```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Mount path to your dataset
file_path = '/content/Global_Cybersecurity_Threats_2015-2024.csv'

# Load the cybersecurity data
df = pd.read_csv(file_path)

import os
```

```
import warnings
warnings.filterwarnings("ignore")
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
pd.set_option("display.max_columns", None)
from sklearn.preprocessing import StandardScaler, OneHotEncoder, LabelEncoder
from sklearn.model_selection import train_test_split, GridSearchCV
from xgboost.sklearn import XGBRegressor
from sklearn.metrics import mean_absolute_error
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3000 entries, 0 to 2999
Data columns (total 10 columns):
 #   Column                          Non-Null Count  Dtype  
---  ------                          --------------  -----  
 0   Country                         3000 non-null   object 
 1   Year                            3000 non-null   int64  
 2   Attack Type                     3000 non-null   object 
 3   Target Industry                 3000 non-null   object 
 4   Financial Loss (in Million $)   3000 non-null   float64
 5   Number of Affected Users        3000 non-null   int64  
 6   Attack Source                   3000 non-null   object 
 7   Security Vulnerability Type     3000 non-null   object 
 8   Defense Mechanism Used          3000 non-null   object 
 9   Incident Resolution Time (in Hours)  3000 non-null   int64  
dtypes: float64(1), int64(3), object(6)
memory usage: 234.5+ KB
```

```
df.describe()
```

	Year	Financial Loss (in Million $)	Number of Affected Users	Incident Resolution Time (in Hours)
count	3000.000000	3000.000000	3000.000000	3000.000000
mean	2019.570333	50.492970	504684.136333	36.476000
std	2.857932	28.791415	289944.084972	20.570768
min	2015.000000	0.500000	424.000000	1.000000
25%	2017.000000	25.757500	255805.250000	19.000000
50%	2020.000000	50.795000	504513.000000	37.000000
75%	2022.000000	75.630000	758088.500000	55.000000
max	2024.000000	99.990000	999635.000000	72.000000

```
df.describe(include = "object")
```

	Country	Attack Type	Target Industry	Attack Source	Security Vulnerability Type	Defense Mechanism Used
count	3000	3000	3000	3000	3000	3000
unique	10	6	7	4	4	5
top	UK	DDoS	IT	Nation-state	Zero-day	Antivirus
freq	321	531	478	794	785	628

```
cat_cols = []
for col in df.columns:
    if df[col].dtypes == "object":
        cat_cols.append(col)

for i in cat_cols:
    print(df[i].value_counts())
    print("-"*30)
```

```
Country
UK           321
Brazil       310
India        308
Japan        305
France       305
Australia    297
Russia       295
Germany      291
USA          287
China        281
Name: count, dtype: int64
------------------------------
Attack Type
DDoS                 531
Phishing             529
SQL Injection        503
Ransomware           493
Malware              485
Man-in-the-Middle    459
Name: count, dtype: int64
------------------------------
Target Industry
IT                    478
Banking               445
Healthcare            429
Retail                423
Education             419
Government            403
Telecommunications    403
Name: count, dtype: int64
------------------------------
Attack Source
Nation-state    794
Unknown         768
Insider         752
Hacker Group    686
Name: count, dtype: int64
------------------------------
```

