

Multivariate Time Series Models for Monthly PM_{2.5}

| Model | Loop Details | Train | Validation | Test | Parameters | MAPE Train + Test |
|---|---|--|----------------------------------|------|--|-------------------|
| ARIMAX Loop for p, d, q and feature_set | p range(6) d [2,3] q range(6) set 1 to set 7 | 2014-2018 | 2019-2020 | 2021 | order (5,2,2) set2 | .206 |
| ARIMAX TimeSeriesSplit Forecast one month 24 splits | set 1 to set 7 | Begins with 2014-2018 Increase one month | 1 month begins from 2019 Jan. | 2021 | order (1,3,2) set7 | .051 |
| ARIMAX TimeSeriesSplit Forecast 6 months 4 splits | p range(1,6) d [2,3] q range(1,6) set 1 to set 7 | Begins with 2014-2018 Increase 6 months | 6 months begins from 2019 Jan | 2021 | order (1,2,2) set7 | 0.240 |
| ARIMAX auto_ARIMA | feature_set_1 | 2014-2020 | - | 2021 | (1,2,2) | 0.64 |
| | feature_set_2 | | | | (0,2,0) | .106 |
| | feature_set_3 | | | | (2,2,2) | .197 |
| | feature_set_4 | | | | (5,2,0) | .1966 |
| | feature_set_5 | | | | (3,2,0) | .264 |
| | feature_set_6 | | | | (0,2,2) | .189 |
| | feature_set_7 | | | | (0,2,2) | .2501 |
| SARIMAX Loop for p, d, q, ps, ds, qs and feature_set | p range(6) d [2,3] q range(6) set 1 to set 7 | 2014-2018 | 2019-2020 | 2021 | order (2,1,2) s_order (1,0,0,12) set_2 | .211 |
| SARIMAX TimeSeriesSplit Forecast 6 months 4 splits | p range(1,6) d [2,3] q range(1,6) set7 | Begins with 2014-2018 Increase 6 months | 6 months begins from 2019 Jan | 2021 | order (0,3,1) s_order (0,0,0,12) set_2 | .256 |
| SARIMAX TimeSeriesSplit | p range(1,6) d [2,3] | Begins with 2014-2018 | 6 months begins | 2021 | order (0,2,2) | .201 |

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|--|----------------------|----------------------|------------------|------|--|-------|
| Forecast 6 months 4 splits | q range(1,6) set7 | Increase 6 months | from 2019 Jan | | s_order (1,0,1,12) set_2 | |
| SARIMAX auto_ARIMA | feature_set2 | 2014-2020 | - | 2021 | order (2,2,3) s_order (0,0,0,12) | 0.205 |
| | feature_set7 | | | | order (2,2,2) s_order (0,0,0,12) | 0.225 |
| FbProphet Default Setting | feature_set_1 | 2014-2020 | - | 2021 | default | 0.23 |
| | feature_set_2 | | | | | 0.149 |
| | feature_set_3 | | | | | 0.139 |
| | feature_set_4 | | | | | 0.233 |
| | feature_set_5 | | | | | 0.51 |
| | feature_set_6 | | | | | 0.161 |
| | feature_set_7 | | | | | 0.150 |
| FbProphet HP Tuning just one validation set | feature_set_3 | 2014-2018 | 2019-2020 | 2021 | changeoint_p rior_scale': 0.4, 'n_changeoin ts': 150, 'seasonality_m ode': 'multiplicative' | 0.185 |
| PyCaret | feature_set_2 | 2014-2020 | - | 2021 | 0.17 | .30 |