Business Intelligence & Machine Learning

By Regeneration & Piraeus Bank

The Essentials of Part I

OLTP DATABASE MIGRATION.

DATA WAREHOUSE DESIGN.

ETL PROCESS IMPLEMENTATION.

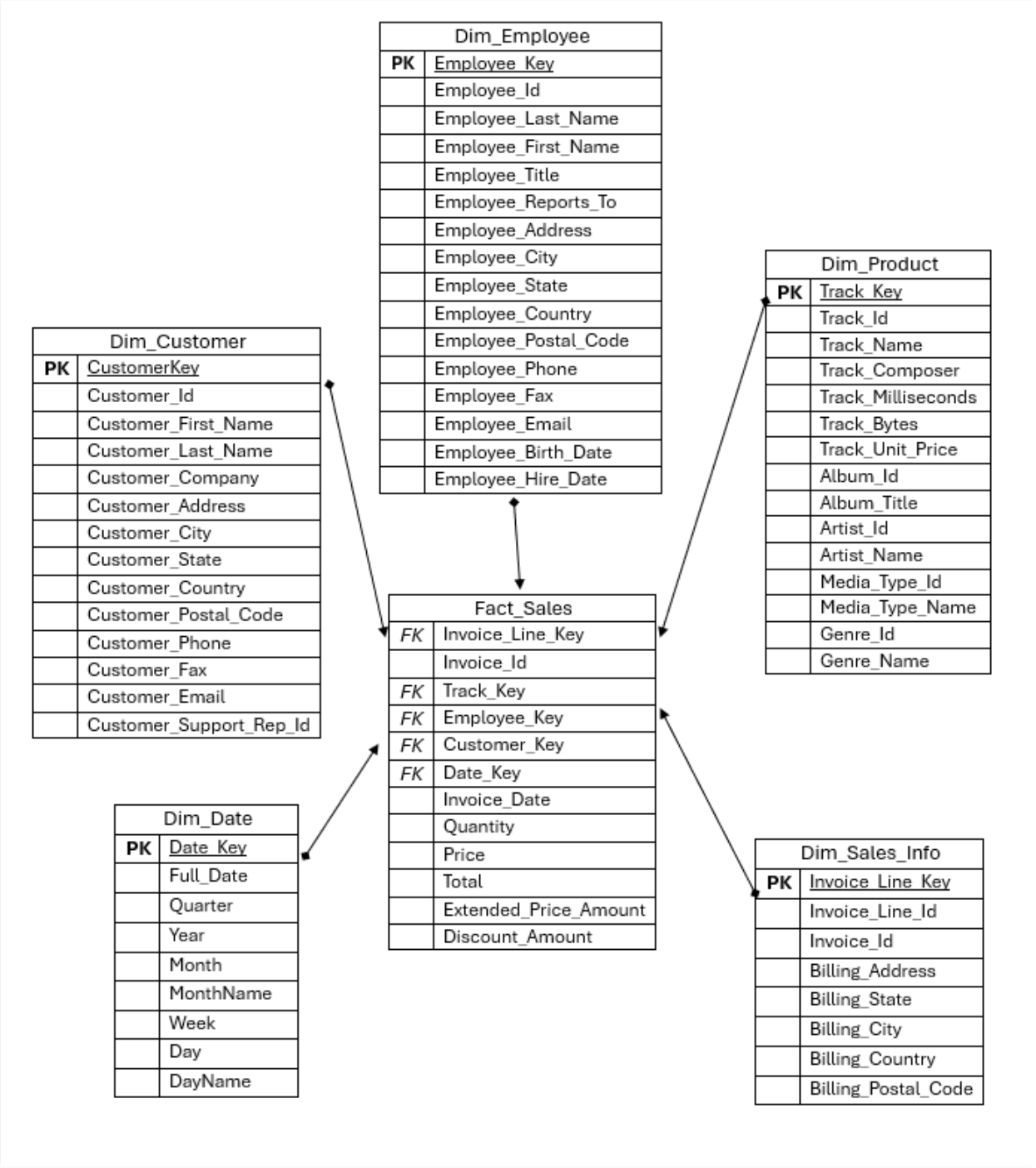
POWER BI INSIGHTS.

SQL Scripts

- To Develop a Staging Area from the OLTP Database.
- To Design the ERD Schemas and define the final Star Schema of the Data Warehouse.
- To Establish the connections to the main Fact Table.
- To Extract, Transform, Load data from the Staging Area into the Data Warehouse.
- To Ensure efficient data transfer and query performance.

