tvmynbnfg

March 31, 2025

1 Experiment Notebook

1.1 0. Setup Environment

1.1.1 0.a Install Mandatory Packages

Do not modify this code before running it

[1]:
```
# Do not modify this code

import os
import sys
from pathlib import Path

COURSE = "36106"
ASSIGNMENT = "AT1"
DATA = "data"

asgmt_path = f"{COURSE}/assignment/{ASSIGNMENT}"
root_path = "./"

print("###### Install required Python packages ######")
! pip install -r https://raw.githubusercontent.com/aso-uts/labs_datasets/main/
  ↪36106-mlaa/requirements.txt

if os.getenv("COLAB_RELEASE_TAG"):

    from google.colab import drive
    from pathlib import Path

    print("\n###### Connect to personal Google Drive ######")
    gdrive_path = "/content/gdrive"
    drive.mount(gdrive_path)
    root_path = f"{gdrive_path}/MyDrive/"

print("\n###### Setting up folders ######")
folder_path = Path(f"{root_path}/{asgmt_path}/") / DATA
```

```
folder_path.mkdir(parents=True, exist_ok=True)
print(f"\nYou can now save your data files in: {folder_path}")

if os.getenv("COLAB_RELEASE_TAG"):
    %cd {folder_path}
```

```
###### Install required Python packages ######
Requirement already satisfied: pandas==2.2.2 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from -r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 1)) (2.2.2)
Requirement already satisfied: scikit-learn==1.6.1 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from -r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 2)) (1.6.1)
Requirement already satisfied: altair==5.5.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from -r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (5.5.0)
Requirement already satisfied: numpy>=1.23.2 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from pandas==2.2.2->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 1)) (1.24.3)
Requirement already satisfied: python-dateutil>=2.8.2 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from pandas==2.2.2->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 1)) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from pandas==2.2.2->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 1)) (2023.3.post1)
Requirement already satisfied: tzdata>=2022.7 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from pandas==2.2.2->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 1)) (2023.3)
Requirement already satisfied: scipy>=1.6.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from scikit-
learn==1.6.1->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 2)) (1.11.1)
Requirement already satisfied: joblib>=1.2.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from scikit-
learn==1.6.1->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 2)) (1.2.0)
Requirement already satisfied: threadpoolctl>=3.1.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from scikit-
learn==1.6.1->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 2)) (3.5.0)
```

```
Requirement already satisfied: jinja2 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from altair==5.5.0->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (3.1.2)
Requirement already satisfied: jsonschema>=3.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from altair==5.5.0->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (4.17.3)
Requirement already satisfied: narwhals>=1.14.2 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from altair==5.5.0->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (1.31.0)
Requirement already satisfied: packaging in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from altair==5.5.0->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (23.1)
Requirement already satisfied: typing-extensions>=4.10.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from altair==5.5.0->-r
https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (4.12.2)
Requirement already satisfied: attrs>=17.4.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from
jsonschema>=3.0->altair==5.5.0->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (22.1.0)
Requirement already satisfied: pyrsistent!=0.17.0,!=0.17.1,!=0.17.2,>=0.14.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from
jsonschema>=3.0->altair==5.5.0->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (0.18.0)
Requirement already satisfied: six>=1.5 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from python-
dateutil>=2.8.2->pandas==2.2.2->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 1)) (1.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in
/Users/ratikpant/anaconda3/lib/python3.11/site-packages (from
jinja2->altair==5.5.0->-r https://raw.githubusercontent.com/aso-
uts/labs_datasets/main/36106-mlaa/requirements.txt (line 3)) (2.1.1)

###### Setting up folders ######

You can now save your data files in: 36106/assignment/AT1/data
```

1.1.2 0.b Disable Warnings Messages

Do not modify this code before running it

[2]:
```
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
```

1.1.3 0.c Install Additional Packages

If you are using additional packages, you need to install them here using the command:
`! pip install <package_name>`

[3]:
```
# <Student to fill this section>
```

1.1.4 0.d Import Packages

[56]:
```
import ipywidgets as widgets
import pandas as pd
import altair as alt
import numpy as np
import matplotlib.pyplot as plt
```

1.2 A. Project Description

[5]:
```
# @title Student Information
wgt_student_name = widgets.Text(
    value=None,
    placeholder='<student to fill this section>',
    description='Student Name:',
    style={'description_width': 'initial'},
    disabled=False
)

wgt_student_id = widgets.Text(
    value=None,
    placeholder='<student to fill this section>',
    description='Student Id:',
    style={'description_width': 'initial'},
    disabled=False
)

widgets.HBox([wgt_student_name, wgt_student_id])
```

