# Vanessa Alexandra Freitas da Silva

# Curriculum Vitae

June, 2024

### **Personal Information**

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Web of Science	https://www.webofscience.com/wos/author/record/15368667
Scholar Citations	https://scholar.google.com/citations?user=OdqyFP4AAAAJ

## Education

2018-23	PhD in Computer Science	
	Faculty of Science of the University of Porto, Porto, Portugal	
	Thesis: "Multidimensional Time Series Analysis: A Complex Networks Approach"	
	Advisors: Prof. Dr. Pedro Ribeiro and Profa. Dra. Maria Eduarda Silva	
2016-18	MSc in Networks and Informatics Systems Engineering	
	Faculty of Science of the University of Porto, Porto, Portugal	
	Dissertation: "Time Series Analysis based on Complex Networks"	
	Advisors: Prof. Dr. Fernando Silva, Prof. Dr. Pedro Ribeiro and Profa. Dra.	
	Maria Eduarda Silva	
	Grade: $19/20$ ; Final Grade: $17/20$	
2013-16	Undergraduate Degree in Computer Engineering Sciences	
	Faculty of Science of the University of Porto, Porto, Portugal	

**Pedagogical Experience** 

Final Grade: 16/20

Sep 2023 -	<ul> <li>Guest Professor</li> <li>Faculty of Science of the University of Porto</li> <li>Algorithms and Data Structures, 1S</li> <li>Algorithm Design, 2S</li> </ul>
Sep 2022 - Aug 2023	<ul> <li>Guest Professor</li> <li>Faculty of Science of the University of Porto</li> <li>Algorithms and Data Structures, 1S</li> <li>Algorithm Design, 2S</li> </ul>
Sep 2021 - Aug 2022	<ul> <li>Guest Professor</li> <li>Faculty of Science of the University of Porto</li> <li><i>Programming</i>, 1S</li> <li><i>Algorithm Design</i>, 2S</li> </ul>

# **Research Experience**

Sep 2023 -	Researcher
	CRACS - INESC TEC
Nov 2018 - Dec 2022 (4 year)	<b>PhD Researcher</b> - FCT Doctoral Grant CRACS - INESC TEC
	Thesis: "Multidimensional Time Series Analysis: A Complex Networks Approach"
	Supervisors: Prof. Dr. Pedro Ribeiro and Profa. Dra. Maria Eduarda Silva
	Reference: SFRH/BD/139630/2018
	variate) time series into complex networks. Develop new tools for time series feature extraction based on topological measures.
Aug 2018 - Dec 2018	<b>Research</b> - Research Grant (BI)
(5  MONTHS)	CRACS - INESC TEC Thome: "Analysis of Time Series using Complex Networks"
	Supervisor: Prof. Dr. Fernando Silva AND Prof. Dr. Pedro and Profa. Dra. Maria Eduarda Silva
	Ribeiro Project, Nane STIMA
	Reference: NORTE-01-0145-FEDER-000016
MAD 2019 Jun 2019	<b>Beggeorgh</b> Degeorgh Creant (DI)
(5  months)	CRACS – INESC TEC
(0	Theme: "Analysis of Time Series using Complex Networks"
	Supervisor: Prof. Dr. Fernando Silva AND Prof. Dr. Pedro Ribeiro and Profa. Dra. Maria Eduarda Silva
	Project: SMILeS
	Reference: <b>NORTE-01-0145-FEDER-000020</b> Subject: Applysis characterization and prediction of time series
	based on the analysis of complex networks. Study of several
	methodologies to convert series into a graph (e.g. visibility and
	transition probability). Analysis of the topologies of the created
	networks, looking for metrics based on existing literature.
Nov 2016 - May 2017	Junior Researcher - Junior Research Grant (BIC)
(7  Months)	CRACS – INESC TEC
	Supervisor: Prof. Dr. Fernando Silva and Prof. Dr. Pedro Ribeiro
	Project: POCI do CRACS - INESC TEC
	Subject: Strategies study to study the evolution of complex net-
	works (dynamics), namely, the application of tensor factorization in the prediction of connections or evolution of thematic areas
	from co-authorship network obtained from Authenticus.
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#### **Research Activity**

#### Domain of Specialization

- Graph Theory and Network Science, with special interest in Multilayer Networks
- Time Series Analysis, with special interest in Multivariate Time Series

• Data Mining, with special interest in the areas of Statistics, Knowledge Discovery and Machine Learning.

#### Main Research Interests

• Multivariate Time Series Analysis based on Complex Networks, given the promising results in univariate series analysis and the existence of complex structures (multilayer networks).

• Spatio-Temporal Data Analysis, given the large amount of data obtained through fixed and mobile sensors, associated with certain spaces on the planet.

