



CEFET/RJ

# PESQUISAS EM ANDAMENTO

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# Biografia

- Doutor em Engenharia de Sistemas e Computação (COPPE/UFRJ)
- Docente da EIC - CEFET/RJ
  - Curso Técnico de Informática
  - Graduação em Ciência da Computação
- Docente permanente
  - Programa de Pós-graduação em Ciência da Computação (PPCIC)
  - Programa de Pós-graduação em Eng. de Produção e Sistemas (PPPRO)
- Data Analytics Lab
  - Líder do grupo de pesquisa
- Membro da SBC, ACM, IEEE e INNS



# Produção científica

- 164 artigos publicados\*
- 39 de periódicos

**ORIGINAL PAPER**  
Neurocomputing  
Contents lists available at ScienceDirect  
www.elsevier.com/locate/neucom

**Original paper prediction**  
**TiWok: A framework for nonstationary time series prediction**  
Rafaela Sales<sup>a</sup>, Suler Peixoto<sup>b</sup>, Edson Bezerra<sup>c</sup>, Fátima Faria<sup>d</sup>, Edson Queiroz<sup>e</sup>

**Abstract**  
Time series prediction challenges the analyst with high-dimensional data and complex models. This paper presents a framework for nonstationary time series prediction. The proposed framework is based on a combination of deep learning and ensemble learning. The framework is able to handle nonstationary time series with varying trends and seasonality. The proposed framework is evaluated using real-world data sets. The results show that the proposed framework outperforms the state-of-the-art methods. The proposed framework is able to handle nonstationary time series with varying trends and seasonality. The proposed framework is evaluated using real-world data sets. The results show that the proposed framework outperforms the state-of-the-art methods.

**ORIGINAL PAPER**  
Neurocomputing  
Contents lists available at ScienceDirect  
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**Original paper prediction**  
**Analyzing flight delay prediction under concept drift**  
Leandro Galvão<sup>a</sup>, Leonardo Cavallari<sup>b</sup>, Antonio Teixeira Neto<sup>c</sup>, Rafael Custódio<sup>d</sup>, Jorge Soares<sup>e</sup>

**Abstract**  
Flight delay prediction is a challenging task due to the high dimensionality and nonstationarity of the data. This paper presents a framework for flight delay prediction under concept drift. The proposed framework is based on a combination of deep learning and ensemble learning. The framework is able to handle nonstationary time series with varying trends and seasonality. The proposed framework is evaluated using real-world data sets. The results show that the proposed framework outperforms the state-of-the-art methods. The proposed framework is able to handle nonstationary time series with varying trends and seasonality. The proposed framework is evaluated using real-world data sets. The results show that the proposed framework outperforms the state-of-the-art methods.

**ORIGINAL ARTICLE**  
Neurocomputing  
Contents lists available at ScienceDirect  
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**Original paper prediction**  
**A horizontal partitioning-based method for frequent pattern mining in transport timetable**  
Claudio Tansche<sup>a</sup>, Luis Foguel<sup>b</sup>, Maria Mateus<sup>c</sup>, Diego Cavallari<sup>d</sup>, Eduardo Mendes<sup>e</sup>, Jorge Soares<sup>f</sup>, Gleison Amorim<sup>g</sup>, Edson Queiroz<sup>h</sup>

**Abstract**  
Frequent pattern mining is an important task in data mining. This paper presents a horizontal partitioning-based method for frequent pattern mining in transport timetable. The proposed method is based on a combination of horizontal partitioning and frequent pattern mining. The proposed method is able to handle large datasets. The proposed method is evaluated using real-world data sets. The results show that the proposed method outperforms the state-of-the-art methods. The proposed method is able to handle large datasets. The proposed method is evaluated using real-world data sets. The results show that the proposed method outperforms the state-of-the-art methods.

