paper07_model_comparison

December 10, 2021

1 Model Comparison

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Prof. Dr. Edgar Francisco Román-Rangel.

We trained our models using Vertex AI in order to have enough computational resources to load as much history as possible within our budget.

2 Comparison of Trained Models using Different Time Windows

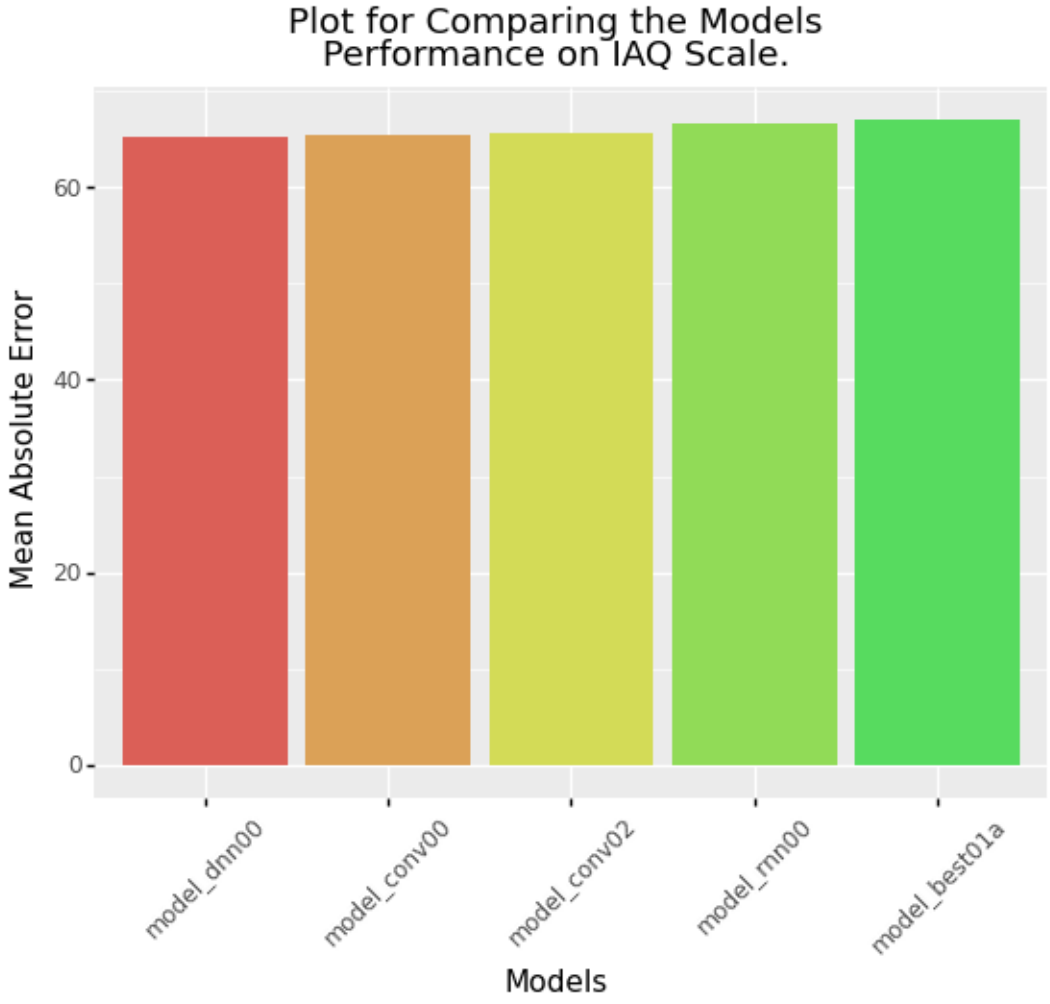
2.1 1 Week History

2.1.1 5 min

```
/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 0.22.2.post1 when using
version 0.23.2. This might lead to breaking code or invalid results. Use at your
own risk.

/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 1.0.1 when using version
0.23.2. This might lead to breaking code or invalid results. Use at your own
risk.
```

	Model	Time	Epochs	Window Size Days	Stride	Sampling Rate	Batch Size	MSE	MAE
0	model_dnn00	217.878893	31	8	1	2	128	0.022354	65.318006
1	model_conv00	304.261804	31	8	1	2	128	0.022398	65.414109
2	model_conv02	588.811753	31	8	1	2	128	0.022474	65.567544
3	model_rnn00	1594.912729	31	8	1	2	128	0.023116	66.682703
4	model_best01a	669.725358	31	8	1	2	128	0.023511	67.104972
5	model_lstm00	266.832087	31	8	1				
6	model_lstm02	323.540315	31	8	1				
7	model_dnn01	217.440506	31	8	1				
8	model_dnn02	293.978746	31	8	1				
9	model_rnn02	1600.787760	31	8	1				
10	model_best03a	665.194710	31	8	1				
11	model_best03b	416.240680	31	8	1				

5	2	128	0.024388	65.582181
6	2	128	0.025541	69.957182
7	2	128	0.026252	70.855299
8	2	128	0.034087	79.413494
9	2	128	0.042607	87.835063
10	2	128	0.043218	79.838635
11	2	128	0.047076	92.035175



