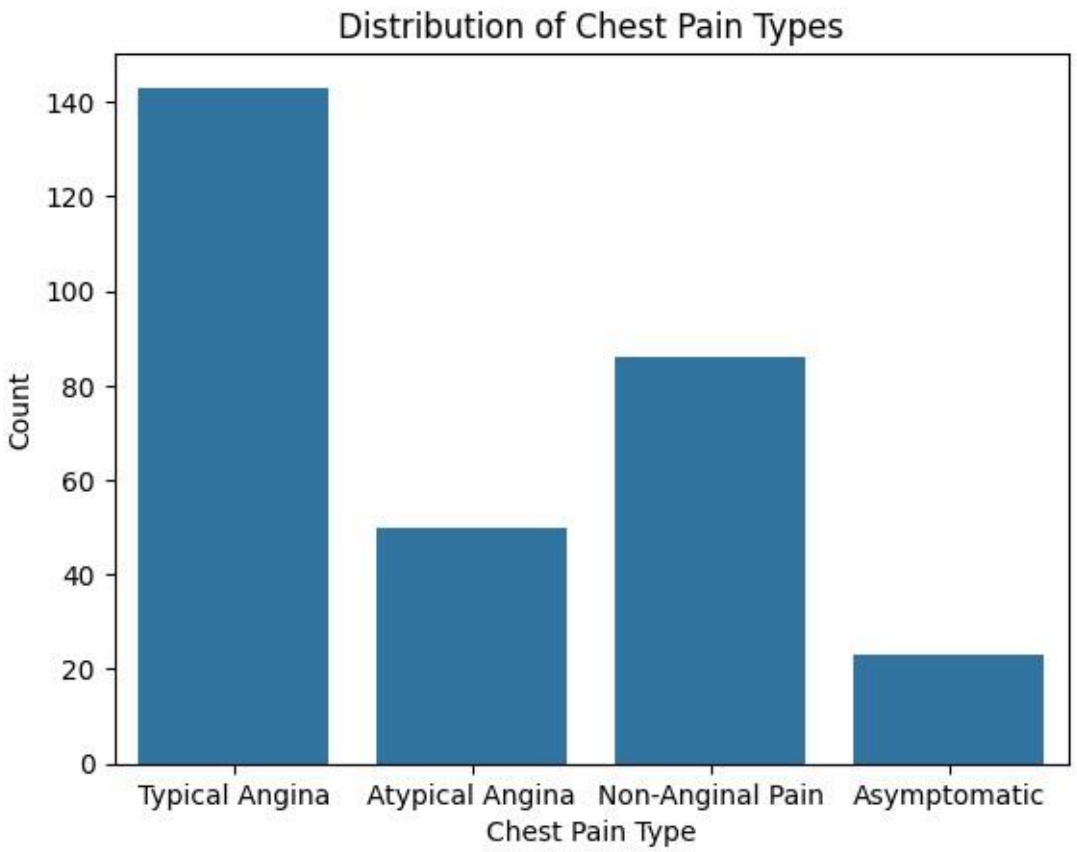
```
<ipython-input-41-71c185254c74>:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.

Please adapt your code to use either `displot` (a figure-level function
with similar flexibility) or `histplot` (an axes-level function for
histograms).
```

```
For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751
sns.distplot(data['age'], bins=20)
```