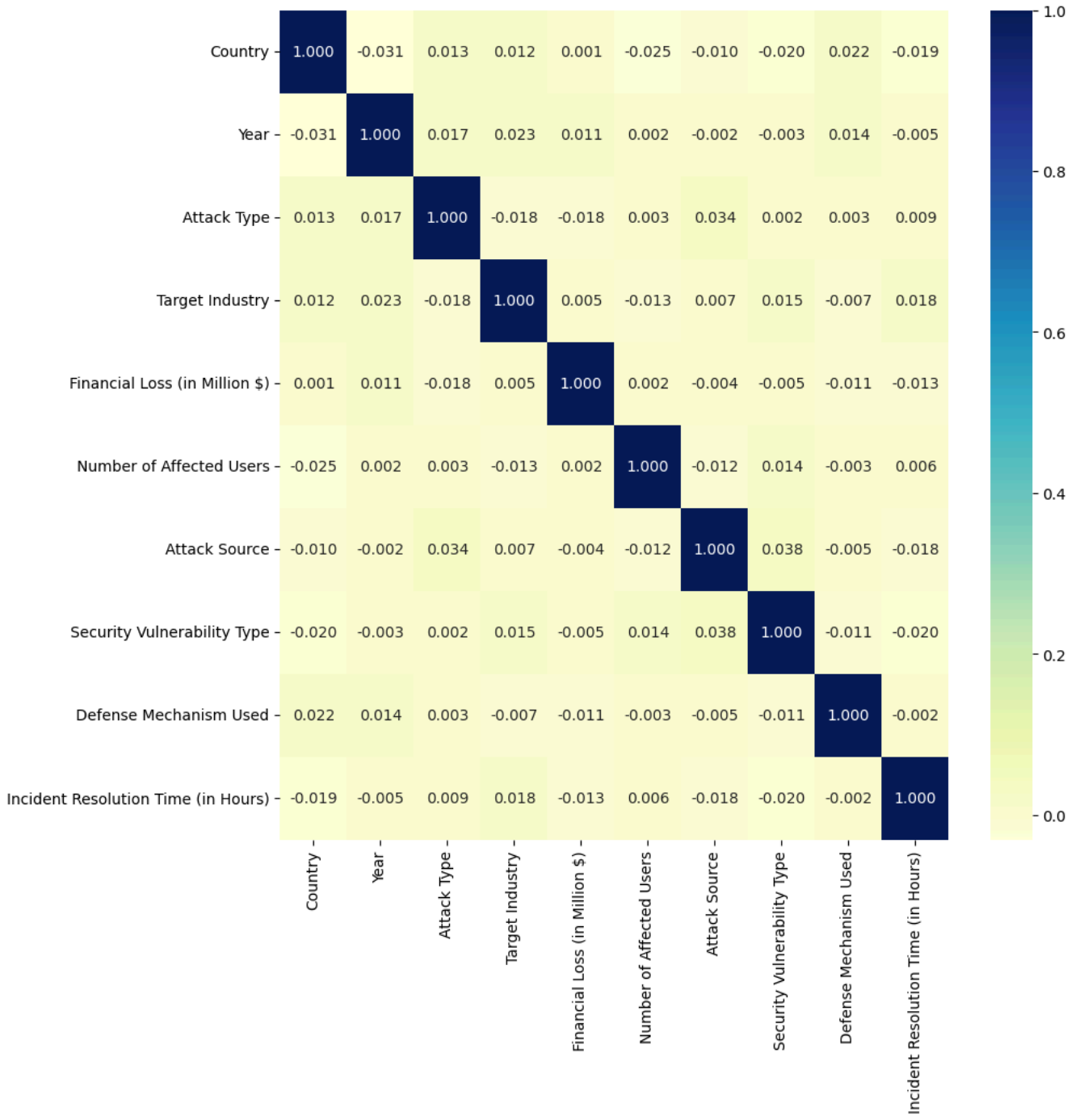
```
Security Vulnerability Type
Zero-day              785
Social Engineering    747
Unpatched Software    738
Weak Passwords        730
Name: count, dtype: int64
------------------------------
Defense Mechanism Used
Antivirus             628
VPN                   612
Encryption            592
Firewall              585
AI-based Detection    583
Name: count, dtype: int64
------------------------------
```

```
le = LabelEncoder()
df_temp = df.copy()
for i in cat_cols:
    df_temp[i] = le.fit_transform(df_temp[i])
df_temp.head()
```

