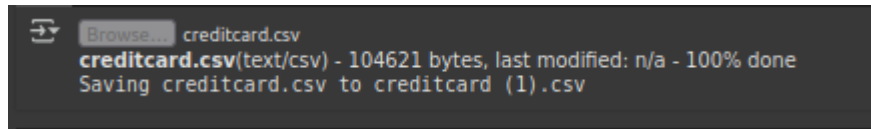


Upload the Dataset

from google.colab import files
uploaded = files.upload()



Load the Dataset

```
import pandas as pd  
df = pd.read_csv('creditcard.csv')
```

Data Exploration

```
df.head()
```

	Time	V1	V2	V3	V4	V5	V6	V7	V8	V9	...	V21	V22	V23	V24	V25	V26	V27	V28	Amount	Class
0	0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698	0.363787	...	-0.018307	0.277838	-0.110474	0.066928	0.128539	-0.189115	0.133558	-0.021053	149.62	0
1	0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102	-0.255425	...	-0.225775	-0.638672	0.101288	-0.339846	0.167170	0.125895	-0.008983	0.014724	2.69	0
2	1	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676	-1.514654	...	0.247998	0.771679	0.909412	-0.689281	-0.327642	-0.139097	-0.055353	-0.059752	378.66	0
3	1	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436	-1.387024	...	-0.108300	0.005274	-0.190321	-1.175575	0.647376	-0.221929	0.062723	0.061458	123.50	0
4	2	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533	0.817739	...	-0.009431	0.798278	-0.137458	0.141267	-0.206010	0.502292	0.219422	0.215153	69.99	0

5 rows × 31 columns

```
print("Shape:", df.shape)
```

```
print("Columns:", df.columns.tolist())
```

```
df.info()
```

```
df.describe()
```

Columns: ['Time', 'V1', 'V2', 'V3', 'V4', 'V5', 'V6', 'V7', 'V8', 'V9', 'V10', 'V11', 'V12', 'V13', 'V14', 'V15', 'V16', 'V17', 'V18', 'V19', 'V20', 'V21', 'V22', 'V23', 'V24', 'V25', 'V26', 'V27', 'V28', 'Amount', 'Class']

<class 'pandas.core.frame.DataFrame'>

RangeIndex: 199 entries, 0 to 198

Data columns (total 31 columns):

Column Non-Null Count Dtype

0 Time 199 non-null int64

1 V1 199 non-null float64

2 V2 199 non-null float64

3 V3 199 non-null float64

4 V4 199 non-null float64

5 V5 199 non-null float64

6 V6 199 non-null float64

7 V7 199 non-null float64

8 V8 199 non-null float64

9 V9 199 non-null float64

10 V10 199 non-null float64

11 V11 199 non-null float64

12 V12 199 non-null float64

13 V13 199 non-null float64

14 V14 199 non-null float64

15 V15 199 non-null float64

16 V16 199 non-null float64

17 V17 199 non-null float64

18 V18 199 non-null float64

19 V19 199 non-null float64

20 V20 199 non-null float64

21 V21 199 non-null float64

22 V22 199 non-null float64

23 V23 199 non-null float64

24 V24 199 non-null float64

25 V25 199 non-null float64

26 V26 199 non-null float64

27 V27 199 non-null float64

28 V28 199 non-null float64

29 Amount 199 non-null float64

30 Class 199 non-null int64

dtypes: float64(29), int64(2)

