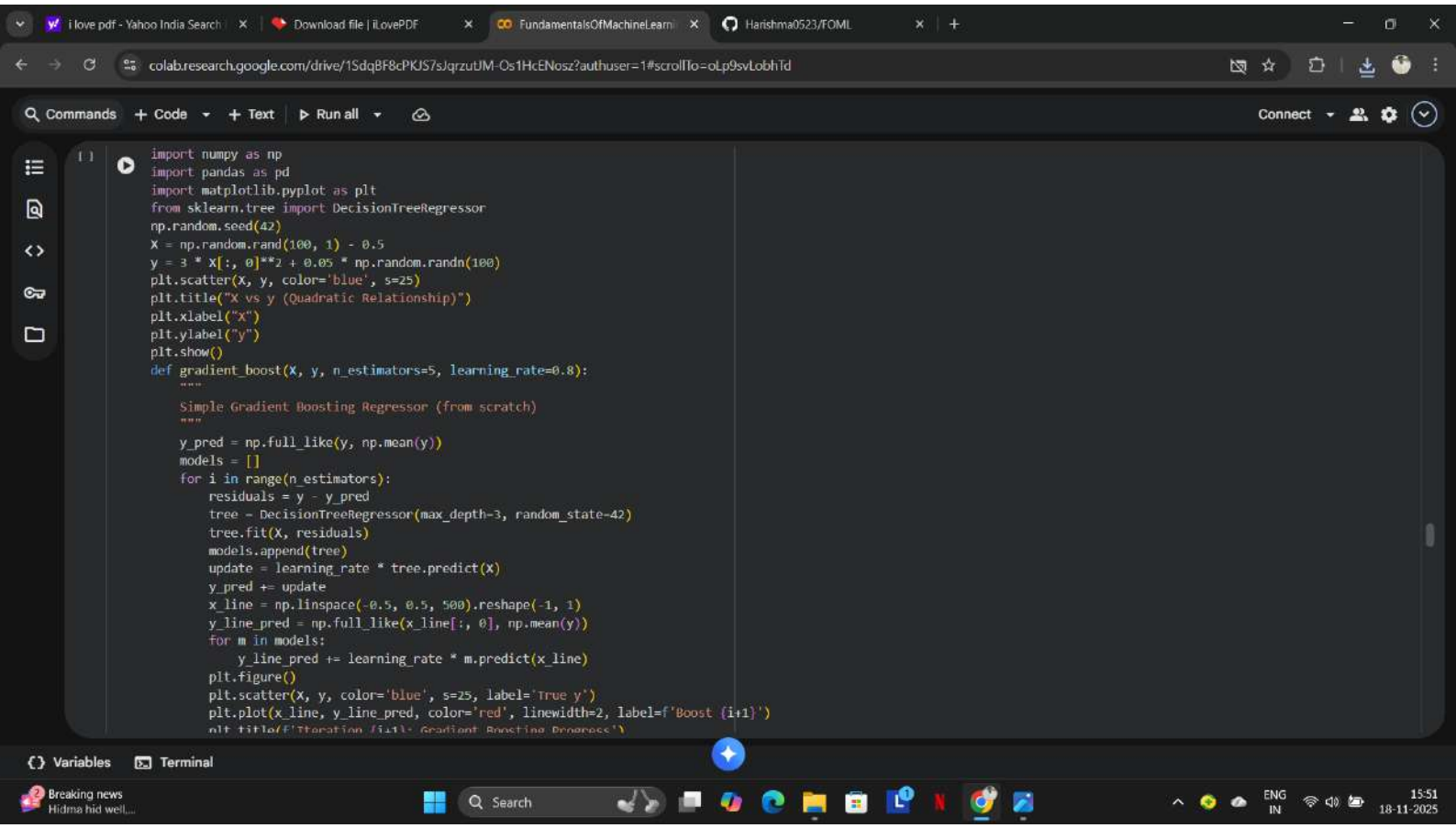
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[ ]
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.tree import DecisionTreeRegressor
np.random.seed(42)
X = np.random.rand(100, 1) - 0.5
y = 3 * X[:, 0]**2 + 0.05 * np.random.randn(100)
plt.scatter(X, y, color='blue', s=25)
plt.title("X vs y (Quadratic Relationship)")
plt.xlabel("X")
plt.ylabel("y")
plt.show()