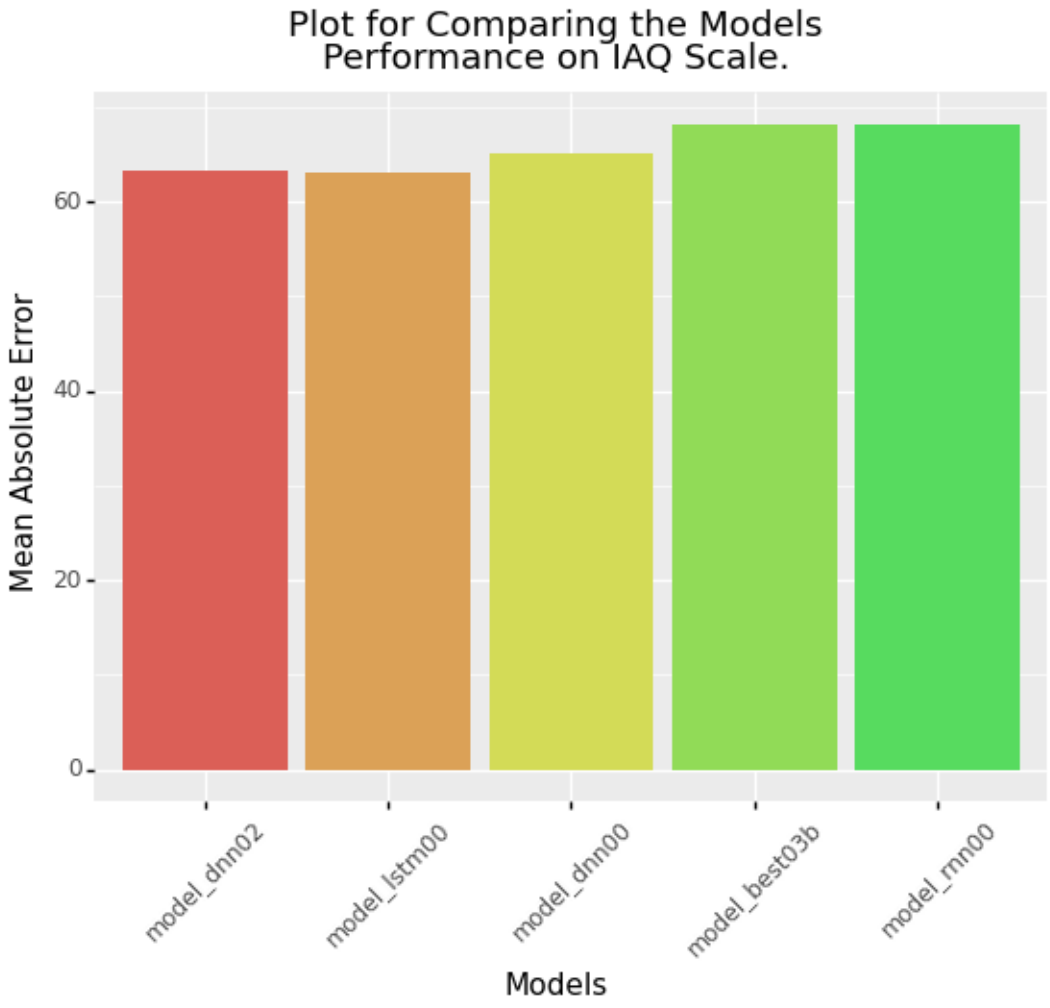
<ggplot: (8786590715385)>

2.1.2 2 Min

```
/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 1.0.1 when using version
0.23.2. This might lead to breaking code or invalid results. Use at your own
risk.

/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 0.22.2.post1 when using
version 0.23.2. This might lead to breaking code or invalid results. Use at your
```

own risk.

	Model	Time	Epochs	Window Size Days	Stride	Sampling Rate	Batch Size	MSE	MAE
0	model_dnn02	3842.451737	77	8	1	2	128	0.021211	63.329056
1	model_lstm00	3538.611173	77	8	1	2	128	0.021481	63.077525
2	model_dnn00	2902.502979	77	8	1	2	128	0.022219	65.089605
3	model_best03b	5510.362569	77	8	1	2	128	0.024159	68.114908
4	model_rnn00	18605.987639	77	8	1	2	128	0.024258	68.245714
5	model_best01a	9027.691227	77	8	1	2	128	0.024798	68.948664
6	model_conv02	8152.342661	77	8	1	2	128	0.026240	70.762903
7	model_dnn01	2908.461928	77	8	1	2	128	0.026618	71.207453
8	model_rnn02	19003.077316	77	8	1	2	128	0.030488	75.748702
9	model_best03a	8879.601115	77	8	1	2	128	0.036016	81.302087
10	model_lstm02	3530.718313	77	8	1	2	128	0.156364	182.239953
11	model_conv00	4126.700369	77	8	1	2	128	0.919341	465.832692



<ggplot: (8786590684605)>

2.1.3 1 Min

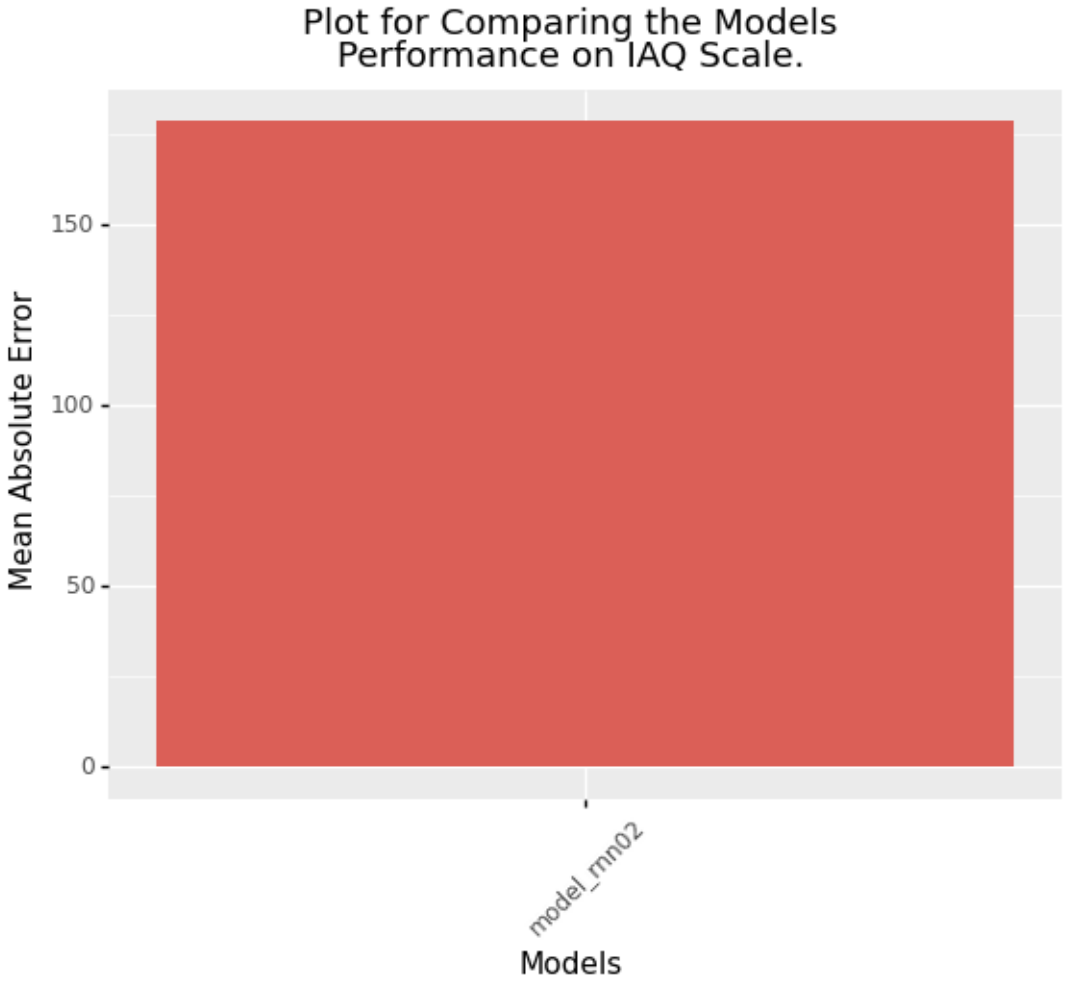
/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 1.0.1 when using version 0.23.2. This might lead to breaking code or invalid results. Use at your own risk.