Chinook Data Warehouse

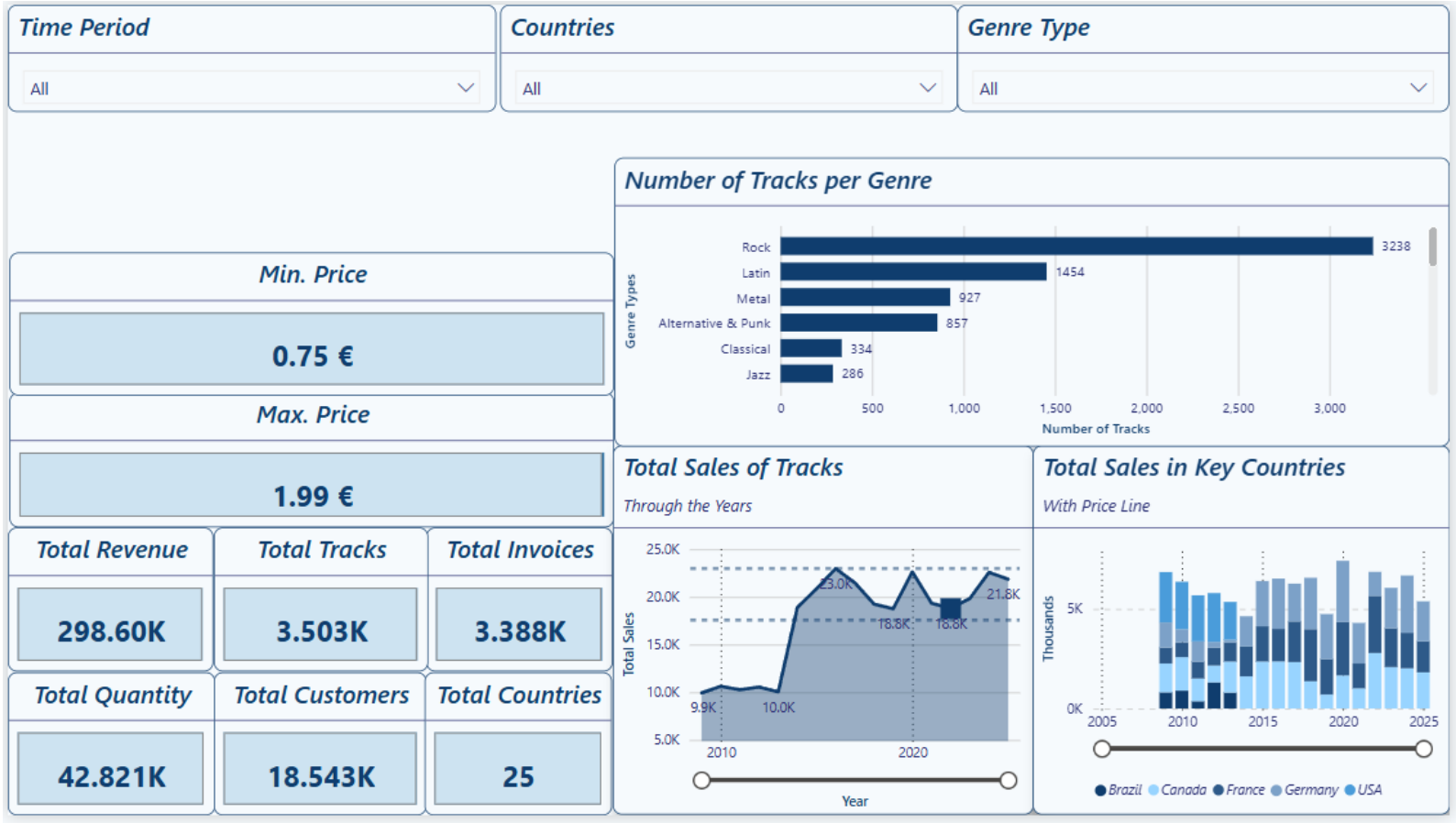
- Star Schema
- 5 Dimension Tables
- Main Focus : Fact_Sales
- Connections with primary keys
- 1 to N Cardinality



PowerBI Insights

Comments:

- Dashboards for a comprehensive analysis
- Slicer usage for customized results
- Cards to portray key analytics
- Variety on Visual Reports