[5]:
```
HBox(children=(Text(value='', description='Student Name:', placeholder='<student
to fill this section>', style…
```

[6]:
```
# @title Experiment ID

wgt_experiment_id = widgets.BoundedIntText(
    value=1,
    min=0,
    max=3,
    step=1,
```

```
    description='Experiment ID:',
    style={'description_width': 'initial'},
    disabled=False
)
wgt_experiment_id
```

[6]:
```
BoundedIntText(value=1, description='Experiment ID:', max=3,
style=DescriptionStyle(description_width='initial…
```

[7]:
```
# @title Business Objective

wgt_business_objective = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Business Objective:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_business_objective
```

[7]:
```
Textarea(value='', description='Business Objective:',
layout=Layout(height='100%', width='auto'), placeholder=…
```

1.3 B. Experiment Description

[8]:
```
# @title Experiment Hypothesis

wgt_experiment_hypothesis = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Experiment Hypothesis:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_experiment_hypothesis
```

[8]:
```
Textarea(value='', description='Experiment Hypothesis:',
layout=Layout(height='100%', width='auto'), placehold…
```

[9]:
```
# @title Experiment Expectations

wgt_experiment_expectations = widgets.Textarea(
    value=None,
```

```
    placeholder='<student to fill this section>',
    description='Experiment Expectations:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_experiment_expectations
```

[9]:
```
Textarea(value='', description='Experiment Expectations:',
layout=Layout(height='100%', width='auto'), placeho…
```

1.4 C. Data Understanding

1.4.1 C.1 Load Datasets

Do not change this code

[22]:
```
# Load training data
X_train = pd.read_csv('/Users/ratikpant/Desktop/machine learning/ X_train.csv')
y_train = pd.read_csv('/Users/ratikpant/Desktop/machine learning/ y_train.csv')
```

[11]:
```
pwd
```

[11]:
```
'/Users/ratikpant/Desktop/machine learning'
```

[23]:
```
# Load validation data
X_val = pd.read_csv('/Users/ratikpant/Desktop/machine learning/ X_val.csv')
y_val = pd.read_csv('/Users/ratikpant/Desktop/machine learning/ y_val.csv')
```

[24]:
```
# Load testing data
X_test = pd.read_csv('/Users/ratikpant/Desktop/machine learning/X_test.csv')
y_test = pd.read_csv('/Users/ratikpant/Desktop/machine learning/y_test.csv')
```

[25]:
```
X_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3316 entries, 0 to 3315
Data columns (total 18 columns):
 #   Column                              Non-Null Count  Dtype
---  ------                              --------------  -----
 0   number_of_bedrooms                  3316 non-null   int64
 1   floor_area                          3316 non-null   int64
 2   current_level                       3316 non-null   float64
 3   total_level                         3316 non-null   float64
 4   number_of_bathrooms                 3316 non-null   int64
 5   advertised_month                    3316 non-null   int64
```

```
 6   suburb_Adelaide                       3316 non-null   int64
 7   suburb_Brisbane                       3316 non-null   int64
 8   suburb_Canberra                       3316 non-null   int64
 9   suburb_Melbourne                      3316 non-null   int64
 10  suburb_Perth                          3316 non-null   int64
 11  suburb_Sydney                         3316 non-null   int64
 12  furnished_Furnished                   3316 non-null   int64
 13  furnished_Semi-Furnished              3316 non-null   int64
 14  furnished_Unfurnished                 3316 non-null   int64
 15  tenancy_preference_Bachelors          3316 non-null   int64
 16  tenancy_preference_Bachelors/Family   3316 non-null   int64
 17  tenancy_preference_Family             3316 non-null   int64
dtypes: float64(2), int64(16)
memory usage: 466.4 KB
```

[ ]:
```
#advertised_month
```

[26]:
```
X_train['advertised_month'].value_counts()
```

[26]:
```
advertised_month
5    1629
6    1461
4     226
Name: count, dtype: int64
```

[ ]:

[27]:
```
X_val['advertised_month'].value_counts()
```

[27]:
```
advertised_month
6    601
5    343
4     39
Name: count, dtype: int64
```

[28]:
```
X_test['advertised_month'].value_counts()
```

[28]:
```
advertised_month
5    352
6    294
4     40
Name: count, dtype: int64
```

[ ]:
```
# Now converting the column 'advertised_month' into one_hot_encoding for the␣
 ↪model
#to learn better patterns from the months 04,05,06.
#Converting for train, val and test for 0 disparity
```

[29]:
```
X_train = pd.get_dummies(X_train, columns = ['advertised_month'], dtype =int)
```