**ORIGINAL ARTICLE**  
Neurocomputing  
Contents lists available at ScienceDirect  
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**Original paper prediction**  
**SVMCS: Spatiotemporal Convolutional Sequence to Sequence Network for snailfish forecasting**  
Rafaela Sales<sup>a</sup>, Yana M. Sousa<sup>b</sup>, Eduardo Queiroz<sup>c</sup>, Fábio Porto<sup>d</sup>, Edson Bezerra<sup>e</sup>

**Abstract**  
Snailfish forecasting is a challenging task due to the high dimensionality and nonstationarity of the data. This paper presents a Spatiotemporal Convolutional Sequence to Sequence Network (SVMCS) for snailfish forecasting. The proposed network is able to handle nonstationary time series with varying trends and seasonality. The proposed network is evaluated using real-world data sets. The results show that the proposed network outperforms the state-of-the-art methods. The proposed network is able to handle nonstationary time series with varying trends and seasonality. The proposed network is evaluated using real-world data sets. The results show that the proposed network outperforms the state-of-the-art methods.

**BMC Research Notes**  
Data Note  
Contents lists available at ScienceDirect  
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**Original paper prediction**  
**Neonatal mortality rates in Brazilian municipalities from 1996 to 2017**  
Luiz Carlos de Aguiar Neto<sup>a</sup>, Leonardo Galvão<sup>b</sup>, Maria Mateus<sup>c</sup>, Edson Queiroz<sup>d</sup>, Jorge Soares<sup>e</sup>, Fábio Porto<sup>f</sup>, Gleison Amorim<sup>g</sup>, Edson Queiroz<sup>h</sup>

**Abstract**  
Neonatal mortality is a global public health problem, and efforts to reduce mortality rates are essential. This paper presents a study on neonatal mortality rates in Brazilian municipalities from 1996 to 2017. The study shows that neonatal mortality rates have decreased over time, but there is still a need for further action. The study is evaluated using real-world data sets. The results show that neonatal mortality rates have decreased over time, but there is still a need for further action. The study is evaluated using real-world data sets. The results show that neonatal mortality rates have decreased over time, but there is still a need for further action.

**ORIGINAL PAPER**  
Neurocomputing  
Contents lists available at ScienceDirect  
www.elsevier.com/locate/neucom

**Original paper prediction**  
**Frequent pattern mining accelerated by social network parameters for production engineering course**  
Renan de Sousa de Azeite, Edson Queiroz, Rafael Custódio, Diego Cavallari

**Abstract**  
Frequent pattern mining is a challenging task due to the high dimensionality and nonstationarity of the data. This paper presents a frequent pattern mining method accelerated by social network parameters. The proposed method is based on a combination of frequent pattern mining and social network parameters. The proposed method is able to handle large datasets. The proposed method is evaluated using real-world data sets. The results show that the proposed method outperforms the state-of-the-art methods. The proposed method is able to handle large datasets. The proposed method is evaluated using real-world data sets. The results show that the proposed method outperforms the state-of-the-art methods.

**ORIGINAL PAPER**  
Neurocomputing  
Contents lists available at ScienceDirect  
www.elsevier.com/locate/neucom

**Original paper prediction**  
**Evaluating Temporal Bias in Time Series Event Detection Methods**  
Leandro Galvão<sup>a</sup>, Leonardo Cavallari<sup>b</sup>, Antonio Teixeira Neto<sup>c</sup>, Rafael Custódio<sup>d</sup>, Jorge Soares<sup>e</sup>

**Abstract**  
Event detection in time series is a challenging task due to the high dimensionality and nonstationarity of the data. This paper presents a study on evaluating temporal bias in time series event detection methods. The study shows that temporal bias can affect the results of event detection methods. The study is evaluated using real-world data sets. The results show that temporal bias can affect the results of event detection methods. The study is evaluated using real-world data sets. The results show that temporal bias can affect the results of event detection methods.

