ALERT

You may skip "0.1" and "1.1" Since the clean data is already made. 😊

0. Import Modules and Setup

```
import pandas as pd
import numpy as np
import seaborn as sns
import tensorflow as tf
import matplotlib.pyplot as plt

from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.metrics import classification_report
from sklearn.metrics import accuracy_score

from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.svm import SVC
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.naive_bayes import GaussianNB

import warnings
warnings.filterwarnings('ignore')
```

>0.1 Convert Large Data Files Into Feather File

```
# # Load the three CSV files
# df1 = pd.read_csv('data/horses.csv', low_memory=False)
# df2 = pd.read_csv('data/horses1.csv', low_memory=False)
# df3 = pd.read_csv('data/horses2.csv', low_memory=False)

# # Concatenate the three DataFrames
# df = pd.concat([df1, df2, df3])
# df.reset_index(drop=True, inplace=True)

# # Convert Row column to Str, avoids error
# df['Row'] = df['Row'].astype(str)

# # Save the concatenated DataFrame as a feather file
# df.to_feather('data/horses.feather')
```

>1. Data PreProcessing

Hassan Kamran. (2022). Historic Australian Horse Racing Dataset [Data set]. Kaggle. https://doi.org/10.34740/KAGGLE/DS/2306807

```
# Load in data
horse_data_raw = pd.read_feather('data/horses.feather')

# View nulls
# null_percetnages = horse_data_raw.isna().mean() * 100

# null_percetnages.to_csv('null_percentages.csv')

# Extract Relevant Features
horse_data_extracted = horse_data_raw[['Winner', 'StartingOdds',
'RecentWinPercent', 'Class', 'laststart', 'Age', 'Colour', 'Sex',
'Sire']]

horse_data_extracted.head()
```

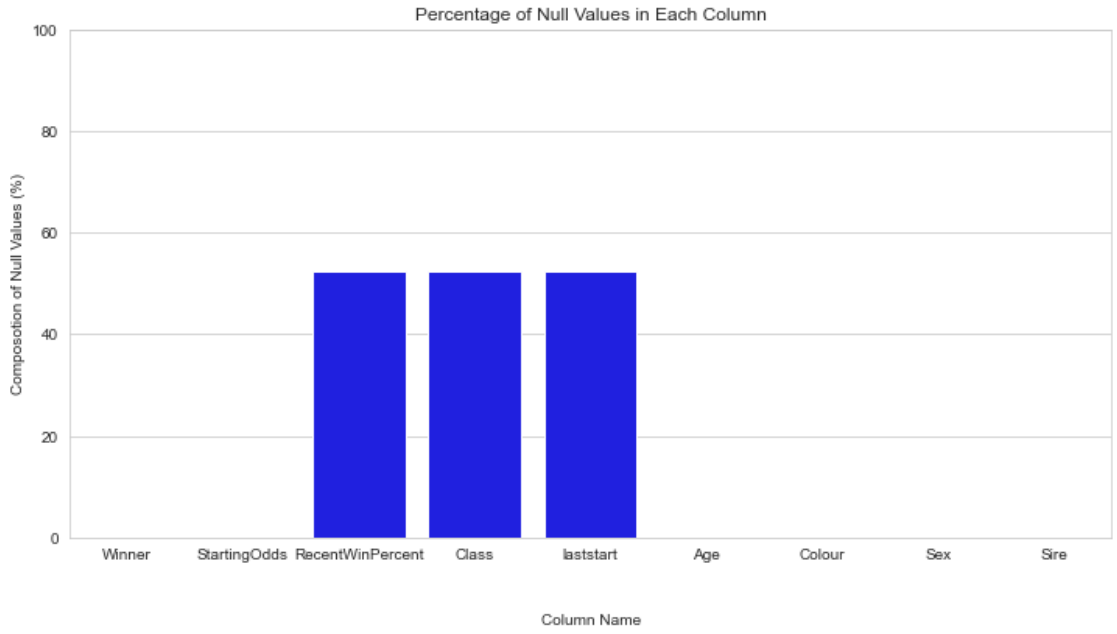
```
   Winner  StartingOdds  RecentWinPercent  Class  laststart  Age
Colour  \
0     1.0           2.4               NaN    NaN        NaN    4
BAY
1     0.0          18.1               NaN    NaN        NaN    5
BROWN/BLACK
2     0.0           6.0               NaN    NaN        NaN    6
BLACK
3     0.0           7.4               NaN    NaN        NaN    5
BROWN/BLACK
4     0.0          53.1               NaN    NaN        NaN    7
BAY

       Sex                    Sire
0  GELDING          CAMMIBEST USA
1  GELDING  ALLAMERICAN INGOT USA
2  GELDING      WASHINGTON VC USA
3  GELDING                ELSU NZ
4  GELDING        REAL DESIRE USA
```

```
null_percentages = horse_data_extracted.isna().mean() * 100

# Create a bar chart
sns.set_style('whitegrid')
plt.figure(figsize=(12,6))
ax = sns.barplot(x=null_percentages.index, y=null_percentages.values,
color='blue', orient='v')
plt.title('Percentage of Null Values in Each Column')
plt.xlabel('Column Name')
plt.ylabel('Composotion of Null Values (%)')
plt.ylim(0, 100)

ax.xaxis.set_label_coords(0.5, -0.15)
```



