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URL :

<https://github.com/nalumenyadavid/VC/tree/nalumenyadavid-internship/week%204>

1. Creation of the model

Model Building

```
[47]: # Import Linear Regression model
      from sklearn.linear_model import LinearRegression
      # initialise model
      model=LinearRegression()
      # Train model with x_train and y_train
      model.fit(x_train,y_train)
```

```
[47]: ▼ LinearRegression ⓘ ⓘ
      LinearRegression()
```

```
[48]: # make predictions /test model
      y_pred=model.predict(x_test)
      y_pred
```

```
[48]: array([17.11920196, 16.86343137, 21.80867738, 24.55443423, 12.3155194 ,
        20.92742165, 10.10412313, 12.37902465, 11.99570844, 16.95369111,
        22.81007152, 15.1981792 ,  8.4657263 , 14.88506108, 18.54549016,
        18.5612111 , 18.70116245, 14.50770633,  9.74439917, 20.58825997,
        14.89035187, 17.71204411, 23.05479076,  7.72066599, 21.4435882 ,
        19.61759881, 13.81348356, 11.64299601, 18.42933279, 12.21072397,
        11.41183731,  9.96393166, 13.49958752, 15.19317807, 18.10601562,
         6.92406996, 14.20072023, 14.27620674, 14.10646271, 10.77352628,
        14.84385103, 11.94916737, 10.70309421, 10.40075312,  6.20529208,
        16.82109527, 16.46119818, 12.07762468, 10.73444639, 20.86473587,
        15.08126005, 15.41063402, 12.79667983, 14.11738167, 12.36964978,
         9.02390838, 20.50392858,  9.34145403,  5.36475925,  8.24787047])
```

```
: # slopes/coefficients of x  
model.coef_
```

```
: array([0.04539939, 0.17757031, 0.00502354])
```

```
: # intercept  
model.intercept_
```

```
: 3.090172035290916
```

```
: # Assignment
```

What will be the total sales **if** my investment on TV = 100, Radio=50 , Newspaper=10

What will be the total sales **if** my investment on TV = 10, Radio=500 , Newspaper=10

What will be the total sales **if** my investment on TV = 5, Radio=10 , Newspaper=100

What will be the total sales **if** my investment on TV = 1000, Radio=300 , Newspaper=50

```
Cell In[52], line 2
```

```
What will be the total sales if my investment on TV = 100, Radio=50 , Newspaper=10
```

```
SyntaxError: expected 'else' after 'if' expression
```

```
: # How to make predictions  
model.predict([[100,50,10]])
```

```
: array([16.55886148])
```

```
: model.predict([[1000,300,50]])
```

```
: array([102.01182817])
```

```
: model.predict([[10,100,1000]])
```

```
: array([26.32473465])
```

2. Evaluation of the model

Evaluate the model

```
[56]: # Loss functions to know the difference between actual and predicted values.  
# Different Error/Loss functions in Regression algorithm are  
* MSE(Mean Squared error)  
* MAE(Mean absolute error)  
* RMSE(Root mean squared error)
```

```
Cell In[56], line 3  
    * MSE(Mean Squared error)  
      ^  
SyntaxError: invalid syntax. Perhaps you forgot a comma?
```

```
[57]: from sklearn.metrics import mean_squared_error, mean_absolute_error, r2_score
```

```
[58]: # MSE  
MSE=mean_squared_error(y_test,y_pred)  
MSE
```

```
[58]: 2.204438630669018
```

```
[59]: # MAE  
MAE=mean_absolute_error(y_test,y_pred)  
MAE
```

```
[59]: 1.1992980850475556
```

```
[60]: # RMSE  
rmse=np.sqrt(MSE)  
rmse
```

```
[60]: 1.484735205573377
```

```
[61]: # r2_score  
r2_score(y_test,y_pred)
```

```
[61]: 0.9134809669573122
```

```
[62]: # 91% better model to make predictions.  
# Model has learnt 91% of the information
```

3. Serialization of the model

```
[63]: # adjusted R2 score

[64]: adj_r2=1-(1-0.91348096695731231)*(60-1)/(60-3-1)
      adj_r2

[64]: 0.9088460187585968

[65]: # clearly adjusted r2 score < r2_score

[ ]: |

[66]: y_test.shape

[66]: (60,)
```