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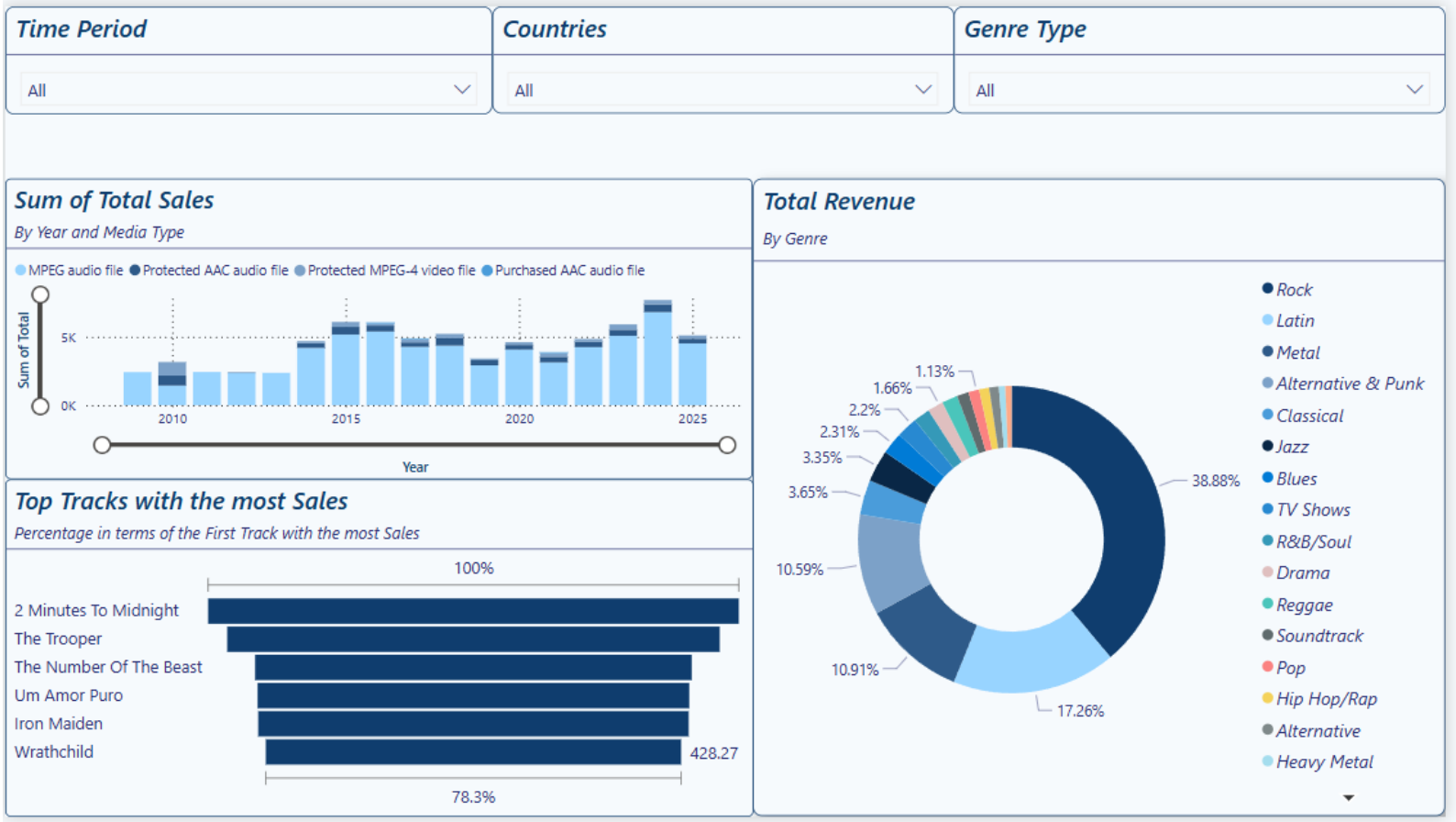

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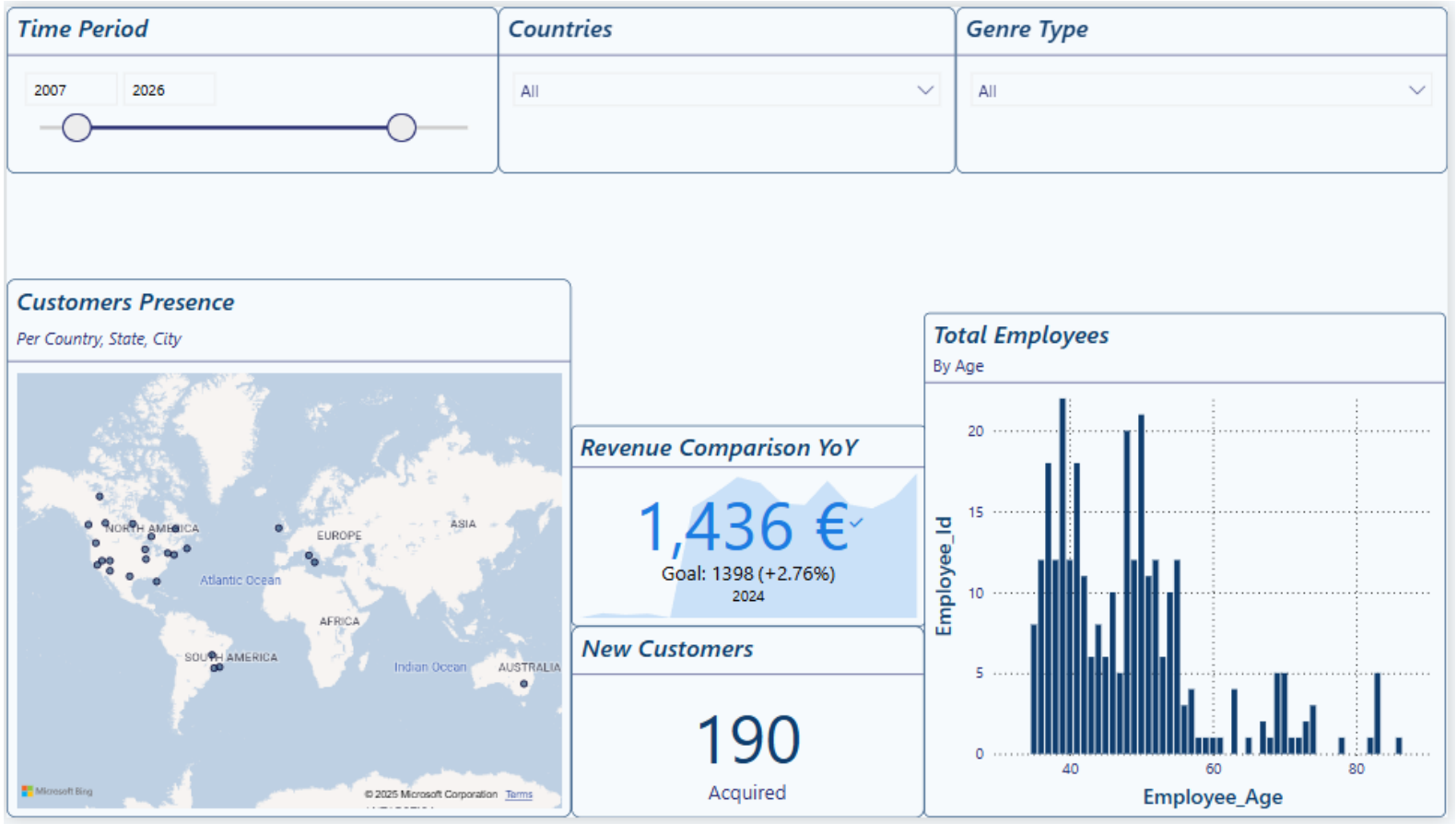
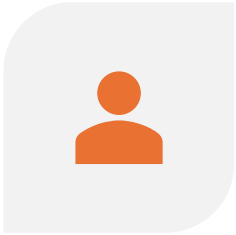


