The background of the slide is a collage of images related to architecture and energy efficiency. At the top, there's a 3D architectural model of a house with a dark roof and two chimneys. Below this, on the left, is a rolled-up blueprint. In the center, there's a small white model of a building. To the right, there's a yellow energy efficiency scale with letters A through I, where A is green and I is black. In the bottom left, there's a calculator and a yellow sticky note. The main title is centered in a white box with a light blue background.

Prediction application on Residential Building Energy Efficiency

By Tim Cheung

Dataset Information

- Source: [Origin data](#) from UCI Machine Learning Repository

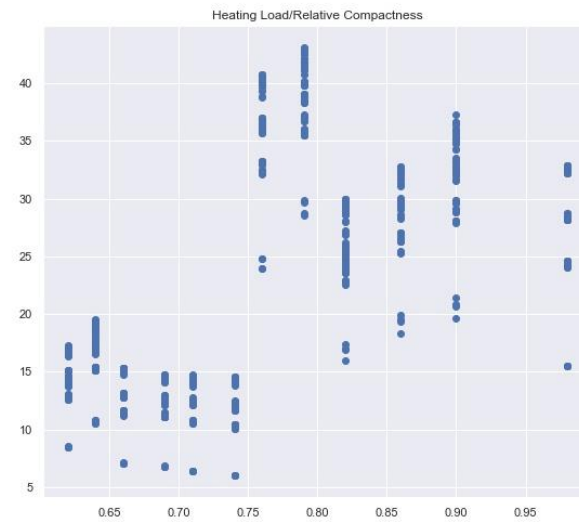
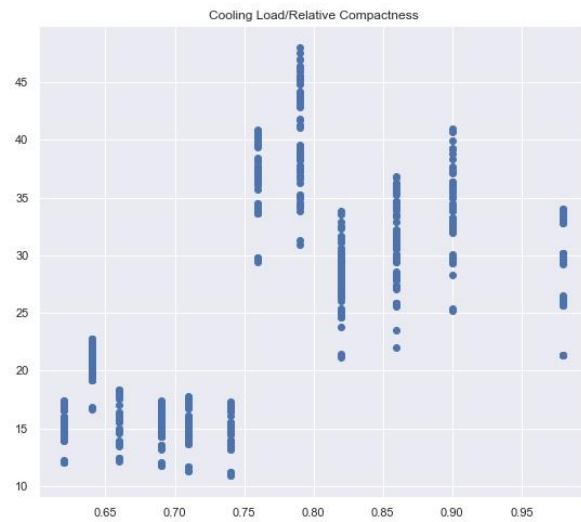
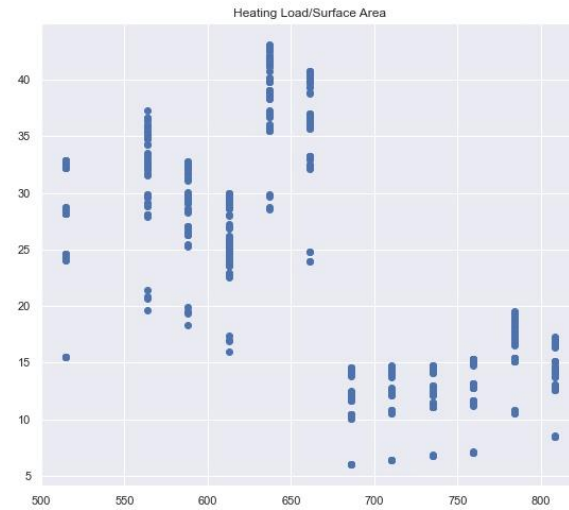
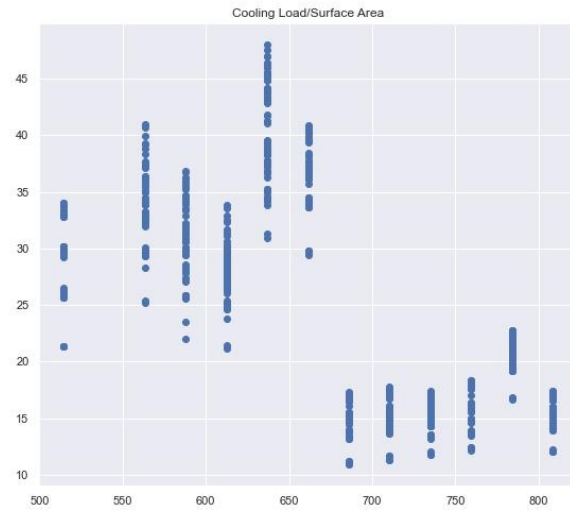
	Relative_Compactness	Surface_Area	Wall_Area	Roof_Area	Overall_Height	Orientation	Glazing_Area	Glazing_Area_Distribution	Heating_Load	Cooling_Load
0	0.98	514.5	294.0	110.25	7.0	2	0.0	0	15.55	21.33
1	0.98	514.5	294.0	110.25	7.0	3	0.0	0	15.55	21.33
2	0.98	514.5	294.0	110.25	7.0	4	0.0	0	15.55	21.33
3	0.98	514.5	294.0	110.25	7.0	5	0.0	0	15.55	21.33
4	0.90	563.5	318.5	122.50	7.0	2	0.0	0	20.84	28.28

