xqemh5ryd

November 26, 2024

[24]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.pipeline import Pipeline
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score
```

[3]:
```
data = pd.read_csv('Labour_training.csv')
```

[4]:
```
data.head()
```

[4]:

	Age	Eduacation	Race	Hisp	MaritalStatus	Nodeg	\
0	45	LessThanHighSchool	NotBlack	NotHispanic	Married	1	
1	21	Intermediate	NotBlack	NotHispanic	NotMarried	0	
2	38	HighSchool	NotBlack	NotHispanic	Married	0	
3	48	LessThanHighSchool	NotBlack	NotHispanic	Married	1	
4	18	LessThanHighSchool	NotBlack	NotHispanic	Married	1	

	Earnings_1974	Earnings_1975	Earnings_1978
0	21516.670	25243.550	25564.670
1	3175.971	5852.565	13496.080
2	23039.020	25130.760	25564.670
3	24994.370	25243.550	25564.670
4	1669.295	10727.610	9860.869

[5]:
```
data.tail()
```

[5]:

	Age	Eduacation	Race	Hisp	MaritalStatus	Nodeg	\
15987	22	HighSchool	black	NotHispanic	NotMarried	0	
15988	20	HighSchool	black	NotHispanic	Married	0	
15989	37	HighSchool	NotBlack	NotHispanic	NotMarried	0	
15990	47	LessThanHighSchool	NotBlack	NotHispanic	Married	1	
