

# Dr. Sara Pérez Vieites

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## RESEARCH PROFILE

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I am a postdoctoral researcher at the CERI Systèmes Numériques (Digital Systems) of IMT Nord Europe, where I am carrying out research in computational statistics under the supervision of Dr. Víctor Elvira (University of Edinburgh). More specifically, I am interested in Bayesian inference, parameter estimation, filtering techniques and their application to different fields of science (e.g., engineering, ecology, meteorology, etc.).

I completed the Ph.D. in Statistical Signal Processing from Universidad Carlos III of Madrid in 2022, under the supervision of Dr. Joaquín Míguez. My novel research has been published in two journals of different disciplines and in three well-known peer-reviewed signal processing conferences. I have presented all my research advances in nine international and two national conferences.

During the William Gordon Seggie Brown Research Fellowship I will propose new Bayesian methodology for parameter and state estimation of high-dimensional dynamical systems. I will design novel and theoretically sound methods for an efficient estimation of the model unknowns, all constrained under the realistic assumption of finite computational resources. The proposed algorithms will be applied in other fields (ecology, meteorology, geosciences, and epidemiology), developing multi and interdisciplinary research. I also plan to contribute to the teaching activity of the School of Mathematics, as well as to undertake development training as necessary.

## PROFESSIONAL EXPERIENCE

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### Visiting Researcher

Jan. 2023 - Present

School of Mathematics, University of Edinburgh (Edinburgh, UK)

### Postdoctoral Researcher

Sept. 2022 - Present

CERI Systèmes Numériques, IMT Nord Europe (Villeneuve-d'Ascq, France)

### Research Assistant

Dec. 2016 - May 2022

Department of Signal Theory & Communications, University Carlos III of Madrid (Madrid, Spain)

### PhD internship

Apr. 2019 - July 2019

Department of Mathematics and Statistics, University of Reading (Reading, UK)

### Research collaboration/visit

Jan. 2019

MeteoGalicia (Santiago de Compostela, Spain)

### Research collaboration/visit

July 2018

Centre Tecnològic de Telecomunicacions de Catalunya (CTTC, in Barcelona, Spain)

### Trainee

June 2015 - Aug. 2015

Gradiant, Technology Centre of Telecommunications of Galicia (Vigo, Spain)

### Trainee

June 2014 - Aug. 2014

R Cable y Telecomunicaciones, S.A. (A Coruña, Spain)

## EDUCATION

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### Ph.D. in Statistical Signal Processing

Sept. 2017 - Jan. 2022

Universidad Carlos III de Madrid (Spain)

Title: Nested filtering methods for Bayesian inference in state space models

Supervisor: Joaquín Míguez Arenas

Description: Development of Bayesian filtering methods, from a practical en theoretical point of view, in order to perform accurate parameter estimation and prediction of time- varying high-dimensional systems.

### Master's Degree in Telecommunications Engineering

Sept. 2015 - Sept. 2017

Universidad Carlos III de Madrid (Spain)

**Master's Degree in Multimedia and Communications**

Sept. 2015 - July 2017

Universidad Carlos III de Madrid (Spain)

Description: Master specialised in topics such as machine learning, computer vision and signal processing.**Bachelor's Degree in Telecommunication Technologies Engineering**

Sept. 2011 - June 2015

Universidade de Vigo (Spain)

Description: Specialisation in Sound and Image.**LIST OF PUBLICATIONS**

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My research has been published in two journals of different disciplines and in three well-known peer-reviewed signal processing conferences/workshops.

**Journal papers:**

- J2. Pérez-Vieites, S., & Míguez, J. (2021). *Nested Gaussian filters for recursive Bayesian inference and nonlinear tracking in state space models*. Signal Processing, 189, 108295.
- J1. Pérez-Vieites, S., Mariño, I. P., & Míguez, J. (2018). *Probabilistic scheme for joint parameter estimation and state prediction in complex dynamical systems*. Physical Review E, 98(6), 063305.

**Conference peer-reviewed papers:**

- C4. Pérez-Vieites, S., & Elvira, V. (2023). *Adaptive Gaussian nested filter for parameter estimation and state tracking in dynamical systems*. In ICASSP 2023 [\[Accepted paper\]](#).
- C3. Pérez-Vieites, S., & Míguez, J. (2020). *A nested hybrid filter for parameter estimation and state tracking in homogeneous multi-scale models*. In 2020 IEEE 23rd International Conference on Information Fusion (FUSION) (pp. 1-8). IEEE.
- C2. Pérez-Vieites, S., & Míguez, J. (2020). *Kalman-based nested hybrid filters for recursive inference in state-space models*. In 2020 28th European Signal Processing Conference (EUSIPCO) (pp. 2468- 2472). IEEE.
- C1. Pérez-Vieites, S., Vilà-Vals, J., Bugallo, M. F., Míguez, J., & Closas, P. (2019). *Second Order Subspace Statistics for Adaptive State-Space Partitioning in Multiple Particle Filtering*. In 2019 IEEE 8th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP) (pp. 609-613). IEEE.