memory usage: 48.3 KB

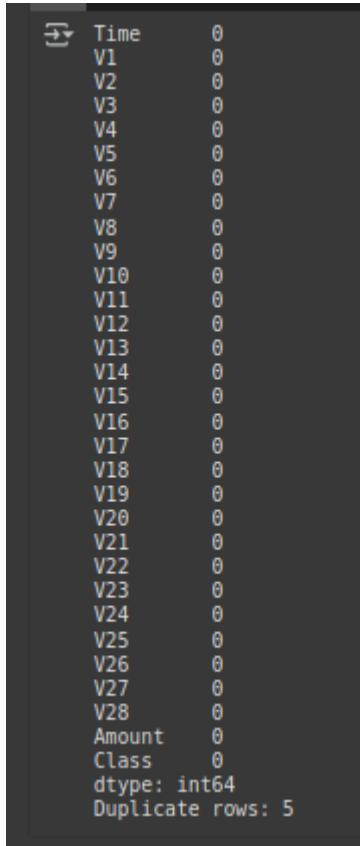
	Time	V1	V2	V3	V4	V5	V6	V7	V8	V9	...	V21	V22	V23	V24	V25	V26	V27	V28	Amount	Class
count	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	...	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.000000	199.0
mean	64.713568	-0.236384	0.158756	0.827502	0.364772	-0.049494	0.346774	0.233932	-0.013544	0.019578	...	0.020145	-0.021384	-0.048934	0.056944	0.146139	-0.005455	0.014588	-0.031633	93.352714	0.0
std	35.863565	1.479451	1.359116	1.136474	1.385853	1.272054	1.378823	0.859246	0.732246	0.820054	...	0.469974	0.626027	0.449990	0.604931	0.413064	0.508815	0.386884	0.307675	321.084247	0.0
min	0.000000	-6.093248	-12.114213	-5.694973	-4.515824	-6.631951	-2.145673	-2.705393	-3.807864	-2.094011	...	-0.923604	-2.776923	-3.553381	-1.688158	-1.120892	-1.243924	-2.377933	-1.648553	0.750000	0.0
25%	35.000000	-0.917862	-0.123737	0.184456	-0.469915	-0.615316	-0.514728	-0.157175	-0.174769	-0.395062	...	-0.200197	-0.469191	-0.164320	-0.370921	-0.099667	-0.330936	-0.050706	-0.046030	6.605000	0.0
50%	68.000000	-0.378602	0.254240	0.863585	0.519507	-0.110459	-0.027353	0.154092	0.048456	-0.042934	...	-0.042142	-0.000235	-0.050125	0.129561	0.156732	-0.090685	0.020337	0.019911	20.530000	0.0
75%	92.500000	1.108861	0.845177	1.531536	1.221565	0.427607	0.495493	0.642855	0.276433	0.334165	...	0.102520	0.345747	0.073547	0.439519	0.472891	0.214745	0.088053	0.062731	67.635000	0.0
max	131.000000	1.492936	4.847323	3.562770	4.075817	3.281972	5.122103	4.808426	1.592032	4.009259	...	2.270069	1.461535	2.458589	1.215279	1.136720	3.065576	2.490503	1.575380	3828.040000	0.0

8 rows x 31 columns

Check for Missing Values and Duplicates

```
print(df.isnull().sum())
```

```
print("Duplicate rows:", df.duplicated().sum())
```



```
Time      0
V1        0
V2        0
V3        0
V4        0
V5        0
V6        0
V7        0
V8        0
V9        0
V10       0
V11       0
V12       0
V13       0
V14       0
V15       0
V16       0
V17       0
V18       0
V19       0
V20       0
V21       0
V22       0
V23       0
V24       0
V25       0
V26       0
V27       0
V28       0
Amount    0
Class     0
dtype: int64
Duplicate rows: 5
```

Visualize a Few Features

```
import seaborn as sns
```

```
import matplotlib.pyplot as plt
```

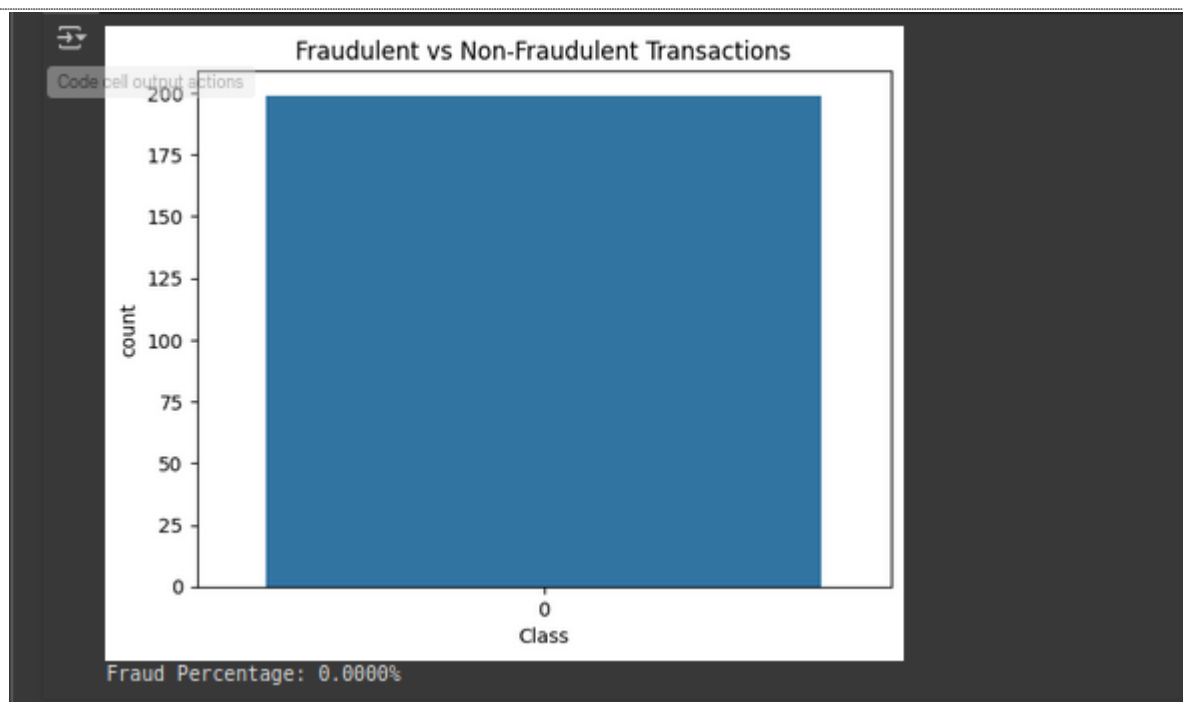
```
sns.countplot(x='Class', data=df)
```

```
plt.title("Fraudulent vs Non-Fraudulent Transactions")
```

```
plt.show()
```

```
fraud_ratio = df['Class'].value_counts(normalize=True).get(1, 0) * 100
```

```
print(f"Fraud Percentage: {fraud_ratio:.4f}%")
```