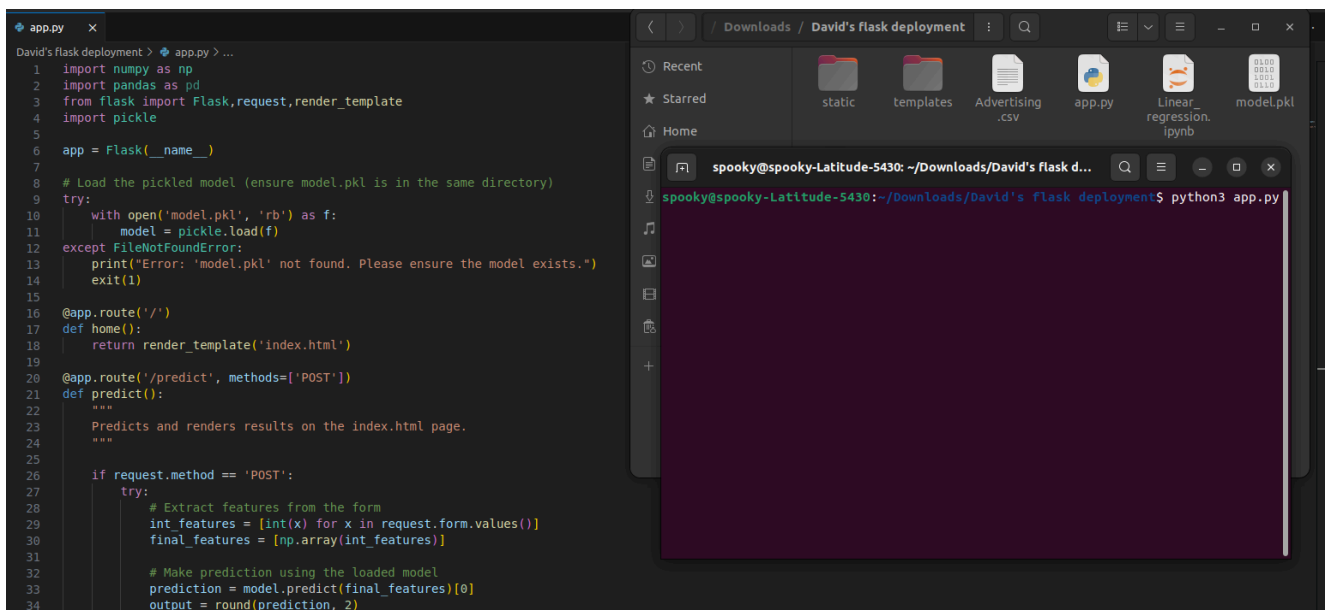
Lets serialize our model using Pickle

```
[69]: import pickle as pkl

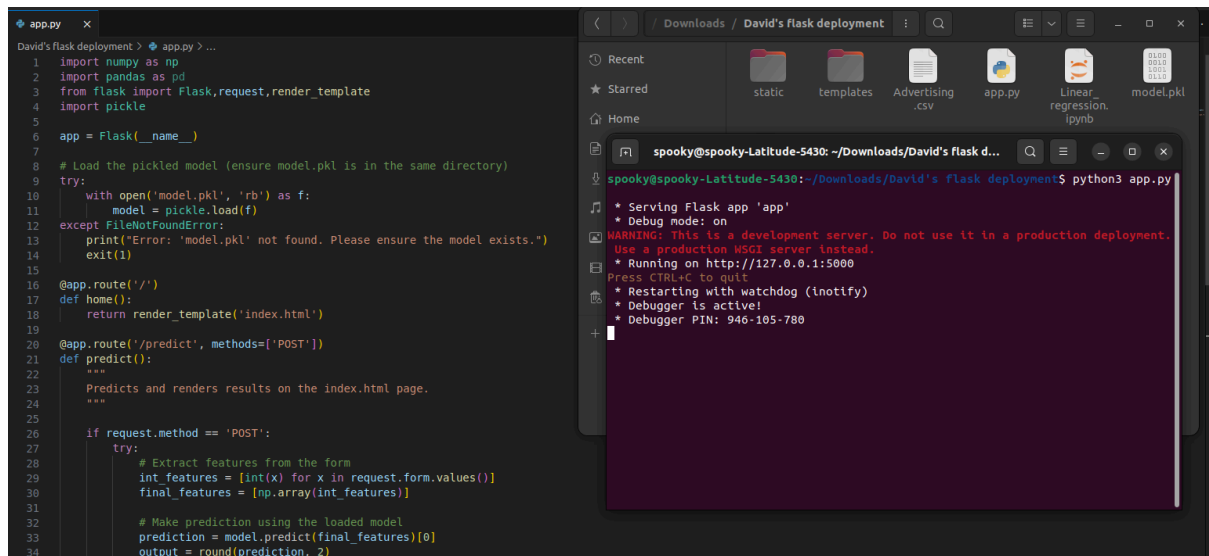
[71]: with open('model.pkl','wb') as f:
      pkl.dump(model,f)
      print('pickling complete')

      pickling complete
```