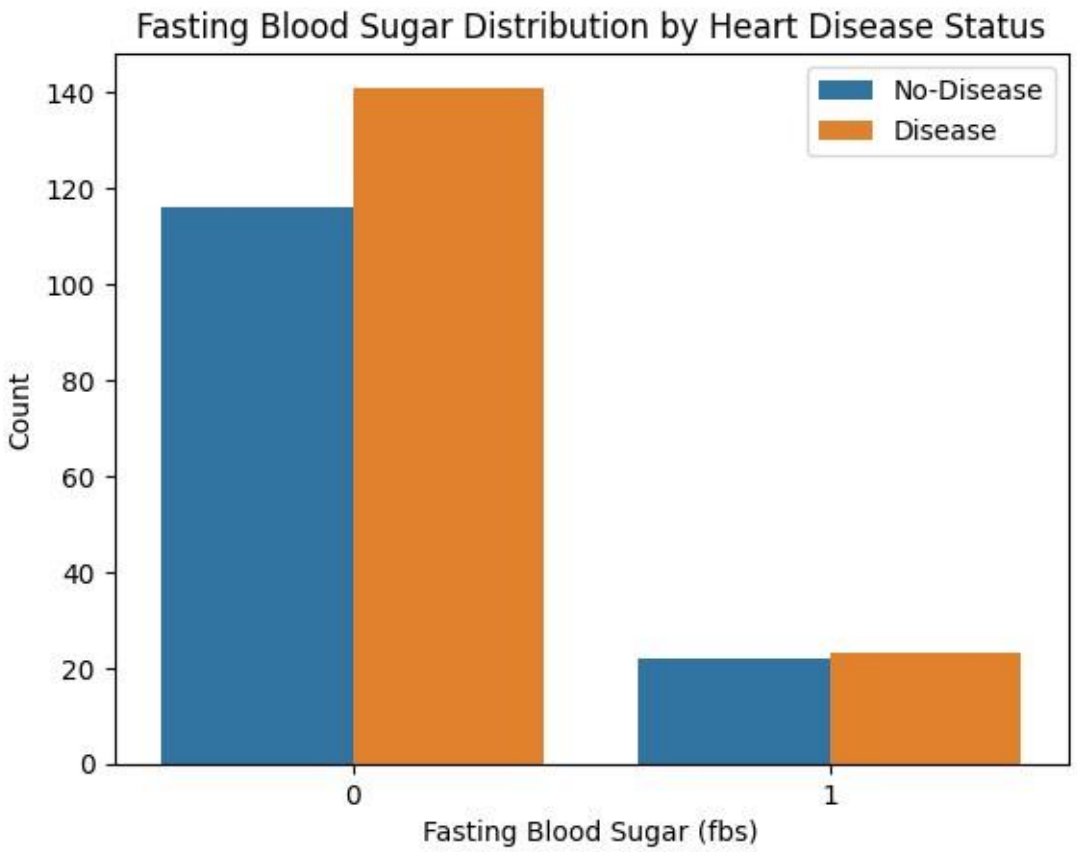
#Which Check Chest Pain Type is More Common

[42]:
```
sns.countplot(x=data['cp'])
plt.xticks([0, 1, 2, 3], ["Typical Angina", "Atypical Angina", "Non-Anginal␣
 ↪Pain", "Asymptomatic"])
plt.xticks(rotation=0)
plt.xlabel("Chest Pain Type")
plt.ylabel("Count")
plt.title("Distribution of Chest Pain Types ")
plt.show()
```



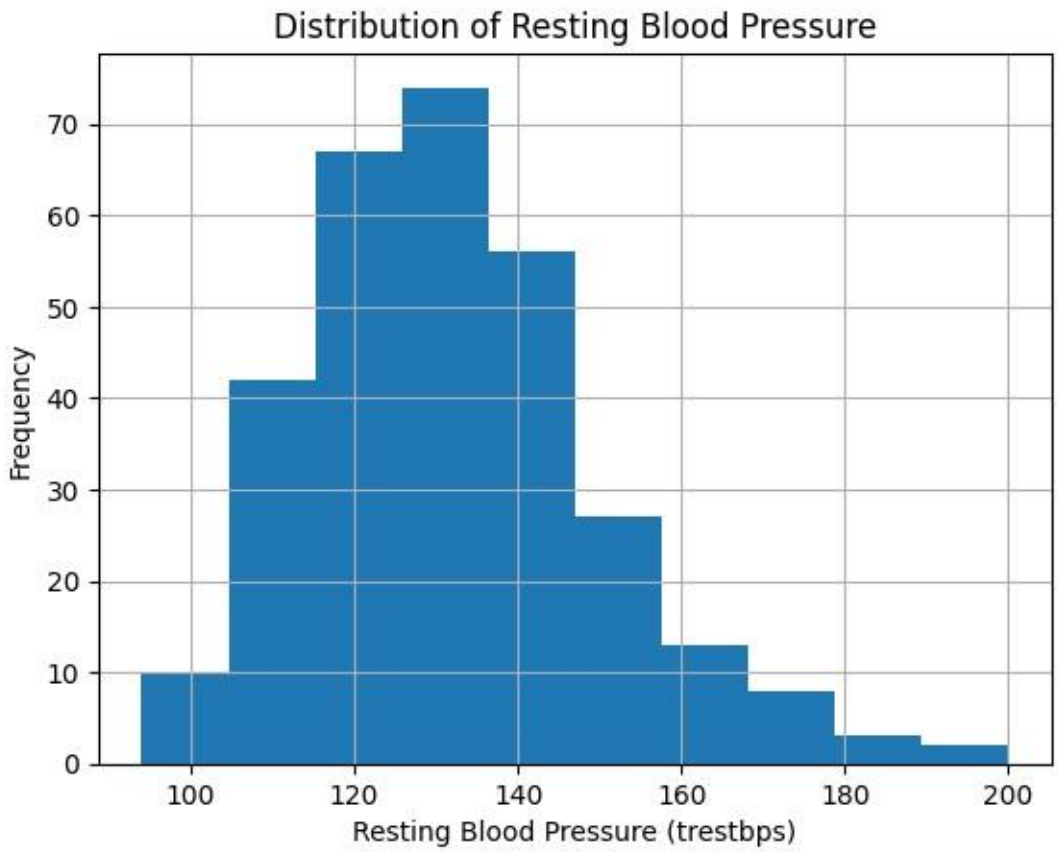
#Show The Chest Pain Distribution As Per Target Variable