The Essentials of Part II



EMPLOYEE SALES PERFORMANCE CLASSIFICATION

PREPROCESSING AND FEATURE ENGINEERING

PERFORMANCE LABELING & ENCODING

MACHINE LEARNING MODEL PIPELINE

EVALUATION INSIGHTS AND ANALYSIS

Python Scripts

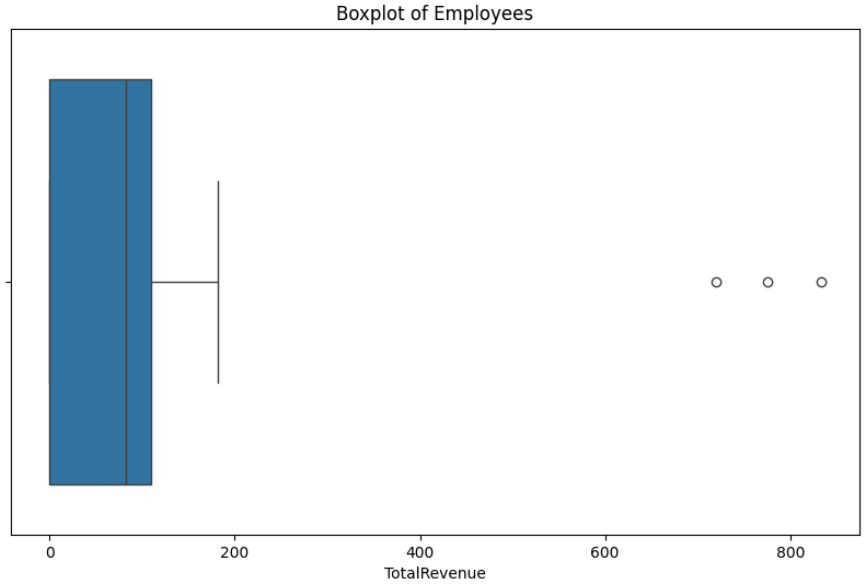
- To Calculate Employee Tenure, Clean Nulls and Remove Outliers.
- To Create Correlation Plots and define the final features.
- To Establish Performance Labels and Encode them.
- To Set Hyperparameters for Optimization, Standardize features and Split the Data Set.
- To Train Models, Evaluate Metrics & Predictions and Generate insightful plots