15991	40	LessThanHighSchool	NotBlack	NotHispanic	NotMarried	1	

```
       Earnings_1974  Earnings_1975  Earnings_1978
15987       3975.352       6801.435       2757.438
15988       1445.939      11832.240       6895.072
15989       1733.951       1559.371       4221.865
15990      16914.350      11384.660      13671.930
15991      13628.660      13144.550       7979.724
```

[6]:
```
data.describe()
```

[6]:
```
                Age          Nodeg  Earnings_1974  Earnings_1975  Earnings_1978
count  15992.000000  15992.000000   15992.000000   15992.000000   15992.000000
mean      33.225238      0.295835   14016.800304   13650.803376   14846.659673
std       11.045216      0.456432    9569.795893    9270.403225    9647.391524
min       16.000000      0.000000       0.000000       0.000000       0.000000
25%       24.000000      0.000000    4403.452250    4398.823000    5669.298000
50%       31.000000      0.000000   15123.580000   14557.110000   16421.975000
75%       42.000000      1.000000   23584.180000   22923.737500   25564.670000
max       55.000000      1.000000   25862.320000   25243.550000   25564.670000
```

[7]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 15992 entries, 0 to 15991
Data columns (total 9 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Age            15992 non-null  int64
 1   Eduacation     15992 non-null  object
 2   Race           15992 non-null  object
 3   Hisp           15992 non-null  object
 4   MaritalStatus  15992 non-null  object
 5   Nodeg          15992 non-null  int64
 6   Earnings_1974  15992 non-null  float64
 7   Earnings_1975  15992 non-null  float64
 8   Earnings_1978  15992 non-null  float64
dtypes: float64(3), int64(2), object(4)
memory usage: 1.1+ MB
```

[8]:
```
data.isnull().sum()
data = data.dropna()
```

[11]:
```
df_encoded = pd.get_dummies(data, columns=['Eduacation', 'Race', 'Hisp',␣
↪'MaritalStatus'], drop_first=True)
```

[13]:
```
X = df_encoded.drop(columns=['Earnings_1978'])
y = df_encoded['Earnings_1978']
```

[14]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)
```

[15]:
```
