MINISTERIO
DE CIENCIA
E INNOVACIÓN

Cofinanciado por
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AGENCIA
ESTATAL DE
INVESTIGACIÓN

Part A. PERSONAL INFORMATION

CV date	01/12/2022

First name	Sergio Antonio		
Family name	Cruces Alvarez		

(*) Mandatory

A.1. Current position

Position	Catedrático de universidad (professor)
Initial date	20/11/2017
Institution	Universidad de Sevilla
Department/Center	Teoría de la Señal y Comunicaciones — Escuela Superior Ingeniería
Country	Spain
Key words	Statistical signal processing, machine learning, information theory, unsupervised learning, brain-computer interfaces.

A.2. Previous positions (research activity interuptions, art. 14.2.b))

Period	Position/Institution/Country/Interruption cause
1995 – 1995	Contratado laboral / Universidad de Vigo
1995 – 2001	Profesor asociado / Universidad de Sevilla
2001 – 2017	Profesor titular de universidad / Universidad de Sevilla

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Ingeniero de Telecomunicación	Universidad de Vigo	1994
Doctor Ingeniero de Telecomunicación	Universidad de Vigo	1999

Part B. CV SUMMARY *(max. 5000 characters, including spaces)*

He graduated in Telecommunication Engineering from the University of Vigo and worked in technology transfer hired by a European project. After getting an assistant professor position at the University of Seville, he completed his Ph.D. under the supervision of Professor Luis Castedo (University of A Coruña). Its results were published in journals and reproduced by Cichocki & Amari in chapters of their book "Adaptive blind signal and image processing", Wiley. He has conducted several invited research stays spanning an accumulated period of one year at their laboratory for Advanced Brain Signal Processing at RIKEN, Tokyo. This allowed him to maintain close collaboration with them through joint publications and the co-authorship of the popular ICAlab toolbox for signal processing. Research on unsupervised learning was reoriented to the study of information-theoretic criteria for the simultaneous extraction of components from a linear mixture, where he unified the interpretation of criteria such as: min. entropy, max. neg-entropy and min. mutual information.

In 2010, he proposed a novel generative model of observations, named bounded component analysis, and, in 2015, obtained its essential identifiability and separability conditions for overdetermined and underdetermined mixtures. His collaboration with professors Cichocki & Amari in 2011, opened a line of research that highlighted the interest of

generalized divergences in the search of low-dimensional structures, with nonnegative elements, that can explain the observations. The work subsequently received the best paper award from the journal.

He was certified in 2014 as a full professor. In 2015, he proposed the principle of minimum complexity that underlies the bounded component analysis criteria. He started a long-term collaboration with the radio-communications group of his department by applying compressed sensing techniques and Bayesian information criteria to solve the problem of modeling and pre-distortion of power amplifiers. Together with A. Cichocki proposed a parameterized family of generalized divergences for positive definite matrices that smoothly interpolates and extends popular matrix divergences, such as von Neumann, Riemannian, Stein, Frobenius, log-Euclidean, etc. Sometime later, he obtained a closed-form expression for the gradient of this family, enabling the creation of new algorithms for clustering, dimensionality reduction, and other problems that rely on a comparison of covariance matrices.

Since 2015, he has served as Associate Editor (AE) for the IEEE TCyb journal, has also served 4 years as AE of IEEE TNN-LS and, recently, accepted the commitment to serve as co-chair of student activities at EUSIPCO'23. He has supervised 5 Ph.D.s, three focused on unsupervised learning topics, and two oriented to improving the preprocessing, dimensionality reduction, and classification stages of Brain-Computer Interfaces. Currently, he leads a research group of five members, which research lines include: unsupervised, self-supervised, and semi-supervised learning; brain-computer interfaces; source separation; data mining, and information processing algorithms. These research lines aim to deepen our analysis and knowledge of the components that underlie the observed data and find applications in areas as diverse as bioengineering, imaging, audio, and communications.