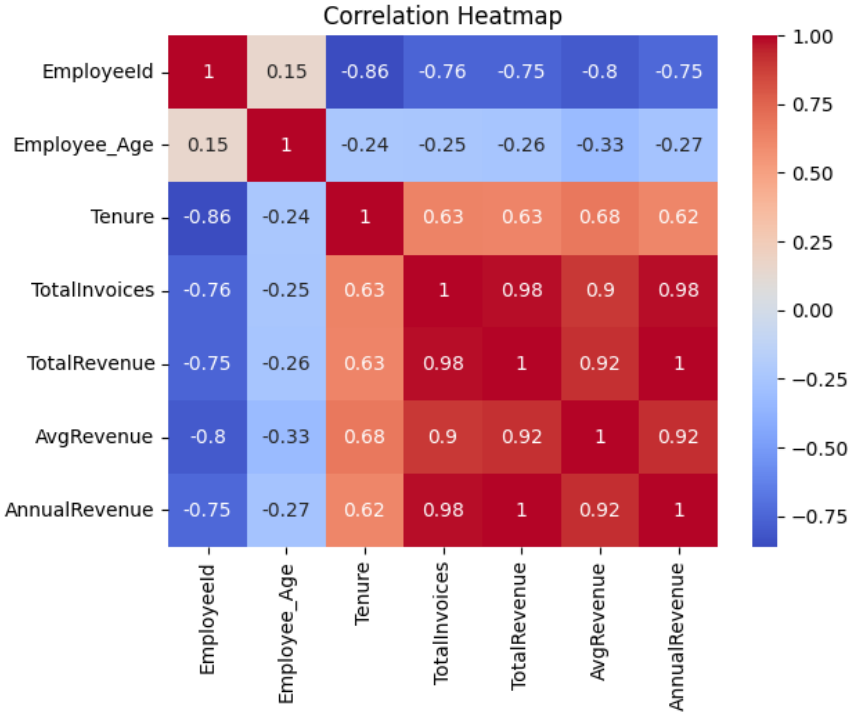
```
# Define performance labels based on quantiles of 'TotalRevenue'
quantile_labels = ['Low Performer', 'Average Performer', 'High Performer']
df_final['Performance_Label'] = pd.qcut(df_final['TotalRevenue'], q=3, labels=quantile_labels, duplicates='drop')

# Create a dictionary to map labels to desired numbers
label_mapping = {'Low Performer': 0, 'Average Performer': 1, 'High Performer': 2}

# Map labels to numbers
df_final['Performance_Label_Encoded'] = df_final['Performance_Label'].map(label_mapping)

# Display the first few rows of the filtered DataFrame
print(df_final.head())

# Define X (features) and y (target)
X = df_final[['TotalInvoices', 'AvgRevenue', 'AnnualRevenue']]
y = df_final['Performance_Label_Encoded']

# Normalize the features using StandardScaler
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Stratified K-Fold Cross-Validation with GridSearchCV
models = {...}

skf = StratifiedKFold(n_splits=5, shuffle=True, random_state=42)

for model_name, (model, param_grid) in models.items():

# Train-Test-Validation Split (80%-10%-10%)
X_train, X_temp, y_train, y_temp = train_test_split(X_scaled, y, test_size=0.2, stratify=y, random_state=42)
X_val, X_test, y_val, y_test = train_test_split(X_temp, y_temp, test_size=0.5, stratify=y_temp, random_state=42)

value_counts = df_final['Performance_Label_Encoded'].value_counts()

plt.figure(figsize=(8, 5))
value_counts.plot(kind='bar')
plt.title('Distribution of Performance Label Encoded')
plt.xlabel('Performance Label Encoded')
plt.ylabel('Count')
plt.xticks(rotation=0)
plt.show()

# Train and Evaluate Models and perform confusion matrix
for model_name, model in best_estimators.items():...
```

Pre-Processing & Feature Engineering

Comments:

- Sample Cleanup with NA filling and Feature Calculation such as “Tenure” as well as “Annual Revenue”
- Outlier Removal such as salesmen with “Total Revenue” more than 600 and employees who are not salesmen
- Feature Selection based on High Correlation to the “Total Revenue” such as “Total Invoices”, “Annual Revenue”, “Average Revenue”