It seems "RecentWinPercent', 'Class', and 'laststart' have ~ 50% missing nullvalues

```
print(f"Rows: {horse_data_extracted.shape[0]}")
```

```
Rows: 1220095
```

Since there are plenty of rows to work with, we will remove all rows with null values

```
horse_data_nonull = horse_data_extracted.dropna()

print(f"Row count after removing null value rows:
{horse_data_nonull.shape[0]}")
```

```
Row count after removing null value rows: 579580
```

```
horse_data_nonull["Winner"].unique()
```

```
array([1., 0.])
```

```
# Convert 'Winner' column to integer using .loc
horse_data_nonull.loc[:, 'Winner'] =
horse_data_nonull['Winner'].astype(int)

horse_data_nonull["Winner"].unique()
```

```
array([1, 0])
```

```
# TODO: Analyse "Age", "Color", "Sex" and "Sire" as categorical
features. For now, only use numerical features

corr_matrix = horse_data_nonull.corr()
print(corr_matrix["Winner"])
```

```
Winner              1.000000
StartingOdds       -0.223145
RecentWinPercent    0.155096
Class               0.165051
laststart          -0.413778
Age                -0.085736
Name: Winner, dtype: float64
```

Age column can be dropped. Keep the rest

```
selected_cols = ["Winner", "StartingOdds", "RecentWinPercent",
"Class", "laststart"]
horse_data_selected = horse_data_nonull[selected_cols]
```

Save selected data to feather

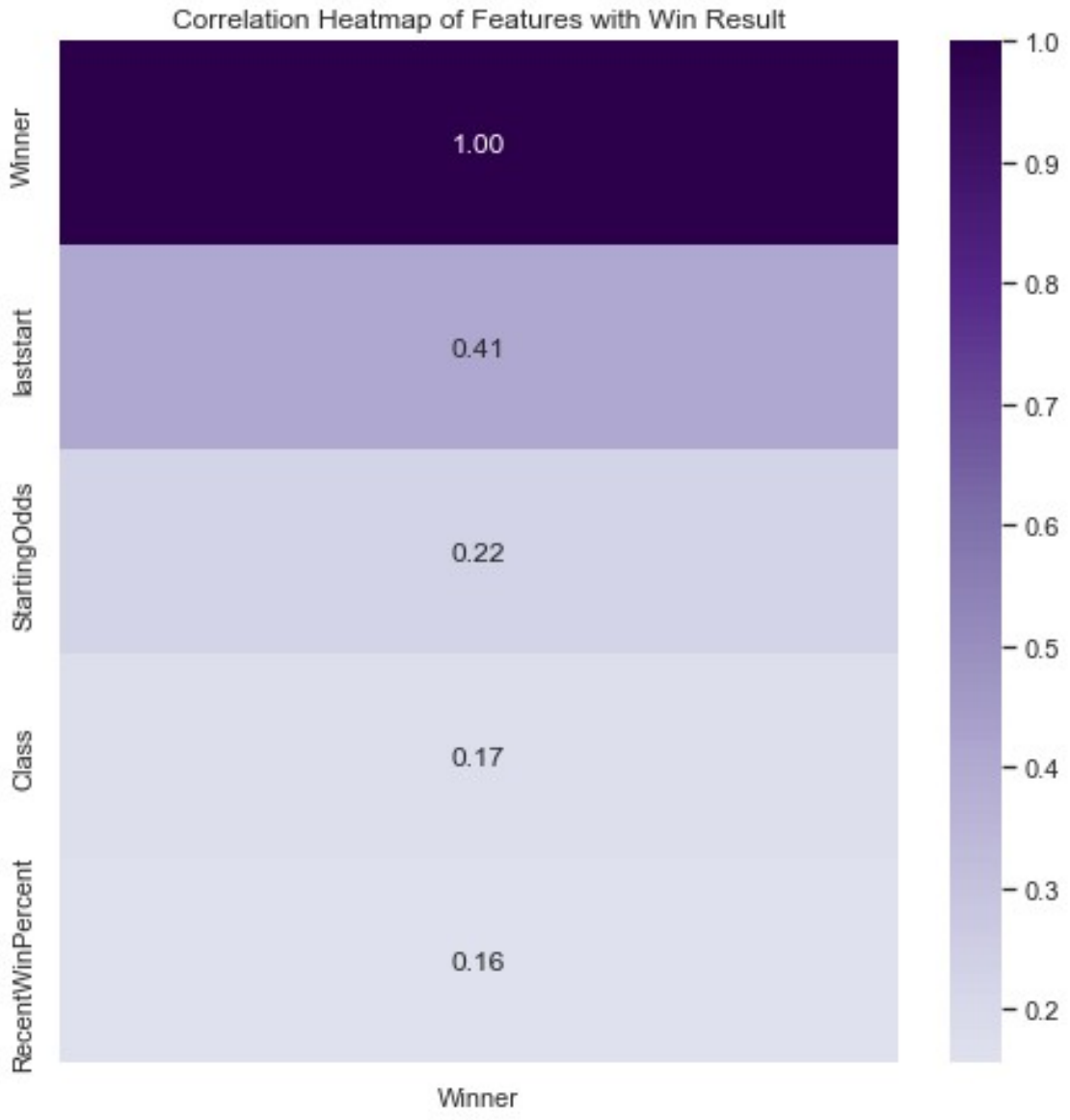
```
horse_data_selected.reset_index(drop=True, inplace=True)
horse_data_selected.to_feather("cleaned_data.feather")
```