General indicators of quality of scientific production

Recipient of the Entropy Best Paper Award 2015 (1st prize).
N. of "sexenios" (six-year research periods): 4 consecutive (1995-2018)
N. of supervised PhD theses since 2011:   3 (in 2013, 2018, 2020)

Database:	(WoS)	(Scopus)	(Scholar)
Total citations:	652	886	1565
Av. citation/year (last 5 years):	55	70	111
h-index:	13	15	20

Q1 publications: 15 (JCR)   23 (SCImago)
Q2 publications: 18 (JCR)   15 (SCImago)

Editorial activities

- Served as Associate Editor
(2015 – 2021) IEEE Trans. on Cybernetics, IF 11.448 (JCR 2020)
(2012 – 2015) IEEE Trans. on Neural Networks and Learning Systems, IF 4.854 (JCR 2015)
(2007 – 2013) Editorial Board of Comp. Intelligence and Neuroscience

- Services for journal Entropy. IF 2.534 (JCR 2020)
(2019 – 2021) Topical Advisory Panel and editor of 2 special issues.

Management of scientifict activities

-   Head of the research group TIC-246 since 2017 (5 Ph.D. members).

-   Supervisor of 6 student grants since 2011 (2 doctoral training FPI + 2 Heritage Erasmus Mundus Partnership + 1 Prog. Op. Empleo Juvenil + 1 Innov. docente).

-   Program Chair of ICIST-2018, Seville.

Evaluation activities

- (2020) Reviewer for the Spanish National Research Agency.
- (2014) National committee of experts for the national I+D+I projects evaluation.
- Since 2014, member of academic commission of Ph.D. program at the Univ. of Seville.
- Joined the subcommittee for the evaluation of "student paper awards" at ICASSP-2019.
- Program Committee member for >30 conferences since 2011.

Part C. RELEVANT MERITS *(sorted by typology)*

***C.1.* Publications** *(selected merits in reverse chronological order since 2015)*

- C. Crespo, M. J. Madero, J. A. Becerra, S. Cruces, (2022) "A Sparse-Bayesian Approach for the Design of Robust Digital Predistorters Under Power-Varying Operation," in **IEEE Trans. on Microwave Theory & Tech.**, doi: 10.1109/TMTT.2022.3157586. (**Q1**)

- R. Martín, J. Olías, S. Cruces, V. Zarzoso, (2019) "Unsupervised Common Spatial Patterns", **IEEE Trans. on Neural Syst. & Rehab. Eng.**, V. 27(10), pp. 2135-2144. (**Q1**)

- J. Olias, R. Martín, M.A. Sarmiento, S. Cruces, (2019) "EEG Signal Processing in MI-BCI Applications with Improved Covariance Matrix Estimators", **IEEE Trans. on Neural Systems & Rehabilitation Eng.**, V. 27(5), pp. 895-904. (**Q1**)

- A. I. Huseyin, A. T. Erdogan, S. Cruces, (2017) "Stationary point characterization for a class of BCA algorithms", **IEEE Trans. on Signal Proc.** 65(20), pp. 5437-5452. (**Q1**)

- D. B. Thiyam, S. Cruces, J. Olías, A. Cichocki, (2107) "Optimization of Alpha-Beta Log-Det Divergences and their Application in the Spatial Filtering of Two Class Motor Imagery Movements", **Entropy**, 19(3), 89, pp. 1-40. (Q2)

- Sunnydayal, K. Kumar, S. Cruces, (2017) "An Iterative Posterior NMF Method for Speech Enhancement in Presence of Gaussian Noise", **Neurocomputing**, V.230 pp.312-315. (**Q1**)

- S. Cruces, (2015) "Bounded component analysis of noisy underdetermined and overdetermined mixtures", **IEEE Trans. on Signal Proc**., Vol. 26(5), pp. 964-981. (**Q1**)

- S. Cruces, I. Durán, (2015) "The minimum risk principle that underlies the criteria of bounded component analysis", **IEEE Trans. on Neural Networks and Learning Systems**, Vol. 26 (5), pp. 964-981. (**Q1**)

- J. Reina, M. Allegue, C. Crespo, C. Yu, S. Cruces, (2015) "Behavioral Modeling and Predistortion of Power Amplifiers under Sparsity Hypothesis", **IEEE Trans. on Microwave Theory and Techniques**, Vol. 63(2), pp. 745-753. (**Q1**)

- A. Sarmiento, I. Durán, A. Cichocki, S. Cruces, (2015) "A contrast based on generalized divergences for solving the permutation problem of convolved speech mixtures", **IEEE-ACM Trans. on Audio, Speech, and Language Processing**, Vol. 23 (11), pp. 1713-1726.

