

Carlos Alzate

SISTA Research Group

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Nationality: Belgian, Colombian.

Current position

2010- [Postdoctoral fellow](#) of the Research Foundation - Flanders (FWO), *ESAT - K. U. Leuven*

Past positions

2009-2010 **Postdoctoral researcher**, *ESAT - K. U. Leuven*

Areas of specialization

Machine learning, kernel methods, unsupervised and semi-supervised learning.

Areas of competence

Artificial intelligence.
Data mining.
Optimization.
Data analysis.

Education

- 2005-2009 **Ph.D in Engineering**, ESAT - K. U. Leuven.
Doctoral dissertation: Support vector methods for unsupervised learning, May 20th, 2009.
Promotor: Prof. Johan Suykens.
- 2004-2005 **Predoctoral year**, ESAT - K. U. Leuven.
- 2003-2004 **Master in Artificial Intelligence**, K. U. Leuven.
Thesis: Microarray data analysis using transductive kernel methods.
Promotor: Prof. Johan Suykens.
- 1997-2002 **Electronic Engineering**, Universidad Nacional de Colombia, Manizales, Colombia.

Publications

Peer-reviewed journal articles

- C. Varón, **C. Alzate**, J. A. K. Suykens and J. Debosscher. Kernel Spectral Clustering of Time Series in the CoRoT Exoplanet Database. *Astronomy & Astrophysics*, vol. 531, no. A156, Jul. 2011, pp. 1-15.
- **C. Alzate** and J. A. K. Suykens. Sparse Kernel Spectral Clustering Models for Large-Scale Data Analysis. *Neurocomputing*, vol. 74, no. 9, Apr. 2011, pp. 1382-1390.
- J. A. K. Suykens, **C. Alzate** and K. Pelckmans. Primal and dual model representations in kernel-based learning. *Statistics Surveys*, vol. 4, Aug. 2010, pp. 148-183, DOI: 10.1214/09-SS052.
- **C. Alzate** and J. A. K. Suykens. Multiway spectral clustering with out-of-sample extensions through weighted kernel PCA. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 32(2):335-347, Feb. 2010.
- **C. Alzate** and J. A. K. Suykens. A regularized kernel CCA contrast function for ICA. *Neural Networks*, 21(2-3):170-181, Mar. 2008.
- **C. Alzate** and J. A. K. Suykens. Kernel component analysis using an epsilon insensitive robust loss function. *IEEE Transactions on Neural Networks*, 19(9):1583-1598, 2008.

International Peer-reviewed conference papers

- **C. Alzate** and J.A.K. Suykens. Out-of-Sample Eigenvectors in Kernel Spectral Clustering. In *Proc. of the International Joint Conference on Neural Networks (IJCNN 2011)*, San Jose, U.S.A., Aug. 2011, pp. 2349-2356.
- R. Langone, **C. Alzate** and J.A.K. Suykens. Modularity-based model selection for kernel spectral clustering. In *Proc. of the International Joint Conference on Neural Networks (IJCNN 2011)*, San Jose, U.S.A., Aug. 2011, pp. 1849-1856.
- S. Mehrkanoon, L. Jiang, **C. Alzate** and J.A.K. Suykens. Symbolic computing of LS-SVM based models. In *Proc. of the 19th European Symposium on Artificial Neural Networks (ESANN 2011)*, pp. 183-18, Bruges, Belgium, Apr. 2011.
- **C. Alzate** and J. A. K. Suykens. Highly sparse kernel spectral clustering with predictive out-of-sample extensions. In *Proc. of the 18th European Symposium on Artificial Neural Networks (ESANN 2010)*, pp. 235-240, Bruges, Belgium, Apr. 2010,
- **C. Alzate**, M. Espinoza, B. De Moor and J. A. K. Suykens. Identifying customer profiles in power load time series using spectral clustering. In *Proc. of the 19th International Conference on Artificial Neural Networks (ICANN 2009)*, LNCS 5769, pages 315-324, Limassol, Cyprus, Sep. 2009.
- **C. Alzate** and J. A. K. Suykens. A regularized formulation for spectral clustering with pairwise constraints. In *Proc. of the 2009 International Joint Conference on Neural Networks (IJCNN 2009)*, pages 141-148, Atlanta, USA, Jun. 2009.
- **C. Alzate** and J. A. K. Suykens. Sparse kernel models for spectral clustering using the incomplete Cholesky decomposition. In *Proc. of the 2008 International Joint Conference on Neural Networks (IJCNN 2008)*, pages 3555-3562, Hong Kong, China, Jun. 2008.