**ORIGINAL PAPER**  
Neurocomputing  
Contents lists available at ScienceDirect  
www.elsevier.com/locate/neucom

**Original paper prediction**  
**Estimation of COVID-19 Under-Reporting in the Brazilian States Through SARI**  
Baltazar Farias<sup>a</sup>, Len Barros<sup>b</sup>, Maurício Pedrosa<sup>c</sup>, Rebecca Sales<sup>d</sup>, Luciano Kubacki<sup>e</sup>, Carlos de Aguiar<sup>f</sup>, Raphael de Sousa Salgueiro<sup>g</sup>, Jorge Soares<sup>h</sup>, Rafael Custódio<sup>i</sup>, Fábio Porto<sup>j</sup>, Edson Queiroz<sup>k</sup>

**Abstract**  
COVID-19 has been showing the capability to work for varying periods of time. This paper presents a study on estimating COVID-19 under-reporting in the Brazilian states through SARI. The study shows that SARI can be used to estimate COVID-19 under-reporting. The study is evaluated using real-world data sets. The results show that SARI can be used to estimate COVID-19 under-reporting. The study is evaluated using real-world data sets. The results show that SARI can be used to estimate COVID-19 under-reporting.

**ORIGINAL PAPER**  
Neurocomputing  
Contents lists available at ScienceDirect  
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**Original paper prediction**  
**Spatial-time motifs discovery**  
Rafaela Sales<sup>a</sup>, Yana M. Sousa<sup>b</sup>, Eduardo Queiroz<sup>c</sup>, Fábio Porto<sup>d</sup>, Edson Bezerra<sup>e</sup>

**Abstract**  
Spatial-time motifs discovery is a challenging task due to the high dimensionality and nonstationarity of the data. This paper presents a spatial-time motifs discovery method. The proposed method is based on a combination of spatial-time motifs discovery and data mining. The proposed method is able to handle large datasets. The proposed method is evaluated using real-world data sets. The results show that the proposed method outperforms the state-of-the-art methods. The proposed method is able to handle large datasets. The proposed method is evaluated using real-world data sets. The results show that the proposed method outperforms the state-of-the-art methods.

**BMC Research Notes**  
Data Note  
Contents lists available at ScienceDirect  
www.elsevier.com/locate/bmcresn

**Original paper prediction**  
**On the relevance of data science for flight delay research: a systematic review**  
Leandro Galvão<sup>a</sup>, Maria Mateus<sup>b</sup>, Edson Queiroz<sup>c</sup>, Jorge Soares<sup>d</sup>, Fábio Porto<sup>e</sup>, Gleison Amorim<sup>f</sup>, Edson Queiroz<sup>g</sup>

**Abstract**  
Flight delay research is a challenging task due to the high dimensionality and nonstationarity of the data. This paper presents a systematic review on the relevance of data science for flight delay research. The review shows that data science is relevant for flight delay research. The review is evaluated using real-world data sets. The results show that data science is relevant for flight delay research. The review is evaluated using real-world data sets. The results show that data science is relevant for flight delay research.

- Revisor de periódicos e conferências internacionais (VLDB, SIAM Data Mining)
- Editor associado da IEEE Transactions of Latin America

# Produção de artefatos computacionais



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GPCA Educação



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Patrocinado pela Secretaria de Geologia, Mineração e Transformação Mineral - SGM / Ministério de Minas

### STMotif: Discovery of Motifs in Spatial-Time Series

Allow to identify motifs in spatial-time series. A motif is a previously unknown subject occurrences. For this purpose, the Combined Series Approach (CSA) is used.

Version: 1.0.4  
Depends: R (≥ 2.10)  
Imports: stats, ggplot2, reshape2, scales, grDevices, RColorBrewer, shiny  
Suggests: knitr, markdown, testthat  
Published: 2019-08-22  
Author: Heraldor Borges [aut, cre] (CEFET/RJ), Amin Bazaz [aut] (Polytec [aut] (University of Montpellier), Eduardo Ogasawara [aut] (CEFE

Maintainer: TSPred: Functions for Benchmarking Time Series Prediction

License: Functions for time series preprocessing, decomposition, prediction and accuracy models and its yielded prediction errors can be used for benchmarking other of such methods. For this purpose, benchmark data from prediction competi

Downloads: 40  
Depends: R (≥ 2.10)  
Imports: forecast, KFAS, stats, MuMIn, EMD, wavelets, vars  
Published: 2018-06-21  
Author: Rebecca Pontes Salles [aut, cre, cph] (CEFET/RJ), Edu

Package source URL: [lirmm-00806557, version 1](#)