model = LinearRegression()
model.fit(X_train, y_train)
```

[15]:
```
LinearRegression()
```

[16]:
```
y_pred = model.predict(X_test)
```

[17]:
```
mse = mean_squared_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)
```

[18]:
```
print(f"Mean Squared Error: {mse:.2f}")
print(f"R-Squared Score: {r2:.2f}")
```

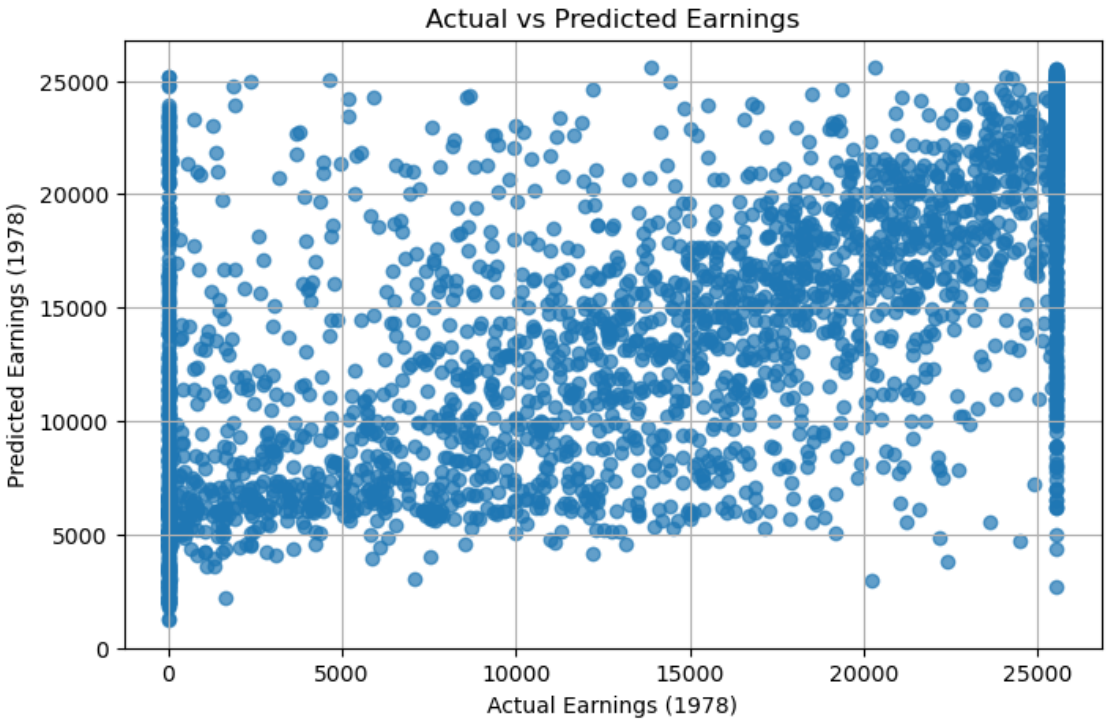
```
Mean Squared Error: 48625764.00
R-Squared Score: 0.48
```

[19]:
```
coefficients = pd.DataFrame({'Feature': X.columns, 'Coefficient': model.coef_})
print("Feature Coefficients:")
display(coefficients)
```

```
Feature Coefficients:
```

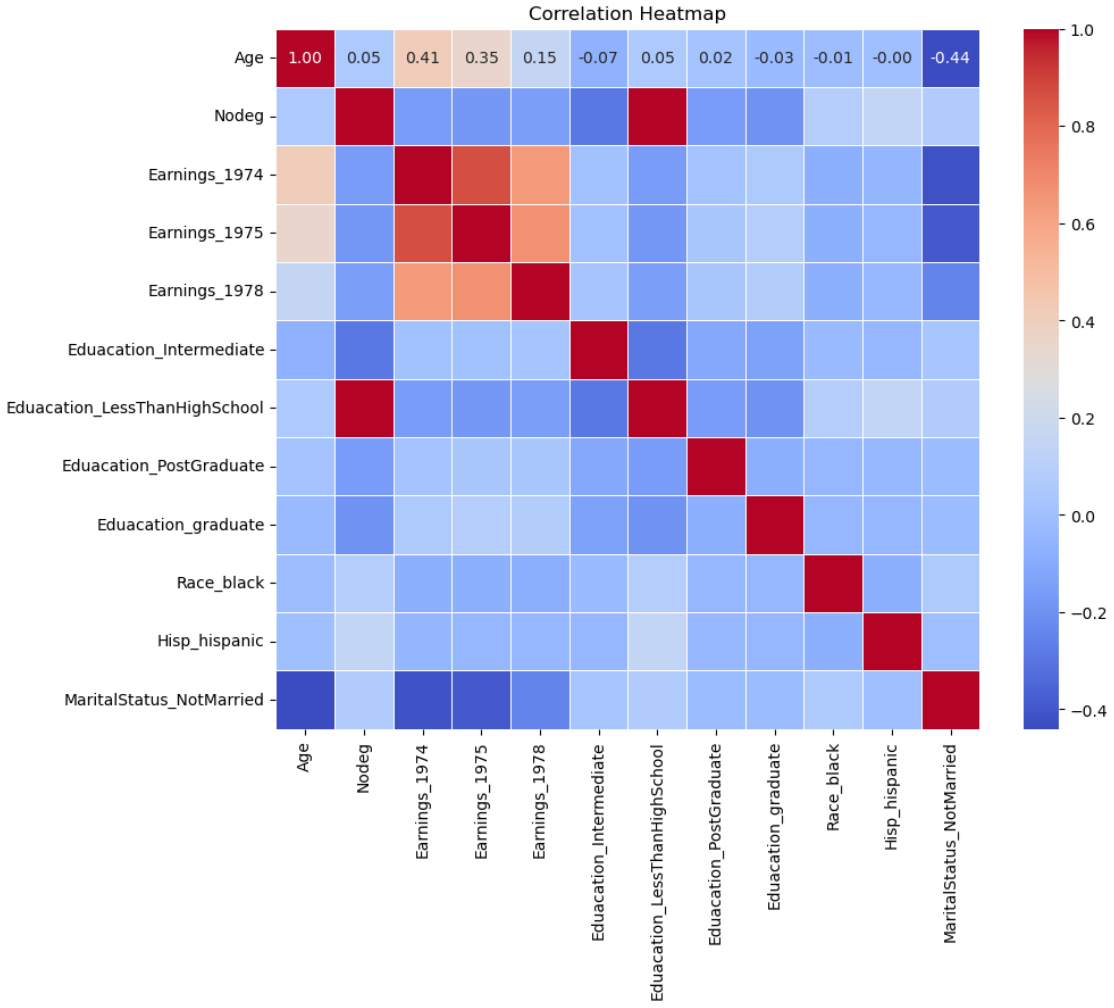
	Feature	Coefficient
0	Age	-107.350492
1	Nodeg	-29.339019
2	Earnings_1974	0.283039
3	Earnings_1975	0.475135
4	Eduacation_Intermediate	274.149983
5	Eduacation_LessThanHighSchool	-29.339019
6	Eduacation_PostGraduate	1059.095110
7	Eduacation_graduate	1033.137733
8	Race_black	-857.181352
9	Hisp_hispanic	-442.428781
10	MaritalStatus_NotMarried	-86.350484

[22]:
```
plt.figure(figsize=(8, 5))
plt.scatter(y_test, y_pred, alpha=0.7)