/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 0.22.2.post1 when using version 0.23.2. This might lead to breaking code or invalid results. Use at your own risk.

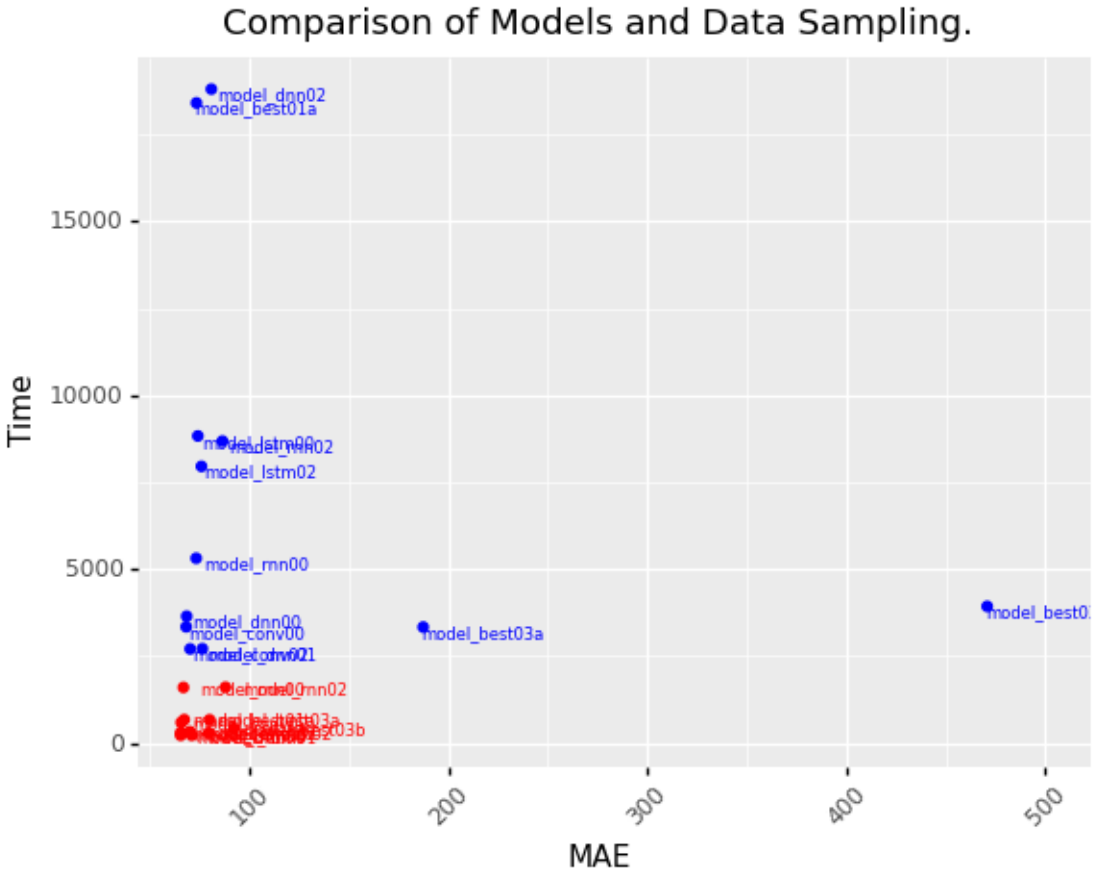
	Model	Time	Epochs	Window Size Days	Stride	Sampling Rate	Batch Size	MSE	MAE
0	model_rnn02	87184.824203	100	8	1	2	128	0.160145	178.394232




```
<ggplot: (8786590715329)>
```

2.2 Comparison Plot

```
''
```



	Model	Time	Epochs	Window Size Days	Stride	\
0	model_dnn02	3842.451737	77	8	1	
1	model_lstm00	3538.611173	77	8	1	
2	model_dnn00	2902.502979	77	8	1	
3	model_best03b	5510.362569	77	8	1	
4	model_rnn00	18605.987639	77	8	1	
5	model_best01a	9027.691227	77	8	1	
6	model_conv02	8152.342661	77	8	1	
7	model_dnn01	2908.461928	77	8	1	
8	model_rnn02	19003.077316	77	8	1	
9	model_best03a	8879.601115	77	8	1	
10	model_lstm02	3530.718313	77	8	1	
11	model_conv00	4126.700369	77	8	1	
12	model_dnn00	217.878893	31	8	1	
13	model_conv00	304.261804	31	8	1	
14	model_conv02	588.811753	31	8	1	
15	model_rnn00	1594.912729	31	8	1	
16	model_best01a	669.725358	31	8	1	
17	model_lstm00	266.832087	31	8	1	
18	model_lstm02	323.540315	31	8	1	
19	model_dnn01	217.440506	31	8	1	
20	model_dnn02	293.978746	31	8	1	
21	model_rnn02	1600.787760	31	8	1	
22	model_best03a	665.194710	31	8	1	
23	model_best03b	416.240680	31	8	1	
24	model_rnn02	87184.824203	100	8	1	