### Chiron: A Parallel Engine for Algebraic Workflows

Eduardo Ogasawara<sup>1</sup>, Dias Jonas<sup>1</sup>, Vitor Silva<sup>1</sup>, Chirigati Fernando<sup>1</sup>, Oliveira Daniel De<sup>1</sup>, Fabio Porto<sup>2</sup>, Marta Ma

### gstat: Generalized Spatial-Time Sequence Miner

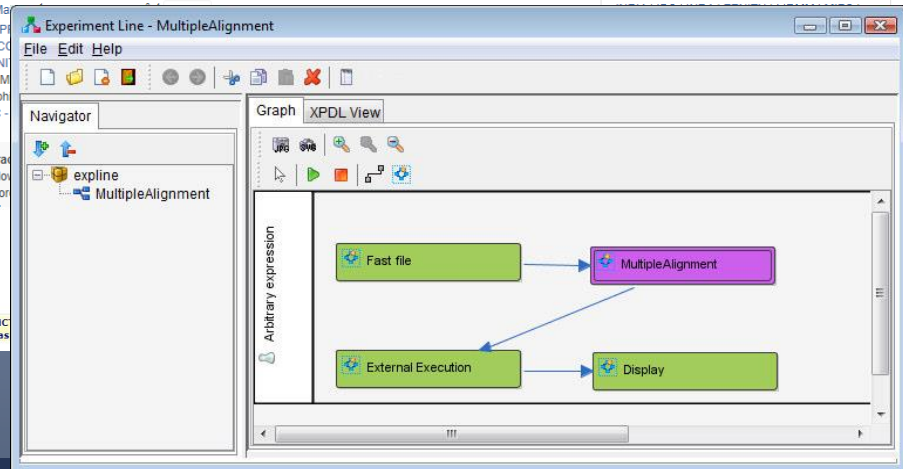
Implementations of the algorithms present in the future article Generalized Discovery of Tight Space-Time Sequences, original title (Castro Filho, A. J.; Borges, H.; Pacini, Esther; Porto, F.; Coutinho, R.; Ogasawara, E. Generalização de Mineração de Sequências Restritas no Espaço e no Tempo. In: XXXVI SBDD - Simpósio Brasileiro de Banco de Dados, 2021).

Version: 0.0.1  
Imports: dplyr  
Suggests: testthat (≥ 3.0.0)  
Published: 2021-11-08  
Author: Cássio Souza [aut, cre], Jorge Rodrigues [aut], Eduardo Ogasawara [ctb], Antonio Filho [ctb], CEFET/RJ [cph]  
Maintainer: Cássio Souza <cassio@ogsouza@gmail.com>  
License: MIT + file LICENSE  
NeedsCompilation: no  
Materials: README NEWS  
CRAN checks: [gstat results](#)

Documentation: [gstat manual](#)

Downloads: [gstat 0.0.1 tar.gz](#)  
Windows binaries: r-devel: [gstat\\_0.0.1.zip](#), r-release: [gstat\\_0.0.1.zip](#), r-oldrel: [gstat\\_0.0.1.zip](#)  
macOS binaries: r-release (arm64): [gstat\\_0.0.1.tgz](#), r-release (x86\_64): [gstat\\_0.0.1.tgz](#), r-oldrel: [gstat\\_0.0.1.tgz](#)

Linking: Please use the canonical form <https://CRAN.R-project.org/package=gstat> to link to this page.



# Orientações

- Concluídas
  - 2 Doutorado
  - 19 Mestrado
  - 23 Trabalhos de conclusão de curso (TCC)
  - 32 Iniciações científicas (IC)
- Em andamento
  - 5 Doutorado
  - 6 Mestrado
  - 3 TCC
  - 1 IC

