# Data Collection and Preprocessing Phase

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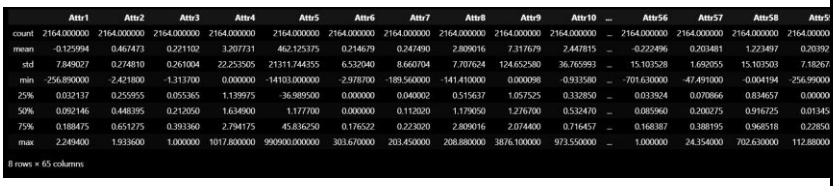
| Date | 04 July 2024 |
| Team ID | 739985 |
| Project Title | Anticipating Business Bankruptcy |
| Maximum Marks | 6 Marks |

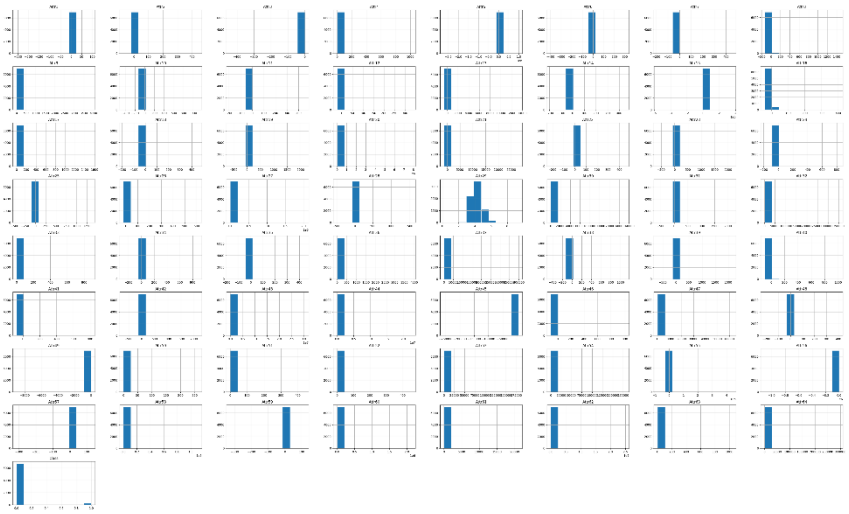
**Data Exploration and Preprocessing Report**

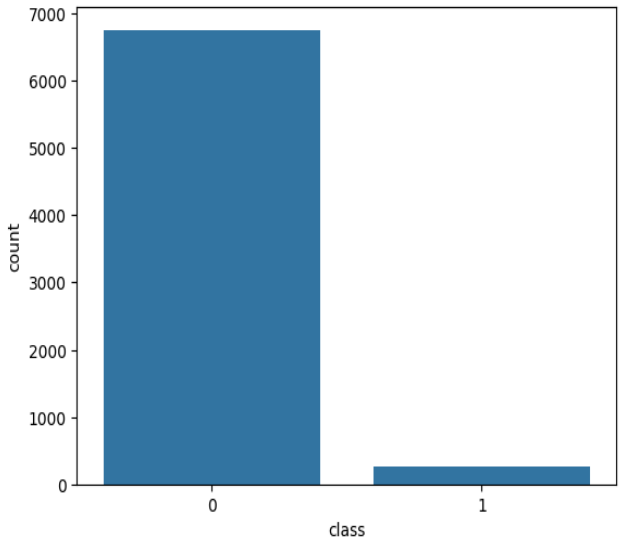
Dataset variables will be statistically analyzed to identify patterns and outliers, with Python employed for preprocessing tasks like normalization and feature engineering. Data cleaning will address missing values and outliers, ensuring quality for subsequent analysis and modeling, and forming a strong foundation for insights and predictions.