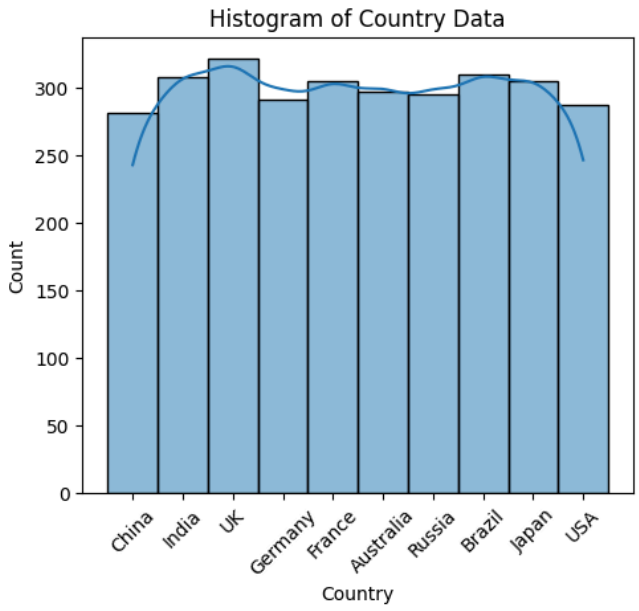
	Country	Year	Attack Type	Target Industry	Financial Loss (in Million $)	Number of Affected Users	Attack Source	Security Vulnerability Type	Defense Mechanism Used	Incident Resolution Time (in Hours)
0	2	2019	3	1	80.53	773169	0	1	4	63
1	2	2019	4	5	62.19	295961	0	1	3	71
2	5	2017	2	4	38.65	605895	0	2	4	20
3	8	2024	4	6	41.44	659320	2	0	0	7
4	4	2018	2	4	74.41	810682	1	0	4	68

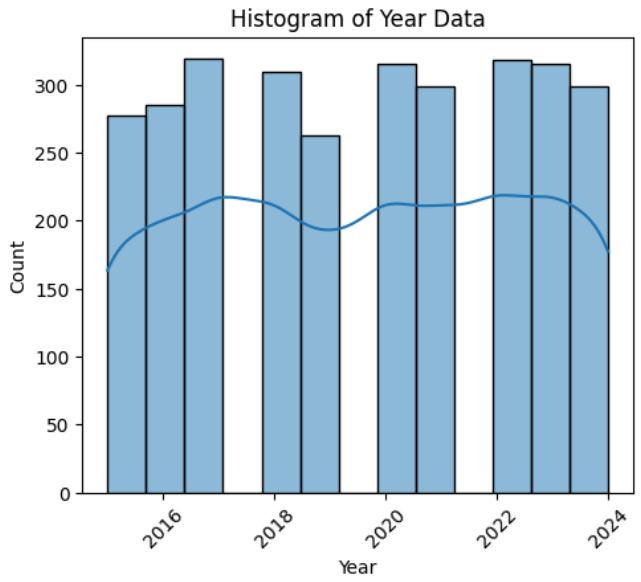
Next steps: Generate code with df_temp | New interactive sheet

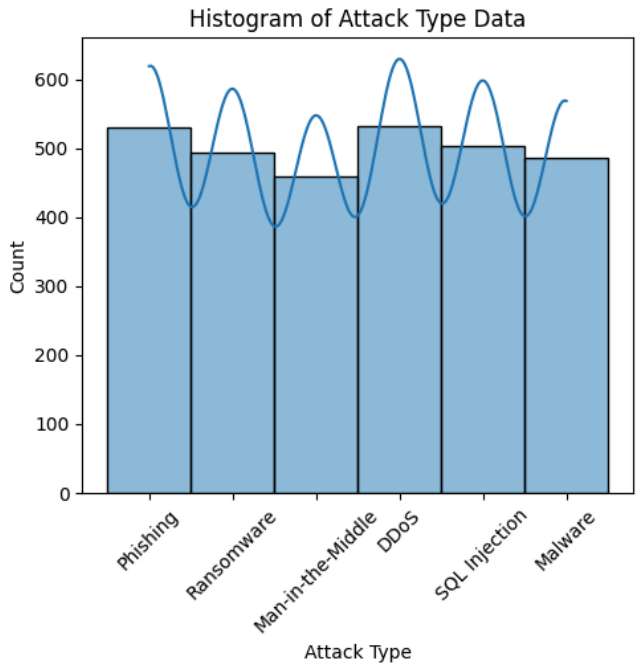
```
df_temp_corr = df_temp.corr()
plt.figure(figsize = (10, 10))
sns.heatmap(df_temp_corr, fmt = ".3f", annot = True, cmap = "YlGnBu")
plt.show()
```