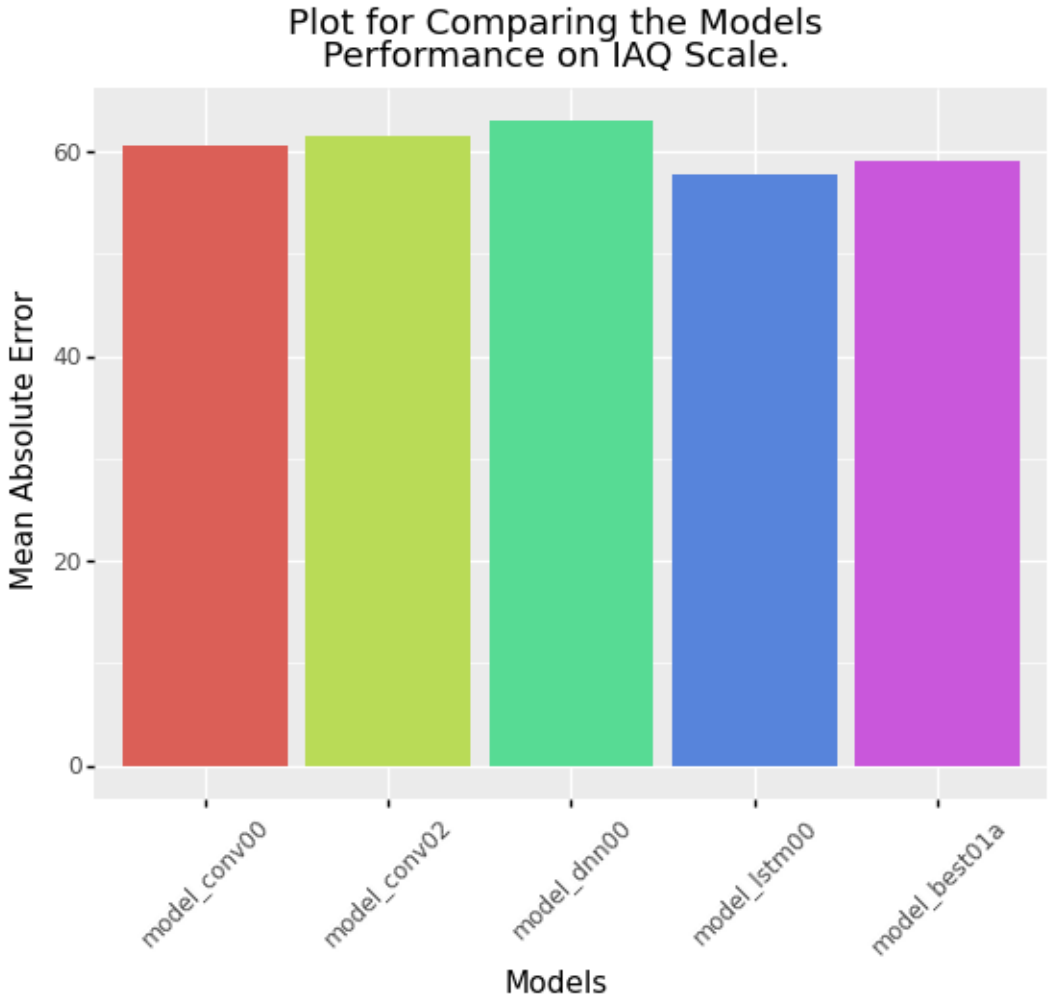
Sampling Rate	Batch Size	MSE	MAE	Modelo2 Resample

0	2	128	0.021211	63.329056	model_dnn02	2 Min
1	2	128	0.021481	63.077525	model_lstm00	2 Min
2	2	128	0.022219	65.089605	model_dnn00	2 Min
3	2	128	0.024159	68.114908	model_best03b	2 Min
4	2	128	0.024258	68.245714	model_rnn00	2 Min
5	2	128	0.024798	68.948664	model_best01a	2 Min
6	2	128	0.026240	70.762903	model_conv02	2 Min
7	2	128	0.026618	71.207453	model_dnn01	2 Min
8	2	128	0.030488	75.748702	model_rnn02	2 Min
9	2	128	0.036016	81.302087	model_best03a	2 Min
10	2	128	0.156364	182.239953	model_lstm02	2 Min
11	2	128	0.919341	465.832692	model_conv00	2 Min
12	2	128	0.022354	65.318006	model_dnn00	5 Min
13	2	128	0.022398	65.414109	model_conv00	5 Min
14	2	128	0.022474	65.567544	model_conv02	5 Min
15	2	128	0.023116	66.682703	model_rnn00	5 Min
16	2	128	0.023511	67.104972	model_best01a	5 Min
17	2	128	0.024388	65.582181	model_lstm00	5 Min
18	2	128	0.025541	69.957182	model_lstm02	5 Min
19	2	128	0.026252	70.855299	model_dnn01	5 Min
20	2	128	0.034087	79.413494	model_dnn02	5 Min
21	2	128	0.042607	87.835063	model_rnn02	5 Min
22	2	128	0.043218	79.838635	model_best03a	5 Min
23	2	128	0.047076	92.035175	model_best03b	5 Min
24	2	128	0.160145	178.394232	model_rnn02	1 Min

2.3 2 Week History

2.3.1 Stride 1, Sample Rate 2

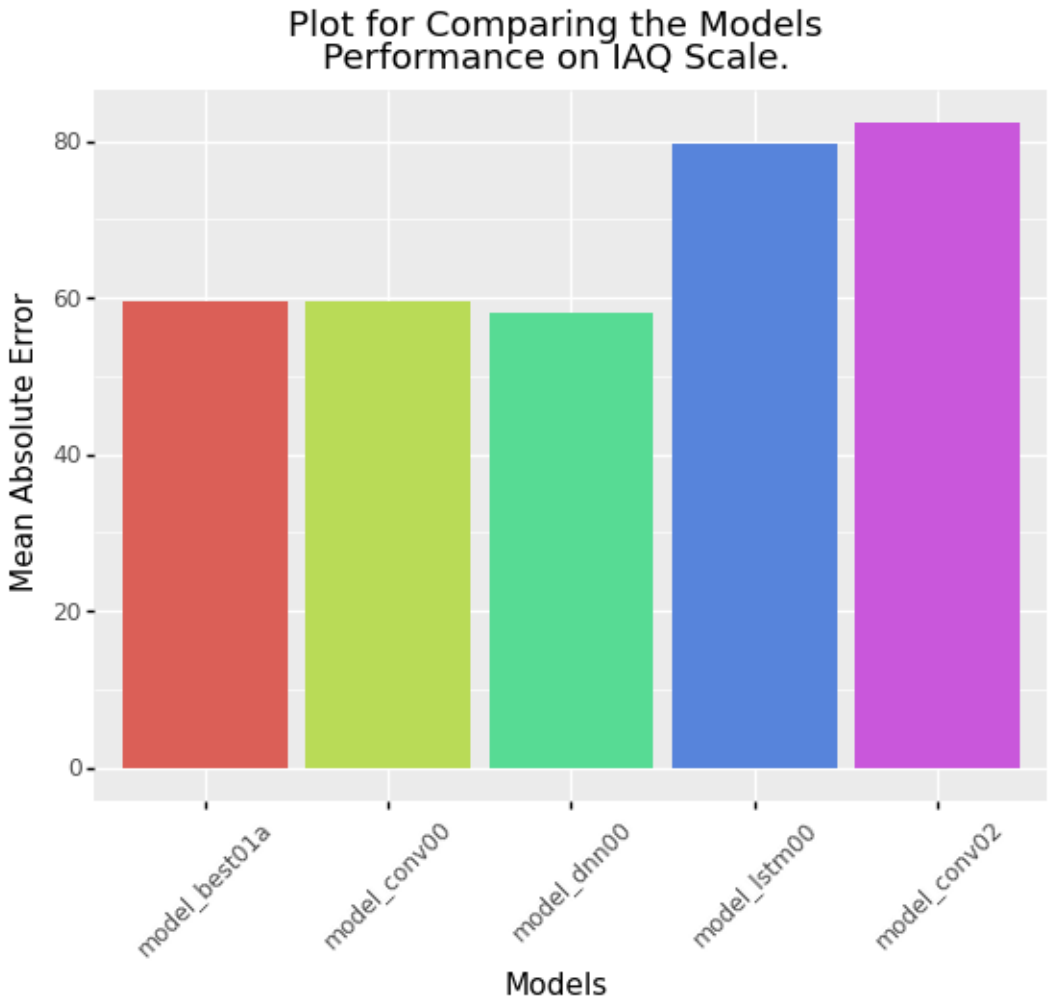
```
/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 1.0.1 when using version
0.23.2. This might lead to breaking code or invalid results. Use at your own
risk.
```




```
<ggplot: (8786589409769)>
```

