

```
Collecting autots
  Downloading https://files.pythonhosted.org/packages/37/04/cd3cdd57d8f27394f6d86f5facc827eabb691b290dc63abb40e3f687163b/AutoTS-0.3.1-py3-none-any.whl (
    |██████████| 399kB 6.5MB/s
Requirement already satisfied: scikit-learn>=0.20.* in /usr/local/lib/python3.7/dist-packages (from autots) (0.22.2.post1)
Requirement already satisfied: pandas>=0.25.* in /usr/local/lib/python3.7/dist-packages (from autots) (1.1.5)
Requirement already satisfied: numpy>=1.14.6 in /usr/local/lib/python3.7/dist-packages (from autots) (1.19.5)
Requirement already satisfied: statsmodels>=0.10.* in /usr/local/lib/python3.7/dist-packages (from autots) (0.10.2)
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packages (from scikit-learn>=0.20.*->autots) (1.0.1)
Requirement already satisfied: scipy>=0.17.0 in /usr/local/lib/python3.7/dist-packages (from scikit-learn>=0.20.*->autots) (1.4.1)
Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dist-packages (from pandas>=0.25.*->autots) (2.8.1)
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-packages (from pandas>=0.25.*->autots) (2018.9)
Requirement already satisfied: patsy>=0.4.0 in /usr/local/lib/python3.7/dist-packages (from statsmodels>=0.10.*->autots) (0.5.1)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateutil>=2.7.3->pandas>=0.25.*->autots) (1.15.0)
Installing collected packages: autots
Successfully installed autots-0.3.1
```

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Requirement already satisfied: holidays==0.10.2 in /usr/local/lib/python3.7/dist-packages (from fbprophet->auto_ts) (0.10.5.2)
Requirement already satisfied: setuptools-git>=1.2 in /usr/local/lib/python3.7/dist-packages (from fbprophet->auto_ts) (1.2)
Requirement already satisfied: python-dateutil>=2.8.0 in /usr/local/lib/python3.7/dist-packages (from fbprophet->auto_ts) (2.8.1)
Requirement already satisfied: tqdm>=4.36.1 in /usr/local/lib/python3.7/dist-packages (from fbprophet->auto_ts) (4.41.1)
Requirement already satisfied: urllib3 in /usr/local/lib/python3.7/dist-packages (from pmdarima->auto_ts) (1.24.3)
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->auto_ts) (2.4.7)
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matplotlib->auto_ts) (1.3.1)
Requirement already satisfied: cyclor>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib->auto_ts) (0.10.0)
Requirement already satisfied: pytz>=2017.2 in /usr/local/lib/python3.7/dist-packages (from pandas->auto_ts) (2018.9)
Requirement already satisfied: jupyterlab-widgets>=1.0.0; python_version >= "3.6" in /usr/local/lib/python3.7/dist-packages (from ipywidgets->jupyter->auto_ts) (1.0.0)
Requirement already satisfied: widgetsnbextension~3.5.0 in /usr/local/lib/python3.7/dist-packages (from ipywidgets->jupyter->auto_ts) (3.5.1)
Requirement already satisfied: nbformat>=4.2.0 in /usr/local/lib/python3.7/dist-packages (from ipywidgets->jupyter->auto_ts) (5.1.3)
Requirement already satisfied: tornado>=4 in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (5.1.1)
Requirement already satisfied: ipython-genutils in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (0.2.0)
Requirement already satisfied: jupyter-core>=4.4.0 in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (4.7.1)
Requirement already satisfied: Send2Trash in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (1.5.0)
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (2.11.3)