[30]:
```
X_val = pd.get_dummies(X_val, columns = ['advertised_month'], dtype =int)
```

[31]:
```
X_test = pd.get_dummies(X_test, columns = ['advertised_month'], dtype =int)
```

1.5 D. Feature Selection

[32]:
```
# <Student to fill this section>

features_list = ['number_of_bedrooms', 'floor_area', 'current_level',␣
 ↪'total_level', 'number_of_bathrooms',
                  'suburb_Brisbane', 'suburb_Adelaide', 'suburb_Canberra',␣
 ↪'suburb_Melbourne', 'suburb_Perth',
                  'suburb_Sydney',␣
 ↪'furnished_Furnished','furnished_Semi-Furnished', 'furnished_Unfurnished',
                  'tenancy_preference_Bachelors', 'tenancy_preference_Bachelors/
 ↪Family', 'tenancy_preference_Family',
                  'advertised_month_4', 'advertised_month_5','advertised_month_6'␣
 ↪]
```

[19]:
```
# @title Feature Selection Explanation

wgt_feat_selection_explanation = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Feature Selection Explanation:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_feat_selection_explanation
```

[19]:
```
Textarea(value='', description='Feature Selection Explanation:',
layout=Layout(height='100%', width='auto'), p…
```

1.6 E. Train Machine Learning Model

1.6.1 E.1 Import Algorithm

Provide some explanations on why you believe this algorithm is a good fit

[20]:
```
# <Student to fill this section>
```

[33]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error as mse
```

2 modelling validation and testing after fitting on the training set , keeping fit_intercpt True

[34]:
```
model1 = LinearRegression(fit_intercept = True)
model1.fit(X_train, y_train)
```

[34]:
```
LinearRegression()
```

3 validation set

[35]:
```
y_val_pred = model1.predict(X_val)
```

[36]:
```
mse_val = mse(y_val_pred, y_val)
rmse = np.sqrt(mse_val)
print("the rmse score is :", rmse)
```

```
the rmse score is : 29.587512894139856
```

4 Test set

[42]:
```
y_test_pred = model1.predict(X_test)
```

[43]:
```
mse_test = mse(y_test_pred, y_test)
rmse_test = np.sqrt(mse_test)
print("the rmse score is :", rmse_test)
```

```
the rmse score is : 42.23105665489805
```

[ ]:
```

```

5 FIT INTERCEPT FALSE

[44]:
```
model2 = LinearRegression(fit_intercept = False)
```

[67]:
```
model2.fit(X_train, y_train)
```

[67]:
```
LinearRegression(fit_intercept=False)
```

[ ]:
```
#validation set
```

[68]:
```
y_pred_val1 = model2.predict(X_val)
```

[69]:
```
mse_val1 = mse(y_pred_val1, y_val)
rmse1 = np.sqrt(mse_val1)
print("the rmse score is: ", rmse1)
```

```
the rmse score is:  29.587512894140335
```

[70]:
```
y_pred_test1 = model2.predict(X_test)
```

[71]:
```
mse_test1 = mse(y_pred_test1,y_test)
rmsee1 = np.sqrt(mse_test1)
print("the rmse score is:", rmsee1)
```