2.3.2 Stride 2, Sample Rate 2

```
/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 1.0.1 when using version
0.23.2. This might lead to breaking code or invalid results. Use at your own
risk.
```



<ggplot: (8786588456561)>

2.4 Comparison of 1 Week Models and 2 Week Models

	Model	Time	Epochs	Window Size Days	Stride	\
0	model_best01a	289.835371	14	15	2	
1	model_conv00	416.815034	28	15	1	
2	model_conv00	145.192476	14	15	2	
3	model_conv02	799.290095	28	15	1	
4	model_dnn00	261.228681	28	15	1	
5	model_dnn00	217.878893	31	8	1	
6	model_conv00	304.261804	31	8	1	
7	model_lstm00	338.718267	28	15	1	
8	model_conv02	588.811753	31	8	1	
9	model_rnn00	1594.912729	31	8	1	
10	model_dnn00	76.777939	14	15	2	
11	model_best01a	669.725358	31	8	1	
12	model_lstm00	266.832087	31	8	1	
13	model_best01a	890.749112	28	15	1	
14	model_lstm02	323.540315	31	8	1	
15	model_dnn01	217.440506	31	8	1	
16	model_lstm00	114.022465	14	15	2	
17	model_dnn02	293.978746	31	8	1	

18	model_conv02	270.753144	14	15	2
19	model_rnn02	1600.787760	31	8	1
20	model_best03a	665.194710	31	8	1
21	model_best03b	416.240680	31	8	1

	Sampling Rate	Batch Size	MSE	MAE	Modelo2	\
0	2	128	0.019915	59.518684	model_best01a	
1	2	128	0.020201	60.608897	model_conv00	
2	2	128	0.020284	59.472804	model_conv00	
3	2	128	0.020658	61.578502	model_conv02	
4	2	128	0.021193	63.077436	model_dnn00	
5	2	128	0.022354	65.318006	model_dnn00	
6	2	128	0.022398	65.414109	model_conv00	
7	2	128	0.022461	57.847824	model_lstm00	
8	2	128	0.022474	65.567544	model_conv02	
9	2	128	0.023116	66.682703	model_rnn00	
10	2	128	0.023332	58.157114	model_dnn00	
11	2	128	0.023511	67.104972	model_best01a	
12	2	128	0.024388	65.582181	model_lstm00	
13	2	128	0.024402	59.030443	model_best01a	
14	2	128	0.025541	69.957182	model_lstm02	
15	2	128	0.026252	70.855299	model_dnn01	
16	2	128	0.032799	79.699521	model_lstm00	
17	2	128	0.034087	79.413494	model_dnn02	
18	2	128	0.034809	82.422247	model_conv02	
19	2	128	0.042607	87.835063	model_rnn02	
20	2	128	0.043218	79.838635	model_best03a	
21	2	128	0.047076	92.035175	model_best03b	

	Resample
0	5 Min, 2 week history, Stride 2, Sample Rate 2
1	5 Min, 2 week history, Stride 1, Sample Rate 2
2	5 Min, 2 week history, Stride 2, Sample Rate 2
3	5 Min, 2 week history, Stride 1, Sample Rate 2
4	5 Min, 2 week history, Stride 1, Sample Rate 2
5	5 Min, 1 week history, Stride 1, Sample Rate 2
6	5 Min, 1 week history, Stride 1, Sample Rate 2
7	5 Min, 2 week history, Stride 1, Sample Rate 2
8	5 Min, 1 week history, Stride 1, Sample Rate 2
9	5 Min, 1 week history, Stride 1, Sample Rate 2
10	5 Min, 2 week history, Stride 2, Sample Rate 2
11	5 Min, 1 week history, Stride 1, Sample Rate 2
12	5 Min, 1 week history, Stride 1, Sample Rate 2
13	5 Min, 2 week history, Stride 1, Sample Rate 2
14	5 Min, 1 week history, Stride 1, Sample Rate 2
15	5 Min, 1 week history, Stride 1, Sample Rate 2
16	5 Min, 2 week history, Stride 2, Sample Rate 2
17	5 Min, 1 week history, Stride 1, Sample Rate 2
18	5 Min, 2 week history, Stride 2, Sample Rate 2
19	5 Min, 1 week history, Stride 1, Sample Rate 2
20	5 Min, 1 week history, Stride 1, Sample Rate 2
21	5 Min, 1 week history, Stride 1, Sample Rate 2

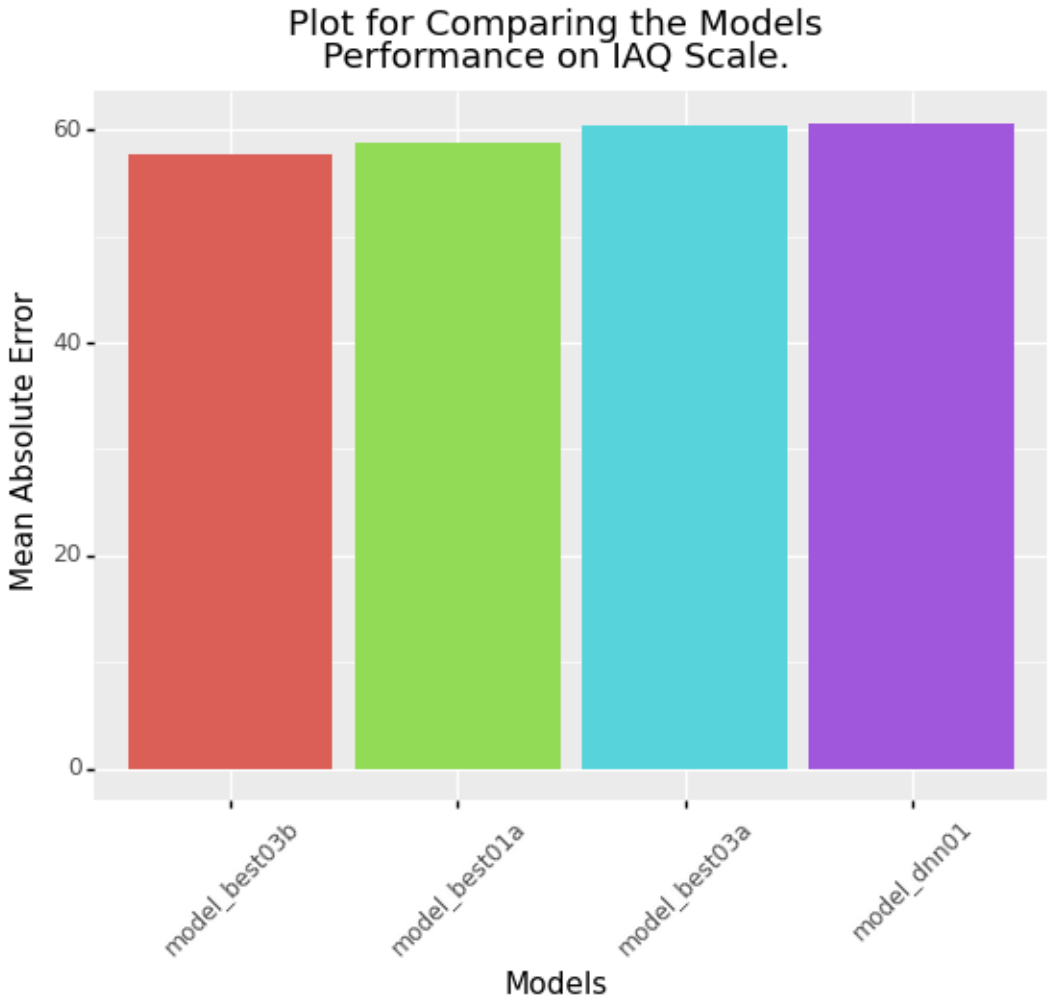
```
MinMaxScaler()
```

```
/opt/intel/oneapi/intelpython/latest/lib/python3.7/site-
packages/sklearn/base.py:334: UserWarning:

Trying to unpickle estimator MinMaxScaler from version 0.22.2.post1 when using
version 0.23.2. This might lead to breaking code or invalid results. Use at your
```

own risk.

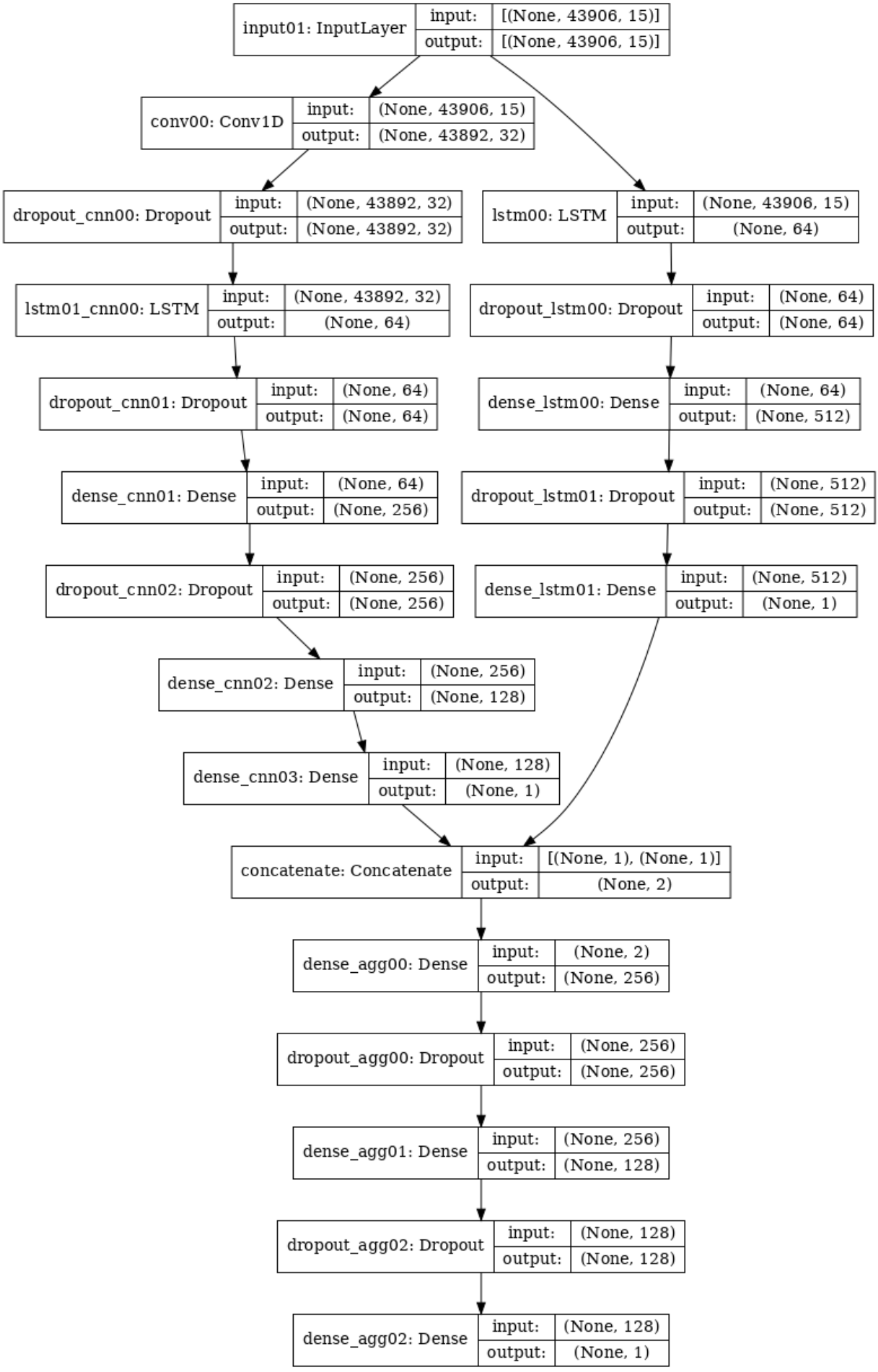
	Model	Time	Epochs	Window Size Days	Stride	Sampling Rate	\
0	model_best03b	629.414618	28	15	1	2	
1	model_best01a	865.906092	28	15	1	2	
2	model_best03a	864.207575	28	15	1	2	
3	model_dnn01	223.165007	28	15	1	2	

	Batch Size	MSE	MAE
0	128	0.019970	57.656134
1	128	0.019819	58.824076
2	128	0.020162	60.483345
3	128	0.020358	60.661538

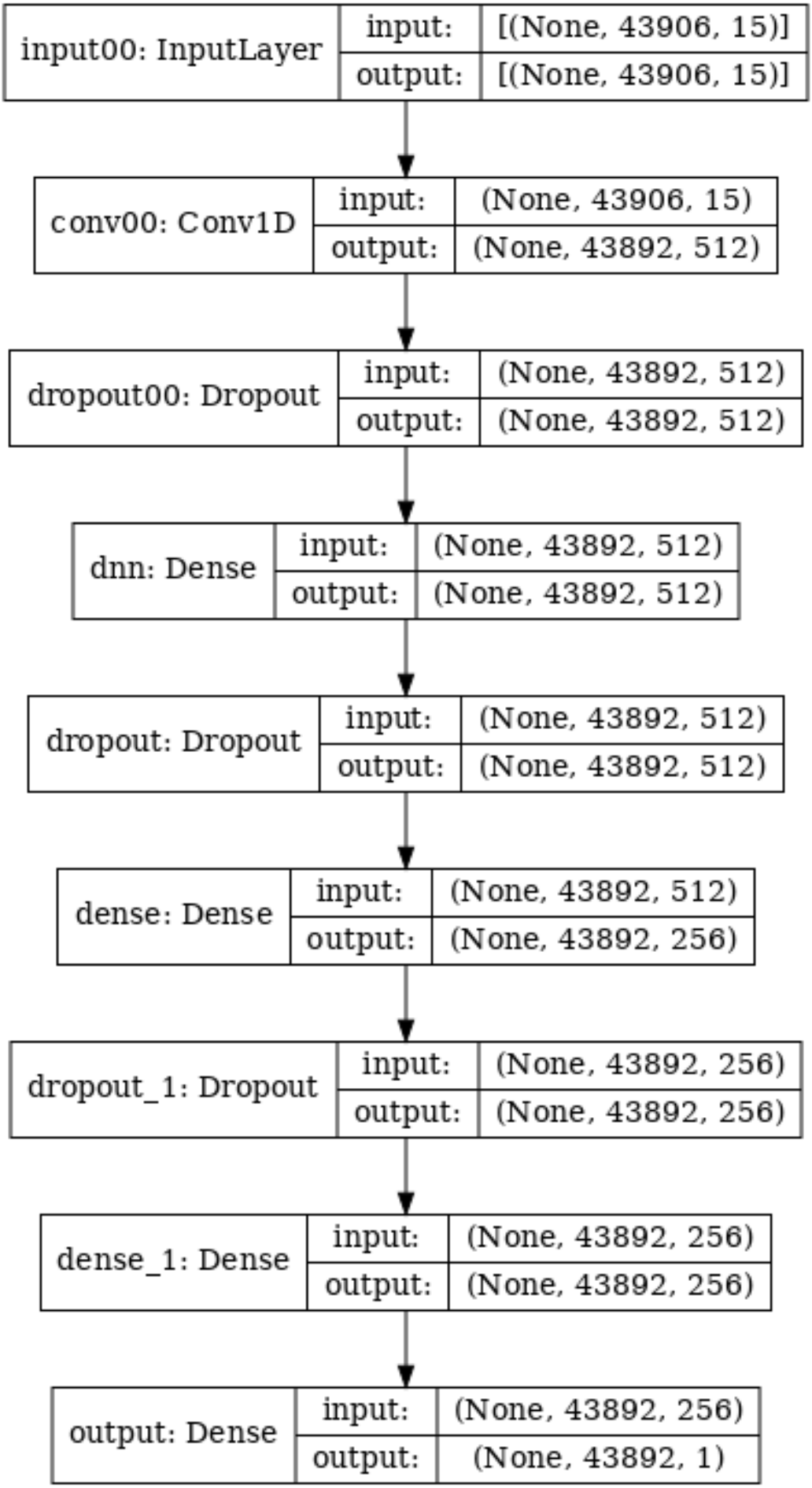


<ggplot: (8786600537517)>

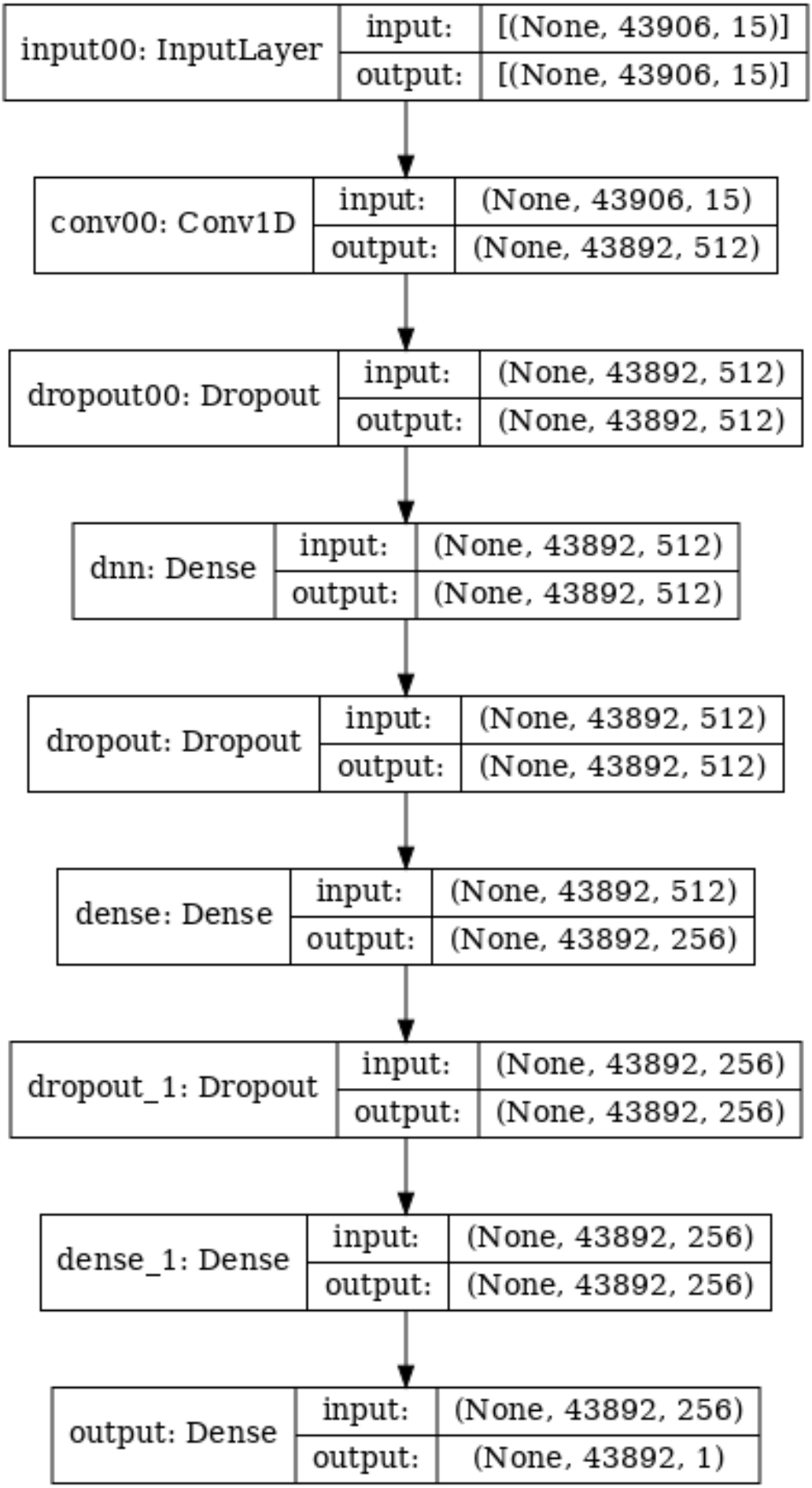
1. Model “model_best03b”


