ml-practical-3-piyusha

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LP3__ML__Practical__3

Given a bank customer, build a neural network-based classifier that can determine whether they will leave or not in the next 6 months. Link to the Kaggle project: https://www.kaggle.com/barelydedicated/bank-customer-churn modeling

[3]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.metrics import confusion_matrix, classification_report,␣
 ↪accuracy_score, precision_score, recall_score, f1_score

from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout
```

[4]:
```
# Load the dataset (adjust path if needed)
df = pd.read_csv("/content/churn.csv")

# Display basic info
print(df.head())
print(df.info())
```

```
   RowNumber  CustomerId   Surname  CreditScore Geography  Gender  Age  \
0          1    15634602  Hargrave          619    France  Female   42
1          2    15647311      Hill          608     Spain  Female   41
2          3    15619304      Onio          502    France  Female   42
3          4    15701354      Boni          699    France  Female   39
4          5    15737888  Mitchell          850     Spain  Female   43

   Tenure    Balance  NumOfProducts  HasCrCard  IsActiveMember  \
0       2       0.00              1          1               1
1       1   83807.86              1          0               1
2       8  159660.80              3          1               0
```

```
3       1       0.00              2          0               0
4       2  125510.82              1          1               1

   EstimatedSalary  Exited
0        101348.88       1
1        112542.58       0
2        113931.57       1
3         93826.63       0
4         79084.10       0
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10000 entries, 0 to 9999
Data columns (total 14 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   RowNumber        10000 non-null  int64
 1   CustomerId       10000 non-null  int64
 2   Surname          10000 non-null  object
 3   CreditScore      10000 non-null  int64
 4   Geography        10000 non-null  object
 5   Gender           10000 non-null  object
 6   Age              10000 non-null  int64
 7   Tenure           10000 non-null  int64
 8   Balance          10000 non-null  float64
 9   NumOfProducts    10000 non-null  int64
 10  HasCrCard        10000 non-null  int64
 11  IsActiveMember   10000 non-null  int64
 12  EstimatedSalary  10000 non-null  float64
 13  Exited           10000 non-null  int64
dtypes: float64(2), int64(9), object(3)
memory usage: 1.1+ MB
None
```

[5]:
```python
# Drop unnecessary columns
df = df.drop(['RowNumber', 'CustomerId', 'Surname'], axis=1)

# Encode categorical variables
le_gender = LabelEncoder()
df['Gender'] = le_gender.fit_transform(df['Gender'])

# One-hot encode Geography (multiple categories)
df = pd.get_dummies(df, columns=['Geography'], drop_first=True)

# Separate features and target
X = df.drop('Exited', axis=1)
y = df['Exited']

# Scale features
```

```
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

# Split into train-test sets
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2,␣
↪random_state=42)
```

[7]:
```
# Check target distribution
sns.countplot(x='Exited', data=df)
plt.title("Customer Churn Distribution")
plt.show()
```

[8]:
```
model = Sequential([
    Dense(16, activation='relu', input_dim=X_train.shape[1]),
    Dropout(0.3),
    Dense(8, activation='relu'),
    Dense(1, activation='sigmoid')
])
```

```
model.compile(optimizer='adam', loss='binary_crossentropy',␣
  ↪metrics=['accuracy'])
model.summary()
```

```
/usr/local/lib/python3.12/dist-packages/keras/src/layers/core/dense.py:93:
UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. When
using Sequential models, prefer using an `Input(shape)` object as the first
layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Model: "sequential"

Layer (type)	Output Shape	Param #
dense (Dense)	(None, 16)	192
dropout (Dropout)	(None, 16)	0
dense_1 (Dense)	(None, 8)	136
dense_2 (Dense)	(None, 1)	9

Total params: 337 (1.32 KB)

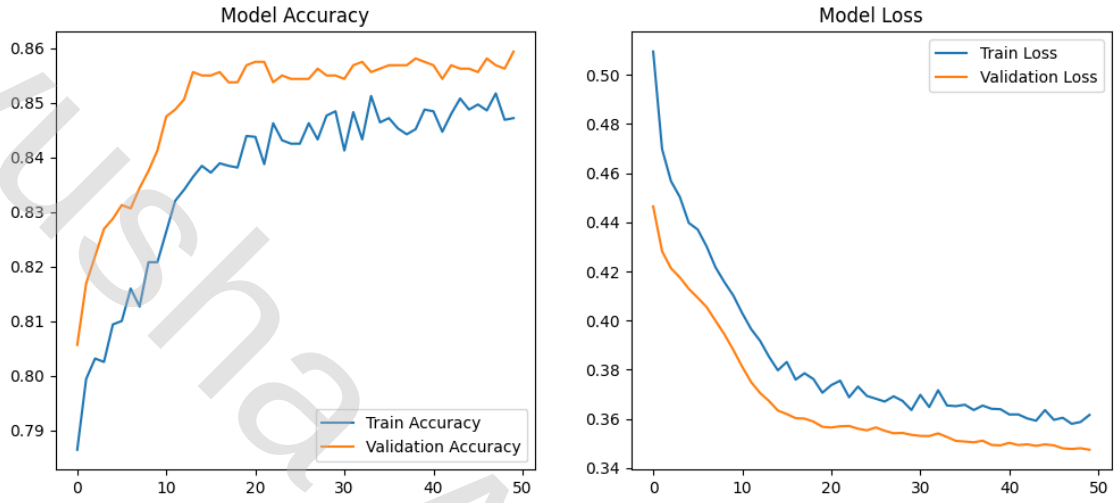
Trainable params: 337 (1.32 KB)