>2. Exploratory Data Analysis

```
df = pd.read_feather("cleaned_data.feather")

# Get correlation Values
corr_with_winner = df.corr()
["Winner"].abs().sort_values(ascending=False)

#Load Heatmap
sns.set(style="white")
plt.figure(figsize=(8, 8))
sns.heatmap(corr_with_winner.to_frame(), cmap='PuOr', center=0,
annot=True, fmt=".2f")
plt.title("Correlation Heatmap of Features with Win Result")
plt.show()
```



>3. Model Building

```
# Split the dataset into features and target
X = df.drop("Winner", axis=1)
y = df['Winner']

# Standardise Training Data
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Perform Split
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)
```

>3.1 Logistic Regression (baseline)

```
# build the logistic regression model
log_reg = LogisticRegression(max_iter=10000)
log_reg.fit(X_train, y_train)

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log_reg = LogisticRegression(max_iter=10000)
log_reg.fit(X_train, y_train)
;

''

# evaluate the model
y_pred = log_reg.predict(X_test)
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.93      0.98      0.96    102950
           1       0.75      0.45      0.56     12966

    accuracy                           0.92    115916
   macro avg       0.84      0.72      0.76    115916
weighted avg       0.91      0.92      0.91    115916
```

>3.2 Random Forest Classifier

```
# Define the model
rfc = RandomForestClassifier()

# Train the model
rfc.fit(X_train, y_train)

# Evaluate the model on the test set
rfc_score = rfc.score(X_test, y_test)
print("Random Forest Classifier Accuracy:", rfc_score)
```

```
Random Forest Classifier Accuracy: 0.9561061458297387
```

>3.3 Support Vector Machine

```
# from sklearn.svm import SVC

# # Define the model
# svm = SVC()

# # Train the model
# svm.fit(X_train, y_train)

# # Evaluate the model on the test set
```

```
# svm_score = svm.score(X_test, y_test)
# print("Support Vector Machine Accuracy:", svm_score)
```

>3.4 Gradient Boost Classifier

```
# Build the Gradient Boosting Classifier model
gb_classifier = GradientBoostingClassifier()

# Train the model on the training set
gb_classifier.fit(X_train, y_train)

# Make predictions on the testing set
y_pred = gb_classifier.predict(X_test)

# Evaluate the accuracy of the model
gb_classifier_score = gb_classifier.score(X_test, y_test)
gb_accuracy = accuracy_score(y_test, y_pred)
print("Accuracy:", gb_accuracy)
```

```
Accuracy: 0.9575986058870216
```

>3.5 Naive Bayes Classifier

```
# create an instance of the model
nb = GaussianNB()

# fit the model to the data
nb.fit(X_train, y_train)

# predict on the test set
y_pred = nb.predict(X_test)

# evaluate the performance of the model
nb_score = nb.score(X_test, y_test)
print("Accuracy:", nb_score)
```

```
Accuracy: 0.8808102418993063
```