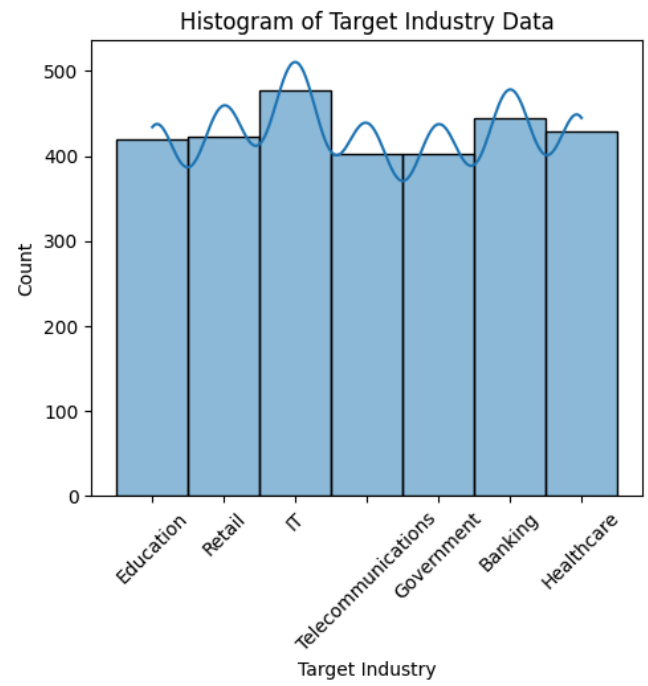


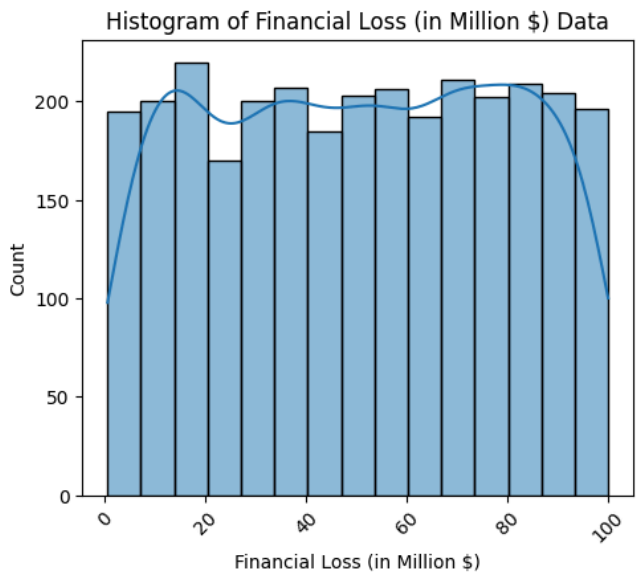

```
plt.figure(figsize = (15, 20))
for i, col in enumerate(df.columns, 1):
    plt.subplot(4, 3, i)
    sns.histplot(x = df[col], kde = True)
    plt.title(f"Histogram of {col} Data")
    plt.tight_layout()
    plt.xticks(rotation = 45)
    plt.plot()
```