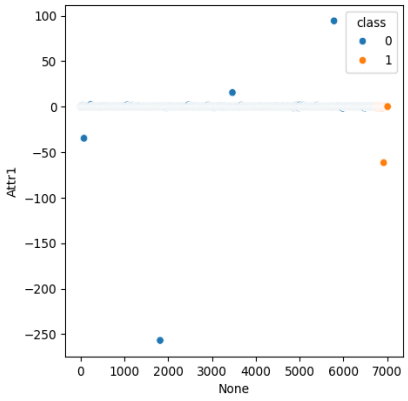
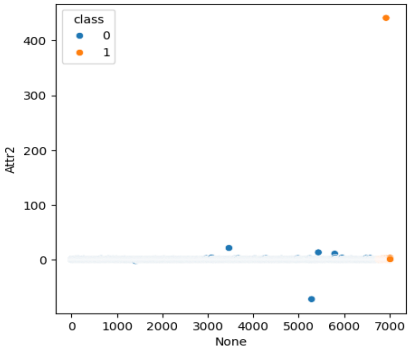
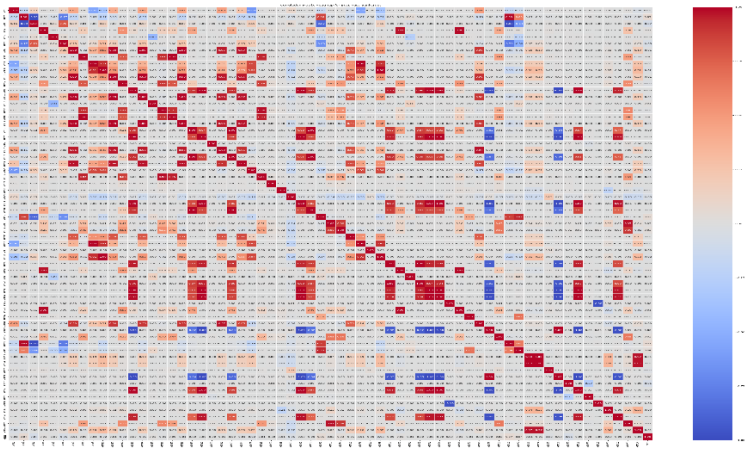
| Section | Description |
|---|---|
| Data Overview | <u>Dimension:</u><br>7012 rows × 65 columns<br><br>`Shape of Data: (7012, 65)`<br>`number of Rows: 7012`<br>`Number of Columns: 65`<br><br><u>Descriptive statistics:</u><br>  |
| Univariate Analysis | |

| | Attr1 | Attr2 | Attr3 | Attr4 | Attr5 | Attr6 | Attr7 | Attr8 | Attr9 | Attr10 | ... | Attr56 | Attr57 | Attr58 | Attr5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| count | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | 2164.000000 | ... | 2164.000000 | 2164.000000 | 2164.000000 | 2164.00000 |
| mean | -0.125994 | 0.467473 | 0.221102 | 3.207731 | 462.125375 | 0.214679 | 0.247490 | 2.809016 | 7.317679 | 2.447815 | ... | -0.222496 | 0.203481 | 1.223497 | 0.20392 |
| std | 7.849027 | 0.274810 | 0.261004 | 22.253505 | 21311.744355 | 6.532040 | 8.660704 | 7.707624 | 124.652580 | 36.765993 | ... | 15.103528 | 1.692055 | 15.103503 | 7.18267 |
| min | -256.890000 | -2.421800 | -1.313700 | 0.000000 | -14103.000000 | -2.978700 | -189.560000 | -141.410000 | 0.000098 | -0.933580 | ... | -701.630000 | -47.491000 | -0.004194 | -256.99000 |
| 25% | 0.032137 | 0.255955 | 0.055365 | 1.139975 | -36.989500 | 0.000000 | 0.040002 | 0.515637 | 1.057525 | 0.332850 | ... | 0.033924 | 0.070866 | 0.834657 | 0.00000 |
| 50% | 0.092146 | 0.448395 | 0.212050 | 1.634900 | 1.177700 | 0.000000 | 0.112020 | 1.179050 | 1.276700 | 0.532470 | ... | 0.085960 | 0.200275 | 0.916725 | 0.01345 |
| 75% | 0.188475 | 0.651275 | 0.393360 | 2.794175 | 45.836250 | 0.176522 | 0.223020 | 2.809016 | 2.074400 | 0.716457 | ... | 0.168387 | 0.388195 | 0.968518 | 0.22850 |
| max | 2.249400 | 1.933600 | 1.000000 | 1017.800000 | 990900.000000 | 303.670000 | 203.450000 | 208.880000 | 3876.100000 | 973.550000 | ... | 1.000000 | 24.354000 | 702.630000 | 112.88000 |