Requirement already satisfied: terminado>=0.8.1 in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (0.9.4)
Requirement already satisfied: jupyter-client>=5.2.0 in /usr/local/lib/python3.7/dist-packages (from notebook->jupyter->auto_ts) (5.3.5)
Requirement already satisfied: pyzmq>=17.1 in /usr/local/lib/python3.7/dist-packages (from qtconsole->jupyter->auto_ts) (22.0.3)
Requirement already satisfied: QtConsole in /usr/local/lib/python3.7/dist-packages (from qtconsole->jupyter->auto_ts) (1.9.0)
Requirement already satisfied: testpath in /usr/local/lib/python3.7/dist-packages (from nbconvert->jupyter->auto_ts) (0.4.4)
Requirement already satisfied: entrypoints>=0.2.2 in /usr/local/lib/python3.7/dist-packages (from nbconvert->jupyter->auto_ts) (0.3)
Requirement already satisfied: pandocfilters>=1.4.1 in /usr/local/lib/python3.7/dist-packages (from nbconvert->jupyter->auto_ts) (1.4.3)
Requirement already satisfied: mistune<2,>=0.8.1 in /usr/local/lib/python3.7/dist-packages (from nbconvert->jupyter->auto_ts) (0.8.4)
Requirement already satisfied: bleach in /usr/local/lib/python3.7/dist-packages (from nbconvert->jupyter->auto_ts) (3.3.0)
Requirement already satisfied: defusedxml in /usr/local/lib/python3.7/dist-packages (from nbconvert->jupyter->auto_ts) (0.7.1)
Collecting lock
Downloading https://files.pythonhosted.org/packages/50/b8/e789e45b9c2db75e9d9e6ceb022c8d1d7e49b2c085ce8c05600f90a96b/locket-0.2.1-py2.py3-none-any.whl
Requirement already satisfied: six>=1.9.0 in /usr/local/lib/python3.7/dist-packages (from prompt-toolkit<2.0.0,>=1.0.4->ipython->auto_ts) (1.15.0)
Requirement already satisfied: ptyprocess>=0.5 in /usr/local/lib/python3.7/dist-packages (from pexpect; sys_platform != "win32"->ipython->auto_ts) (0.7.0)
Requirement already satisfied: zipp>=0.5 in /usr/local/lib/python3.7/dist-packages (from importlib-metadata; python_version < "3.8"->prettytable->auto_ts) (3.5.0)
Requirement already satisfied: typing-extensions>=3.6.4; python_version < "3.8" in /usr/local/lib/python3.7/dist-packages (from importlib-metadata; python_version < "3.8"->prettytable->auto_ts) (3.7.4.3)
Requirement already satisfied: ephemeris>=3.7.5.3 in /usr/local/lib/python3.7/dist-packages (from LunarCalendar>=0.0.9->fbprophet->auto_ts) (3.7.7.1)
Requirement already satisfied: pymeeus<1,>=0.3.13 in /usr/local/lib/python3.7/dist-packages (from convertdate>=2.1.2->fbprophet->auto_ts) (0.5.11)
Requirement already satisfied: korean-lunar-calendar in /usr/local/lib/python3.7/dist-packages (from holidays>=0.10.2->fbprophet->auto_ts) (0.2.1)
Requirement already satisfied: hijri-converter in /usr/local/lib/python3.7/dist-packages (from holidays>=0.10.2->fbprophet->auto_ts) (2.1.1)
Requirement already satisfied: jsonschema!=2.5.0,>=2.4 in /usr/local/lib/python3.7/dist-packages (from nbformat>=4.2.0->ipywidgets->jupyter->auto_ts) (2.6.0)
Requirement already satisfied: MarkupSafe>=0.23 in /usr/local/lib/python3.7/dist-packages (from Jinja2->notebook->jupyter->auto_ts) (1.1.1)
Requirement already satisfied: webencodings in /usr/local/lib/python3.7/dist-packages (from bleach->nbconvert->jupyter->auto_ts) (0.5.1)
Requirement already satisfied: packaging in /usr/local/lib/python3.7/dist-packages (from bleach->nbconvert->jupyter->auto_ts) (20.9)
ERROR: pmdarima 1.8.2 has requirement statsmodels!=0.12.0,>=0.11, but you'll have statsmodels 0.10.2 which is incompatible.