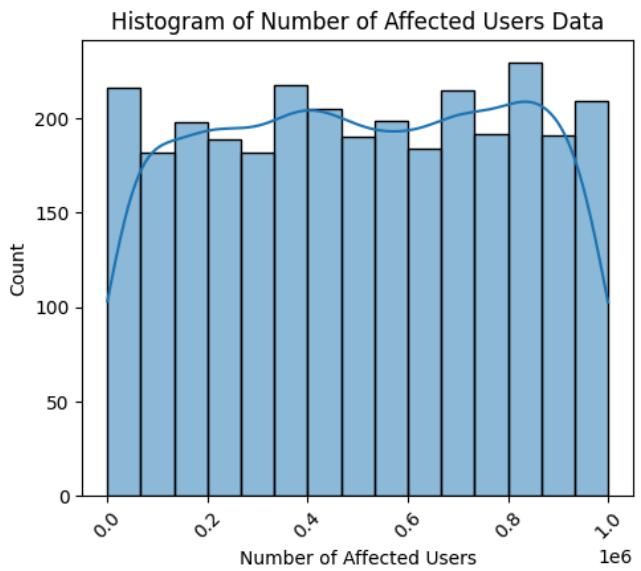


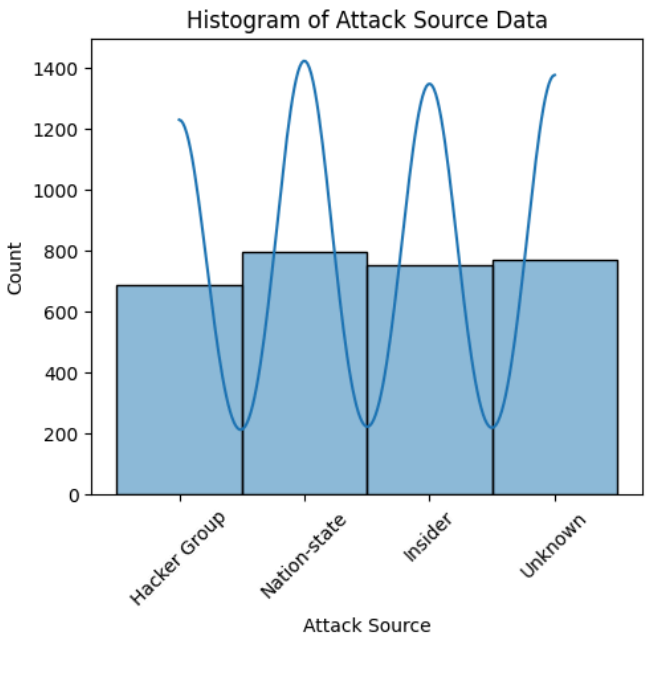


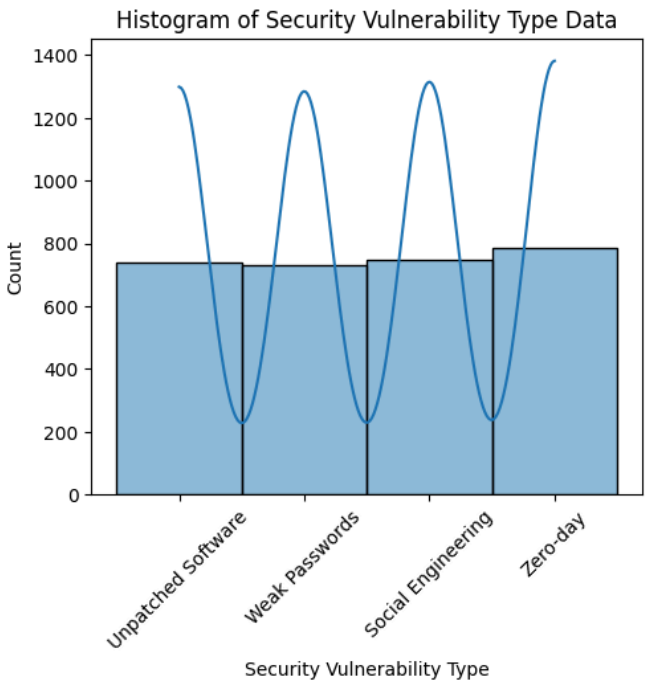


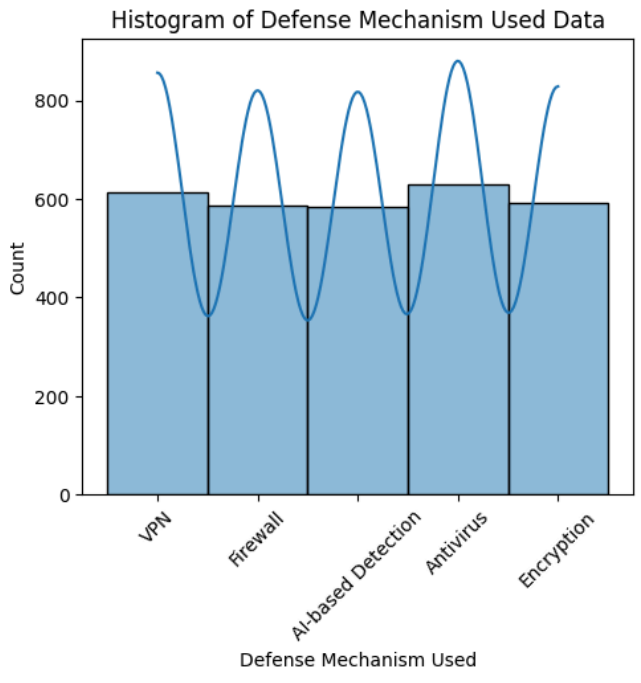


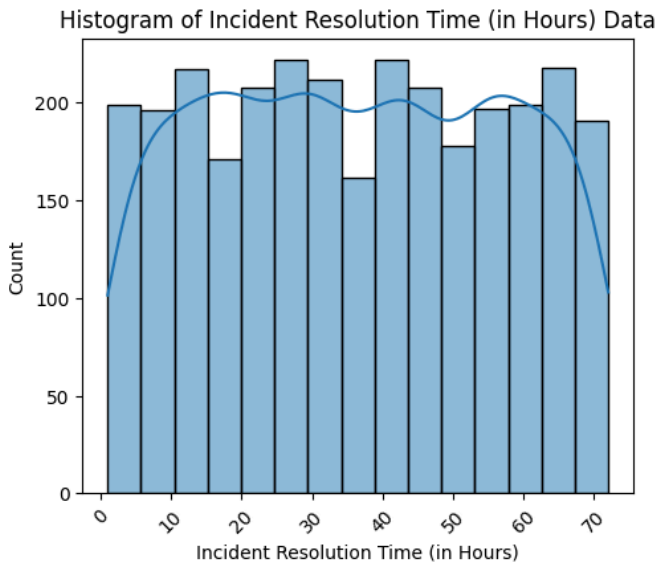













```
df1 = df.copy()
df.drop(["Year", "Financial Loss (in Million $)", "Number of Affected Users", "Incident Resolution Time (in Hours)"], axis = 1, inplace = True)
df = pd.concat([df, df1[["Year", "Number of Affected Users", "Incident Resolution Time (in Hours)", "Financial Loss (in Million $)"]]], axis = 1)
df.head()
```

	Country	Attack Type	Target Industry	Attack Source	Security Vulnerability Type	Defense Mechanism Used	Year	Number of Affected Users	Incident Resolution Time (in Hours)	Financial Loss (in Million $)
0	China	Phishing	Education	Hacker Group	Unpatched Software	VPN	2019	773169	63	80.53
1	China	Ransomware	Retail	Hacker Group	Unpatched Software	Firewall	2019	295961	71	62.19
2	India	Man-in-the-Middle	IT	Hacker Group	Weak Passwords	VPN	2017	605895	20	38.65
3	UK	Ransomware	Telecommunications	Nation-state	Social Engineering	AI-based Detection	2024	659320	7	41.44

Next steps: Generate code with df | New interactive sheet

```
df2 = df.copy()
df.drop("Year", axis = 1, inplace = True)
df = pd.concat([df2["Year"], df], axis = 1)
df.head()
```

	Year	Country	Attack Type	Target Industry	Attack Source	Security Vulnerability Type	Defense Mechanism Used	Number of Affected Users	Incident Resolution Time (in Hours)	Financial Loss (in Million $)