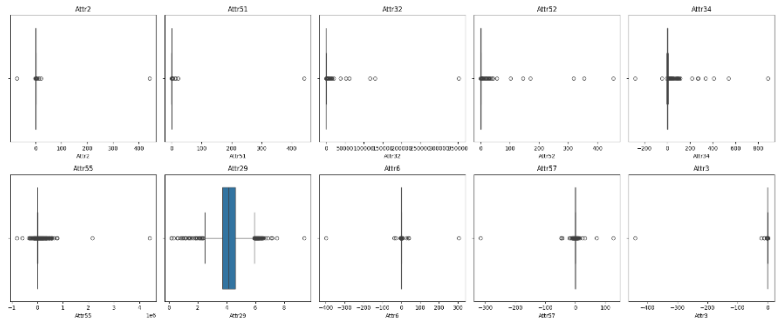
8 rows × 65 columns



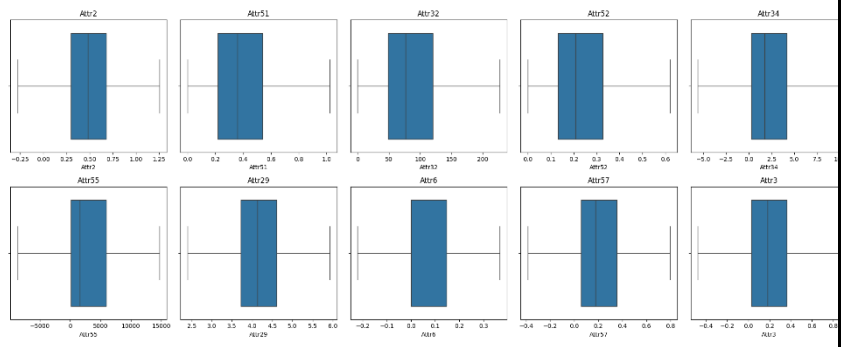

7000
6000
5000
4000
3000
2000
1000
0
count
0
1
class

| | |
|---|---|
| Bivariate Analysis |  <br>  |
| Multivariate Analysis |  |

| | |
|---|---|
| Outliers and Anomalies | |




```
q1=data.quantile(0.25)
q3=data.quantile(0.75)
IQR=q3-q1
upper_limit=q1+1.5*IQR
lower_limit=q1-1.5*IQR
k=["Attr2","Attr51","Attr32","Attr52", "Attr34","Attr55","Attr29","Attr6","Attr57","Attr3"]
for i in k:
  data[i]=np.where(data[i]>upper_limit[i],upper_limit[i],data[i])
  data[i]=np.where(data[i]<lower_limit[i],lower_limit[i],data[i])
```




## Data Preprocessing Code Screenshots

Loading Data

```
data = pd.read_csv("/content/drive/MyDrive/1year.csv")
```

```
data.head()
```

| | Attr1 | Attr2 | Attr3 | Attr4 | Attr5 | Attr6 | Attr7 | Attr8 | Attr9 | Attr10 | ... | Attr56 | Attr57 | Attr58 | Attr59 | Attr60 | Attr61 | Attr62 | Attr63 | Attr64 | class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.20055 | 0.37951 | 0.39641 | 2.0472 | 32.351 | 0.38825 | 0.24976 | 1.3305 | 1.1389 | 0.50494 | ... | 0.121960 | 0.39718 | 0.87804 | 0.001924 | 8.416 | 5.1372 | 82.658 | 4.4158 | 7.4277 | 0 |
| 1 | 0.20912 | 0.49988 | 0.47225 | 1.9447 | 14.786 | 0 | 0.25834 | 0.99601 | 1.6996 | 0.49788 | ... | 0.121300 | 0.42002 | 0.85300 | 0 | 4.1486 | 3.2732 | 107.350 | 3.4 | 60.987 | 0 |
| 2 | 0.24866 | 0.69592 | 0.26713 | 1.5548 | -1.1523 | 0 | 0.30906 | 0.43695 | 1.309 | 0.30408 | ... | 0.241140 | 0.81774 | 0.76599 | 0.69484 | 4.9909 | 3.951 | 134.270 | 2.7185 | 5.2078 | 0 |
| 3 | 0.081483 | 0.30734 | 0.45879 | 2.4928 | 51.952 | 0.14988 | 0.092704 | 1.8661 | 1.0571 | 0.57353 | ... | 0.054015 | 0.14207 | 0.94598 | 0 | 4.5746 | 3.6147 | 86.435 | 4.2228 | 5.5497 | 0 |
| 4 | 0.18732 | 0.61323 | 0.2296 | 1.4063 | -7.3128 | 0.18732 | 0.18732 | 0.6307 | 1.1559 | 0.38677 | ... | 0.134850 | 0.48431 | 0.86515 | 0.12444 | 6.3985 | 4.3158 | 127.210 | 2.8692 | 7.898 | 0 |