## *Características esperadas ...*

- Dedicção
- Engajamento
- Programação
- Escrita
- Atitude

# Temas de Pesquisas

# Análise de séries temporais

## Predição

- Classificação
- Regressão
- Desvio de conceito

## Mineração de Padrões

- Padrões frequentes
- Sequências frequentes
- Motifs

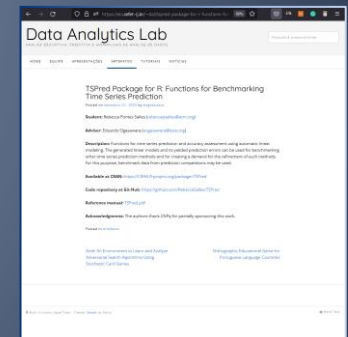
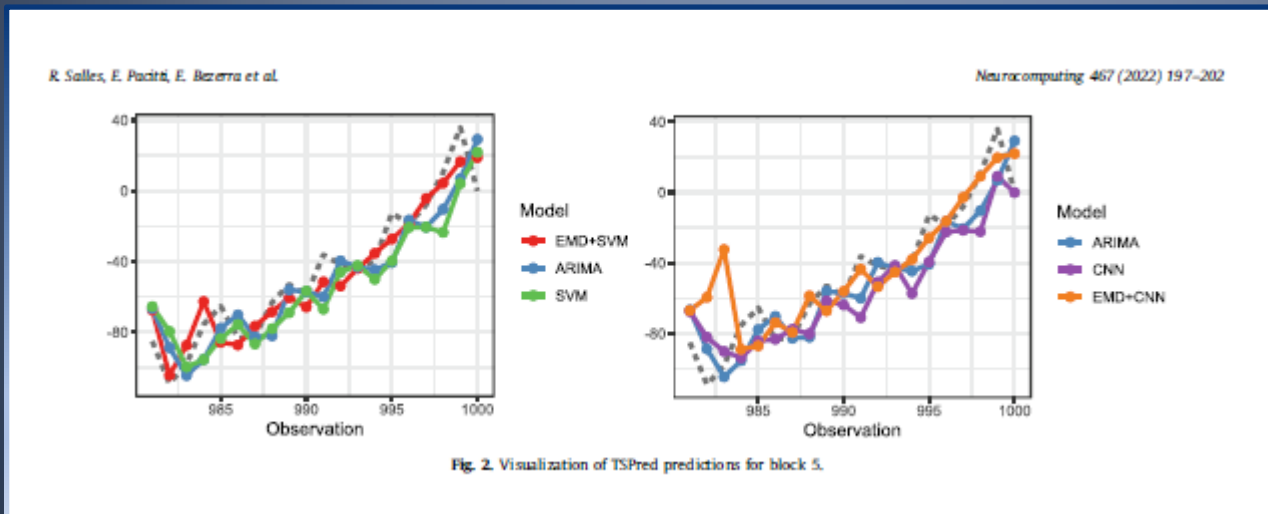
## Detecção de eventos

- Preprocessamento
- Anomalias
- Pontos de mudança
- Detecção online



# Predição

- Classificação
- Regressão
- Concept-drift



[1] B. Paixão, L. Baroni, M. Pedrosa, R. Salles, L. Escobar, C. de Sousa, R. de Freitas Saldanha, J. Soares, R. Coutinho, et al., 2021, Estimation of COVID-19 Under-Reporting in the Brazilian States Through SARI, *New Generation Computing*  
[2] R. Salles, E. Pacitti, E. Bezerra, F. Porto, and E. Ogasawara, 2021, TSPred: A framework for nonstationary time series prediction, *Neurocomputing*, v. 467, p. 197–202.  
[3] L. Giusti, L. Carvalho, A.T. Gomes, R. Coutinho, J. Soares, and E. Ogasawara, 2022, Analyzing flight delay prediction under concept drift, *Evolving Systems*

# Pattern mining

- Mineração de padrões frequentes
- Mineração de sequências frequentes
- Descoberta de motivos