0	2019	China	Phishing	Education	Hacker Group	Unpatched Software	VPN	773169	63	80.53
1	2019	China	Ransomware	Retail	Hacker Group	Unpatched Software	Firewall	295961	71	62.19
2	2017	India	Man-in-the-Middle	IT	Hacker Group	Weak Passwords	VPN	605895	20	38.65
3	2024	UK	Ransomware	Telecommunications	Nation-state	Social Engineering	AI-based Detection	659320	7	41.44

Next steps: Generate code with df | New interactive sheet

```
def create_pivot_tables(df, column_name):
    df = df.pivot_table(index = "Year",
                        columns = cat_cols,
                        values = column_name,
                        aggfunc = "mean").unstack().reset_index()
    df = df.rename(columns = {0: f"Avg {column_name}"})
    return df

dfs = {}
column_names = df.columns[7:-1]
for i, column_name in enumerate(column_names):
    df_name = f"df_{i+1}"
    dfs[df_name] = create_pivot_tables(df, column_name)
```

```
df_merged = df.copy()

for column_name in column_names:
    if column_name in df_merged.columns:
        df_merged = df_merged.drop(column_name, axis=1)

for df_name, df_pivot in dfs.items():
    df_merged = pd.merge(df_merged, df_pivot,
                         on=['Year', 'Country', 'Attack Type', 'Target Industry',
                             'Attack Source', 'Security Vulnerability Type', 'Defense Mechanism Used'],
                         how='left')

df_merged
```