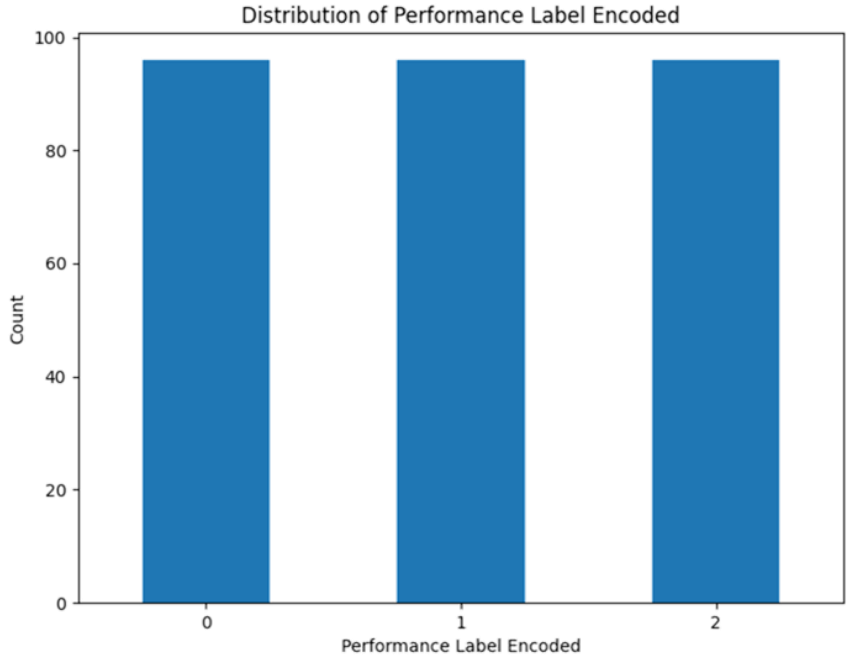


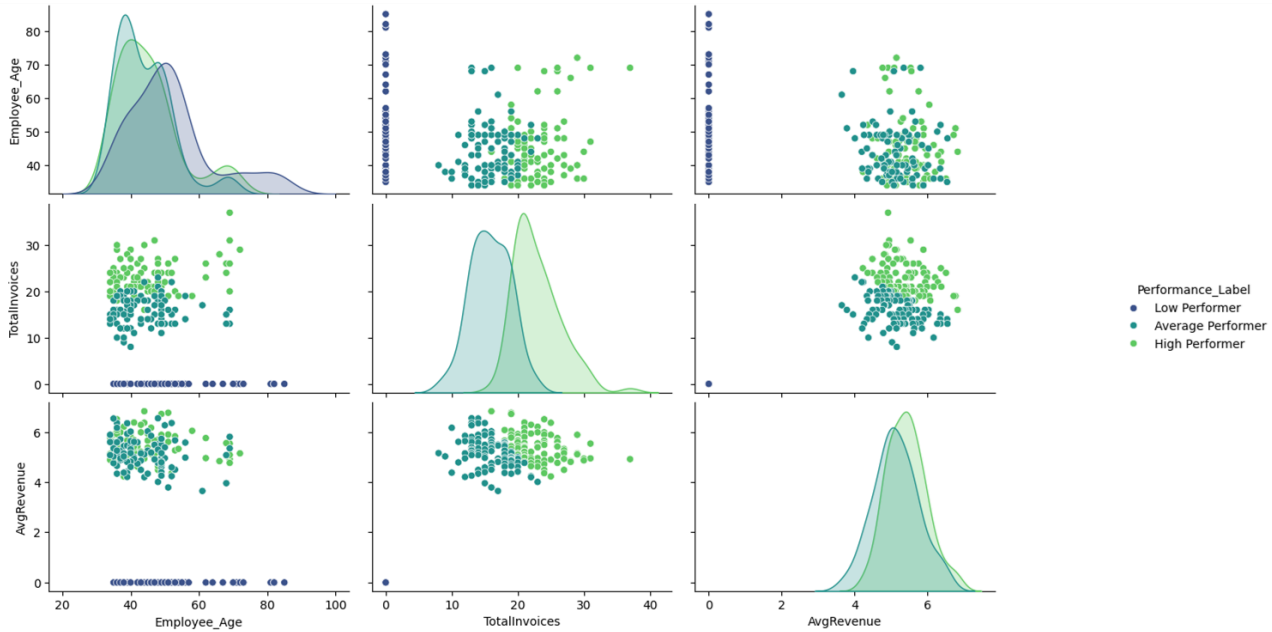


Label Performance & Encoding

Comments:

- Labeling based on Performance using Quantiles (High, Average, Low)
- Label Encoding manually with Pandas and Label Mapping