Dataset Information

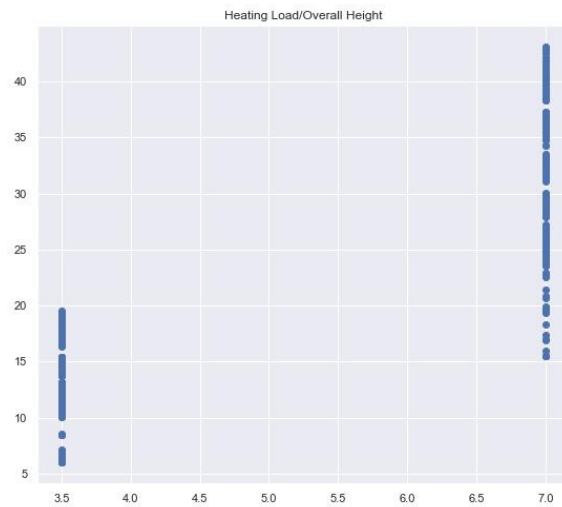
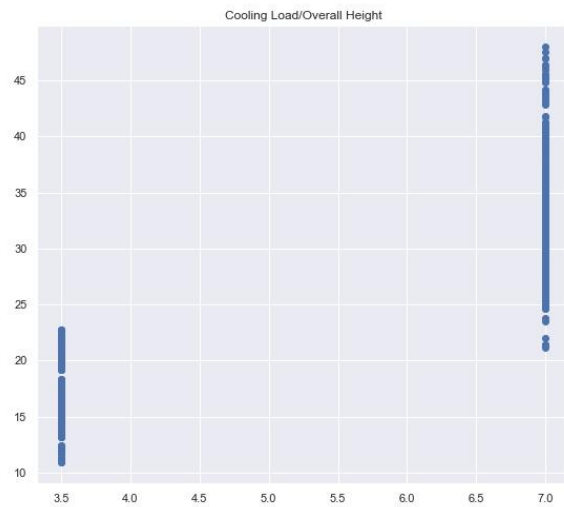
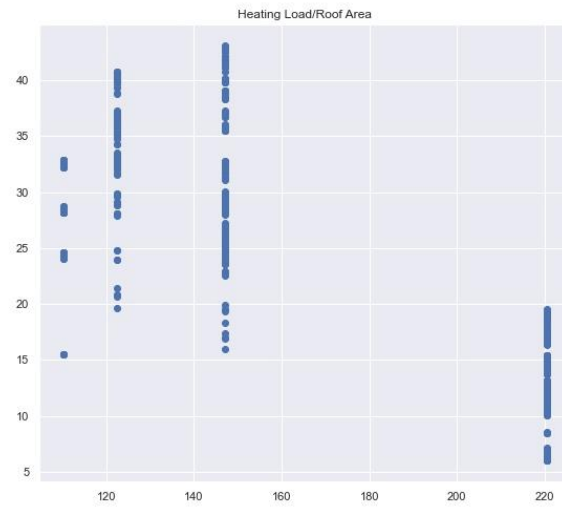
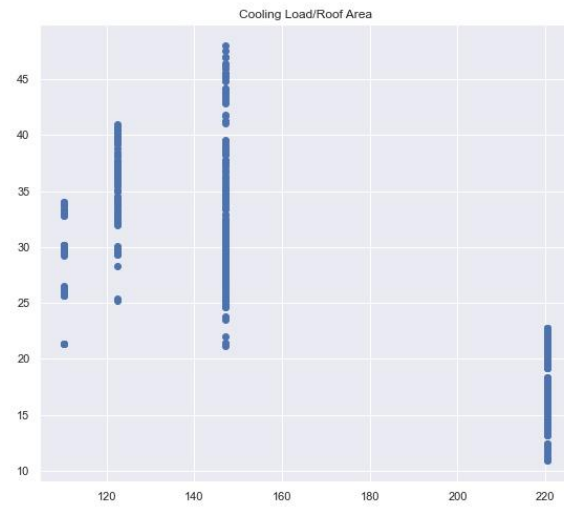