Feature Scaling

```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
X = df.drop('Class', axis=1)
y = df['Class']
X['Amount'] = StandardScaler().fit_transform(X['Amount'].values.reshape(-1, 1))
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42, stratify=y)
```

Model Building

```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
X = df.drop('Class', axis=1)
y = df['Class']
X['Amount'] = StandardScaler().fit_transform(X['Amount'].values.reshape(-1, 1))
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42, stratify=y)
```

Evaluation

```
from sklearn.metrics import classification_report, confusion_matrix,
roc_auc_score
y_pred = model.predict(X_test)
print("Confusion Matrix:\n", confusion_matrix(y_test, y_pred))
print("\nClassification Report:\n", classification_report(y_test, y_pred))
print("ROC AUC Score:", roc_auc_score(y_test, y_pred))
```

Convert to DataFrame and Encode

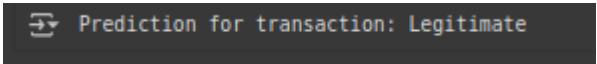
```
def detect_transaction(input_data):
```

```
    input_df = pd.DataFrame([input_data], columns=X.columns)
    input_df['Amount'] = StandardScaler().fit_transform(input_df['Amount'].values.reshape(-1, 1))
    prediction = model.predict(input_df)
    return "Fraudulent" if prediction[0] == 1 else "Legitimate"
```

Predict the Final Grade

```
sample_input = X_test.iloc[0].tolist()
```

```
print("Prediction for transaction:", detect_transaction(sample_input))
```

A terminal window with a dark background showing the output of the predict function. The text "Prediction for transaction: Legitimate" is displayed in a light blue monospace font. A small icon of a terminal window is visible in the top left corner of the output area.

```
➤ Prediction for transaction: Legitimate
```