[43]:
```
sns.countplot(x='fbs', hue='target', data=data)
plt.legend(labels=['No-Disease', 'Disease'])
plt.xlabel("Fasting Blood Sugar (fbs)")
plt.ylabel("Count") plt.title("Fasting Blood Sugar
Distribution by Heart Disease Status") plt.show()
```



#Check Resting Blood Pressure Distribution

[44]:
```
data['trestbps'].hist()
plt.xlabel("Resting Blood Pressure (trestbps) ")
plt.ylabel("Frequency")
plt.title("Distribution of Resting Blood Pressure ")
plt.show()
```

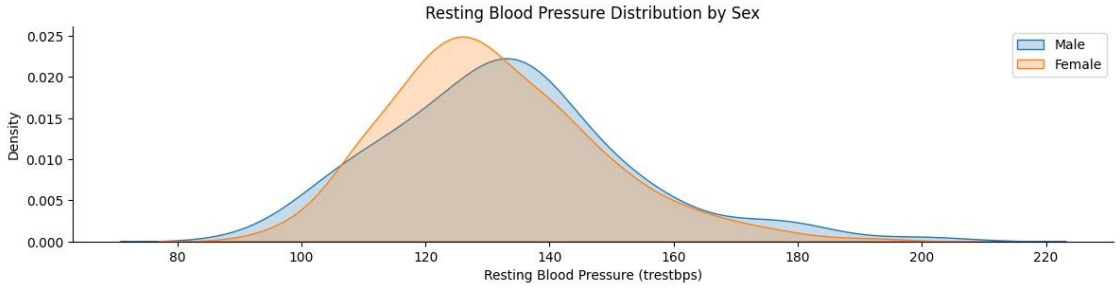


#Compare Resting Blood Pressure As Per Sex Column

[45]:
```
g = sns.FacetGrid(data, hue="sex", aspect=4)
g.map(sns.kdeplot, 'trestbps', shade=True)
plt.legend(labels=['Male', 'Female'])
plt.xlabel("Resting Blood Pressure (trestbps)")
plt.ylabel("Density") plt.title("Resting Blood
Pressure Distribution by Sex") plt.show()
```

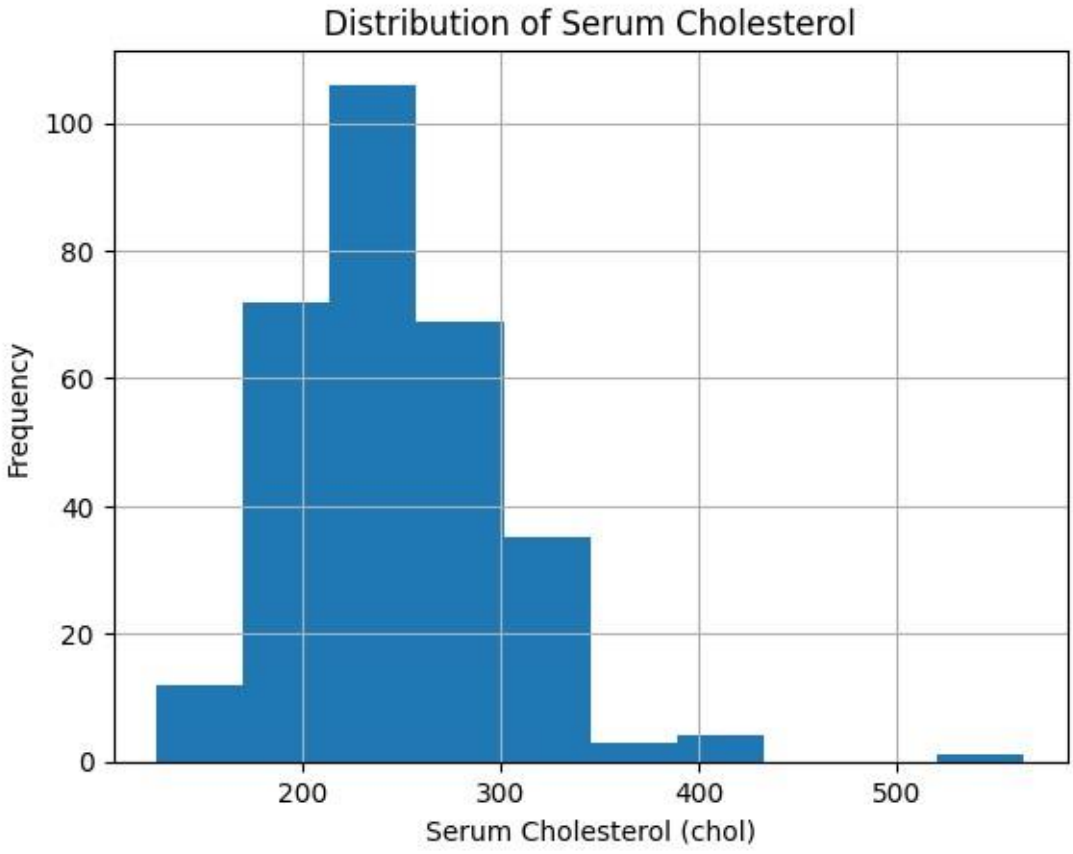
```
/usr/local/lib/python3.10/dist-packages/seaborn/axisgrid.py:854:
FutureWarning:

`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.

  func(*plot_args, **plot_kwargs)
/usr/local/lib/python3.10/dist-packages/seaborn/axisgrid.py:854:
FutureWarning:

`shade` is now deprecated in favor of `fill`; setting `fill=True`.
```

```
This will become an error in seaborn v0.14.0; please update your code.
func(*plot_args, **plot_kwargs)
```