- A. Cichocki, S. Cruces and S. Amari, (2015) "Log-Determinant Divergences Revisited: Alpha-Beta and Gamma Log-Det Divergences", **Entropy**, Vol. 17 (5), pp. 2988-3034. (Q2)

***C.2.* Congress** *(selected merits in reverse chronological order since 2011)*

- A. Sarmiento, I. Durán, I. Fondón, and S. Cruces, (2021) "Generalization of an Active Set Newton Algorithm with Alpha-Beta divergences for audio separation," 29th European Signal Processing Conference (EUSIPCO), pp. 306-310. (poster)

- C. Crespo, M.J. Madero, J.A. Becerra, and S. Cruces, (2021) "A Fast Sparse Bayesian Pursuit Approach for Power Amplifier Linearization," IEEE MTT-S International Wireless Symposium (IWS), China, pp. 1-3. (oral presentation)
- J. Olias, R. Martín, M. A. Sarmiento, S. Cruces, (2019) "A Technique for Artifact Attenuation in Motor-Imagery BCI", Unión Científica Internacional de Radio, Seville. (oral presentation)
- M. A. Sarmiento, I. Durán-Díaz, I. Fondón, S. Cruces, (2019) "Descomposición de señales de audio mediante un algoritmo de conjunto activo con ab-divergencias", Unión Científica Internacional de Radio, Seville. (oral presentation)
- S. Cruces, R. Martín, (2018) "Information techniques in component analysis", International Workshop on Information Science and Technology. (invited speaker 45'').
- D. Thiyam, S. Cruces, E. Rajkumar, (2016) "ThinICA-CSP algorithm for discrimination of multiclass motor imagery movements", IEEE conf. TENCON, Singapore, pp. 2483-2486.
- J. Reina, M. Allegue, M. J. Madero, C. Crespo, S. Cruces, (2013) "Digital predistortion based on a compressed-sensing approach," Europ. Microwave Conf., pp. 408-411. (oral)
- P. Aguilera, I. Durán, A. Sarmiento and S. Cruces, (2012) "Bounded Component Analysis of the training error," Int. Joint Conf. on Neural Networks (IJCNN), Brisbane, pp. 1-7. (oral)
- A. Sarmiento, I. Durán, S. Cruces, P. Aguilera, (2011) "Solving the permutation problem in frequency-domain BSS of convolved speech signals", Interspeech, pp. 565-568. (oral)

C.3. Research projects *(merits in reverse chronological order since 2011)*

- Title: "Técnicas de procesado estadístico de señal para la reducción de la dimensionalidad, el análisis de componentes y el modelado del comportamiento no-lineal".
   Reference: TEC2017-82807-P
   Funding entity/call: Ministerio de Ciencia y Tecnología
   Excelencia - Proyectos I+D
   Duration: from 01/01/2018 to 31/12/2021 (4 years)
   Amount of the grant: 154.880 Euros
   Type of participation: Principal investigator
   Intermediate evaluation: **"Satisfactory"**

- Title: "Métodos de procesado de señales complejas para el modelado y el análisis de sistemas lineales y no-lineales".
   Reference: TEC2014-53103-P
   Funding entity/call: Ministerio de Economía y Competitividad
   Excelencia - Proyectos I+D
   Duration: from 01/01/2015 to 31/12/2107 (3 years)
   Amount of the grant: 108.000 Euros
   Type of participation: Principal investigator
   Received evaluation: **"Very satisfactory"**

- Title: "Técnicas avanzadas de análisis de componentes de las observaciones: aplicaciones en modelado de comportamiento de subsistemas de comunicaciones y en separación de voz".
   Reference: TEC2011-23559
   Funding entity/call: Ministerio de Ciencia e Innovación,
   Plan Nacional de I+D
   Duration: from 01/01/2012 to 31/12/2014 (3 years)
   Amount of the grant: 85.063 Euros
   Type of participation: Principal investigator
   Received evaluation: **"Very satisfactory"**

C.4. Contracts, technological or transfer merits *(merits since 2011)*