def gradient_boost(X, y, n_estimators=5, learning_rate=0.8):
"""
Simple Gradient Boosting Regressor (from scratch)
"""
y_pred = np.full_like(y, np.mean(y))
models = []
for i in range(n_estimators):
residuals = y - y_pred
tree = DecisionTreeRegressor(max_depth=3, random_state=42)
tree.fit(X, residuals)
models.append(tree)
update = learning_rate * tree.predict(X)
y_pred += update
x_line = np.linspace(-0.5, 0.5, 500).reshape(-1, 1)
y_line_pred = np.full_like(x_line[:, 0], np.mean(y))
for m in models:
y_line_pred += learning_rate * m.predict(x_line)
plt.figure()
plt.scatter(X, y, color='blue', s=25, label='True y')
plt.plot(x_line, y_line_pred, color='red', linewidth=2, label=f'Boost {i+1}')
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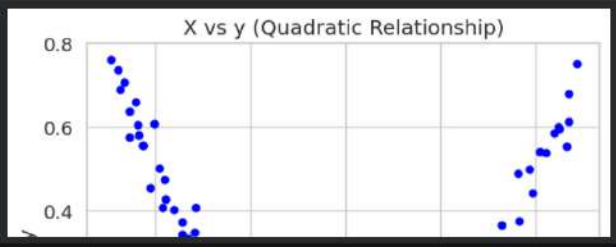
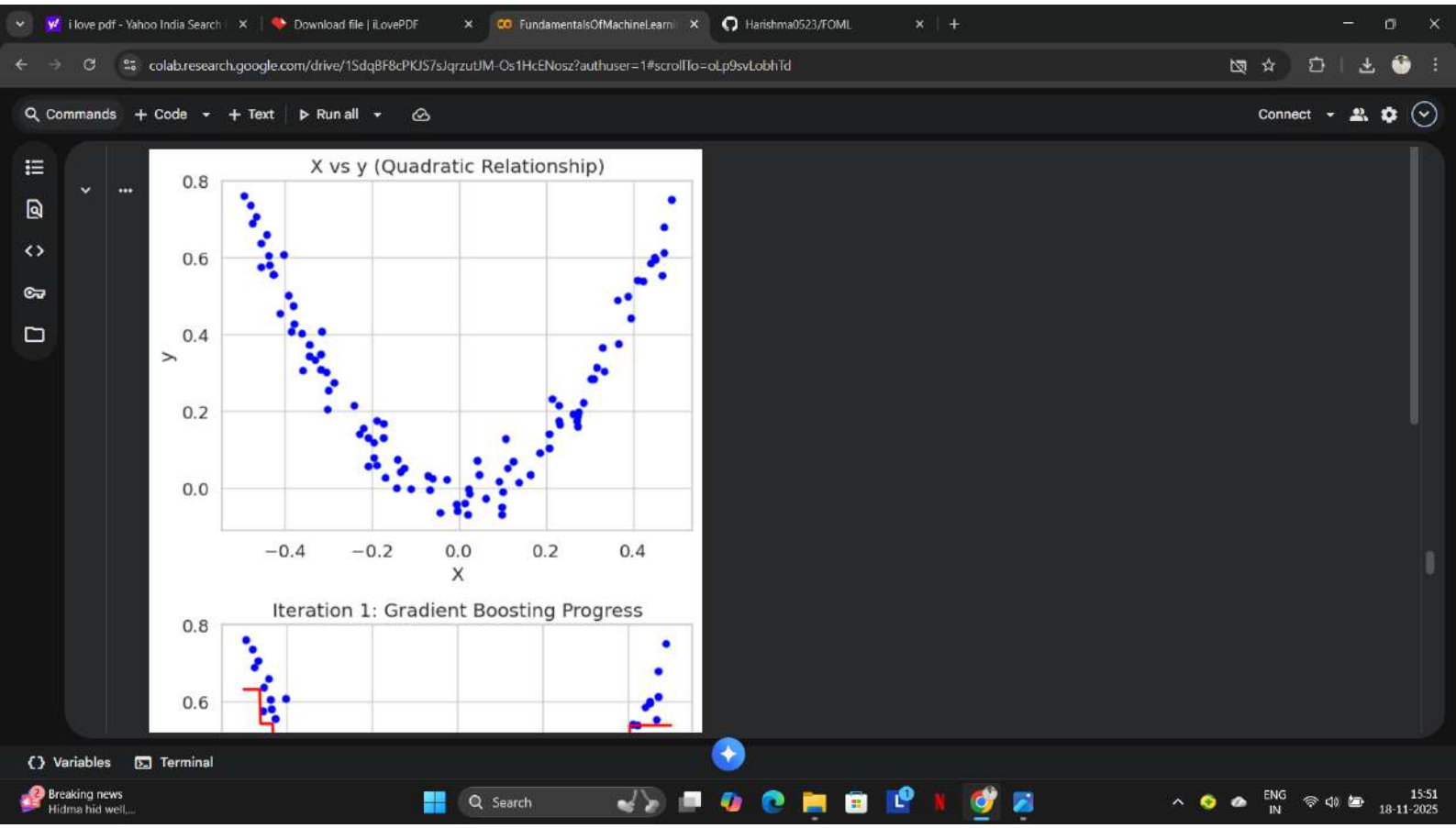
```
            plt.figure()
            plt.scatter(X, y, color='blue', s=25, label='True y')