4. Creation of Flask app and deployment



5. Deployment and running on local host server



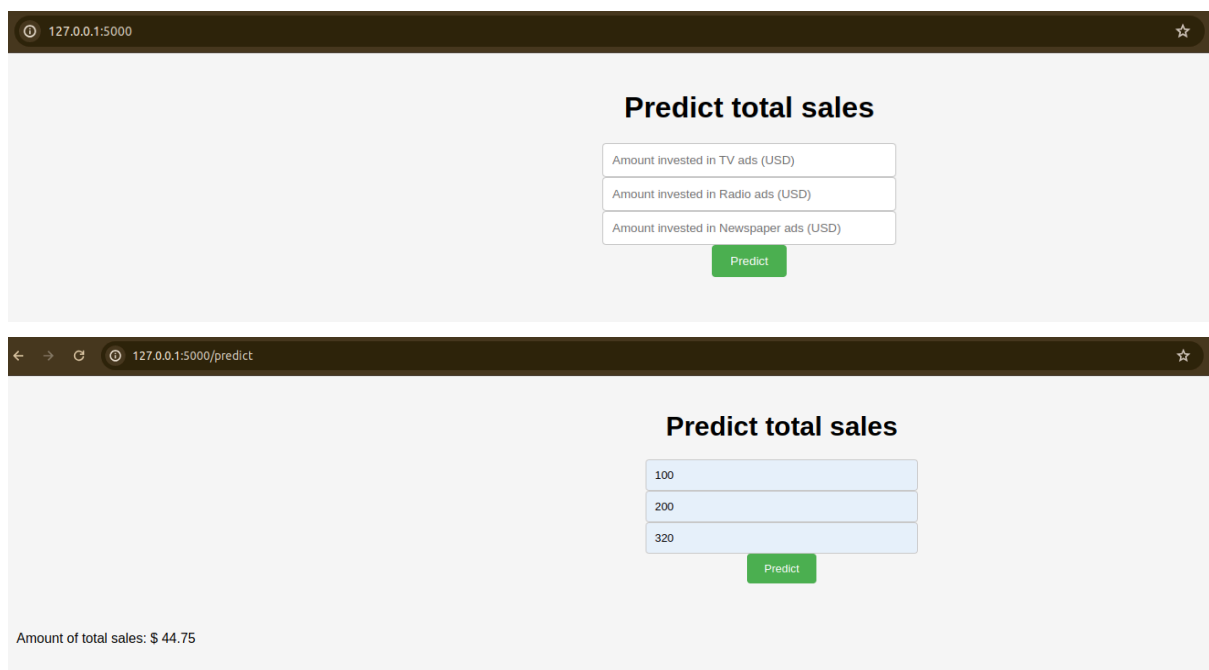
The screenshot shows a code editor on the left with the following Python code in `app.py`:

```
1 import numpy as np
2 import pandas as pd
3 from flask import Flask, request, render_template
4 import pickle
5
6 app = Flask(__name__)
7
8 # Load the pickled model (ensure model.pkl is in the same directory)
9 try:
10     with open('model.pkl', 'rb') as f:
11         model = pickle.load(f)
12 except FileNotFoundError:
13     print("Error: 'model.pkl' not found. Please ensure the model exists.")
14     exit(1)
15
16 @app.route('/')
17 def home():
18     return render_template('index.html')
19
20 @app.route('/predict', methods=['POST'])
21 def predict():
22     """
23     Predicts and renders results on the index.html page.
24     """
25
26     if request.method == 'POST':
27         try:
28             # Extract features from the form
29             int_features = [int(x) for x in request.form.values()]
30             final_features = np.array(int_features)
31
32             # Make prediction using the loaded model
33             prediction = model.predict(final_features)[0]
34             output = round(prediction, 2)
```

On the right, a file explorer shows the directory structure: `static`, `templates`, `Advertising.csv`, `app.py`, `Linear_regression.ipynb`, and `model.pkl`. Below it, a terminal window shows the command `python3 app.py` being executed, with the following output:

```
* Serving Flask app 'app'
* Debug mode: on
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Running on http://127.0.0.1:5000
Press CTRL+C to quit
* Restarting with watchdog (inotify)
* Debugger is active!
* Debugger PIN: 946-105-780
```

6. Prediction of total sales based on advertisement costs for each media of advertisement



The screenshot shows a web application interface for predicting total sales. The browser address bar shows `127.0.0.1:5000`. The page title is "Predict total sales".

The form contains three input fields for advertisement costs:

- Amount invested in TV ads (USD)
- Amount invested in Radio ads (USD)
- Amount invested in Newspaper ads (USD)

A green "Predict" button is located below the input fields.

Below the form, the predicted total sales are displayed:

Amount of total sales: \$ 44.75