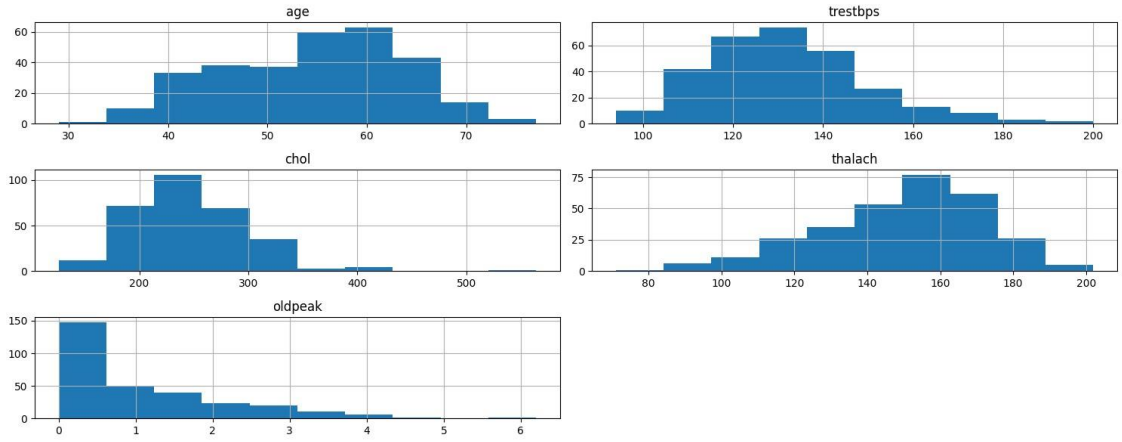
#Show Distribution of Serum Cholesterol

[46]:
```
data['chol'].hist()
plt.xlabel("Serum Cholesterol (chol)")
plt.ylabel("Frequency")
plt.title("Distribution of Serum Cholesterol")
plt.show()
```



#Plot Continuous Variables

[47]:
```
categorical_cols = [col for col in data.columns if data[col].nunique() <= 10]
continuous_cols = [col for col in data.columns if col not in categorical_cols]

data.hist(continuous_cols, figsize=(15, 6))
plt.tight_layout()
plt.show()
```



Heart Disease Analysis Project Summary

This project analyzed a heart disease dataset to understand the factors that influence heart disease risk. Here's a breakdown of the key findings:

Data Acquisition and Exploration:

- The heart disease dataset was downloaded from Kaggle.
- The data contains information on various factors like age, sex, chest pain type, blood pressure, cholesterol, and presence of heart disease.
- Initial exploration revealed a mix of individuals with varying heart health conditions and a range of values for key factors.

Data Cleaning and Preprocessing:

- There were no missing values in the dataset.
- Duplicate data points were identified and removed.
- Descriptive statistics were calculated to summarize the data.

Data Visualization:

- Heatmaps were used to visualize correlations between numerical features.
- Count plots explored the distribution of the target variable (presence of heart disease) and its relation to other factors like gender.
- Distribution plots were created to analyze the spread of continuous features like age, blood pressure, and cholesterol.
- These visualizations helped identify potential relationships between features and heart disease risk.

Next Steps:

- Further analysis can involve feature engineering to create new features or combine existing ones.
- Machine learning models can be trained on the data to predict the risk of heart disease for new patients.
- Model evaluation will be crucial to assess the accuracy and effectiveness of the models.

Overall, this project provided a basic understanding of the heart disease dataset and highlighted some potential factors influencing heart disease risk. Further analysis and modeling can lead to more robust insights and potentially contribute to better heart disease prediction and prevention strategies.

Shaun Mia | LinkedIn