            plt.plot(x_line, y_line_pred, color='red', linewidth=2, label=f'Boost {i+1}')
            plt.title(f'Iteration {i+1}: Gradient Boosting Progress')
            plt.xlabel('X')
            plt.ylabel('Predicted y')
            plt.legend()
            plt.show()
        print("\n✅ Training Complete!")
        return models, y_pred
models, final_pred = gradient_boost(X, y, n_estimators=5, learning_rate=0.8)
plt.figure(figsize=(8,5))
plt.scatter(X, y, color='blue', s=25, label='True y')
plt.scatter(X, final_pred, color='red', s=25, label='Predicted y (Final)')
plt.title("Final Gradient Boosting Prediction")
plt.xlabel("X")
plt.ylabel("y")
plt.legend()
plt.show()
```

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Commands
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X vs y (Quadratic Relationship)
y
X
0.8
0.6
0.4
0.2
0.0
−0.4
−0.2
0.0
0.2
0.4
Iteration 1: Gradient Boosting Progress
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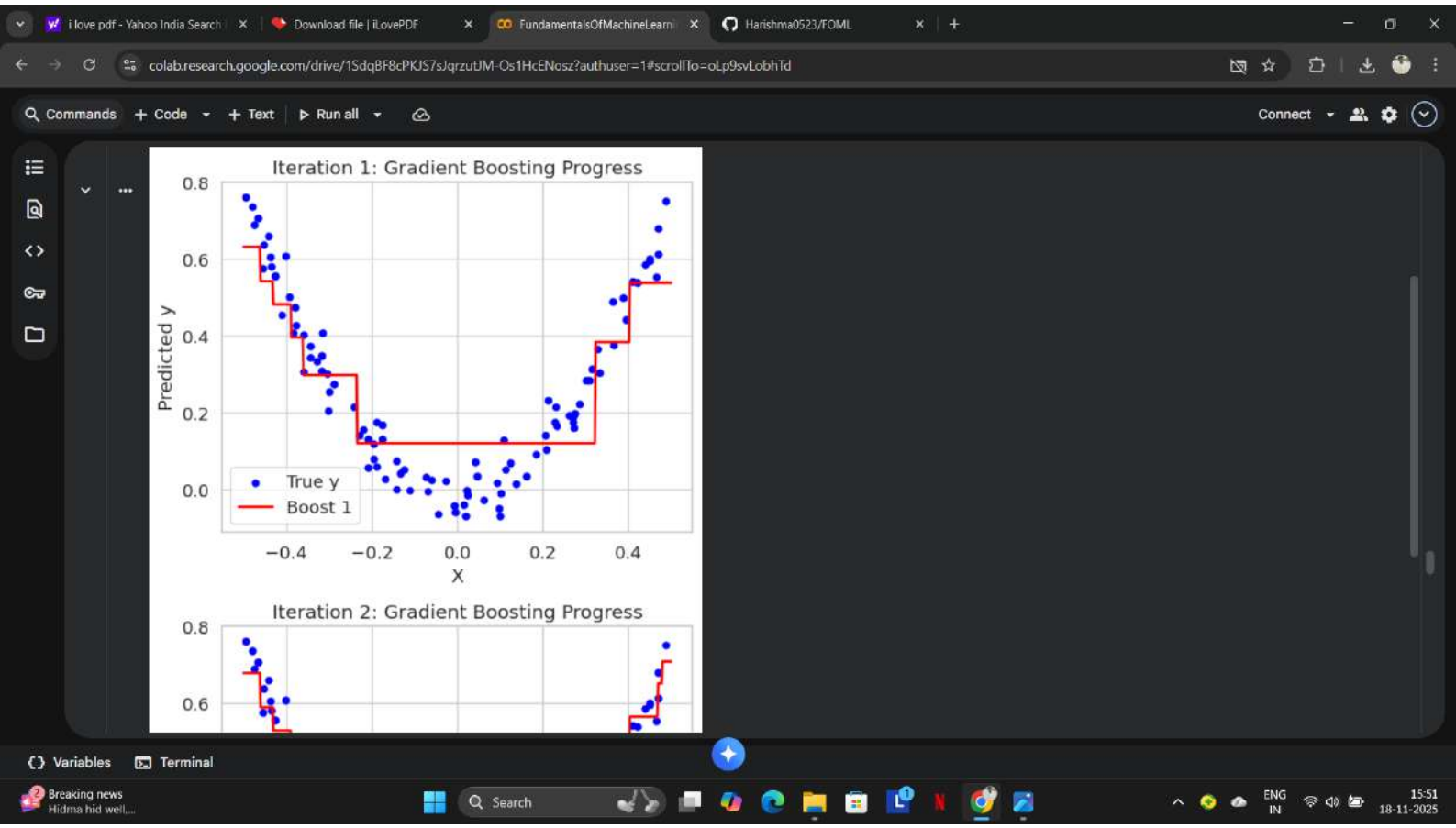
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True y
Boost 1
Iteration 2: Gradient Boosting Progress
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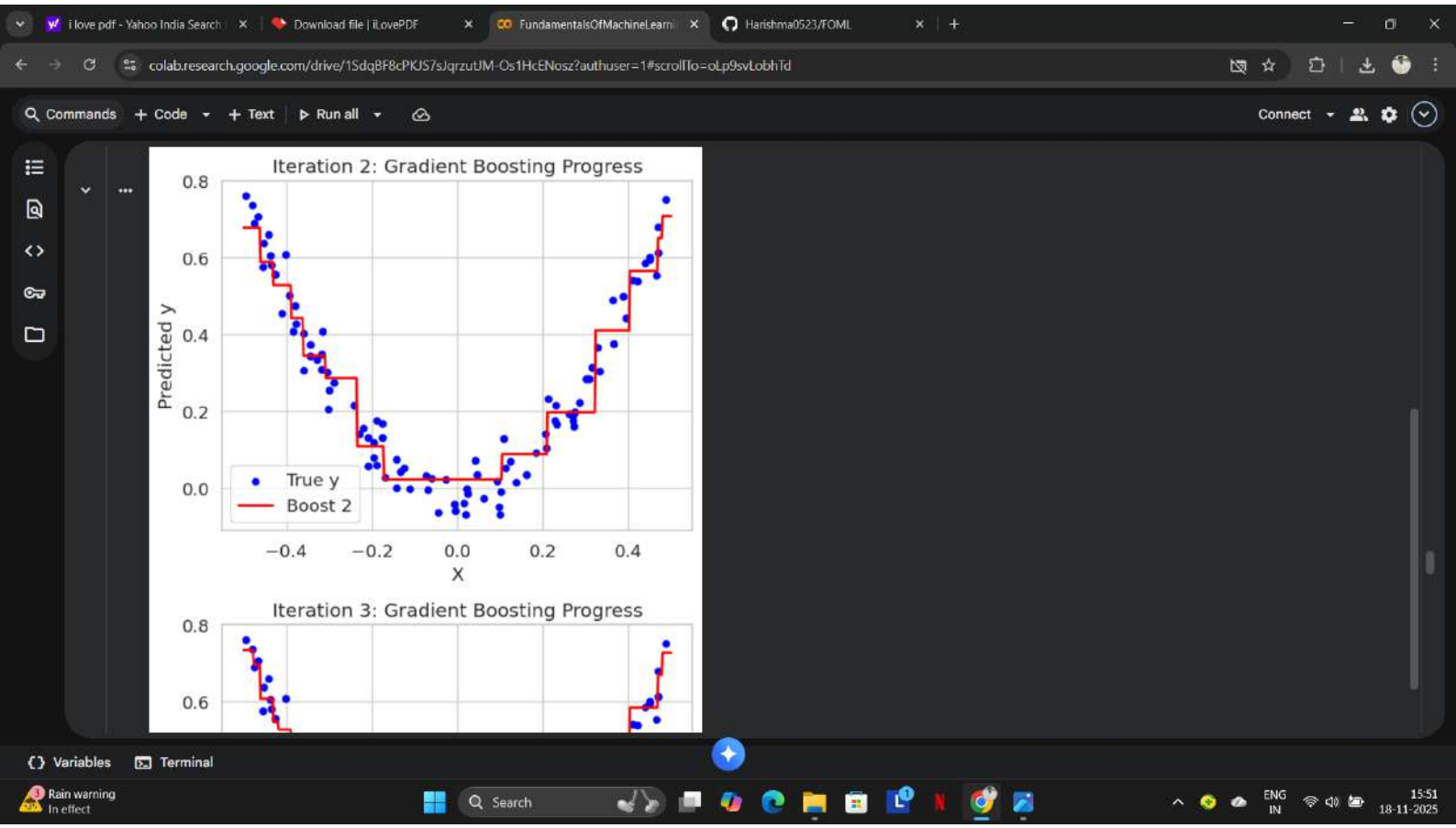
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Iteration 3: Gradient Boosting Progress