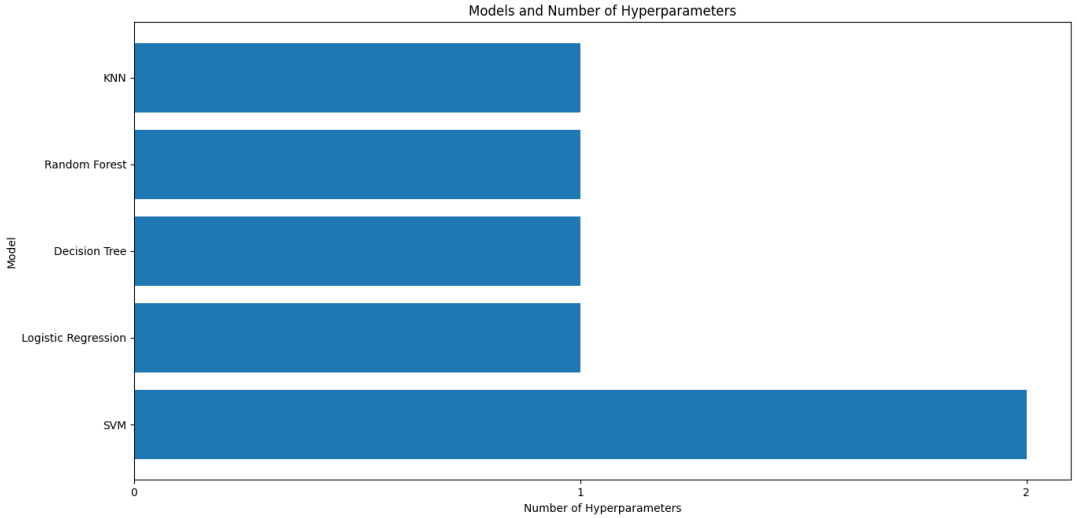


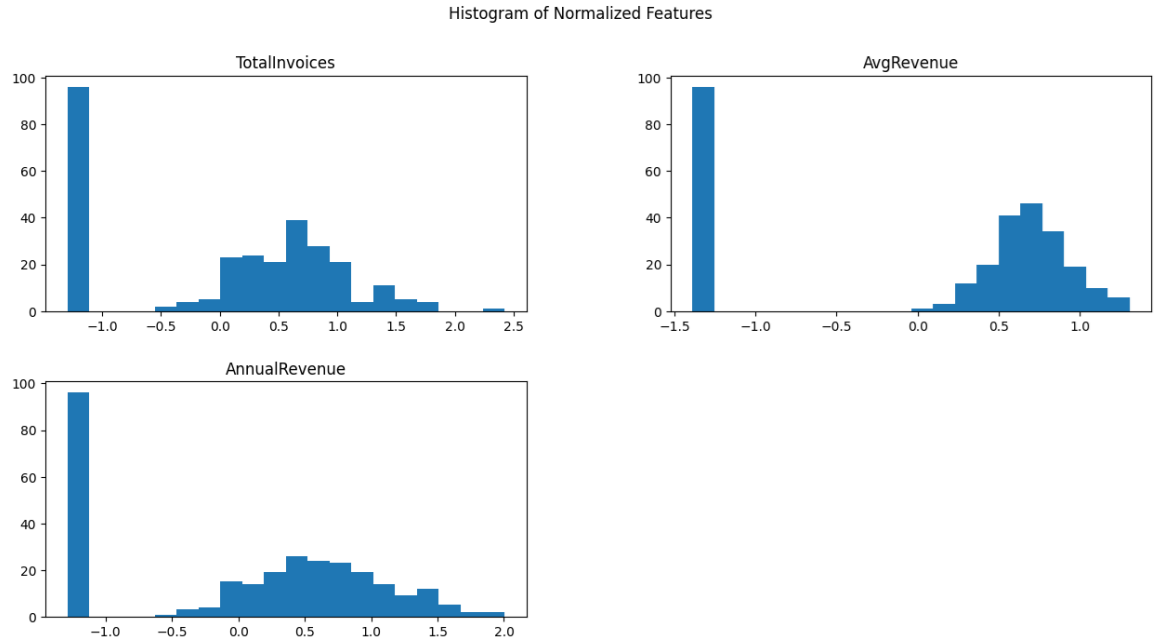


Standardization, Model Selection & Training

Comments:

- Feature Scaling of the Training Data with Standard Scaler
- Classification Model Selection for the training
- Set of Hyperparameters per Model using Stratified K-fold Cross Validation with GridSearch

