Method Description

General Information

Type of Entry (*Academic, Practitioner, Researcher, Student*)	Academic
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Type of Affiliation (*University, Company-Organization, Individual*)	University
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Team Members (*if applicable*):

1st Member	
First Name	Ivan
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Information about the method utilized

Name of Method	AICc-weighted combination of SSOE state space models
Type of Method (*Statistical, Machine Learning, Combination, Other*)	Combination of statistical models
Short Description (up to 200 words)	The forecasts are produced from 4 models: 1. ETS; 2. State space ARIMA; 3. Complex Exponential Smoothing; 4. Generalised Exponential Smoothing. Given that the models are formulated in one and the same framework (SSOE state space), the produced information criteria are comparable. So we used weighted combination of forecasts, where weights were calculated based on AICc. All the forecasts were produced using functions from the R package smooth.

Extended Description:

1. Find the best ETS model for the data using AICc. This is done using es() function from smooth.
2. Find the best SARIMA model for the data using AICc. This is done using auto.ssarima() function from smooth.
3. Find the best CES model for the data using AICc. This is done using auto.ces() function from smooth.
4. Find the best GES model for the data using AICc. This is done using auto.ges() function from smooth.
5. Extract AICc from each of the models (1) – (4). Calculate AICc weights using formula:

$$AICcw_i = \frac{\exp(-0.5(AICc_i - AICc_k))}{\sum \exp(-0.5(AICc_i - AICc_k))},$$

where $AICc_i$ is the AICc of the i-th model and $AICc_k$ is the lowest AICc of the four models.

6. Combine the forecasts using these weights:

$\hat{y}_{t+h} = \sum AICcw_i \hat{y}_{i,t+h}$, where $\hat{y}_{i,t+h}$ is the point forecast from the i-th model and $\hat{y}_{t+h}$ is the final forecast.

7. In order to produce prediction intervals, we generated quantiles from each of the model (100 each), formed new series from these quantiles (400) and selected those upper and lower values, that cut off 2.5% and 97.5% of the set of 400 quantiles.

Based on this approach a function called smoothCombine() was written and now is available in smooth package from CRAN.

The experiment was conducted on High End Computing Cluster of Lancaster University.