**Pre-prints and submitted papers:**

- Pérez-Vieites, S., Molina-Bulla, H., & Míguez, J. (2022). *Nested smoothing algorithms for inference and tracking of heterogeneous multi-scale state-space systems*. arXiv preprint arXiv:2204.07795.

**FELLOWSHIPS, GRANTS, PRIZES AND AWARDS**

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**Submission to MSCA Postdoctoral Fellowship**

Sept. 2022

Assessment in progress

**Submission to EPSRC Open Postdoc Fellowship**

Aug. 2022

Assessment in progress

**Runner up poster presentation**

07/06/2019

SIAM-IMA student chapter conference, University of Reading (Reading, UK)

**PIPF grant (Personal Pre-doctoral en Formación) for Ph.D. students**

11/09/2017 – 09/04/2019

Universidad Carlos III de Madrid (Madrid, Spain)

## ORGANISATION ACTIVITIES

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**Support activities in the MSc Earth Observation Challenge 2023** 20/02/2023 - 23/02/2023  
Organised by Saxavord and the University of Edinburgh.

**Local arrangements committee, SMC 2022** 04/05/2022 - 06/05/2022  
I have been involved in the organisation of the 5<sup>th</sup> Workshop in Sequential Monte Carlo Methods 2022 (SMC 2022) in Madrid, Spain. To be specific, I led the **local arrangements committee**, producing the programme, arranging the registration materials, and supporting the sessions.

## INVITED TALKS

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**Statistics Seminar, School of Mathematics, University of Edinburgh.** 27/02/2023  
Title: *Nested filtering methods for Bayesian inference in state space models*

## CONFERENCES AND SUMMER SCHOOLS

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I have presented all my research advances in nine international and two national conferences. I have also attended other workshops and summer schools.

- **SIAM Conference on Mathematics of Data Science (MDS22)** 26/09/2022 - 30/09/2022  
Hybrid conference. San Diego, California (US)  
Attendance and poster presentation
- **5<sup>th</sup> Workshop in Sequential Monte Carlo Methods 2022 (SMC 2022)** 04/05/2022 - 06/05/2022  
Universidad Carlos III de Madrid (Spain)  
Attendance and poster presentation  
Part of the local arrangements committee
- **9<sup>th</sup> Spanish Workshop on Signal Proc., Communications & Inf. Theory (SIC 2022)** 03/05/2022  
Universidad Carlos III de Madrid (Spain)  
Attendance and poster presentation
- **28<sup>th</sup> European Signal Processing Conference (EUSIPCO 2020)** 18/01/2021 - 22/01/2021  
Virtual conference  
Attendance and poster presentation  
Paper title: *Kalman-based nested hybrid filters for recursive inference in state-space models.*
- **23<sup>rd</sup> Conference on Information Fusion (FUSION 2020)** 06/07/2020 - 09/07/2020  
Virtual conference  
Attendance and poster presentation  
Paper title: *A nested hybrid filter for parameter estimation and state tracking in homogeneous multi-scale models.*
- **27<sup>th</sup> European Signal Processing Conference (EUSIPCO 2019)** 02/09/2019 - 07/09/2019  
Universidade de A Coruña (Spain)  
Attendance and 3 minutes thesis talk
- **Workshop on Stochastic Parametrizations & Their Use in Data Assimilation** 01/07/2019 - 05/07/2019  
Imperial College London (UK)  
Attendance
- **Mathematics of Planet Earth Centre for Doctoral Training Summer School** 24/06/2019 - 28/06/2019  
Met Office (Exeter, UK)  
Attendance
- **SIAM-IAM student chapter conference** 07/06/2019  
University of Reading (UK)  
Attendance and poster presentation

- **LMS Invited Lecture Series & CRISM Summer School in Comp. Statistics** 09/06/2018 - 13/06/2018  
Warwick University (UK)  
Attendance and poster presentation
- **ISBA 2018 World Meeting** 24/06/2018 - 29/06/2018  
University of Edinburgh (UK)  
Attendance and poster presentation
- **Particle methods and Data assimilation workshop** 08/05/2018 - 10/05/2018  
Imperial College London (UK)  
Attendance
- **7<sup>th</sup> Spanish Workshop on Signal Proc., Inf. Theory & Communications** 23/01/2018  
Universidad de Navarra (San Sebastián, Spain)  
Attendance and poster presentation
- **Sequential Monte Carlo Workshop 2017 (SMC 2017)** 30/08/2017 - 01/09/2017  
Uppsala University (Sweden)  
Attendance and poster presentation

## PROJECTS

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I have participated in the following research projects at Universidad Carlos III as part of the scientific team.

