Online Adaptive Bagging for Multivariate Time Series Forecasting*

Amal Saadallah[0000−0003−2976−7574] and Hanna Mykula

The Lamarr Institute for Machine Learning and Artificial Intelligence
Dortmund, Germany
{firstname.lastname}@tu-dortmund.de

1 OB-MTS Details

1.1 Page-Hinkley Test for Error Drift Detection Pseudo-code

Algorithm 1 PageHinkleyTest for Error Drift Detection

Require: Error time series: ϵ_t; **Admissible Change** ν; **Threshold** ϱ
Ensure: Drift at time t_{d_ϵ}: $alert_{t_{d_\epsilon}}$
/* Initialize CUSUM and the error estimator */
$E(0) \leftarrow 0$; $cusum_T \leftarrow 0$; $M_T \leftarrow 1$
for $i \in \{1...\infty\}$ **do**
  $alerts_i = 0$
  $E(i) \leftarrow E(i-1) + \epsilon_t$
  $cusum_T(t) \leftarrow cusum(i-1) + \epsilon_t - \frac{E(t)}{t} - \nu$
  $M_T \leftarrow min(M_T, cusum_T(t))$
  if $(cusum_T(t) - M_t) \geqslant \varrho$ **then**
    return $alert_t = 1$
  end if
end for

In addition to the pseudo code for our **OB-MTS** algorithm, provided in the paper, we also show how it works in Figure 1.

1.2 OB-MTS algorithm

2 Experiments

2.1 Hyperparameters setting of OB-MTS

OB-MTS has also a number hyper-parameters that are summarized in Table 1.

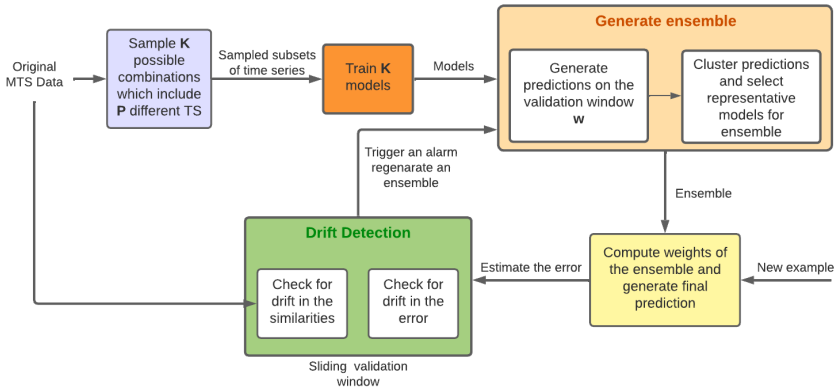

Fig. 1: Schematic visualization of our approach.

Parameter	Description	Value
k	Number of randomly selected candidates	100
s	Number of TS to include in the models training	25% of the initial number of TS
t	Train-test split	0.8
w	Prediction horizon to define weights of the ensemble	8
s	Size of sliding window for drift detection	20
ω	Size of validation set	50
μ	Hoeffding-Bound parameter	0.97
ν	Admissible change in the Page-Hinkley Test	0.005
ϱ	Page-Hinkley Test threshold	0.025

Table 1: Hyperparameters of **OB-MTS** and their values for the experiments.

2.2 Datasets

All used datasets, together with a short description, can be found in Tables 2.

2.3 Code and reproducibility

We provide all the Python code necessary for applying our method and all its variants, under the following link: `https://github.com/hannamykula/ob-mts`

⋆ Supported by The Lamarr Institute for Machine Learning and Artificial Intelligence.

[1] `https://archive.ics.uci.edu/ml/datasets/CNNpred\%3A+CNN-based+stock+market+prediction+using+a+diverse+set+of+variables`

[2] `https://www1.nyc.gov/site/tlc/about/tlc-trip-record-data.page`

[3] `https://www1.nyc.gov/site/tlc/about/tlc-trip-record-data.page`

[4] `https://archive.ics.uci.edu/ml/datasets/SML2010#`

[5] `https://archive.ics.uci.edu/ml/datasets/Bike+Sharing+Dataset`

[6] `https://archive.ics.uci.edu/ml/datasets/Air+Quality`

Name	Nr of datasets	Nr of time series	Source	Characteristics	Target variable
Stock data	5	82	UCI [1]	Daily Closing Price from 2010 to 2017	Close
TLC Trip Record Data (Yellow taxi - 2021-01)	3	16	NYC [2]	New York taxi trip data	total_amount
TLC Trip Record Data (Yellow taxi - 2021-07)	3	16	NYC [3]	New York taxi trip data	total_amount
SML10 Dataset	1	19	UCI [4]	Weather data	Weather forecast temperature
Bike Sharing Dataset	2	16	UCI [5]	Hourly count of rental bikes between 2011 and 2012	cnt
Air quality data	3	15	UCI [6]	Hourly responses of gas multisensor device	PT08.S1.CO.

Table 2: The summary of datasets used for the evaluation.

In addition, the archive contains a README file, which aims to help in reproducing the results.