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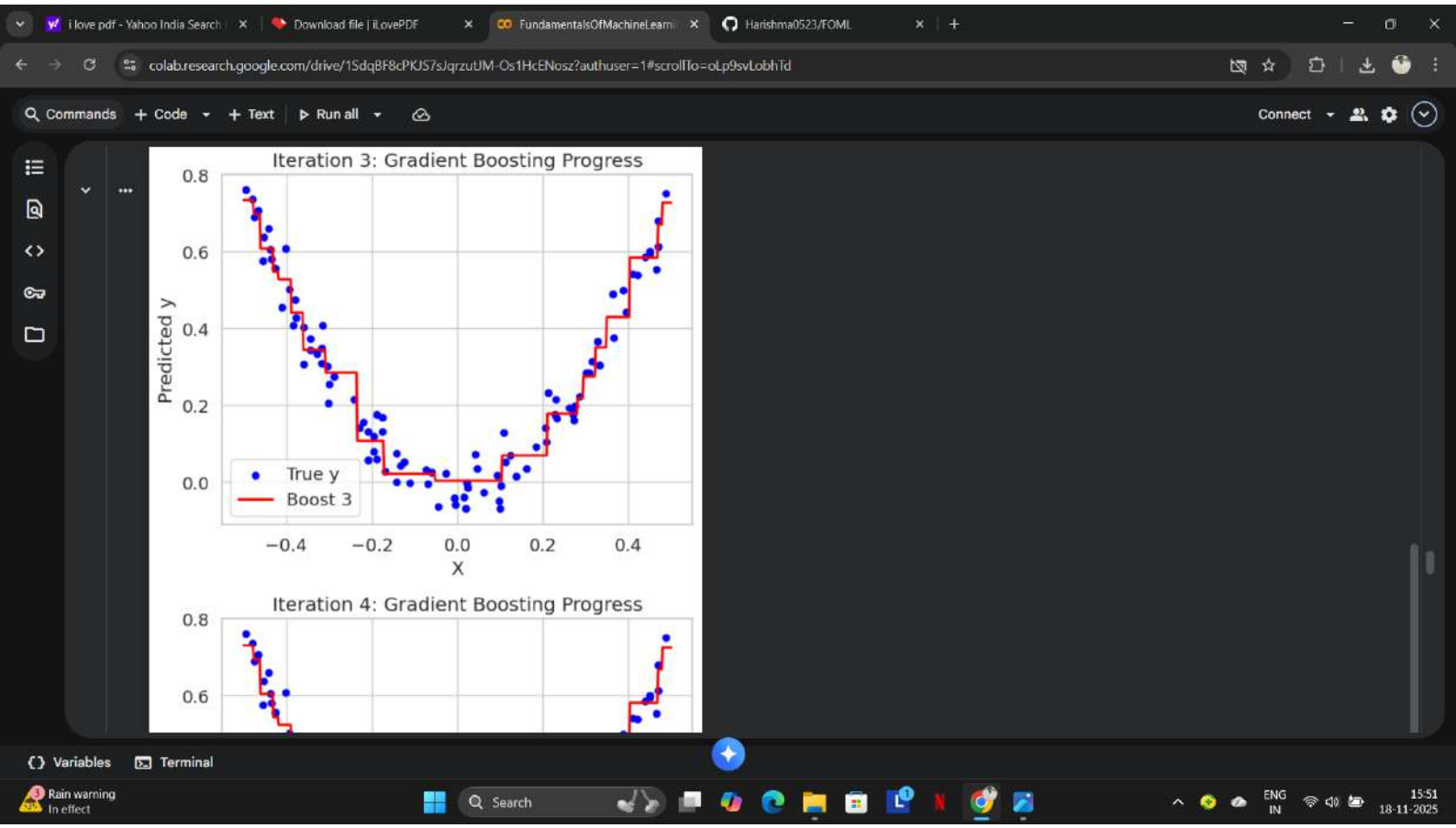
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Iteration 4: Gradient Boosting Progress
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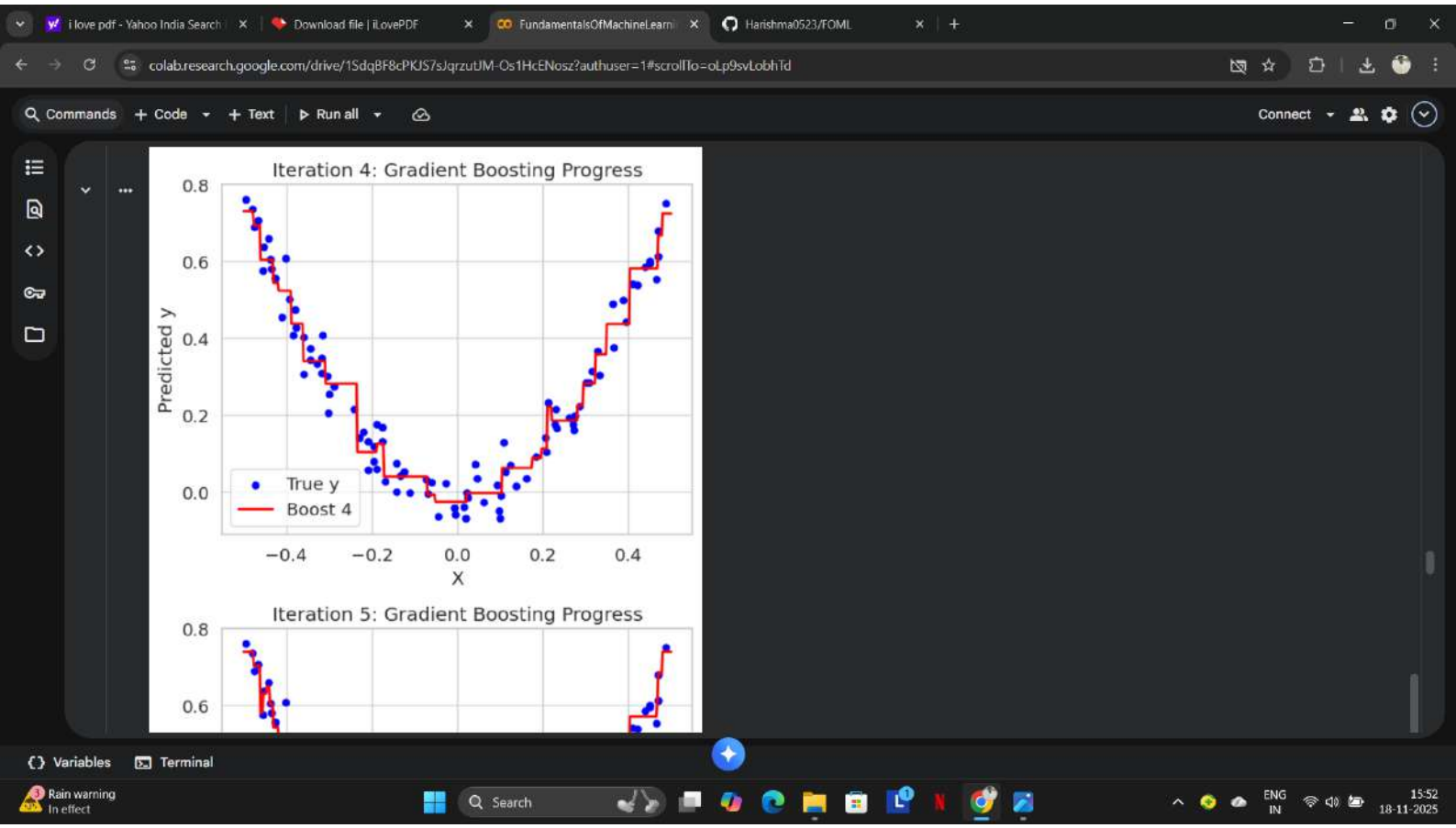
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Iteration 5: Gradient Boosting Progress