Non-trainable params: 0 (0.00 B)

[ ]:
```
history = model.fit(X_train, y_train, epochs=50, batch_size=32,␣
  ↪validation_split=0.2, verbose=1)
```

[10]:
```
# Plot training & validation accuracy/loss
plt.figure(figsize=(12,5))

plt.subplot(1,2,1)
plt.plot(history.history['accuracy'], label='Train Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.legend()
plt.title('Model Accuracy')

plt.subplot(1,2,2)
plt.plot(history.history['loss'], label='Train Loss')
```

```
plt.plot(history.history['val_loss'], label='Validation Loss')
plt.legend()
plt.title('Model Loss')

plt.show()
```

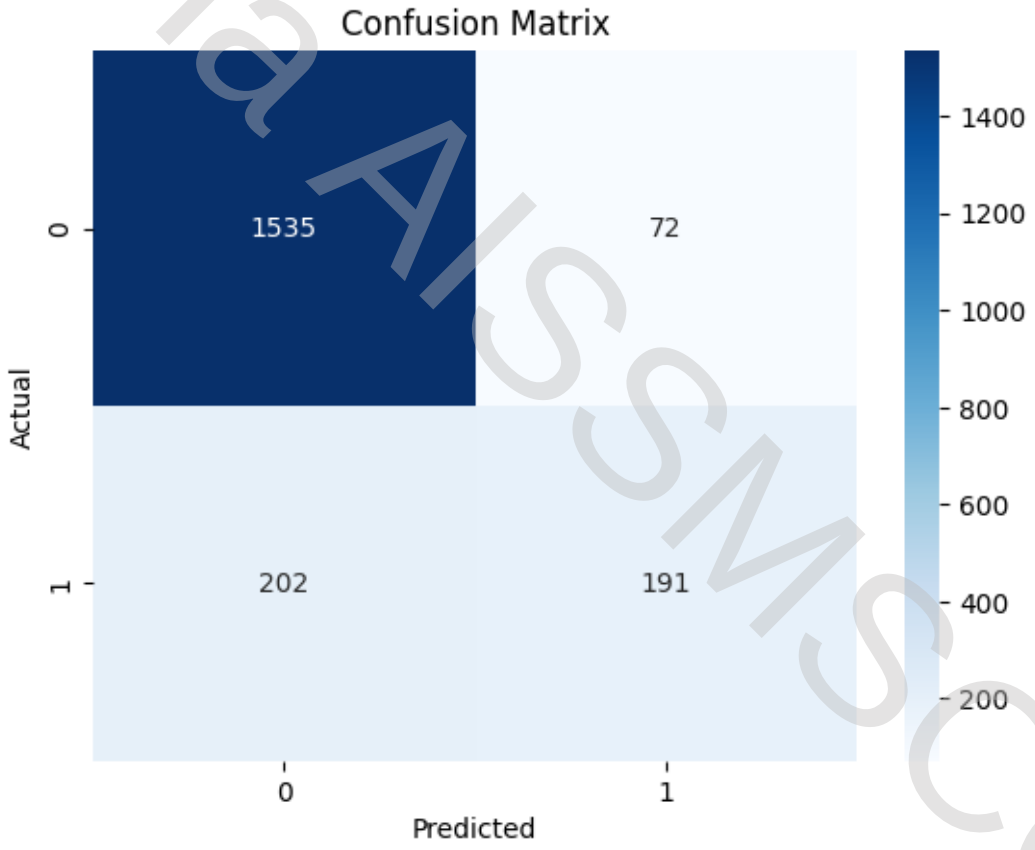


[11]:
```
# Predictions
y_pred_prob = model.predict(X_test)
y_pred = (y_pred_prob > 0.5).astype(int)

# Evaluation Metrics
acc = accuracy_score(y_test, y_pred)
prec = precision_score(y_test, y_pred)
rec = recall_score(y_test, y_pred)
f1 = f1_score(y_test, y_pred)

print("Accuracy:", acc)
print("Precision:", prec)
print("Recall:", rec)
print("F1-Score:", f1)
print("\nClassification Report:\n", classification_report(y_test, y_pred))
```

```
63/63              1s 9ms/step
Accuracy: 0.863
Precision: 0.7262357414448669
Recall: 0.4860050890585242
F1-Score: 0.5823170731707317

Classification Report:
              precision    recall  f1-score   support
```

0	0.88	0.96	0.92	1607
1	0.73	0.49	0.58	393
accuracy			0.86	2000
macro avg	0.80	0.72	0.75	2000
weighted avg	0.85	0.86	0.85	2000

[12]:
```
cm = confusion_matrix(y_test, y_pred)
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```



[13]:
```
from sklearn.metrics import roc_curve, roc_auc_score

fpr, tpr, _ = roc_curve(y_test, y_pred_prob)
roc_auc = roc_auc_score(y_test, y_pred_prob)
```

```
plt.plot(fpr, tpr, label='AUC = %.3f' % roc_auc)
plt.plot([0,1], [0,1], linestyle='--')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('ROC Curve')
plt.legend()
plt.show()
```