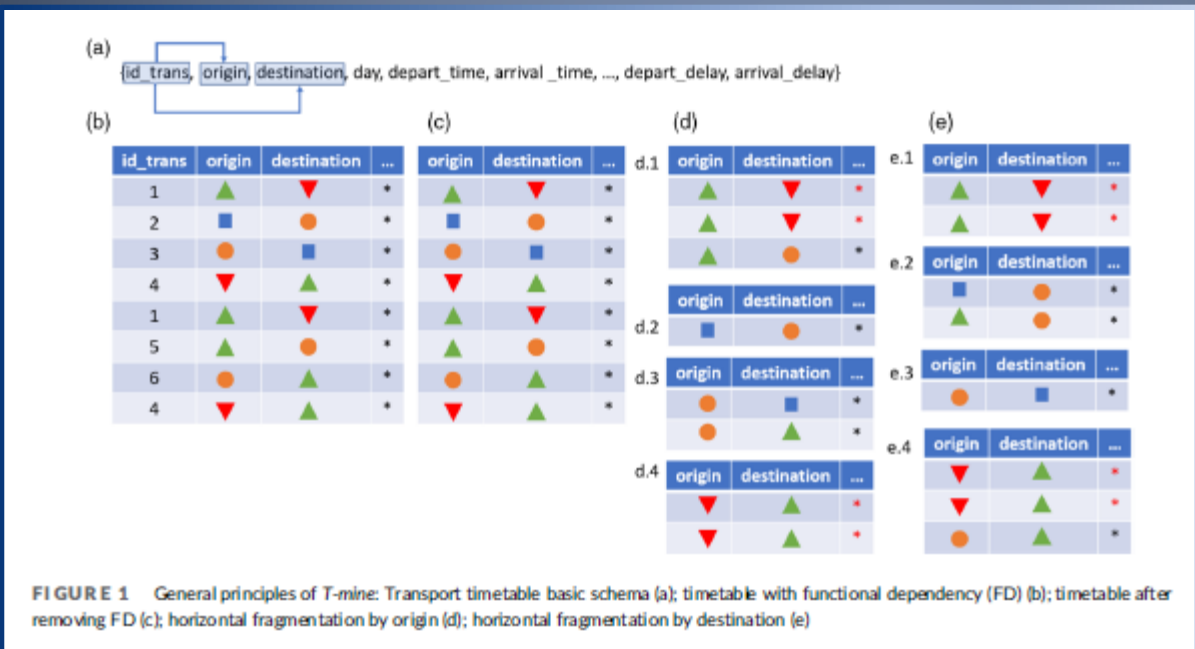
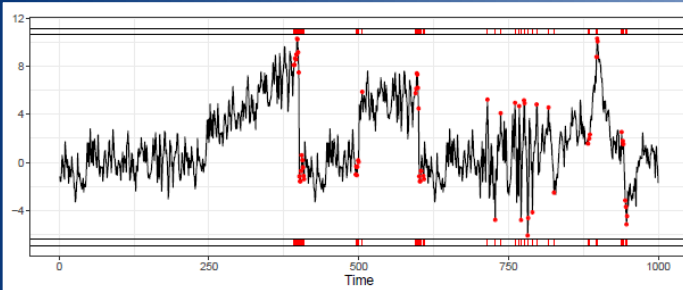


FIGURE 1 General principles of T-mine: Transport timetable basic schema (a); timetable with functional dependency (FD) (b); timetable after removing FD (c); horizontal fragmentation by origin (d); horizontal fragmentation by destination (e)

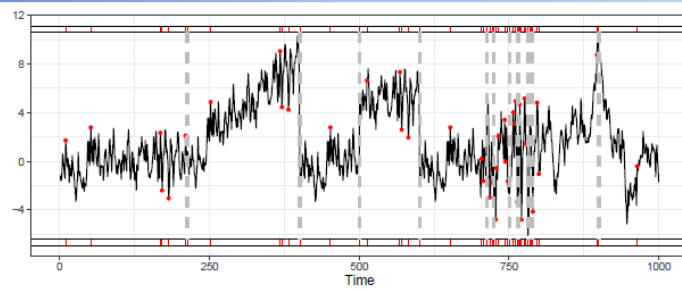
[1] L. Baroni, R. Salles, S. Salles, G. Guedes, F. Porto, E. Bezerra, C. Barcellos, M. Pedrosa, and E. Ogasawara, 2020, An analysis of malaria in the Brazilian Legal Amazon using divergent association rules, *Journal of Biomedical Informatics*, v. 108  
 [2] H. Borges, M. Dutra, A. Bazaz, R. Coutinho, F. Perosi, F. Porto, F. Massegla, E. Pacitti, and E. Ogasawara, 2020, Spatial-time motifs discovery, *Intelligent Data Analysis*, v. 24, n. 5, p. 1121–1140.  
 [3] C. Teixeira, L. Fragoso, M. Mattoso, D. Carvalho, E. Bezerra, J. Soares, G. Amorim, and E. Ogasawara, 2022, A horizontal partitioning-based method for frequent pattern mining in transport timetable, *Expert Systems*, v. 39, n. 2, p. e12881.