- **C. Alzate** and J. A. K. Suykens. Image segmentation using a weighted kernel PCA approach to spectral clustering. In *Proc. of the 2007 IEEE Symposium on Computational Intelligence in Image and Signal Processing (CIISP 2007)*, pages 208–213, Honolulu, USA, Apr. 2007.
- **C. Alzate** and J. A. K. Suykens. ICA through an LS-SVM based kernel CCA measure for independence. In *Proceedings of the 2007 International Joint Conference on Neural Networks (IJCNN'07)*, pages 2920–2925, Orlando, USA, Aug. 2007.
- **C. Alzate** and J. A. K. Suykens. A weighted kernel PCA formulation with out-of-sample extensions for spectral clustering methods. In *Proceedings of the 2006 International Joint Conference on Neural Networks (IJCNN'06)*, pages 138–144, Vancouver, Canada, Jul. 2006.
- **C. Alzate** and J. A. K. Suykens. Extending kernel principal component analysis to general underlying loss functions. In *Proceedings of the International Joint Conference on Neural Networks (IJCNN'05)*, pages 214–219, Montreal, Canada, Aug. 2005.

Abstracts & posters

- **C. Alzate**, J. A. K. Suykens. Highly Sparse Model Representations for Kernel Spectral Clustering, *Interdisciplinary Workshop on Sparsity and Modern Mathematical Methods for High Dimensional Data*, Brussels, Belgium, 2010.
- **C. Alzate**, J. A. K. Suykens. Sparse Kernel Spectral Clustering for Large-Scale Data Analysis, *Large Graphs and Networks, Université Catholique de Louvain, UCL, Louvain-La-Neuve, Belgium*, 2010. (Invited talk).
- **C. Alzate**, J. A. K. Suykens. Kernel-Based Modeling for Spectral Clustering, *Machine Learning Group, Université Catholique de Louvain, UCL, Louvain-La-Neuve, Belgium*, 2010. (Invited talk).
- **C. Alzate**, J. A. K. Suykens. Spectral Clustering of Time Series: Identifying Profiles in Power Load Data, *29th Benelux Meeting on Systems and Control*, Heeze, The Netherlands, 2010.
- **C. Alzate**, J. A. K. Suykens. Sparse Spectral Clustering with Out-of-Sample Extensions for Large-Scale Data, *European Workshop on Challenges in Modern Massive Data Sets (EMMDS 2009)*, Copenhagen, Denmark, 2009.
- **C. Alzate** and J. A. K. Suykens, Multiway Spectral Clustering through Weighted Kernel PCA, *22nd European Conference on Operational Research (EURO 2007)*, Prague, Czech Republic, 2007. (Invited talk).
- M. Espinoza, **C. Alzate**, J. A. K. Suykens and B. De Moor, Clustering of Time Series: Looking for the Dynamics, *IAP VI/4, DYSCO Workshop*, Brussels, Belgium, 2007.
- **C. Alzate** and J. A. K. Suykens, A Contrast Function for ICA Using LS-SVM Based Formulations to Kernel CCA, *Benelearn 2007*, Amsterdam, The Netherlands, 2007.
- **C. Alzate** and J. A. K. Suykens, A Weighted Kernel PCA Approach to Graph-Based Image Segmentation, *Embeddings of Graphs and Groups into Hilbert and Banach Spaces*, Lausanne, Switzerland, 2007.
- **C. Alzate** and J. A. K. Suykens, An Out-of-Sample Extension to Spectral Clustering based on Weighted Kernel PCA and its Application to Image Segmentation, *International Workshop on Current Challenges in Kernel Methods (CCKM06)*, Brussels, Belgium, 2006.
- **C. Alzate** and J. A. K. Suykens, A Unifying Framework for Spectral Clustering based on Weighted Kernel PCA, *Benelearn 2006*, Ghent, Belgium, 2006.
- **C. Alzate** and J. A. K. Suykens, An Out-of-Sample Extension for Spectral Clustering based on Weighted Kernel PCA, *CIL Research Day*, Brussels, Belgium, 2006.