plt.xlabel("Actual Earnings (1978)")
plt.ylabel("Predicted Earnings (1978)")
plt.title("Actual vs Predicted Earnings")
plt.grid()
plt.show()
```

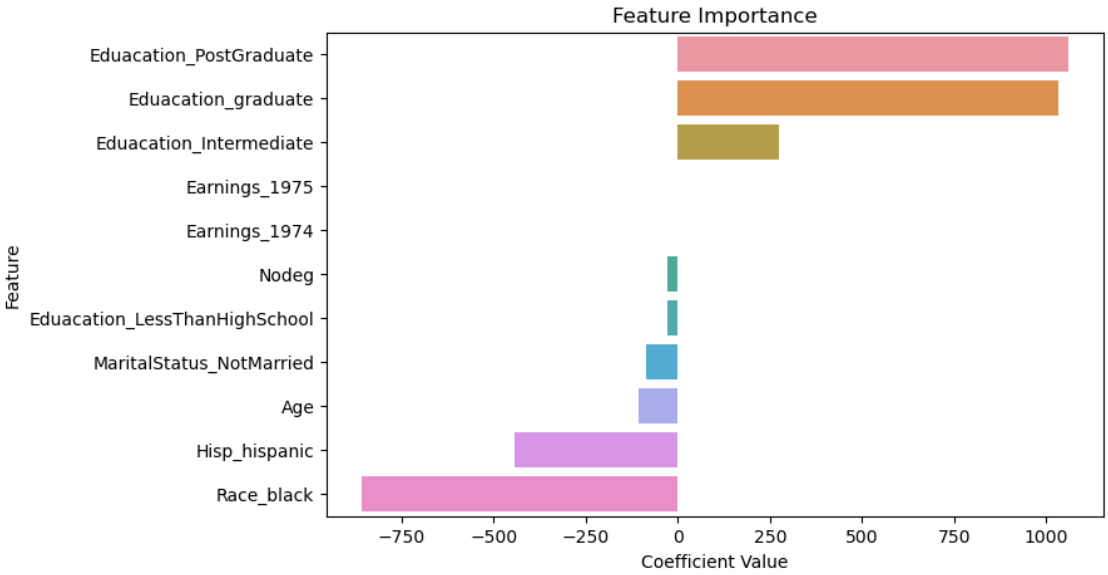


[25]:
```
# Compute correlation matrix
correlation_matrix = df_encoded.corr()

# Plot heatmap
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f",␣
 ↪linewidths=0.5)
plt.title("Correlation Heatmap")
plt.show()
```

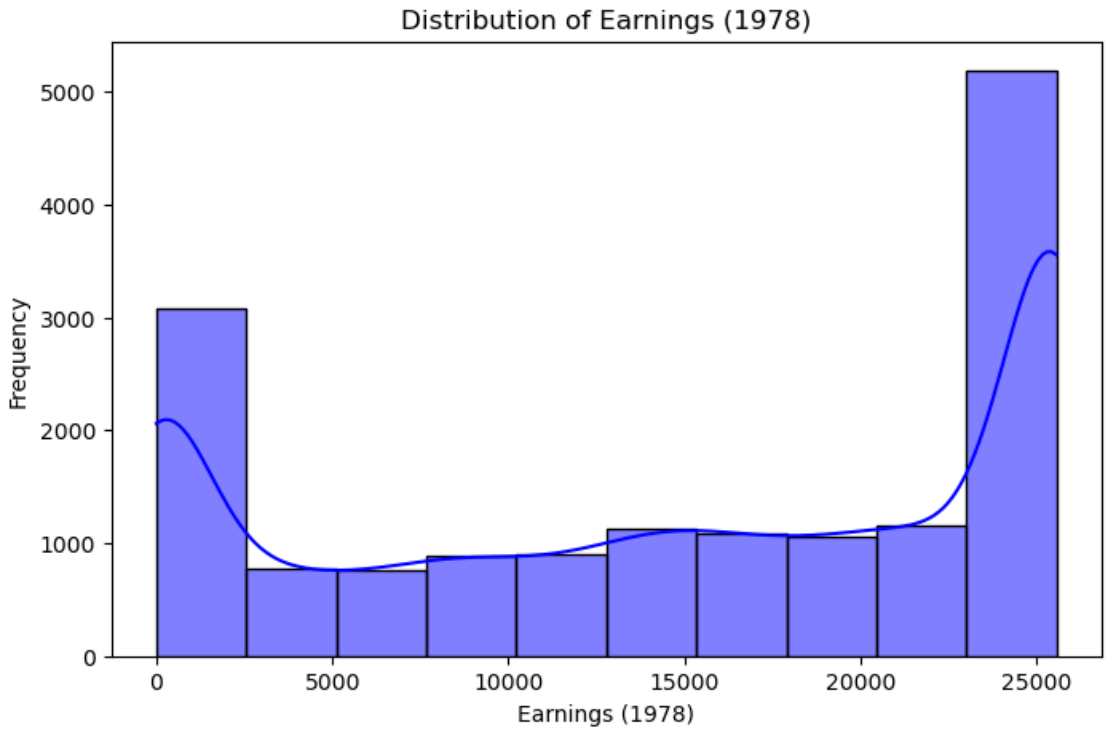


[26]:
```
# Plot feature importance
coefficients.sort_values(by="Coefficient", ascending=False, inplace=True)
plt.figure(figsize=(8, 5))
sns.barplot(x='Coefficient', y='Feature', data=coefficients)
plt.title("Feature Importance")
plt.xlabel("Coefficient Value")
plt.ylabel("Feature")
plt.show()
```

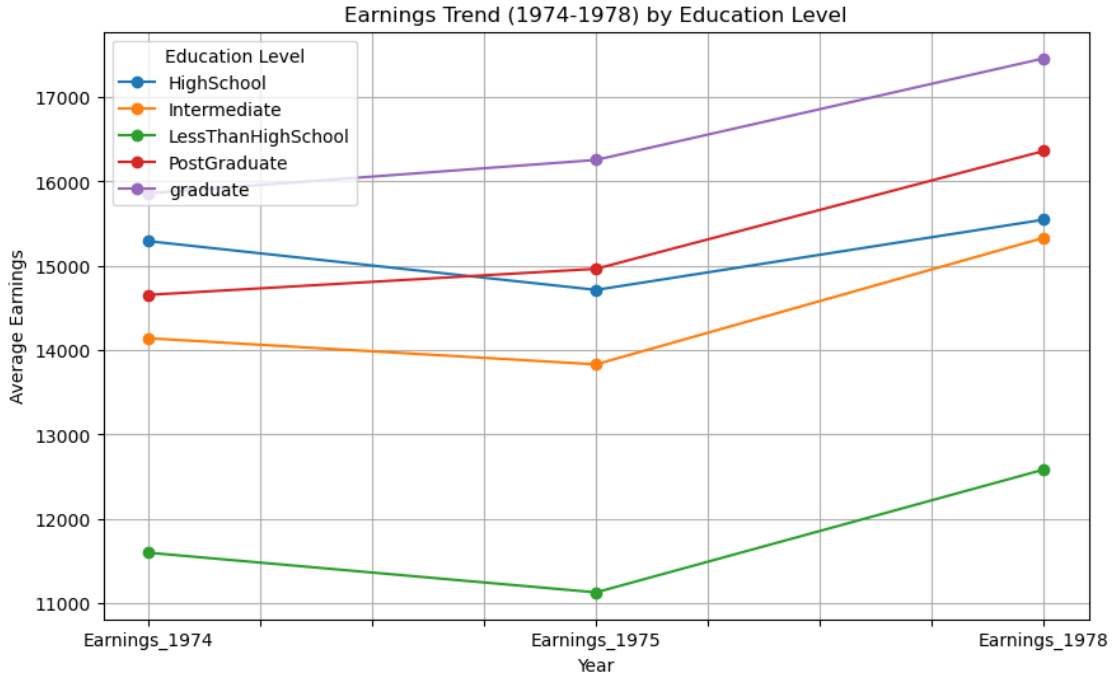


[28]:
```
# Distribution of target variable
plt.figure(figsize=(8, 5))
sns.histplot(data['Earnings_1978'], kde=True, bins=10, color='blue')
plt.title("Distribution of Earnings (1978)")
plt.xlabel("Earnings (1978)")
plt.ylabel("Frequency")
plt.show()