- **PRACTICO-CM** Psiquiatría Computacional y Modelos Integrales de Comportamiento  
Funding agency: CAM. Consejería de Educación e Investigación (Y2018/TCS-4705)  
PI: Antonio Artés Rodríguez  
Duration: 01/01/2019 - 30/06/2022 (42 months)  
Budget: 645.775,90 €
- **BAYTREE** Advanced Bayesian computation methods for modelling and inference in complex dynamical networks  
Funding agency: Office of Naval Research Global (N00014-18-S-B001)  
PI: Joaquín Míguez Arenas  
Duration: 01/03/2019 - 28/02/2022 (36 months)  
Budget: 137.565,10 €
- **Métodos computacionales bayesianos avanzados para estimación, predicción y control en sistemas multisensoriales complejos**  
Funding agency: Ministerio de asuntos económicos y transformación digital (TEC2015-69868-C2- 1-R)  
PI: Antonio Artés Rodríguez, Joaquín Míguez Arenas  
Duration: 01/01/2016 - 31/12/2019 (48 months)  
Budget: 314.600,00 €
- **NICOP** - a new sequential Monte Carlo framework for tracking of non-linear complex dynamical systems  
Funding agency: Office of Naval Research Global (N62909-15-1-2011)  
PI: Joaquín Míguez Arenas  
Duration: 17/04/2015 - 16/04/2018 (36 months)  
Budget: 162.229,00 €

## TEACHING EXPERIENCE

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I have taken part in the teaching duties at undergraduate level, teaching (in Spanish and/or English) different courses in telecommunications engineering. I have also obtained good teaching quality indicators.

**Courses** taught at Universidad Carlos III as **teaching assistant**:

- **Linear systems** (2017-2019)  
Degrees: Mobile and Space Communications Engineering (B.Sc.), Telecommunication Technologies Engineering (B.Sc.) and Telematics Engineering (B.Sc.)  
Teaching hours: 112 hours
- **Linear networks analysis and synthesis** (2017 – 2018)  
Degree: Telecommunication Technologies Engineering (B.Sc.)  
Teaching hours: 5 hours

At Universidad Carlos III, detailed polls are anonymously filled by students at the end of each course. All the grades obtained have been averaged over all courses and all academic years yielding: **4.1/5**.

## OUTREACH ACTIVITIES

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- I have established a collaboration with **MeteoGalicia**, a meteorological centre (equivalent to the MetOffice in Galicia region, Spain), to apply stochastic filtering in **weather forecasting**. I have used the Weather Research and Forecasting (WRF) Model and data collected from meteorological base stations in Galicia.
- Participation in the **three minutes thesis (3MT)** at EUSIPCO 2019. Qualified as a finalist. Here I had to present a compelling oration on my thesis and its significance to an audience specialised in different areas.

## REVIEWER ACTIVITIES

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I have served as reviewer for several journals and conferences.

- **Journals:** Foundations of Data Science, IEEE Transactions on Signal Processing, and IEEE Signal Processing Letters.
- **Conferences:** EUSIPCO.

## MAJOR COLLABORATIONS

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I have started several collaborations with other six researchers from different research areas and universities.

- **Inés Pérez Mariño** (Professor at the Universidad Juan Carlos, Spain).  
Research area: Applied Physics.  
Description: We investigated the use of Bayesian inference methods in chaotic and nonlinear systems.
- **Jochen Broecker** (Associate Professor at the University of Reading, UK).  
Research area: Statistics.  
Description: Analysis of different stochastic parameterisations and how they affect the behaviour of simplified models.
- **Jordi Vilà-Valls** (Associate Professor at ISAE-SUPAERO, University of Toulouse, France), **Pau Closas** (Assistant Professor at Northeastern University, USA), **Mónica F. Bugallo** (Professor at Stony Brook University, USA) and **Petar M. Djurić** (Distinguished Professor at Stony Brook University, USA).  
Research area: Electrical and Computer Engineering.  
Description: We have investigated the use of Bayesian methods in engineering challenges such as multiple target tracking and estimation of high-dimensional systems.

## LANGUAGES

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<b>English</b>	Professional level
<b>French</b>	Intermediate level
<b>Spanish</b>	Native speaker
<b>Galician</b>	Native speaker