**Preliminary Draft Results**

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Note: LightGBM results are at the end of the document. To summarize:

Toronto City acts as the “house” and uses Toronto City Centre, Toronto Intl A and Buttonville A as exogenous features.

* I model results in LightGBM, SARIMAX, Prophet, and tried LSTM
* I look into the LightGBM model results having changed the “house” to King City North
* I also look into LightGBM model results having changed the “house” to Vancouver Harbour CS, while having West Vancouver Aut, Vancouver Intl A, and Point Atkinson as exogenous features and also using the RETScreen radiation data
* Feature weighing at the end of report

Initial model comparison of all data from 2016-01-01 to 2022-01-01

|  |  |  |  |
| --- | --- | --- | --- |
| Model | RMSE | MAE | R2 |
| SARIMAX | 2.25 | 1.77 | 0.95 |
| Prophet | 0.70 | 0.50 | 1.00 |
| LightGBM | 0.81 | 0.58 | 1.00 |

Comparison of Day vs. Night and Winter vs. Summer results across different stations (however it’s nice to know) – sectioned off to three groups (the RMSEs, the MAEs, and the R2)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Summer + Day | Summer + Night | Winter + Day | Winter + Night |
| RMSE Toronto | 0.95 | 0.61 | 0.69 | 0.63 |
| RMSE King City North | 1.07 | 0.75 | 0.84 | 0.78 |
| RMSE Vancouver | 0.80 | 0.65 | 0.65 | 0.57 |
| MAE Toronto | 0.73 | 0.42 | 0.52 | 0.40 |
| MAE King City North | 0.80 | 0.51 | 0.62 | 0.50 |
| MAE Vancouver | 0.59 | 0.47 | 0.46 | 0.39 |
| R2 Toronto | 0.99 | 0.99 | 1.00 | 1.00 |
| R2 King City North | 0.99 | 0.99 | 0.99 | 0.99 |
| R2 Vancouver | 0.98 | 0.98 | 0.98 | 0.98 |

Model Feature correlation:

A picture containing checker

Description automatically generated

Autocorrelation Function plot of ground truth temperature (Toronto City)

A picture containing histogram

Description automatically generated

LSTM model results:

* Could not be figured out due to issues in configuring initial model

SARIMAX (Seasonal Autoregressive Integrated Moving Average with eXogenous factors)

Table

Description automatically generated

Facebook Prophet

Table

Description automatically generated

Decomposition of Facebook Prophet model with respect to ground truth temperatures (Toronto City)

Chart, line chart

Description automatically generated

LightGBM Chart

Description automatically generated

Comparison of results using Toronto City as center, and using Buttonville, Toronto International Airport, and Toronto City Centre as exogenous features

Text, letter

Description automatically generated

Results of training LightGBM models for Winter vs. Summer, and Day vs. Night – Toronto with Toronto City as center

A picture containing table

Description automatically generated

summer+day

RMSE of LightGBM: 0.9514951470499308

MAE of LightGBM: 0.7292005655663253

R2 of LightGBM: 0.9895270358380436

A picture containing chart

Description automatically generated

summer+night

RMSE of LightGBM: 0.606674750678484

MAE of LightGBM: 0.41617815053945373

R2 of LightGBM: 0.994825827592962

Bar chart

Description automatically generated with low confidence

winter+day

RMSE of LightGBM: 0.6867777040983187

MAE of LightGBM: 0.5153370074675717

R2 of LightGBM: 0.9952860250738357

Chart

Description automatically generated

winter+night

RMSE of LightGBM: 0.6297058167375451

MAE of LightGBM: 0.4009749623637006

R2 of LightGBM: 0.9954531382083441

Results of training LightGBM models for Winter vs. Summer, and Day vs. Night with King City North as Center

Graphical user interface, application, table

Description automatically generated

summer+day

RMSE of LightGBM: 1.0748284425722083

MAE of LightGBM: 0.7956344756208281

R2 of LightGBM: 0.988149204188182

Graphical user interface, application, table, Excel

Description automatically generated

summer+night

RMSE of LightGBM: 0.754676539626915

MAE of LightGBM: 0.5060721453669853

R2 of LightGBM: 0.9926396277284432

Table

Description automatically generated

winter+day

RMSE of LightGBM: 0.8448025457852129

MAE of LightGBM: 0.6161362978373904

R2 of LightGBM: 0.9936708273499005

Table

Description automatically generated winter+night

RMSE of LightGBM: 0.7779397089068562

MAE of LightGBM: 0.4959331002135865

R2 of LightGBM: 0.9938311538898326

Results of training LightGBM models for Winter vs. Summer, and Day vs. Night in Vancouver with center as Vancouver Harbour CS, exogenous features of West Vancouver Aut, Vancouver Intl Airport, and Point Atkinson

A picture containing graphical user interface

Description automatically generated

summer+day

RMSE of LightGBM: 0.8014885854789044

MAE of LightGBM: 0.5949593485724824

R2 of LightGBM: 0.9816951047783669

A picture containing graphical user interface

Description automatically generated summer+night

RMSE of LightGBM: 0.6469117191366816

MAE of LightGBM: 0.4675209745026675

R2 of LightGBM: 0.9838411211703266

A picture containing table

Description automatically generated

winter+day

RMSE of LightGBM: 0.6540143516556265

MAE of LightGBM: 0.4598819412611143

R2 of LightGBM: 0.9790691160005198

A picture containing bar chart

Description automatically generated

winter+night

RMSE of LightGBM: 0.5735699336463019

MAE of LightGBM: 0.39290662098983825

R2 of LightGBM: 0.980163293814143