• Univariate Time Series Analysis based on Complex Networks, given its potential.

• Complex Networks for Big Data, given the increasing need to analyze huge amounts of data and the power of network structures.

• Evolutionary Network Analysis, given that most complex networks are eminently dynamic, e.g. evolving over time, the parameters that characterize them may change.

• Data Analytics to decision support and to clustering, classification and forecasting applications.

#### **Conference Organization**

Member of the Organizing Committee on the following conference: MAPiS ("1st edition of MAPi International scientific meeting in the field of Computer Science for PhD students").

• Program Chair and Publicity Chair

#### Awards and Distinctions

#### APR 2023 Award Fernando Nicolau

Attributed to Professor Dra. Maria Eduarda Silva for our joint article "Novel features for time series analysis: a complex networks approach" submitted in the journal Data Mining and Knowledge Discovery and published in March 2022

#### Apr 2023 BOLSA CLAD

By work "Are multilayer networks useful for mining multivariate time series?", in the call for grants awarded by CLAD (Associação Portuguesa de Classificação e Análise de Dados) in XXX Jornadas de Classificação e Análise de Dados in Abril 2023 (JOCLAD2023)

FEB 2023 Top Cited Article Certificate of (one of) the journal's most cited articles of 2021-2022 Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, referring to the work with the title Time series analysis via network science: Concepts and algorithms"

#### Publications

Ana R. F. Rodrigues, Maria Eduarda Silva, <u>Vanessa Freitas Silva</u>, Margarida R. G. Maia, Ana R. J. Cabrita, Henrique Trindade, António J. M. Fonseca, and José L. S. Pereira. **Implications of seasonal and daily variation on methane and ammonia emissions from naturally ventilated dairy cattle barns in a Mediterranean climate: A two-year study**. Accepted in *Science of the Total Environment*, June 2024.

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, Pedro Ribeiro, and Fernando Silva. **Multilayer quantile graph for multivariate time series analysis and dimensionality reduction**. *International Journal of Data Science and Analytics*, 1-13, May 2024.

<u>Vanessa Freitas Silva</u>. Multidimensional Time Series Analysis: A Complex Networks Approach. PhD Thesis. PhD in Computer Science. *University of Porto*, May 2023.

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, and Pedro Ribeiro. **Are multilayer networks useful for mining multivariate time series?**. In *Program and Book of Abstracts XXX Meeting of the Portuguese Association for Classification and Data Analysis (CLAD)*, (p. 49). April 2023.

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, Pedro Ribeiro, and Fernando Silva. **MHVG2MTS: Multilayer Horizontal Visibility Graphs for Multivariate Time Series Analysis**. *Submitted to Transactions on Knowledge Discovery from Data*, December 2022. A first version is available at arXiv https://arxiv.org/abs/ 2301.02333

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, Pedro Ribeiro, and Fernando Silva. **Novel features for time series analysis: a complex networks approach**. *Data Mining and Knowledge Discovery*, *36(3)*, 1062-1101, March 2022.

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, Pedro Ribeiro, and Fernando Silva. **Multivariate Time Series Feature Extraction via Multilayer Networks**. In *Program and Book of Abstracts 17th conference of the International Federation of Classification Societies (IFCS)*, (p. 128). July 2022.

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, Pedro Ribeiro, and Fernando Silva. **Time series analysis via network science: Concepts and algorithms**. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, 11(3), e1404, March 2021.

<u>Vanessa Freitas Silva</u>, Maria Eduarda Silva, and Pedro Ribeiro. **Time series analysis via complex networks: a first approach**. In *Program and Book of Abstracts XXVI Meeting of the Portuguese Association for Classification and Data Analysis (CLAD)*, (p. 53). April 2019.

<u>Vanessa Freitas Silva</u>. **Time Series Analysis based on Complex Networks**. MSc Thesis. Master's degree in Networks and Informatics Systems Engineering. *University of Porto*, July 2018.

#### Software

# *tsmnet* - Multidimensional Time Series Analysis via Multilayer Networks URL: *(available soon)*

A framework implemented in C++ to analyse multi-dimensional time series data using multilayer network analysis methodologies. Extracts time series networks (multilayer networks) resulting from univariate and multivariate mappings methods, and allows extracts sets of topological features.

#### NetF - A Novel Set of Time Series Features

URL: https://github.com/vanessa-silva/NetF

R implementation to maps univariate time series data into three types of complex networks, namely, *Quantile Graphs*, *Weighted Natural Visibility Graphs* e *Weighted Horizontal Visibility Graphs*, and extracts (for each of them) five topological features, namely, *average weighted degree*, *average path length*, *clustering coefficient*, *number of communities* e *modularity*.