```
the rmse score is: 42.23105665489979
```

[61]:
```
import seaborn as sns
```

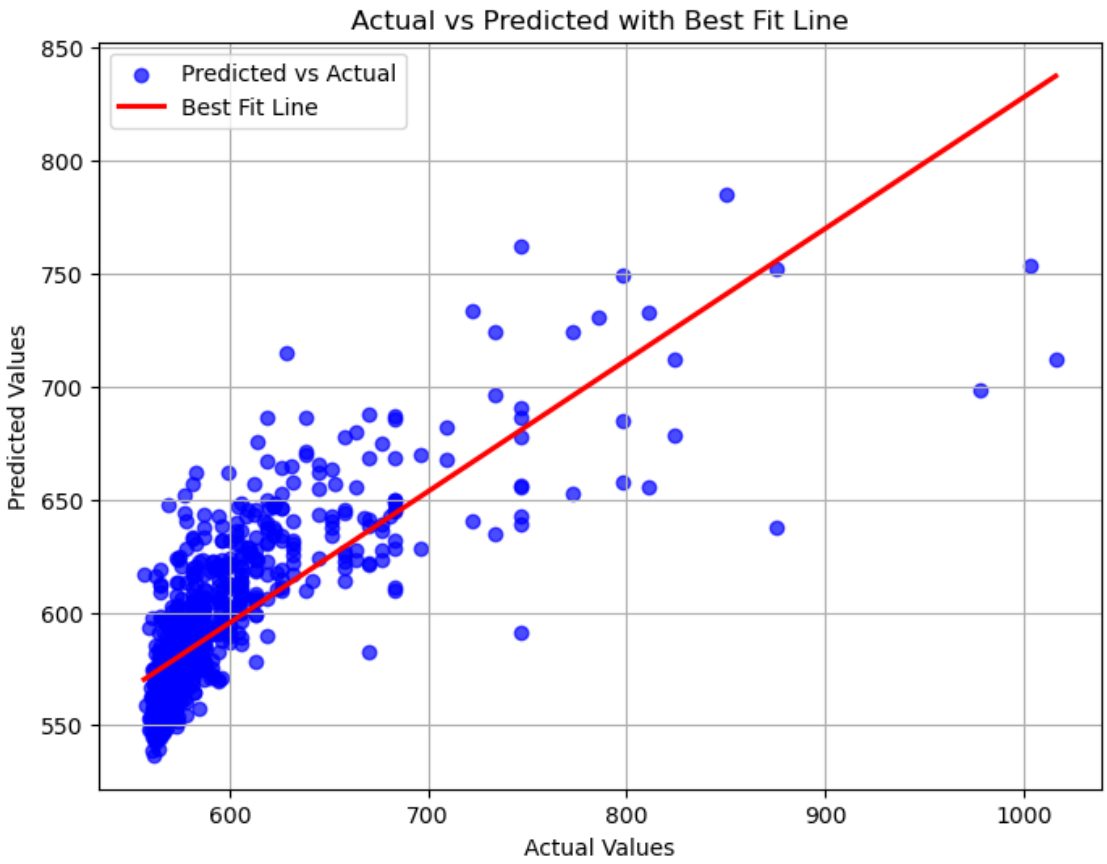
[ ]:
```
#validation set when fit_intercept -> true
```

[65]:
```
plt.figure(figsize=(8, 6))
plt.scatter(y_val, y_val_pred, color='blue', alpha=0.7, label='Predicted vs␣
 ↪Actual')

# Best-fit line (using Seaborn's regression plot)
sns.regplot(x=y_val, y=y_val_pred, scatter=False, color='red', label='Best Fit␣
 ↪Line', ci=None)

# Labels and title
plt.xlabel('Actual Values')
plt.ylabel('Predicted Values')
plt.title('Actual vs Predicted with Best Fit Line')
plt.legend()
plt.grid(True)

plt.show()
```



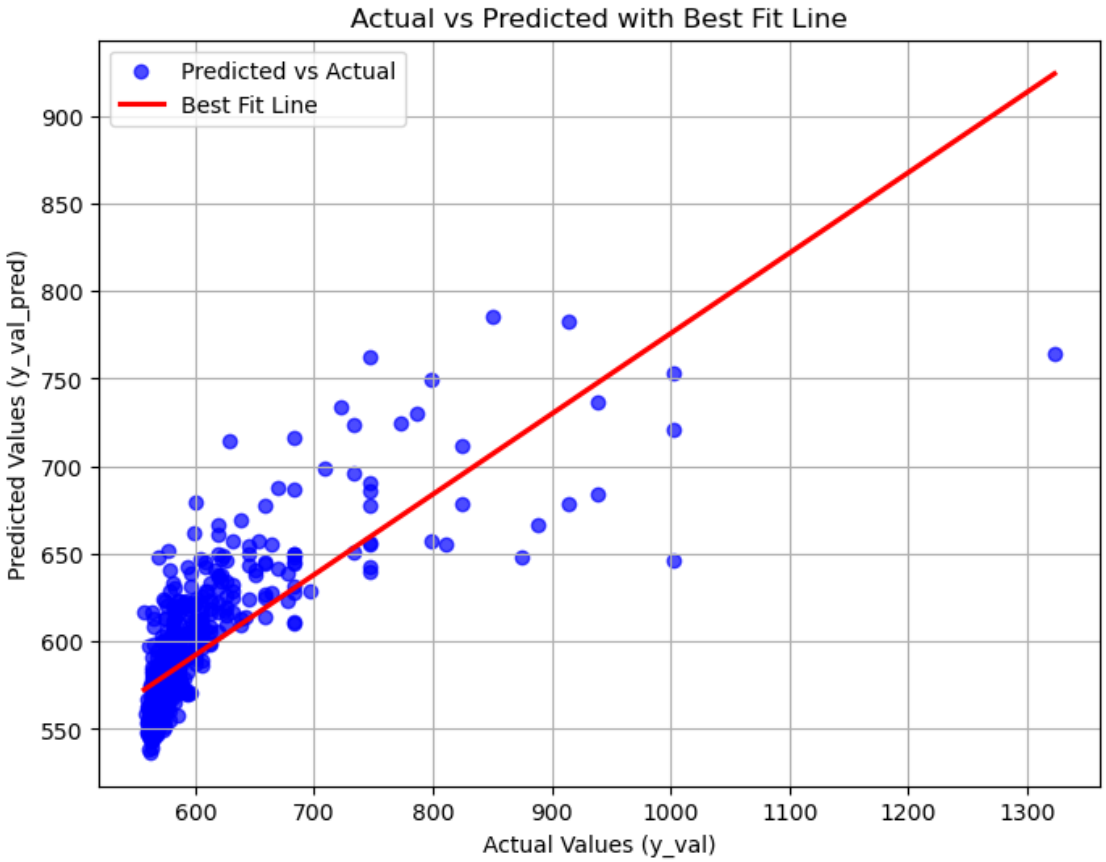
[ ]:
```
#test set when intercept -> true
```

[64]:
```
plt.figure(figsize=(8, 6))
plt.scatter(y_test, y_test_pred, color='blue', alpha=0.7, label='Predicted vs␣
↪Actual')