```

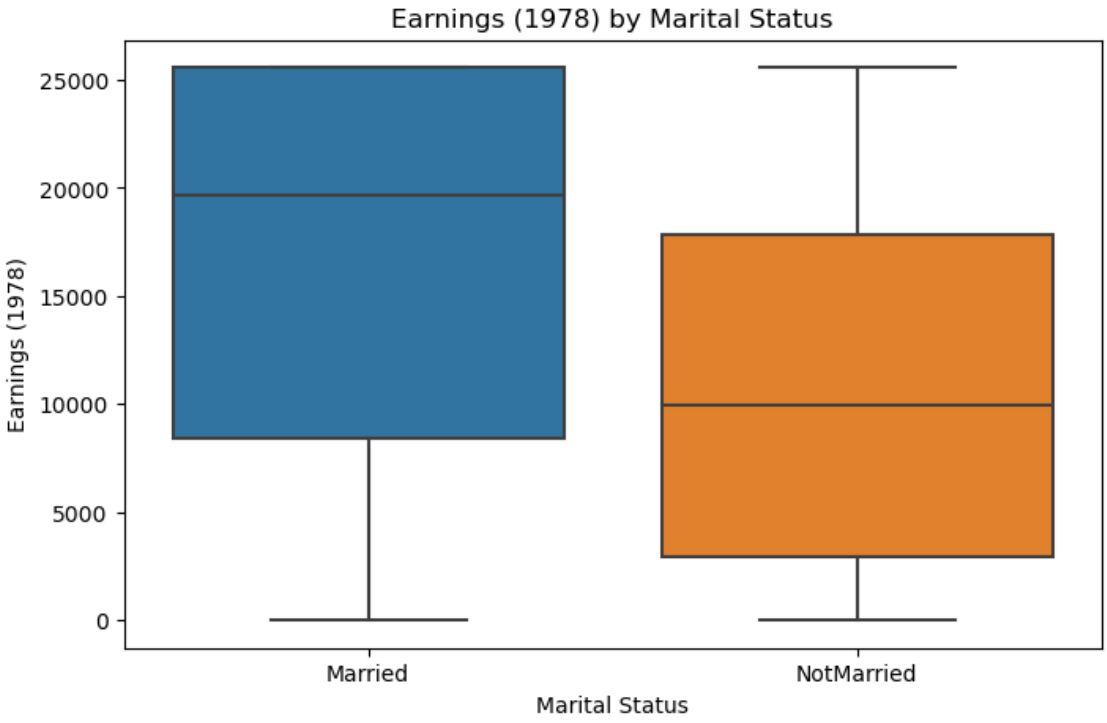
```
D:\python\Lib\site-packages\seaborn\_oldcore.py:1119: FutureWarning:
use_inf_as_na option is deprecated and will be removed in a future version.
Convert inf values to NaN before operating instead.
  with pd.option_context('mode.use_inf_as_na', True):
```



[31]:
```
# Earnings trend by education level
grouped = data.groupby("Eduacation")[["Earnings_1974", "Earnings_1975",␣
 ↪"Earnings_1978"]].mean().T
grouped.plot(figsize=(10, 6), marker='o')
plt.title("Earnings Trend (1974-1978) by Education Level")
plt.xlabel("Year")
plt.ylabel("Average Earnings")
plt.legend(title="Education Level")
plt.grid()
plt.show()
```



[33]:
```
# Boxplot for earnings by marital status
plt.figure(figsize=(8, 5))
sns.boxplot(x='MaritalStatus', y='Earnings_1978', data=data)
plt.title("Earnings (1978) by Marital Status")
plt.xlabel("Marital Status")
plt.ylabel("Earnings (1978)")
plt.show()
```


Earnings (1978) by Marital Status
25000
20000
15000
10000
5000
0
Earnings (1978)
Married
NotMarried
Marital Status

[ ]: