

```
In[ ]:= ClearAll["Global`*"]
```

```
In[ ]:= (*Our dataset*)
```

```
x1(*Phishing attack*) =
```

```
{41, 18, 48, 35, 3, 15, 36, 45, 29, 49, 22, 49, 25, 39, 30, 6, 40, 46, 15, 15, 30, 24, 18,
5, 35, 30, 45, 21, 15, 18, 46, 32, 10, 48, 48, 26, 33, 4, 11, 5, 30, 1, 44, 50, 19, 1,
33, 7, 33, 24, 50, 21, 24, 16, 47, 35, 43, 17, 14, 45, 26, 29, 16, 2, 38, 46, 5, 33, 32,
47, 16, 7, 23, 47, 42, 47, 13, 9, 30, 36, 35, 16, 31, 11, 17, 45, 46, 19, 48, 21, 31, 4,
5, 16, 16, 40, 38, 17, 21, 9, 30, 1, 7, 33, 5, 11, 20, 1, 43, 8, 10, 14, 44, 32, 41, 1,
41, 29, 36, 45, 24, 28, 24, 44, 23, 40, 11, 12, 43, 11, 3, 30, 15, 26, 50, 33, 22, 12, 7,
47, 33, 13, 28, 44, 43, 5, 21, 20, 27, 19, 27, 48, 20, 20, 38, 30, 14, 11, 33, 22, 44,
10, 31, 30, 13, 32, 42, 50, 15, 30, 8, 43, 21, 47, 29, 29, 41, 34, 18, 19, 21, 10, 10,
27, 30, 27, 45, 25, 20, 35, 39, 18, 25, 26, 9, 26, 2, 9, 17, 30, 25, 17, 48, 15, 42, 16,
10, 43, 30, 24, 48, 11, 2, 25, 5, 16, 20, 37, 28, 33, 27, 24, 10, 34, 35, 28, 21, 29, 37,
22, 12, 17, 45, 34, 47, 49, 42, 2, 26, 43, 36, 48, 45, 17, 13, 35, 13, 18, 34, 13, 12,
35, 4, 9, 7, 31, 12, 8, 5, 4, 20, 36, 39, 34, 20, 37, 48, 41, 6, 36, 27, 31, 19, 30, 17,
13, 15, 10, 20, 19, 45, 18, 29, 28, 17, 44, 49, 3, 31, 18, 41, 23, 43, 27, 43, 3, 17,
26, 35, 13, 49, 49, 36, 45, 41, 11, 36, 8, 10, 33, 31, 36, 39, 5, 22, 19, 38, 29, 22,
25, 45, 15, 21, 25, 10, 33, 29, 1, 42, 17, 26, 44, 41, 35, 16, 15, 7, 7, 20, 4, 28, 27,
11, 25, 32, 30, 17, 19, 5, 20, 17, 25, 25, 19, 43, 37, 4, 19, 23, 40, 47, 9, 42, 3, 9};
```

```
x2 (*Ransomware*) = {8, 16, 7, 6, 2, 33, 13, 35, 38, 11, 18, 22, 7, 17, 35, 36, 24, 5, 50, 7, 41,
```

```
23, 45, 39, 47, 25, 36, 50, 3, 5, 21, 26, 17, 36, 38, 24, 32, 8, 44, 25, 34, 44, 35, 42,
28, 47, 49, 41, 39, 49, 34, 32, 20, 37, 32, 50, 31, 34, 35, 13, 43, 34, 15, 38, 15, 41,
3, 16, 14, 37, 31, 7, 28, 4, 7, 22, 13, 28, 16, 7, 1, 11, 14, 25, 30, 47, 32, 14, 35, 4,
33, 33, 39, 26, 38, 6, 37, 14, 16, 43, 21, 30, 5, 17, 16, 29, 40, 43, 7, 7, 18, 46, 41,
17, 28, 22, 17, 36, 1, 10, 38, 9, 3, 16, 50, 48, 12, 48, 48, 45, 31, 23, 2, 22, 18, 26,
2, 38, 39, 21, 8, 17, 1, 47, 13, 43, 43, 33, 21, 36, 43, 12, 26, 19, 39, 29, 33, 43, 43,
6, 20, 2, 40, 27, 46, 26, 45, 7, 12, 4, 30, 34, 49, 33, 11, 17, 18, 32, 29, 16, 35, 15,
46, 27, 27, 25, 2, 31, 49, 48, 15, 28, 22, 47, 40, 38, 6, 30, 25, 21, 18, 6, 35, 42, 3,
13, 16, 8, 45, 11, 46, 20, 20, 26, 38, 7, 44, 3, 43, 42, 32, 41, 28, 42, 50, 47, 16, 16,
40, 2, 32, 22, 18, 13, 27, 16, 46, 6, 45, 38, 34, 36, 30, 15, 21, 49, 14, 47, 39, 19, 20,
9, 36, 41, 1, 31, 4, 5, 37, 10, 6, 49, 40, 25, 38, 40, 7, 14, 11, 5, 29, 19, 46, 5, 41,
28, 42, 5, 39, 29, 20, 33, 6, 48, 2, 37, 44, 49, 34, 12, 32, 27, 7, 45, 26, 30, 21, 33,
30, 34, 32, 4, 9, 32, 39, 20, 27, 30, 32, 46, 31, 10, 33, 18, 33, 47, 43, 35, 36, 30,
16, 50, 48, 25, 32, 38, 7, 47, 10, 22, 42, 35, 46, 3, 41, 48, 49, 29, 2, 19, 10, 37, 12,
40, 38, 41, 43, 44, 29, 41, 30, 31, 37, 45, 26, 44, 39, 50, 15, 17, 50, 41, 3, 38, 6};
```

```
x3 (*DDOS*) = {2, 15, 44, 38, 6, 39, 46, 27, 18, 45, 10, 7, 23, 3, 8, 19, 37, 3, 19, 25, 24, 14,
```

```
44, 41, 16, 18, 15, 50, 21, 14, 14, 42, 9, 35, 28, 15, 6, 10, 28, 25, 17, 47, 49, 22,
11, 47, 12, 20, 13, 11, 1, 2, 16, 6, 5, 9, 36, 39, 49, 46, 42, 29, 5, 36, 1, 4, 22, 18,
35, 37, 27, 43, 27, 44, 4, 7, 35, 12, 5, 4, 6, 27, 26, 1, 19, 36, 10, 4, 4, 4, 34, 6,
5, 8, 39, 27, 34, 43, 17, 42, 49, 40, 35, 9, 24, 35, 42, 36, 9, 48, 19, 22, 17, 4, 18,
50, 11, 46, 8, 35, 36, 3, 23, 43, 36, 10, 27, 22, 16, 7, 15, 20, 43, 18, 23, 44, 8, 17,
28, 28, 25, 3, 34, 48, 24, 22, 8, 20, 26, 9, 25, 40, 36, 14, 42, 29, 31, 6, 41, 49,
15, 3, 50, 41, 45, 16, 1, 50, 45, 36, 9, 36, 29, 28, 48, 49, 50, 41, 5, 18, 6, 25, 14,
22, 4, 50, 49, 1, 25, 48, 32, 32, 43, 11, 35, 37, 42, 12, 21, 22, 49, 31, 4, 5, 49, 2,
9, 37, 17, 39, 8, 7, 37, 46, 45, 45, 39, 23, 24, 22, 7, 30, 12, 18, 31, 38, 6, 49, 43,
32, 14, 18, 36, 6, 32, 45, 32, 19, 16, 24, 23, 22, 18, 8, 8, 45, 48, 38, 19, 15, 1, 18,
```

```

19, 49, 37, 29, 17, 26, 41, 10, 16, 27, 15, 29, 28, 4, 49, 17, 16, 11, 45, 3, 19, 44,
38, 8, 10, 4, 48, 8, 45, 35, 39, 21, 6, 38, 18, 49, 42, 38, 6, 22, 11, 32, 49, 6, 8, 1,
27, 24, 41, 14, 19, 8, 16, 36, 6, 8, 46, 18, 16, 25, 48, 50, 18, 20, 32, 31, 49, 21,
37, 27, 31, 43, 3, 22, 34, 10, 5, 40, 6, 25, 49, 40, 44, 6, 41, 11, 3, 23, 16, 44, 6,
44, 10, 17, 1, 35, 23, 28, 20, 7, 23, 19, 18, 50, 48, 15, 41, 44, 43, 7, 20, 24, 19};
x4(*Malware*) = {48, 9, 48, 28, 14, 2, 42, 15, 1, 28, 14, 6, 23, 47, 25, 41, 13, 43, 6, 18, 11,
43, 42, 11, 11, 41, 44, 4, 26, 37, 42, 30, 16, 17, 38, 9, 49, 41, 39, 39, 36, 8, 18, 8,
30, 17, 33, 41, 10, 35, 39, 8, 4, 6, 49, 9, 11, 28, 47, 20, 24, 8, 22, 15, 5, 15, 5, 43,
9, 31, 13, 28, 30, 42, 26, 16, 29, 18, 29, 42, 49, 32, 4, 25, 28, 43, 13, 38, 48, 38, 11,
12, 44, 37, 3, 43, 21, 46, 26, 20, 5, 37, 14, 23, 19, 46, 34, 20, 17, 36, 39, 14, 33, 6,
3, 9, 48, 28, 5, 3, 10, 20, 14, 7, 27, 16, 2, 27, 18, 25, 13, 15, 13, 5, 42, 35, 17, 3,
23, 39, 37, 46, 35, 48, 28, 40, 47, 43, 45, 13, 44, 37, 1, 28, 21, 44, 48, 19, 40, 16,
13, 16, 5, 37, 25, 10, 49, 28, 34, 16, 30, 39, 40, 36, 31, 16, 50, 16, 46, 22, 9, 45, 5,
35, 14, 38, 37, 23, 27, 35, 15, 2, 44, 30, 2, 43, 28, 4, 14, 49, 27, 2, 23, 50, 2, 40,
31, 14, 50, 39, 50, 38, 44, 13, 41, 50, 8, 35, 5, 1, 28, 46, 47, 40, 30, 18, 18, 30, 25,
21, 23, 39, 1, 16, 36, 31, 29, 15, 20, 31, 28, 23, 20, 47, 48, 12, 31, 49, 7, 24, 46, 3,
45, 32, 19, 22, 31, 32, 44, 37, 8, 39, 50, 29, 20, 40, 14, 43, 12, 1, 39, 15, 45, 15, 43,
35, 18, 11, 37, 30, 26, 32, 3, 39, 15, 2, 37, 12, 29, 28, 31, 21, 22, 19, 36, 21, 50,
43, 4, 40, 29, 18, 29, 2, 46, 1, 15, 42, 19, 27, 30, 13, 9, 27, 1, 38, 10, 23, 35, 13,
25, 3, 46, 42, 9, 7, 30, 27, 31, 45, 22, 21, 32, 5, 19, 28, 46, 45, 21, 24, 34, 12, 40,
16, 15, 30, 30, 11, 38, 45, 13, 16, 37, 2, 1, 48, 32, 39, 13, 49, 44, 41, 29, 47, 21};
y(*Software threats*) =
{27.216, 44.973, 84.288, 113.706, 118.758, 145.311, 181.002, 220.476, 250.125, 288.978,
308.682, 340.056, 361.422, 390.846, 420.672, 444.585, 480.15, 508.194, 536.46, 553.215,
586.869, 613.581, 651.492, 677.154, 713.25, 743.934, 784.644, 822.21, 837.729, 855.045,
890.736, 926.616, 940.683, 983.844, 1028.7, 1052.673, 1085.34, 1097.043, 1127.592,
1148.484, 1181.328, 1207.842, 1252.125, 1294.179, 1318.071, 1346.691, 1384.383,
1410.627, 1442.382, 1476.102, 1514.643, 1536.051, 1557.411, 1578.906, 1617.567,
1652.862, 1691.622, 1722.594, 1757.124, 1794.105, 1832.244, 1863.864, 1879.779,
1903.158, 1925.862, 1962.672, 1971.39, 2000.655, 2028.402, 2073.618, 2098.638, 2117.067,
2146.287, 2183.421, 2208.486, 2240.202, 2261.64, 2279.838, 2303.163, 2327.532,
2350.764, 2371.461, 2396.151, 2412.657, 2437.857, 2486.769, 2521.668, 2540.328,
2580.087, 2596.305, 2629.959, 2645.532, 2667.261, 2689.35, 2718.135, 2749.176, 2788.5,
2815.914, 2837.538, 2867.637, 2899.443, 2923.308, 2937.573, 2962.713, 2977.926,
3005.895, 3041.601, 3066.816, 3092.328, 3113.295, 3132.744, 3160.884, 3201.906,
3223.401, 3255.294, 3275.271, 3307.482, 3346.002, 3364.71, 3396.159, 3428.691,
3447.246, 3465.729, 3501., 3539.175, 3577.107, 3592.227, 3621.744, 3662.586, 3687.084,
3703.668, 3730.932, 3749.403, 3772.884, 3811.35, 3848.733, 3863.034, 3885.159,
3910.299, 3949.173, 3976.59, 3994.347, 4018.965, 4070.712, 4102.905, 4129.248,
4160.448, 4190.046, 4220.334, 4244.355, 4281.624, 4320.363, 4346.016, 4367.775,
4409.541, 4444.368, 4474.359, 4497.231, 4540.224, 4564.836, 4595.961, 4603.701, 4642.5,
4678.464, 4712.619, 4740.267, 4780.149, 4819.224, 4844.052, 4868.664, 4887.894,
4931.097, 4968.096, 5010.597, 5041.605, 5072.988, 5114.436, 5151.258, 5175.675,
5196.141, 5219.559, 5240.079, 5263.56, 5293.728, 5318.649, 5354.736, 5390.811,
5415.285, 5449.353, 5495.838, 5527.098, 5551.764, 5585.148, 5618.475, 5643.807,
5681.508, 5697.162, 5714.304, 5736.561, 5767.785, 5799.078, 5815.752, 5852.436,
5880.342, 5911.113, 5927.91, 5943.489, 5975.181, 6013.41, 6041.184, 6085.74, 6103.512,

```

```

6124.686, 6156.255, 6186.162, 6211.737, 6244.911, 6271.749, 6304.443, 6338.088,
6365.73, 6402.357, 6424.566, 6462.564, 6505.326, 6544.059, 6562.257, 6595.029,
6637.398, 6657.519, 6679.44, 6703.107, 6737.196, 6759.921, 6801.312, 6842.199,
6886.836, 6895.785, 6928.326, 6969.213, 7005.069, 7046.082, 7082.508, 7102.608,
7123.053, 7166.376, 7191.279, 7229.385, 7262.547, 7280.928, 7298.796, 7321.698,
7345.215, 7377.678, 7391.67, 7424.901, 7439.148, 7454.073, 7483.128, 7495.005,
7510.419, 7553.511, 7593.627, 7627.053, 7657.263, 7692.819, 7729.062, 7760.991,
7772.346, 7792.56, 7828.992, 7851.594, 7885.101, 7911.699, 7946.625, 7967.802,
7992.882, 8001.228, 8038.302, 8061.861, 8101.689, 8132.376, 8156.277, 8194.152,
8205.543, 8246.082, 8291.037, 8321.04, 8359.017, 8382.885, 8416.89, 8443.56, 8470.131,
8506.545, 8549.601, 8564.838, 8587.305, 8615.349, 8647.365, 8674.707, 8719.788,
8748.198, 8774.964, 8807.622, 8848.023, 8867.682, 8895.834, 8916.318, 8943.963,
8981.25, 9012.579, 9039.042, 9079.11, 9101.745, 9126.621, 9159.822, 9199.347, 9233.589,
9270.528, 9297.879, 9334.476, 9364.149, 9401.997, 9436.134, 9453.003, 9486.054,
9512.499, 9534.135, 9561.036, 9590.325, 9619.893, 9659.217, 9707.553, 9733.587,
9766.449, 9793.869, 9828.054, 9848.796, 9861.591, 9877.752, 9901.248, 9936.801,
9951.933, 9988.089, 10019.016, 10053.453, 10079.232, 10111.443, 10133.1, 10167.384,
10190.961, 10215.906, 10248.984, 10276.869, 10308.738, 10356.822, 10386.177,
10419.39, 10445.298, 10484.514, 10536.99, 10561.236, 10588.89, 10613.985, 10626.78};

```

```
n = Length[y]
```

```
nn = Floor[0.7 n]
```

```
test = Floor[0.81 * n]
```

```
Out[ ]:=
```

```
365
```

```
Out[ ]:=
```

```
255
```

```
Out[ ]:=
```

```
295
```

```
In[ ]:= ytrain = y[[1 ;; nn]];
```

```
x = Range[1, n + 1];
```

$$\text{parameters} = \sum_{i=1}^{nn} ((y_{\text{train}}[[i]]) - (x[[i]] \beta + b))^2;$$

```
Res = ArgMin[parameters, {β, b}];
```

```
β = Part[Res, 1]
```

```
b = Part[Res, 2]
```

```
Out[ ]:=
```

```
28.8671
```

```
Out[ ]:=
```

```
- 11.8782
```

```

In[ ]:= Y = {};
For[i = 1 + test, i ≤ n, i = i + 1,
  AppendTo[Y, x[[i]] β + b]
]
Y

```

```

Out[ ]:= {8532.79, 8561.65, 8590.52, 8619.39, 8648.25, 8677.12, 8705.99, 8734.85,
8763.72, 8792.59, 8821.46, 8850.32, 8879.19, 8908.06, 8936.92, 8965.79, 8994.66,
9023.53, 9052.39, 9081.26, 9110.13, 9138.99, 9167.86, 9196.73, 9225.6, 9254.46,
9283.33, 9312.2, 9341.06, 9369.93, 9398.8, 9427.67, 9456.53, 9485.4, 9514.27,
9543.13, 9572., 9600.87, 9629.74, 9658.6, 9687.47, 9716.34, 9745.2, 9774.07,
9802.94, 9831.8, 9860.67, 9889.54, 9918.41, 9947.27, 9976.14, 10005., 10033.9,
10062.7, 10091.6, 10120.5, 10149.3, 10178.2, 10207.1, 10235.9, 10264.8,
10293.7, 10322.5, 10351.4, 10380.3, 10409.1, 10438., 10466.9, 10495.7, 10524.6}

```

```

In[ ]:= realdataT = y[[test + 1 ;; Length[y]]];
PmseT = Mean[(realdataT - Y) ^ 2]
PrmseT = Sqrt[PmseT]

```

```

Out[ ]:= 5917.74

```

```

Out[ ]:= 76.9268

```

```

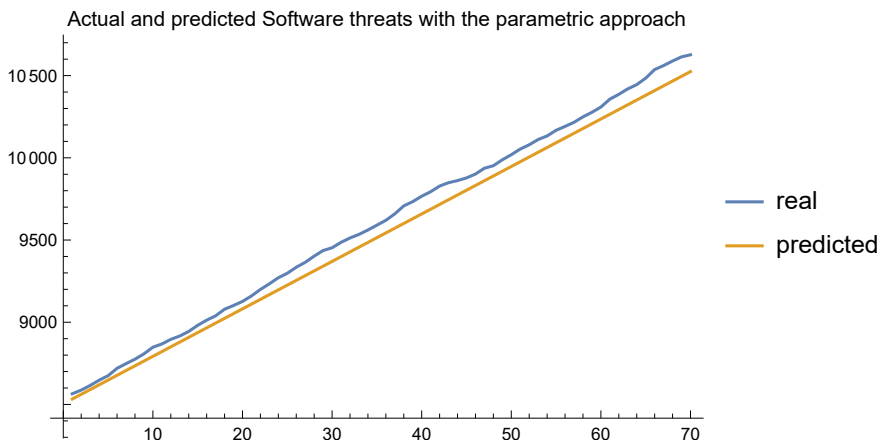
In[ ]:= (*Obtained from LSTM univariate=0.06530773*)
ytarget = y[[test + 1 ;; n]];
yreal = Transpose[{Range[Length[ytarget]], ytarget}];
ypredictpp = Transpose[{Range[Length[ytarget]], Y}];
ListLinePlot[{yreal, ypredictpp}, PlotLegends → {"real", "predicted"},
  PlotLabel → "Actual and predicted Software threats with the parametric approach"]

```

```

Out[ ]:=

```



```
In[*]:= Yt = {};
For[i = 1, i ≤ n, i = i + 1,
  AppendTo[Yt, x[[i]] β + b]
]
sseTt = Total[(y - Yt) ^ 2]
```

Out[*]=

893 092.

(*Obtai\ned from LSTM Univariate=462309.14866535977*)

```
In[*]:= (*For Multivariate data*)
```

```
In[*]:= parametersMulti =  $\sum_{i=1}^{nn} ((ytrain[[i]]) - (x1[[i]] a + x2[[i]] bb + x3[[i]] c + x4[[i]] d + e))^2;$ 
```

```
Res = ArgMin[parametersMulti, {a, bb, c, d, e}];
```

```
a = Part[Res, 1]
```

```
bb = Part[Res, 2]
```

```
c = Part[Res, 3]
```

```
d = Part[Res, 4]
```

```
e = Part[Res, 5]
```

Out[*]=

-8.36307

Out[*]=

5.09178

Out[*]=

16.704

Out[*]=

12.957

Out[*]=

3015.9

```
In[*]:= Ym = {};
```

```
For[i = 1 + test, i ≤ n, i = i + 1,
```

```
  AppendTo[Ym, x1[[i]] a + x2[[i]] bb + x3[[i]] c + x4[[i]] d + e]
```

```
]
```

```
Ym
```

Out[*]=

```
{3515.88, 3762.13, 3540.34, 3378.78, 3999.47, 3829.66, 3093.56, 3453.78, 2962.04, 3734.88,
3640.04, 3146.88, 3779.57, 4109.77, 3624.65, 3570.46, 3351.79, 3776.17, 4250.77, 3313.57,
3922.76, 3581.15, 3767.42, 4287.2, 3478.8, 3663., 3634.92, 4198.52, 4196.58, 3261.93,
3391.59, 3765.66, 3763.73, 3200.75, 4236.97, 3397.59, 3515.83, 4140.35, 3471.41, 4072.01,
3597.87, 4487.74, 3871.82, 3181.03, 3774.35, 3540.45, 3868.95, 3603.51, 3952.78, 3303.16,
3646.44, 3498.08, 3808.2, 3998.3, 4108.17, 3529., 3288.9, 3858.82, 3429.42, 3102.3,
4387.64, 4397.44, 3867.47, 3753.23, 4137.8, 4165.8, 3797.56, 3389.76, 4194.17, 3560.65}
```

```

In[ ]:= realdataT = y[[test + 1 ;; Length[y]]];
PmseTm = Mean[(realdataT - Ym)^2];
PrmseTm = Sqrt[PmseTm]

```

```

Out[ ]:=
5921.95

```

```

(*0.20406714*)

```

```

In[ ]:= Ytm = {};
For[i = 1, i ≤ n, i = i + 1,
  AppendTo[Ytm, x1[[i]] a + x2[[i]] bb + x3[[i]] c + x4[[i]] d + e]
]
sseTt = Total[(y - Ytm)^2]

```

```

Out[ ]:=
4.31334 × 109

```

```

(*474175.63179652544*)

```

```

In[ ]:= ytarget = y[[test + 1 ;; n]];
yreal1 = Transpose[{Range[Length[ytarget]], ytarget}];
ypredictpp = Transpose[{Range[Length[ytarget]], Ym}];
ListLinePlot[{yreal1, ypredictpp}, PlotLegends → {"real", "predicted"},
  PlotLabel → "Actual and predicted software threats with the parametric approach"]

```

```

Out[ ]:=

```