- **C. Alzate** and J. A. K. Suykens, Generalized Kernel PCA, *21st European Conference on Operational Research (EURO 2006)*, Reykjavik, Iceland, 2006. (Invited talk).
- **C. Alzate** and J. A. K. Suykens, Extending Kernel PCA to General Underlying Loss Functions, *The Analysis of Patterns Doctoral School*, Erice, Italy, 2005.
- **C. Alzate** and J. A. K. Suykens, Robust Kernel Principal Component Analysis using Huber's Loss Function, *Benelux Meeting on Systems and Control*, Houffalize, Belgium, 2005.

Academic activities

- 2005- Master thesis advisor of 7 students of the Master in Artificial Intelligence of the K.U.Leuven.
Teaching assistant. Course: Support vector machines: methods and applications. Master in Artificial Intelligence. K. U. Leuven.
- 2000-2002 **Teaching assistant.** Course: Power electronics. Universidad Nacional de Colombia.
- 2000-2002 **Teaching assistant.** Course: Digital circuits I. Universidad Nacional de Colombia.

Project involvement

OPTEC - Optimization in Engineering:

The OPTEC project corresponds to an interdisciplinary research center on optimization for engineering applications. OPTEC provides interaction between research groups within the Departments of Mechanical, Chemical, Electrical Engineering and Computer Science of the K.U.Leuven.

IAP VI/4 - DYSCO - Dynamical Systems, Control and Optimization:

The aim of this project is to structure research on systems, control (in a very broad sense) and optimization by promoting collaborative research, through networks of research teams in different Belgian universities.

MaNet - Mathematical Engineering Tools for Networks:

The MaNet project is aimed at combining data-driven mining, optimization, system identification and control in order to solve generic network problems. Particularly network applications of concepts and insights deriving from linear, multilinear algebra and kernels.

IntelliCIS - Intelligent Monitoring, Control and Security of Critical Infrastructure Systems:

The main objective of this Action is to develop innovative intelligent monitoring, control and safety methodologies for critical infrastructure systems, such as electric power systems, telecommunication networks, and water distribution systems.

POM - Prognosis for Optimal Maintenance:

POM will provide the tools needed to improve the way maintenance of industrial machinery is done. It addresses the needs of a very specific industrial sector, namely the Flemish machine builders. POM will develop tools and methodologies (e.g. data mining approaches) that will help machine builders to reduce the costs and market the whole assemble of machine plus maintenance.

Awards & honors

- 2010-2013 **FWO postdoctoral fellow:** Recipient of a postdoctoral research fellowship from the Research Foundation - Flanders (FWO).
- 2010 **Tutorial speaker:** J. A. K. Suykens, **C. Alzate**, *Support Vector Machines And Kernel Methods: New Approaches In Unsupervised Learning*. International Joint Conference on Neural Networks (IJCNN 2010), Barcelona, Spain.
- 2009 **Best student paper award:** **C. Alzate**, J. A. K. Suykens, *A regularized formulation for spectral clustering with pairwise constraints*, International Joint Conference on Neural Networks (IJCNN 2009), Atlanta, USA, Jun. 2009.
- 2009-2010 **Postdoctoral contract:** Recipient of the postdoctoral mandate PDMK/09/139 from the K.U.Leuven.
- 2007 **Outstanding poster award:** F. Ojeda, **C. Alzate**, J. A. K. Suykens, B. De Moor, *A large-scale spectral clustering with out-of-sample extension: application to gene expression data*, 15th Annual International Conference on Intelligent Systems for Molecular Biology, 6th Annual European Conference on Computational Biology, Vienna, Austria, Jul. 2007.

IT & programming skills

Operating systems (Windows, Linux, Mac OS).
Numerical computation and data analysis (Matlab, Octave).
Programming languages (Basic knowledge of: C, C++, Java, Shell scripting).
Version control (Subversion, Git).
Typesetting (\LaTeX).

Languages

Spanish (native speaker).
English (fluent).
Dutch (basic).

References

Marcelo Espinoza, *Senior Analyst - Energy Risk Evaluation*, GDFSuez, Brussels, Belgium.
Contact information: marcelo.espinoza.tapia@gmail.com

Johan Suykens, *Professor* - Department of Electrical Engineering, ESAT, K. U. Leuven, Belgium. Contact information: johan.suykens@esat.kuleuven.be