5 rows × 65 columns

## Handling Missing Data

```
(data.eq('?')).any()
```

```
Attr1     True
Attr2     True
Attr3     True
Attr4     True
Attr5     True
          ...
Attr61    True
Attr62   False
Attr63    True
Attr64    True
class    False
Length: 65, dtype: bool
```

```
data.replace('?',np.NAN,inplace=True)
```

```
data.isnull().sum()
```

```
Attr1     3
Attr2     3
Attr3     3
Attr4    30
Attr5     8
         ..
Attr61   22
Attr62    0
Attr63   30
Attr64   34
class     0
Length: 65, dtype: int64
```

```
data.isnull().sum().sum()
```

```
5818
```

```
for i in range(1, 65):
    data[f'Attr{i}'] = pd.to_numeric(data[f'Attr{i}'], errors='coerce')
```

```
data=data.fillna(data.mean())
```

```
data.isnull().sum().sum()
```

```
0
```

```
data.isnull().any()
```

```
Attr1     False
Attr2     False
Attr3     False
Attr4     False
Attr5     False
          ...
Attr61    False
Attr62    False
Attr63    False
Attr64    False
class     False
Length: 65, dtype: bool
```

## Data Transformation

```
x=selected_variable
y=data['class']
```

```
x_scaled=pd.DataFrame(StandardScaler(copy=False).fit_transform(x))
x_scaled.columns=x.columns
```

```
x.head()
```

| | Attr2 | Attr51 | Attr32 | Attr52 | Attr34 | Attr55 | Attr29 | Attr6 | Attr57 | Attr3 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.37951 | 0.37854 | 94.14 | 0.25792 | 0.56393 | 348690.0 | 5.9443 | 0.38825 | 0.39718 | 0.39641 |
| 1 | 0.49988 | 0.49988 | 122.17 | 0.33472 | 2.98760 | 2304.6 | 3.6884 | 0.00000 | 0.42002 | 0.47225 |
| 2 | 0.69592 | 0.48152 | 176.93 | 0.48474 | 1.42740 | 6332.7 | 4.3749 | 0.00000 | 0.81774 | 0.26713 |
| 3 | 0.30734 | 0.30734 | 91.37 | 0.25033 | 0.37581 | 20545.0 | 4.6511 | 0.14988 | 0.14207 | 0.45879 |
| 4 | 0.61323 | 0.56511 | 147.04 | 0.40285 | 0.32340 | 3186.6 | 4.1424 | 0.18732 | 0.48431 | 0.22960 |

SMOTE

```
!pip install imblearn
from imblearn.over_sampling import SMOTE

sm=SMOTE(random_state=123) # Now SMOTE is defined
x_sm, y_sm = sm.fit_resample(x_scaled, y)
print(f'''Shape of X before SMOTE: {x_scaled.shape}
Shape of X after SMOTE: {x_sm.shape}''','\n\n')
print(f'''Target Class distribution before SMOTE;\n{y.value_counts(normalize=True)}
|Target Class distribution after SMOTE :\n{y_sm.value_counts(normalize=True)}''')
```

```
Requirement already satisfied: imblearn in /usr/local/lib/python3.10/dist-packages (0.0)
Requirement already satisfied: imbalanced-learn in /usr/local/lib/python3.10/dist-packages (from imblearn) (0.10.1)
Requirement already satisfied: numpy>=1.17.3 in /usr/local/lib/python3.10/dist-packages (from imbalanced-learn->imblearn) (1.25.2)
Requirement already satisfied: scipy>=1.3.2 in /usr/local/lib/python3.10/dist-packages (from imbalanced-learn->imblearn) (1.11.4)
Requirement already satisfied: scikit-learn>=1.0.2 in /usr/local/lib/python3.10/dist-packages (from imbalanced-learn->imblearn) (1.2.2)
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.10/dist-packages (from imbalanced-learn->imblearn) (1.4.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from imbalanced-learn->imblearn) (3.5.0)
Shape of X before SMOTE: (7012, 10)
Shape of X after SMOTE: (13512, 10)


Target Class dstribution before SMOTE;
class
0    0.963491
1    0.036509
Name: proportion, dtype: float64
 Target Class distribution after SMOTE :
class
0    0.5
1    0.5
Name: proportion, dtype: float64
```

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| Feature Engineering | Attached the codes in final submission. |
| Save Processed Data | - |