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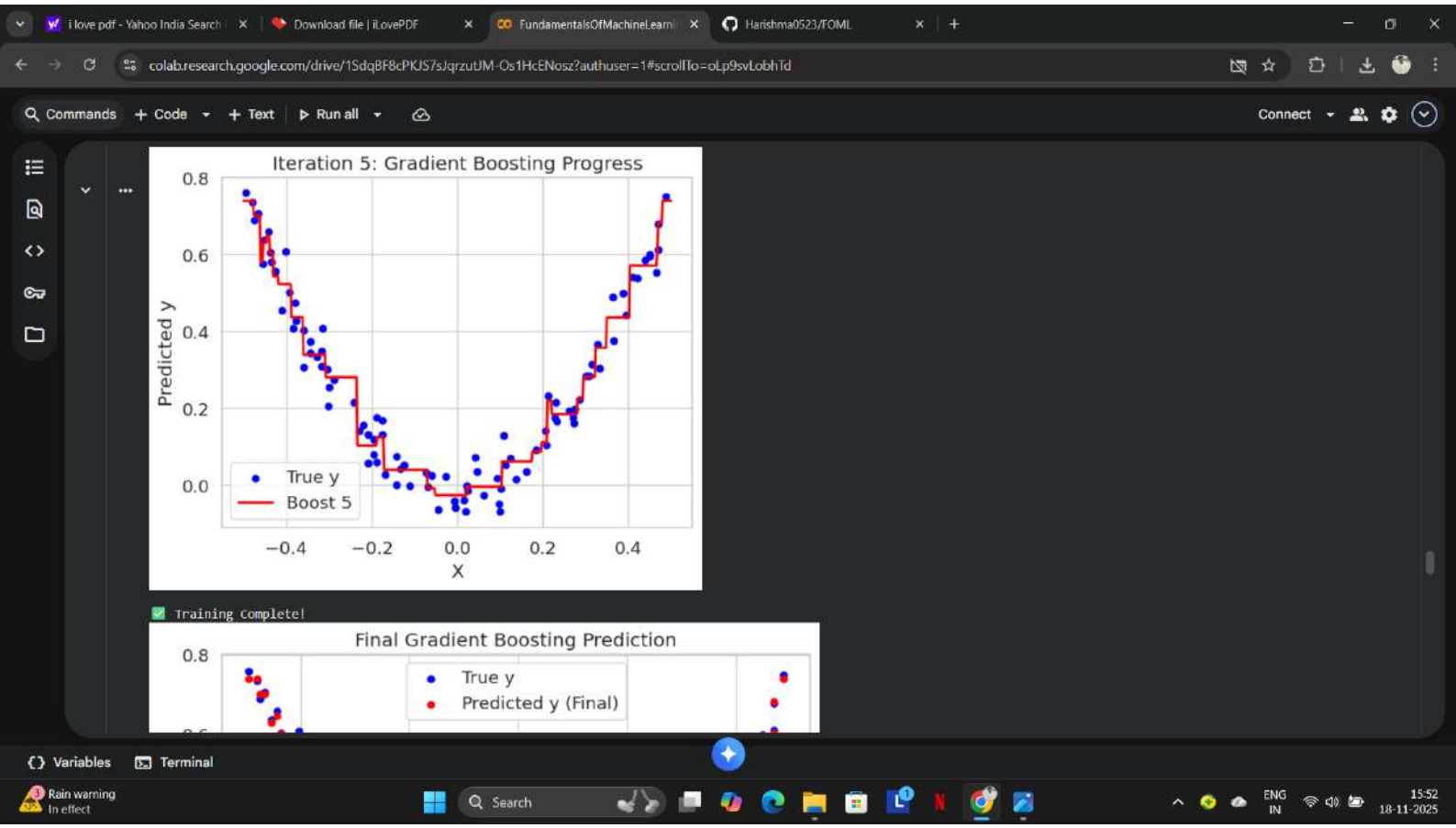
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Iteration 5: Gradient Boosting Progress
Predicted y
X
True y
Boost 5
Training Complete!
Final Gradient Boosting Prediction
True y
Predicted y (Final)
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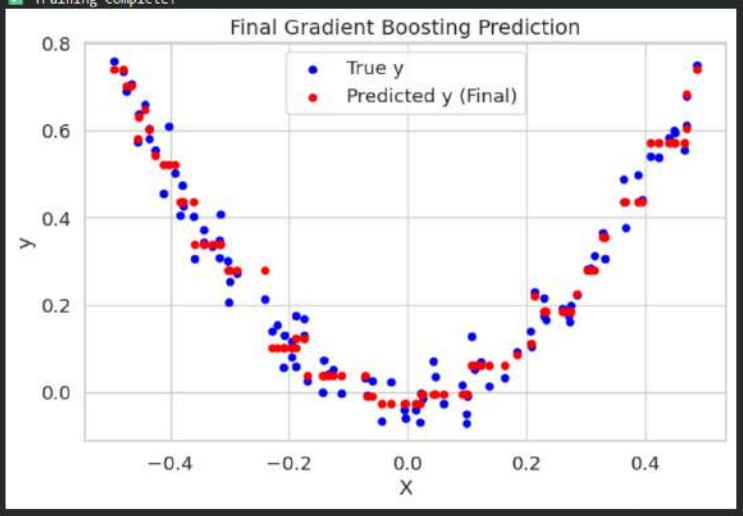
Training Complete!



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