Deployment-Building an Interactive App

```
!pip install gradio
```

```
Requirement already satisfied: gradio in /usr/local/lib/python3.11/dist-packages (5.29.0)
Requirement already satisfied: aiofiles<25.0,>=22.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (24.1.0)
Requirement already satisfied: anyio<5.0,>=3.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (4.9.0)
Requirement already satisfied: fastapi<1.0,>=0.115.2 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.115.12)
Requirement already satisfied: ffmpy in /usr/local/lib/python3.11/dist-packages (from gradio) (0.5.0)
Requirement already satisfied: gradio-client==1.10.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (1.10.0)
Requirement already satisfied: groovy==0.1 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.1.2)
Requirement already satisfied: httpx>=0.24.1 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.28.1)
Requirement already satisfied: huggingface-hub>=0.28.1 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.30.2)
Requirement already satisfied: jinja2<4.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (3.1.6)
Requirement already satisfied: markupsafe<4.0,>=2.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (3.0.2)
Requirement already satisfied: numpy<3.0,>=1.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (2.0.2)
Requirement already satisfied: orjson==3.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (3.10.17)
Requirement already satisfied: packaging in /usr/local/lib/python3.11/dist-packages (from gradio) (24.2)
Requirement already satisfied: pandas<3.0,>=1.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (2.2.2)
Requirement already satisfied: pillow<12.0,>=8.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (11.2.1)
Requirement already satisfied: pydantic<2.12,>=2.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (2.11.3)
Requirement already satisfied: pydub in /usr/local/lib/python3.11/dist-packages (from gradio) (0.25.1)
Requirement already satisfied: python-multipart==0.0.18 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.0.20)
Requirement already satisfied: pyyaml<7.0,>=5.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (6.0.2)
Requirement already satisfied: ruff>=0.3 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.11.8)
Requirement already satisfied: safetensors<0.2.0,>=0.1.6 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.1.6)
Requirement already satisfied: semantic-version==2.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (2.10.0)
Requirement already satisfied: starlette<1.0,>=0.40.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.46.2)
Requirement already satisfied: tomli<1.4.0,>=0.12.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.13.2)
Requirement already satisfied: typer<1.0,>=0.12 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.15.3)
Requirement already satisfied: typing-extensions==4.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (4.13.2)
Requirement already satisfied: uvicorn==0.14.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.34.2)
Requirement already satisfied: fsspec in /usr/local/lib/python3.11/dist-packages (from gradio-client==1.10.0->gradio) (2025.3.2)
Requirement already satisfied: websockets<16.0,>=10.0 in /usr/local/lib/python3.11/dist-packages (from gradio-client==1.10.0->gradio) (15.0.1)
Requirement already satisfied: idna==2.8 in /usr/local/lib/python3.11/dist-packages (from anyio<5.0,>=3.0->gradio) (3.10)
Requirement already satisfied: sniffio==1.1 in /usr/local/lib/python3.11/dist-packages (from anyio<5.0,>=3.0->gradio) (1.3.1)
Requirement already satisfied: certifi in /usr/local/lib/python3.11/dist-packages (from httpx>=0.24.1->gradio) (2025.4.26)
Requirement already satisfied: httpcore==1.* in /usr/local/lib/python3.11/dist-packages (from httpx>=0.24.1->gradio) (1.0.9)
Requirement already satisfied: h11>=0.16 in /usr/local/lib/python3.11/dist-packages (from httpcore==1.*->httpx>=0.24.1->gradio) (0.16.0)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from huggingface-hub>=0.28.1->gradio) (3.18.0)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from huggingface-hub>=0.28.1->gradio) (2.32.3)
Requirement already satisfied: tqdm==4.42.1 in /usr/local/lib/python3.11/dist-packages (from huggingface-hub>=0.28.1->gradio) (4.67.1)
Requirement already satisfied: python-dateutil==2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas<3.0,>=1.0->gradio) (2.9.0.post0)
Requirement already satisfied: pytz==2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas<3.0,>=1.0->gradio) (2025.2)
Requirement already satisfied: tzdata==2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas<3.0,>=1.0->gradio) (2025.2)
Requirement already satisfied: annotated-types==0.6.0 in /usr/local/lib/python3.11/dist-packages (from pydantic<2.12,>=2.0->gradio) (0.7.0)
Requirement already satisfied: pydantic-core==2.33.1 in /usr/local/lib/python3.11/dist-packages (from pydantic<2.12,>=2.0->gradio) (2.33.1)
Requirement already satisfied: typing-inspection==0.4.0 in /usr/local/lib/python3.11/dist-packages (from pydantic<2.12,>=2.0->gradio) (0.4.0)
Requirement already satisfied: click==8.0.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0,>=0.12->gradio) (8.1.8)
Requirement already satisfied: shellingham==1.3.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0,>=0.12->gradio) (1.5.4)
Requirement already satisfied: rich==10.11.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0,>=0.12->gradio) (13.9.4)
Requirement already satisfied: six==1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil==2.8.2->pandas<3.0,>=1.0->gradio) (1.17.0)
Requirement already satisfied: markdown-it-py==2.2.0 in /usr/local/lib/python3.11/dist-packages (from rich==10.11.0->typer<1.0,>=0.12->gradio) (3.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /usr/local/lib/python3.11/dist-packages (from rich==10.11.0->typer<1.0,>=0.12->gradio) (2.19.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests->huggingface-hub>=0.28.1->gradio) (3.4.1)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests->huggingface-hub>=0.28.1->gradio) (2.4.0)
Requirement already satisfied: mdurl==0.1 in /usr/local/lib/python3.11/dist-packages (from markdown-it-py==2.2.0->rich==10.11.0->typer<1.0,>=0.12->gradio) (0.1.2)
```