>4 Evaluation of Models

```
# Set up vars
log_reg_score = log_reg.score(X_test, y_pred)

scores = [log_reg_score, rfc_score, gb_classifier_score, nb_score]
rounded_scores = []

for score in scores:
    rounded_score = round(score, 2) * 100
    rounded_scores.append(rounded_score)
```

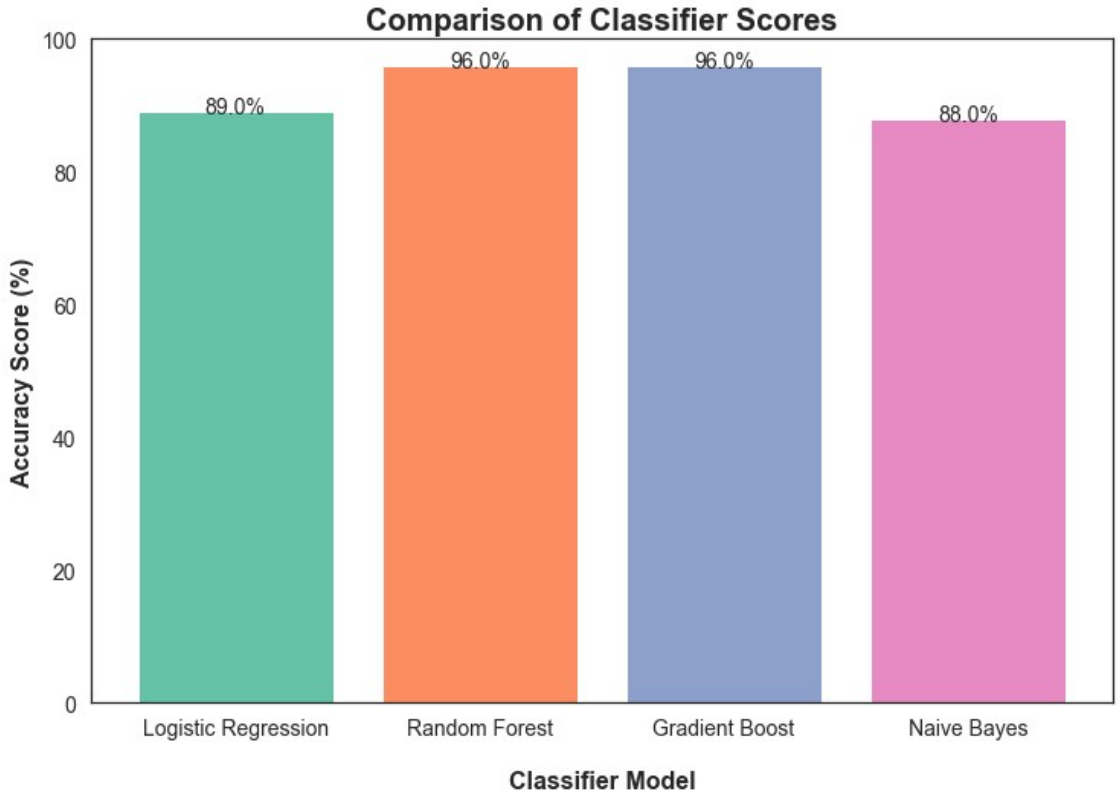
```
labels = ["Logistic Regression", "Random Forest", "Gradient Boost",
"Naive Bayes"]
colors = ["#66c2a5", "#fc8d62", "#8da0cb", "#e78ac3"]

rounded_scores
```

```
[89.0, 96.0, 96.0, 88.0]
```

```
# Plot scores
fig, ax = plt.subplots(figsize=(12, 8))
bars = ax.bar(labels, rounded_scores, color=colors)
ax.set_title("Comparison of Classifier Scores", fontsize=20,
fontweight='bold')
ax.set_xlabel("Classifier Model", fontsize=16, fontweight='bold')
ax.set_ylabel("Accuracy Score (%)", fontsize=16, fontweight='bold')
ax.set_ylim([0, 100])
ax.tick_params(axis='x', labelsize=14)
ax.tick_params(axis='y', labelsize=14)
ax.xaxis.labelpad = 20
# Add labels
for i, score in enumerate(rounded_scores):
    ax.text(i, score-1, str(score) + "%", ha='center', va='bottom',
fontsize=14)

plt.show()
```


Comparison of Classifier Scores
Accuracy Score (%)
100
80
60
40
20
0
89.0%
96.0%
96.0%
88.0%
Logistic Regression
Random Forest
Gradient Boost
Naive Bayes
Classifier Model