- Relative Compactness – Ratio of cooling/heating volume to surface area
- Surface Area (m^2)
- Wall Area (m^2)
- Roof Area (m^2)
- Overall Height (m, 3.5 = 1 Storey, 7.0 = 2 Storey)
- Orientation (details in [Labels](#))
- Glazing Area – (0%, 10%, 25%, 40% of floor area) with glass component
- Glazing Area Distribution (details in [Labels](#))
- Heating Load (kWh)
- Cooling Load (kWh)

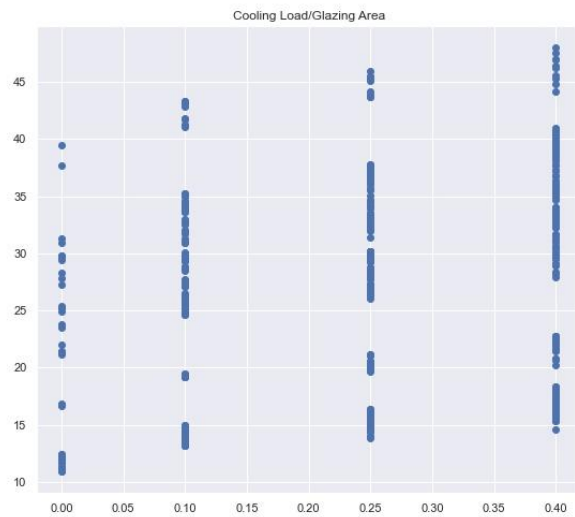
Column Relationship



Column Relationship



Column Relationship



Labels

- Orientation - 2:North, 3:East, 4:South, 5:West
- Glazing Area Distribution – 0:Not glazed, 1:Uniform, 2:North, 3:East, 4:South, 5:West
- [Source](#)



Model Build

- Cooling

```
In [22]: r2c_score = CXGB.score(X_test, yc_test)
print(f'{r2c_score*100}%')
```

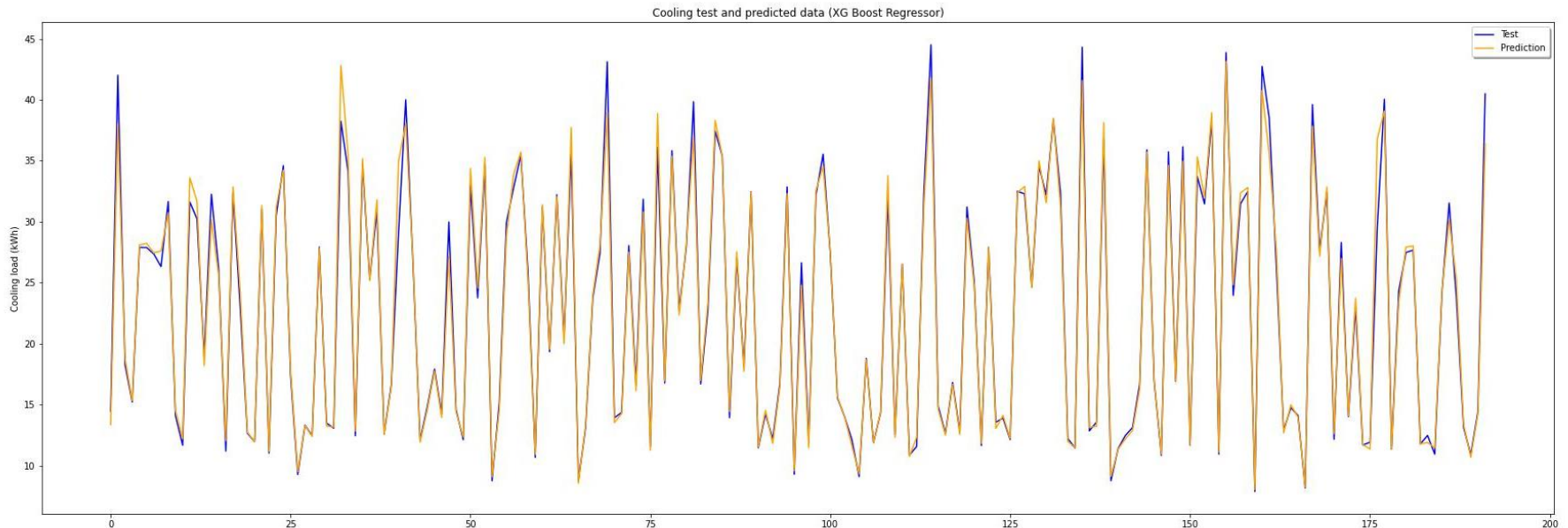
98.51856217190276%

```
In [23]: print(f'Mean Absolute Error: {metrics.mean_absolute_error(yc_test, yc_pred)}')
print(f'Mean Squared Error: {metrics.mean_squared_error(yc_test, yc_pred)}')
print(f'Root Mean Squared Error: {np.sqrt(metrics.mean_squared_error(yc_test, yc_pred))}')
```