input01: InputLayer | input: [(None, 43906, 15)] | output: [(None, 43906, 15)]
conv00: Conv1D | input: (None, 43906, 15) | output: (None, 43892, 32)
dropout_cnn00: Dropout | input: (None, 43892, 32) | output: (None, 43892, 32)
lstm00: LSTM | input: (None, 43906, 15) | output: (None, 64)
lstm01_cnn00: LSTM | input: (None, 43892, 32) | output: (None, 64)
dropout_lstm00: Dropout | input: (None, 64) | output: (None, 64)
dropout_cnn01: Dropout | input: (None, 64) | output: (None, 64)
dense_lstm00: Dense | input: (None, 64) | output: (None, 512)
dense_cnn01: Dense | input: (None, 64) | output: (None, 256)
dropout_lstm01: Dropout | input: (None, 512) | output: (None, 512)
dropout_cnn02: Dropout | input: (None, 256) | output: (None, 256)
dense_lstm01: Dense | input: (None, 512) | output: (None, 1)
dense_cnn02: Dense | input: (None, 256) | output: (None, 128)
dense_cnn03: Dense | input: (None, 128) | output: (None, 1)
concatenate: Concatenate | input: [(None, 1), (None, 1)] | output: (None, 2)
dense_agg00: Dense | input: (None, 2) | output: (None, 256)
dropout_agg00: Dropout | input: (None, 256) | output: (None, 256)
dense_agg01: Dense | input: (None, 256) | output: (None, 128)
dropout_agg02: Dropout | input: (None, 128) | output: (None, 128)
dense_agg02: Dense | input: (None, 128) | output: (None, 1)

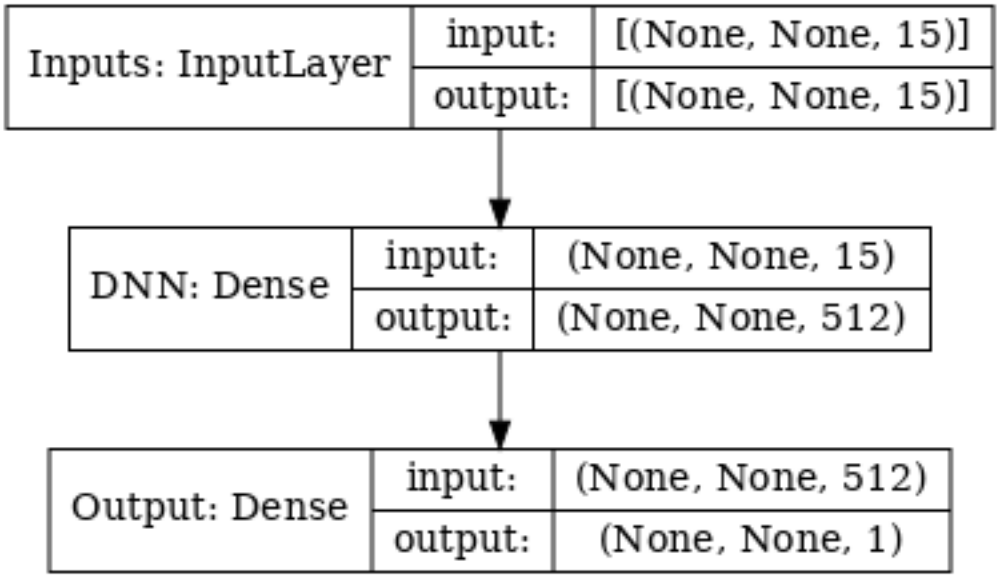
2. Model “model_best01a”


input00: InputLayer
input: [(None, 43906, 15)]
output: [(None, 43906, 15)]
conv00: Conv1D
input: (None, 43906, 15)
output: (None, 43892, 512)
dropout00: Dropout
input: (None, 43892, 512)
output: (None, 43892, 512)
dnn: Dense
input: (None, 43892, 512)
output: (None, 43892, 512)
dropout: Dropout
input: (None, 43892, 512)
output: (None, 43892, 512)
dense: Dense
input: (None, 43892, 512)
output: (None, 43892, 256)
dropout_1: Dropout
input: (None, 43892, 256)
output: (None, 43892, 256)
dense_1: Dense
input: (None, 43892, 256)
output: (None, 43892, 256)
output: Dense
input: (None, 43892, 256)
output: (None, 43892, 1)

3. Model “model_best03a”


input00: InputLayer
input: [(None, 43906, 15)]
output: [(None, 43906, 15)]
conv00: Conv1D
input: (None, 43906, 15)
output: (None, 43892, 512)
dropout00: Dropout
input: (None, 43892, 512)
output: (None, 43892, 512)
dnn: Dense
input: (None, 43892, 512)
output: (None, 43892, 512)
dropout: Dropout
input: (None, 43892, 512)
output: (None, 43892, 512)
dense: Dense
input: (None, 43892, 512)
output: (None, 43892, 256)
dropout_1: Dropout
input: (None, 43892, 256)
output: (None, 43892, 256)
dense_1: Dense
input: (None, 43892, 256)
output: (None, 43892, 256)
output: Dense
input: (None, 43892, 256)
output: (None, 43892, 1)

4. Model “model_dnn01”



3 Referencias

- Keras contributors et al. Keras / Code examples / Timeseries / Timeseries forecasting for weather prediction. 2021.
- Tensorflow Contributors. Tensorflow: Tutorial on Time series forecastingTime series forecasting. 2021.
- Román-Rangel, Francisco. Notas y Código del Curso de Aprendizaje Profundo. 2021.
- González-Pérez, Felipe. Notas de aprendizaje de máquina (2020)