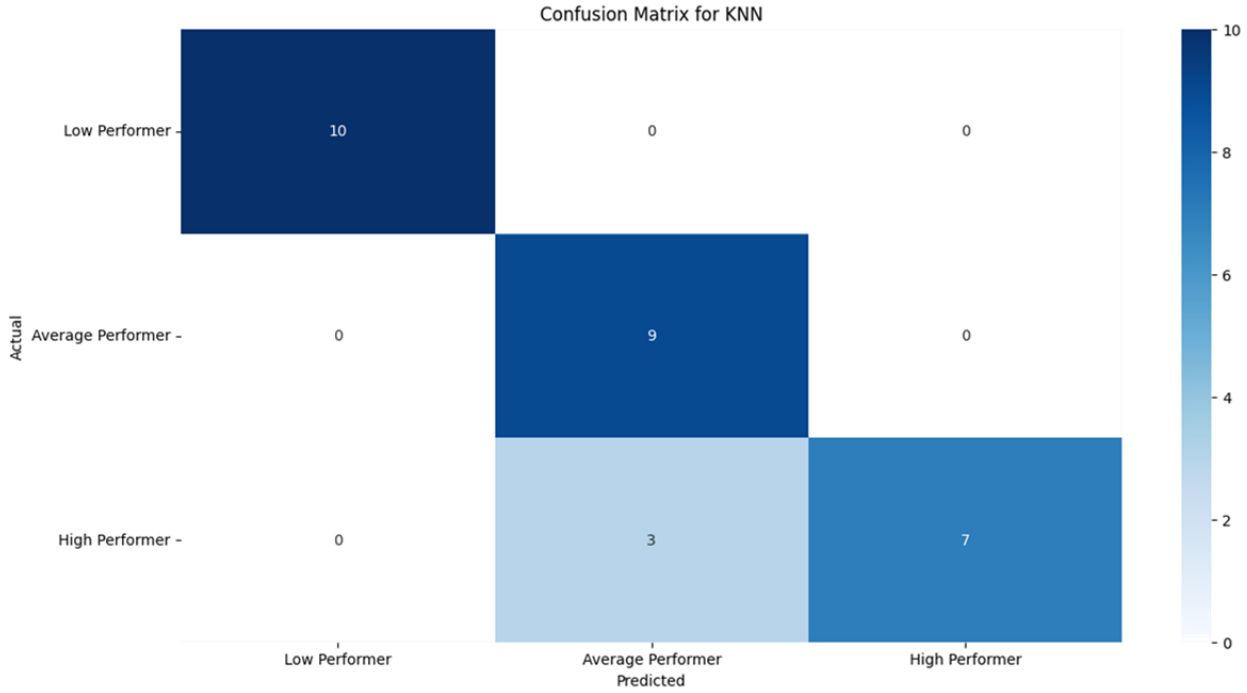


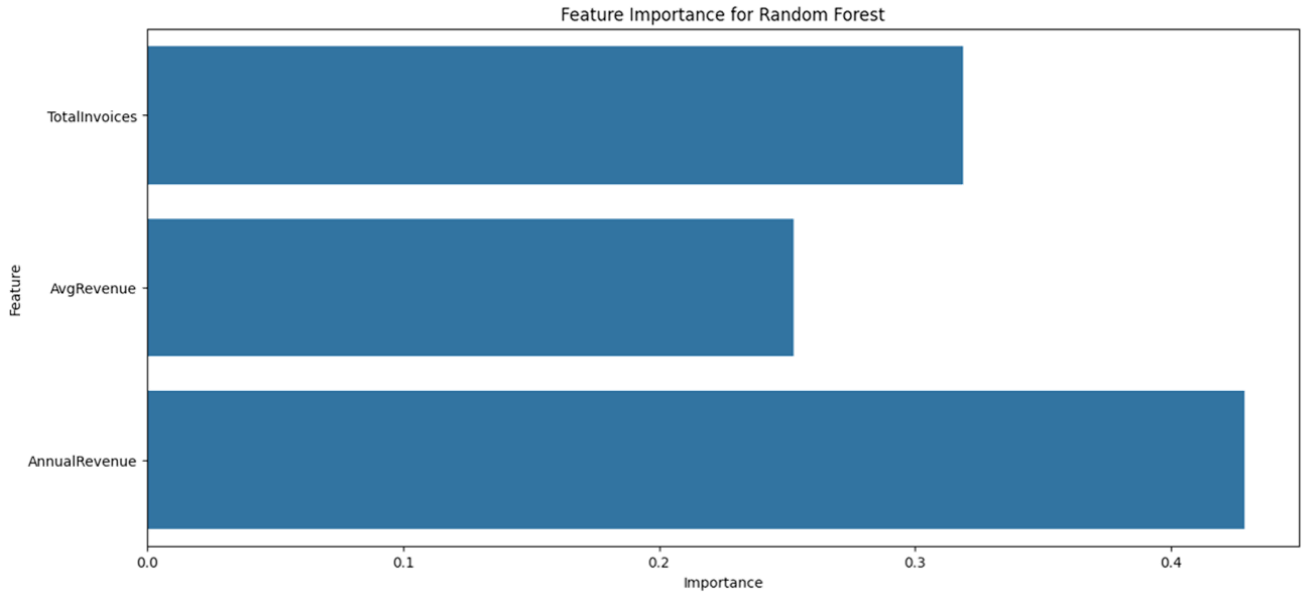


Model Evaluation, Metrics & Confusion Matrix (Part I)

Comments:

- Strong results based on the classification report per Model
- Metrics achieve over 96% score on Average

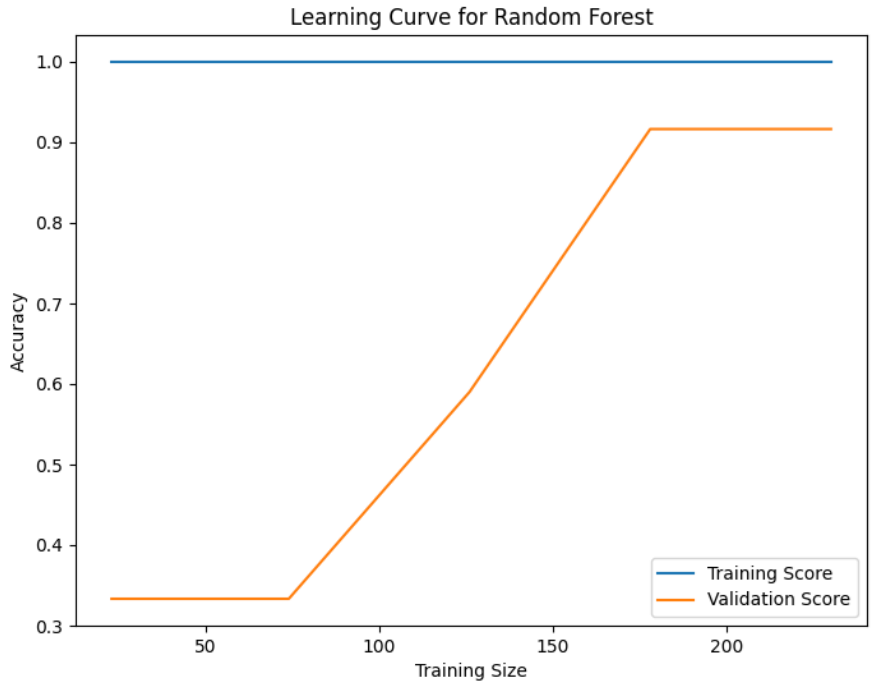




Model Evaluation, Metrics & Confusion Matrix (Part II)

Comments:

- Strong results based on the classification report per Model
- Metrics achieve over 96% score on Average
- Difference between Metrics when we removed all NA values reducing however the Data Set size




```
Evaluating Decision Tree...

Accuracy: 0.966
Precision: 0.969
Recall: 0.966
F1 Score: 0.966

Classification Report:
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        10
           1       0.90      1.00      0.95         9
           2       1.00      0.90      0.95        10

    accuracy                           0.97        29
   macro avg       0.97      0.97      0.96        29
weighted avg       0.97      0.97      0.97        29
```

vs

```
Evaluating Decision Tree...

Accuracy: 0.850
Precision: 0.863
Recall: 0.850
F1 Score: 0.853

Classification Report:
              precision    recall  f1-score   support

           0       1.00      0.83      0.91         6
           1       0.75      0.86      0.80         7
           2       0.86      0.86      0.86         7

    accuracy                           0.85        20
   macro avg       0.87      0.85      0.86        20
weighted avg       0.86      0.85      0.85        20
```

Project Highlights

Learning Outcomes

- ❑ End-to-end process of transforming raw data into insights.
- ❑ Implementing modern techniques to solve real problems
- ❑ Getting Familiar with the Tech Stack

Tech Stack

- ❑ GitHub
- ❑ MS SQL Server
- ❑ MS Power BI
- ❑ Python

Challenges Faced

- ❑ Schema Set up for DW
- ❑ Feature Engineering
- ❑ Learning a new coding language
- ❑ The correct order of steps for a ML project

Thank you for your attention.

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