Mean Absolute Error: 0.07064996228063408

Mean Squared Error: 0.015159172688821942

Root Mean Squared Error: 0.12312259211380315



Model Build

- Heating

```
In [27]: r2h_score = HXGB.score(X_test,yh_test)
print(f'{r2h_score*100}%')
```

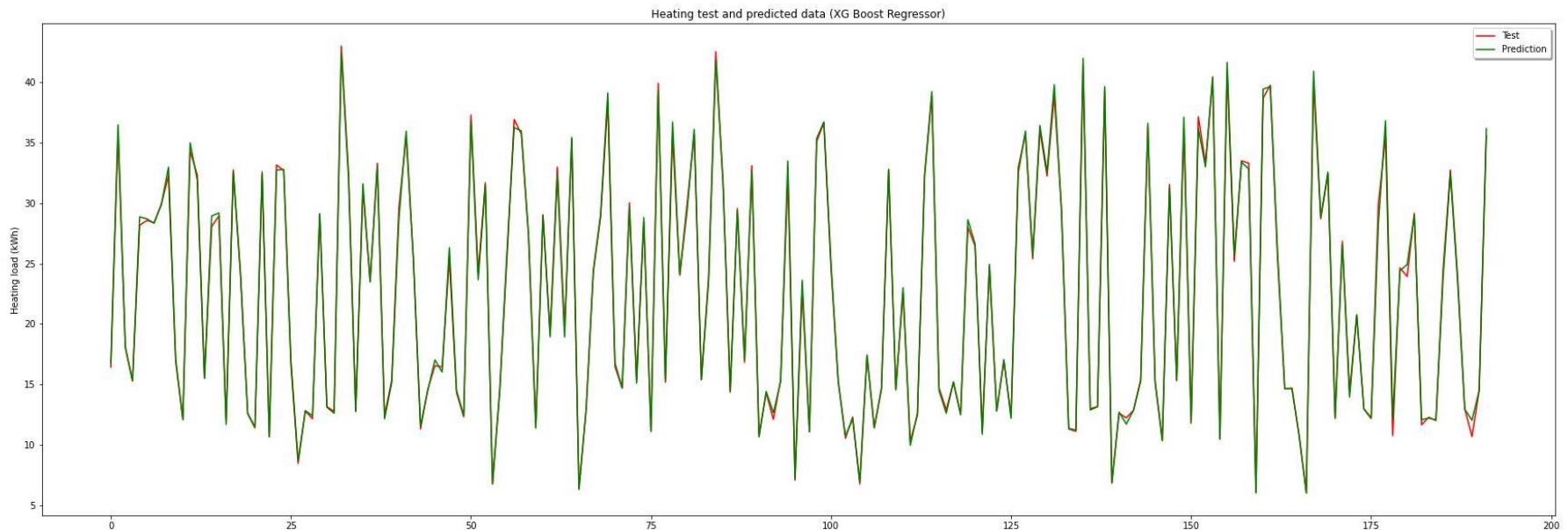
99.82505792928691%

```
In [28]: print(f'Mean Absolute Error: {metrics.mean_absolute_error(yh_test, yh_pred)}')
print(f'Mean Squared Error: {metrics.mean_squared_error(yh_test, yh_pred)}')
print(f'Root Mean Squared Error: {np.sqrt(metrics.mean_squared_error(yh_test, yh_pred))}')
```

Mean Absolute Error: 0.02999238941504229

Mean Squared Error: 0.0017997990903303271

Root Mean Squared Error: 0.042424039061955514



Application interface

Energy Efficiency Prediction

127.0.0.1:5000

Relative Compactness (%)

Surface Area (m²)

Wall Area (m²)

Roof Area (m²)

No. of Storey
☐ 1 Storey ☐ 2 Storey

Orientation
☐ East ☐ South
☐ West ☐ North

Not Glazed ☐

Glazing Area
☐ 10% ☐ 25% ☐ 40%

Glazing Direction
☐ Uniform
☐ Eastward ☐ Southward
☐ Westward ☐ Northward

Get result

Prediction Result

127.0.0.1:5000/result

Cooling Load: 32.56kWh
Heating Load: 28.86kWh

Back



Source

- Dataset

https://www.kaggle.com/datasets/ujjwalchowdhury/energy-efficiency-data-set?resource=download&select=energy_efficiency_data.csv

- Labels

<https://www.kaggle.com/code/winternguyen/modeling-energy-efficiency-residential-building/notebook>