Installing collected packages: threadpoolctl, scikit-learn, fsspec, lock, partd, dask, pmdarima, auto-ts
Found existing installation: scikit-learn 0.22.2.post1
Uninstalling scikit-learn-0.22.2.post1:
Successfully uninstalled scikit-learn-0.22.2.post1
Found existing installation: dask 2.12.0
Uninstalling dask-2.12.0:
Successfully uninstalled dask-2.12.0
Successfully installed auto-ts-0.0.36 dask-2021.4.1 fsspec-2021.4.0 lock-0.2.1 partd-1.2.0 pmdarima-1.8.2 scikit-learn-0.24.1 threadpoolctl-2.1.0
Imported auto-timeseries version:0.0.36. Call by using:
model = auto_timeseries(score_type='rmse',
                        time_interval='M',
                        non_seasonal_pdq=None, seasonality=False, seasonal_period=12,
                        model_type=['best'],
                        verbose=2)
model.fit(traindata, ts_column,target)
model.predict(testdata, model='best')
```

```
1 import matplotlib.pyplot as plt
2 train_df.Close.plot(figsize=(15,8), title= 'AMZN Stock Price', fontsize=14, label='Train')
3 test_df.Close.plot(figsize=(15,8), title= 'AMZN Stock Price', fontsize=14, label='Test')
4 plt.legend()
5 plt.grid()
6 plt.show()
```



```
1 model = auto_timeseries(forecast_period=219, score_type='rmse', time_interval='D', model_type='best')
2 model.fit(traindata= train_df, ts_column="Date", target="Close")
```

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Building Auto SARIMAX Model

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Running Auto SARIMAX Model...

Using smaller parameters for larger dataset with greater than 1000 samples

Using smaller parameters for larger dataset with greater than 1000 samples

Using smaller parameters for larger dataset with greater than 1000 samples

Using smaller parameters for larger dataset with greater than 1000 samples

Using smaller parameters for larger dataset with greater than 1000 samples

SARIMAX RMSE (all folds): 73.9230

SARIMAX Norm RMSE (all folds): 35%

Model Cross Validation Results:

MAE (as % Std Dev of Actuals) = 34.61%

MAPE (Mean Absolute Percent Error) = 12%

RMSE (Root Mean Squared Error) = 89.2354

Normalized RMSE (MinMax) = 14%

Normalized RMSE (as Std Dev of Actuals)= 48%

Using smaller parameters for larger dataset with greater than 1000 samples

Refitting data with previously found best parameters

Best aic metric = 18805.2

Statespace Model Results						
=====						
Dep. Variable:	Close		No. Observations:		2800	
Model:	SARIMAX(2, 2, 0)		Log Likelihood		-9397.587	
Date:	Sun, 25 Apr 2021		AIC		18805.174	
Time:	13:47:01		BIC		18834.854	
Sample:	0		HQIC		18815.888	
	- 2800					
Covariance Type:	opg					
=====						
	coef	std err	z	P> z	[0.025	0.975]

intercept	-0.0033	0.557	-0.006	0.995	-1.094	1.088
drift	3.618e-06	0.000	0.015	0.988	-0.000	0.000
ar.L1	-0.6405	0.008	-79.601	0.000	-0.656	-0.625
ar.L2	-0.2996	0.009	-32.618	0.000	-0.318	-0.282
sigma2	48.6323	0.456	106.589	0.000	47.738	49.527
=====						
Ljung-Box (Q):	387.16		Jarque-Bera (JB):		282	
Prob(Q):	0.00		Prob(JB):			
Heteroskedasticity (H):	19.43		Skew:			
Prob(H) (two-sided):	0.00		Kurtosis:			
=====						

Warnings:

[1] Covariance matrix calculated using the outer product of gradients (complex-step).

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Skipping VAR Model since dataset is > 1000 rows and it will take too long

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Building ML Model

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Creating lag=12 variable using target for Machine Learning model...

Fitting ML model

14 variables used in training ML model = ['Close(t-4)', 'Close(t-3)', 'Close(t-2)', 'Close(t-1)', 'Date_hour', 'Date_minute', 'Date_dayofweek', 'Date'

Running Cross Validation using XGBoost model..

Max. iterations using expanding window cross validation = 5

Fold Number: 1 --> Train Shape: 1701 Test Shape: 219

Exception occurred while building ML model...

Invalid Parameter format for verbosity expect int but value='None'

For ML model, evaluation score is not available.

Best Model is: auto_SARIMAX

Best Model (Mean CV) Score: 73.92

Total time taken: 83 seconds.

Leaderboard with best model on top of list:

	name	rmse
1	auto_SARIMAX	73.922971
0	Prophet	93.608085
2	ML	inf

<auto_ts.auto_timeseries at 0x7f0149f58890>