	Year	Country	Attack Type	Target Industry	Attack Source	Security Vulnerability Type	Defense Mechanism Used	Financial Loss (in Million $)	Avg Number of Affected Users	Avg Incident Resolution Time (in Hours)
0	2019	China	Phishing	Education	Hacker Group	Unpatched Software	VPN	80.53	773169.0	63.0
1	2019	China	Ransomware	Retail	Hacker Group	Unpatched Software	Firewall	62.19	295961.0	71.0
2	2017	India	Man-in-the-Middle	IT	Hacker Group	Weak Passwords	VPN	38.65	605895.0	20.0
3	2024	UK	Ransomware	Telecommunications	Nation-state	Social Engineering	AI-based Detection	41.44	659320.0	7.0
4	2018	Germany	Man-in-the-Middle	IT	Insider	Social Engineering	VPN	74.41	810682.0	68.0
...	...	...	...	...	...	...	...	...	...	...
2995	2021	UK	Ransomware	Government	Unknown	Social Engineering	Firewall	51.42	190694.0	52.0
2996	2023	Brazil	SQL Injection	Telecommunications	Hacker Group	Zero-day	VPN	30.28	892843.0	26.0
2997	2017	Brazil	SQL Injection	IT	Nation-state	Weak Passwords	AI-based Detection	32.97	734737.0	30.0
2998	2022	UK	SQL Injection	IT	Insider	Unpatched Software	Firewall	32.17	379954.0	9.0

Next steps: Generate code with df_merged | New interactive sheet

```
for i in cat_cols:
    df_merged[i] = le.fit_transform(df_merged[i])
df_merged
```

	Year	Country	Attack Type	Target Industry	Attack Source	Security Vulnerability Type	Defense Mechanism Used	Financial Loss (in Million $)	Avg Number of Affected Users	Avg Incident Resolution Time (in Hours)
0	2019	2	3	1	0	1	4	80.53	773169.0	63.0
1	2019	2	4	5	0	1	3	62.19	295961.0	71.0
2	2017	5	2	4	0	2	4	38.65	605895.0	20.0
3	2024	8	4	6	2	0	0	41.44	659320.0	7.0
4	2018	4	2	4	1	0	4	74.41	810682.0	68.0
...	...	...	...	...	...	...	...	...	...	...
2995	2021	8	4	2	3	0	3	51.42	190694.0	52.0
2996	2023	1	5	6	0	3	4	30.28	892843.0	26.0
2997	2017	1	5	4	2	2	0	32.97	734737.0	30.0
2998	2022	8	5	4	1	1	3	32.17	379954.0	9.0
2999	2021	4	5	5	3	3	4	48.20	480984.0	64.0

3000 rows × 10 columns

Next steps: Generate code with df_merged | New interactive sheet

```
df_merged.drop("Financial Loss (in Million $)", axis = 1, inplace = True)
df_merged.head()
```

	Year	Country	Attack Type	Target Industry	Attack Source	Security Vulnerability Type	Defense Mechanism Used	Avg Number of Affected Users	Avg Incident Resolution Time (in Hours)
0	2019	2	3	1	0	1	4	773169.0	63.0
1	2019	2	4	5	0	1	3	295961.0	71.0
2	2017	5	2	4	0	2	4	605895.0	20.0
3	2024	8	4	6	2	0	0	659320.0	7.0
4	2018	4	2	4	1	0	4	810682.0	68.0

Next steps: Generate code with df_merged | New interactive sheet

```
X = df_merged.iloc[:, :]
y = df_merged.iloc[:, -1]
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3, random_state = 0)
```

```
sc = StandardScaler()
X_train = sc.fit_transform(X_train)
X_test = sc.transform(X_test)
```

```
xgbr = XGBRegressor()
xgbr.fit(X_train, y_train)
y_xgbr = xgbr.predict(X_test)

mean_absolute_error(y_test, y_xgbr)
```

```
0.003017850054634942
```