Method Description

General Information

Type of Entry (*Academic, Practitioner, Researcher, Student*)	**Student**
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Country	**Turkey**
Type of Affiliation (*University, Company-Organization, Individual*)	**--**
Affiliation	**--**

Information about the method utilized

Name of Method	ATA-simple
Type of Method (*Statistical, Machine Learning, Combination, Other*)	Statistical
Short Description (up to 200 words)	ATA method is an innovative new forecasting technique where the forms of the models are similar to exponential smoothing models but the smoothing parameters depend on the sample size, are optimized on a discrete space and initialization is both easier as it is done simultaneously when the parameters are optimized and is less influential since the weights assigned to initial values approach zero quickly. ATA can be applied to all time series settings easily and provides better forecasting performance due to its flexibility. ATA-simple is the most basic version of ATA that can be used to model time series that do not show any trend or seasonality behavior and is developed as an alternative for simple exponential smoothing.

Extended Description:

The Model:

For a time series $\{y_1, \dots y_n\}$ *ATA-simple can be given as below:*

$$l_t = \left(\frac{p}{t}\right) y_t + \left(\frac{t-p}{t}\right) l_{t-1}, \quad (1.1)$$

$$\hat{y}_{t+h|t} = l_t\ , \quad (1.2)$$

where $p \in \{1,2,\dots,n\}$ *and* $l_t = y_t$ *for* $t \leq p$.

The smoothing parameter value that minimized the in-sample one step ahead sMAPE is used as the optimum value.

Obtaining the point forecasts:

1. *The data sets are tested for stationarity using the Augmented Dickey-Fuller test using the function ndiffs from the forecast package in R.*

2. *The data sets are tested for seasonality using the SeasonalityTest function from the 4Thetamethod.R code downloaded from the competitions GitHub repository for* $\alpha = 0.20$ *and seasonality periods 4 for quarterly, 12 for monthly, 7 for daily. The data sets that could be classified as seasonal by this test are de-seasonalized by the classical multiplicative decomposition method. The hourly and weekly data are treated slightly different as they have not been put through the seasonality test and all have been de-seasonalized using the classical multiplicative decomposition method for periods 168 and 52 respectively. Note that if the length of the series was not sufficient to calculate the seasonality indexes, they were treated as non-seasonal.*

3. *The model in (1.1) is optimized for all data sets and forecasts are obtained using the equation (1.2).*

4. *The forecasts are re-seasonalized using the seasonality indexes from the classical multiplicative decomposition to obtain final point forecasts. If negative forecasts are obtained they are set equal to zero.*

Obtaining the prediction intervals:

For forecasting horizon h the prediction interval is obtained by:

$$\hat{y}_{n+h|n} \pm C_h,$$

where $C_h = \sqrt{h} Z_{\alpha/2} S_e$, $Z_{\alpha/2}$ *is the Normal deviate corresponding to* $(1-\alpha)\%$ *confidence interval and* S_e *is the standard deviation of the one step ahead errors of model fitting. If lower bound of any interval is found to be less than zero, they are set equal to zero.*

R-package:

You can download an R package that we developed for our method using the code below:

devtools::install_github("alsabtay/ATAforecasting")

Alternatively, you can visit https://atamethod.wordpress.com/software/ to download the package. The package has a help file that can guide you to fit the necessary versions of ATA to calculate the forecasts as explained above.