# Detecção de eventos

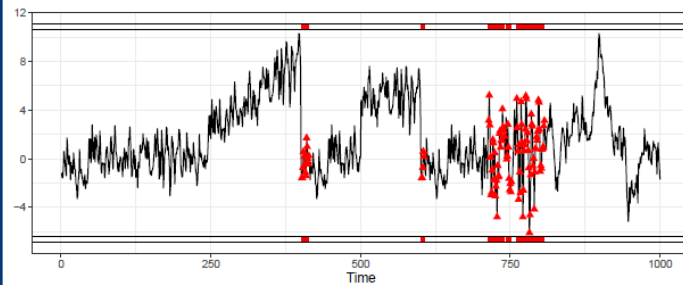
- Préprocessamento
- Anomalias (tendência e volatilidade)
- Pontos de mudança
- Detecção online



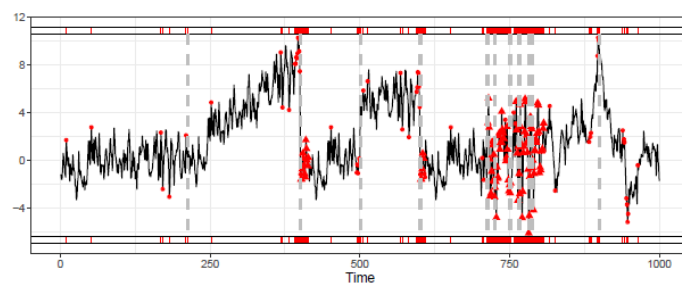
(a) Eventos detectados por AN



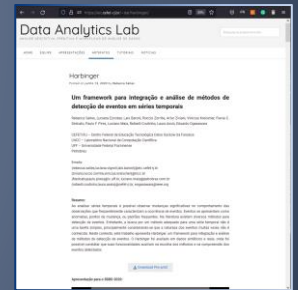
(b) Eventos detectados por CF



(c) Eventos detectados por GARCH



(d) Eventos detectados pelo módulo *combinação*



[1] L. Escobar, R. Salles, J. Lima, C. Gea, L. Baroni, A. Ziviani, P. Pires, F. Delicato, R. Coutinho, et al., 2021, Evaluating Temporal Bias in Time Series Event Detection Methods, *Journal of Information and Data Management*, v. 12, n. 3 (Oct)

[2] R. Salles, L. Escobar, L. Baroni, R. Zorrilla, A. Ziviani, V. Kreischer, F. Delicato, P.F. Pires, L. Maia, et al., 2020, Harbinger: Um framework para integração e análise de métodos de detecção de eventos em séries temporais, In: *Anais do Simpósio Brasileiro de Banco de Dados (SBBDD)*, p. 73-84

[3] E. Ogasawara, R. Salles, L. Escobar, L. Baroni, J. Lima, and F. Porto, 2021, Online event detection for sensor data, In: *Ibero-Latin American Congress on Computational Methods in Engineering*

# Colaboração

- Institutos de Pesquisa
  - LNCC
    - Fabio Porto, Antônio Tadeu A. Gomes
  - Fiocruz
    - Marcel Pedroso, Cristiano Boccolini, Christovam Barcellos
- Academia
  - CEFET/RJ
    - Docentes do PPCIC/PPPRO
  - COPPE/UFRJ
    - Marta Mattoso, Geraldo Zimbrão, Geraldo Xexéo
  - UFF
    - Daniel Oliveira, Leonardo Murta, Vanessa Braganholo
- Internacionais
  - INRIA / University of Montpellier
    - Patrick Valduriez, Esther Pacitti, Florent Masseglia
  - Saint Martin's University
    - Mario Guimarães



**CEFET/RJ**

*Boa sorte!*

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