# Best-fit line (using Seaborn's regression plot)
sns.regplot(x=y_test, y=y_test_pred, scatter=False, color='red', label='Best␣
↪Fit Line', ci=None)

# Labels and title
plt.xlabel('Actual Values (y_val)')
plt.ylabel('Predicted Values (y_val_pred)')
plt.title('Actual vs Predicted with Best Fit Line')
plt.legend()
plt.grid(True)

plt.show()
```



[ ]:
```
\
```

[ ]:
```

```

[ ]:
```

```

[ ]:
```

```

[ ]:
```

```

[ ]:
```

```

[21]:
```
# @title Algorithm Selection Explanation

wgt_algo_selection_explanation = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Algorithm Selection Explanation:',
    disabled=False,
```

```
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_algo_selection_explanation
```

[21]:
```
Textarea(value='', description='Algorithm Selection Explanation:',
layout=Layout(height='100%', width='auto'),…
```

5.0.1 E.2 Set Hyperparameters

Provide some explanations on why you believe this algorithm is a good fit

[22]:
```
# <Student to fill this section>
```

[23]:
```
# @title Hyperparameters Selection Explanation

wgt_hyperparams_selection_explanation = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Hyperparameters Selection Explanation:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_hyperparams_selection_explanation
```

[23]:
```
Textarea(value='', description='Hyperparameters Selection Explanation:',
layout=Layout(height='100%', width='a…
```

5.0.2 E.3 Fit Model

[24]:
```
# <Student to fill this section>
```

5.0.3 E.4 Model Technical Performance

Provide some explanations on model performance

[25]:
```
# <Student to fill this section>
```

[26]:
```
# @title Model Performance Explanation

wgt_model_performance_explanation = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Model Performance Explanation:',
    disabled=False,
    style={'description_width': 'initial'},
```

```
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_model_performance_explanation
```

[26]:
```
Textarea(value='', description='Model Performance Explanation:',
layout=Layout(height='100%', width='auto'), p…
```

5.0.4 E.5 Business Impact from Current Model Performance

Provide some analysis on the model impacts from the business point of view

[27]:
```
# <Student to fill this section>
```

[28]:
```
# @title Model Business Impacts Explanation

wgt_model_business_explanation = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Model Business Impacts Explanation:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_model_business_explanation
```

[28]:
```
Textarea(value='', description='Model Business Impacts Explanation:',
layout=Layout(height='100%', width='auto…
```

5.1 F. Experiment Outcomes

[29]:
```
# @title Experiment Outcomes Explanation

wgt_experiment_outcomes_explanation = widgets.Select(
    options=['Hypothesis Confirmed', 'Hypothesis Partially Confirmed',␣
 ↪'Hypothesis Rejected'],
    value='Hypothesis Rejected',
    description='Experiment Outcomes:',
    disabled=False,
)

wgt_experiment_outcomes_explanation
```

[29]:
```
Select(description='Experiment Outcomes:', index=2, options=('Hypothesis
Confirmed', 'Hypothesis Partially Con…
```

[30]:
```
# @title Experiments Results Explanation
```

```
wgt_experiment_results_explanation = widgets.Textarea(
    value=None,
    placeholder='<student to fill this section>',
    description='Experiments Results Explanation:',
    disabled=False,
    style={'description_width': 'initial'},
    layout=widgets.Layout(height="100%", width="auto")
)
wgt_experiment_results_explanation
```

[30]: Textarea(value='', description='Experiments Results Explanation:', layout=Layout(height='100%', width='auto'),…