Themelis Konstantinos

Current position	Postdoctoral research associate	
Contact information	CEA Saclay, Service d'Astrophysique Orme des Merisiers, Building 709 91191 Gif-sur-Yvette, France	phone: +30 697 643 9027 email: konstantinos.themelis@cea.fr web: https://themelis.github.io/
Date of birth	23 December 1981	
Nationality	Greek	
Military obligations	Fullfiled	

Education

University of Athens

10.2005 – 01.2012

Ph.D. in Bayesian methods for hypersectral image unmixing
"Bayesian signal processing techniques for hyperspectral image unmixing"
Department of Informatics and Telecommunications
Supervisor: Sergios Theodoridis, Professor, UOA

University of Patras

09.2000 – 09.2005

Diploma degree in Computer Engineering and Informatics
Thematic area: "Decision feedback equalization of MIMO channels"
GPA: 8.49/10

Research interests

Statistical signal processing with emphasis on Bayesian modelling and approximate inference methods.
Probabilistic machine learning with application to image processing and adaptive estimation.
Bayesian inverse problems for applications to remote sensing, e.g. development of (un/semi)supervised methods for hyperspectral image unmixing.

Awards

10.2003 – 09.2004

Hellenic State Scholarship Foundation
Honorary Distinction Award for academic excellence

Fellowships

08.2017 – 12.2018

Participant of the **Enhanced Eurotalents** Marie Sklodowska-Curie Actions Programm co-funded by the European Commission and managed by the French Atomic Energy and Alternative Energies Commission (CEA) with the research proposal "PRobabilistic cOmponent separaTion tEchniqUes with application to aStrophysical data analysis – PROTEUS".

Working experience

University of Piraeus

11.2005 – 12.2006

Web developer, linux system administrator

National Observatory of Athens

01.2007 – 12.2010

Linux system administrator
High-Performance Computing Cluster development

National Observatory of Athens

05.2013 – 09.2014

Linux system administrator
Java, OpenSSO developer

Teaching experience

University of Athens

09.2009 – 02.2010

"Introduction to Matlab", self-paced introduction to Matlab, supporting the course "Digital signal processing" by Prof. S. Theodoridis

Programming skills

Scientific computing: C++, Python 3, and Matlab
Programming: C, PHP, Java, Javascript, MySQL, programming
Systems: Experienced Unix/Linux system administrator, Debian HPC cluster developer

Peer reviewing

Journals

IEEE Transactions on Image Processing
IEEE Transactions on Neural Networks and Learning Systems
IEEE Transactions on Signal Processing
IEEE Signal Processing Letters
IEEE Transactions on Geoscience and Remote Sensing
IEEE Journal of Selected Topics in Signal processing
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing
Elsevier Signal Processing Journal

Conferences

MLSP, IEEE Workshop on Machine Learning and Signal Processing
SSP, IEEE Workshop on Statistical Signal Processing
EUSIPCO, European Signal Processing Conference
ICASSP, IEEE International Conference on Acoustics, Speech, and Signal Processing
DSP, International Conference on Digital Signal Processing

Project participation

Greek & EU funded projects

11.2012

THALES: "Secure wireless nonlinear communications at the physical layer." Nov. 2012 – 2015

9.2012

ARISTEIA: "Advancing Hyperspectral Image Processing for Planetary Mineral Exploration and Thematic Mapping: the Case of Planet Mars." Sep. 2012 – 2015.

EU funded projects

1.2014

EIS: European Ionosode and Neutron Monitor Service, 2014-2015.

9.2014

A-Effort: Athens Effective Solar Flare Forecasting, 2014-2015.

3.2015

PHySIS: Sparse signal processing technologies for hyperspectral imaging systems, 2015-2017.

3.2017

DEDALE: Data Learning on Manifolds and Future Challenges, 2017-2018.

Attended seminars and conferences

Conferences

DEDALE workshop, Nice, 2017 (tutorial on ABC)
EUSIPCO Nice, 2016, (poster presentation)
WHISPERS Tokyo, 2015 (oral talk)
Sustain Workshop Bristol, 2014 (poster presentation)
ICASSP Florence, 2014 (oral talk)
WHISPERS Florida, 2013 (oral talk)
EPSC Rome, 2012, (oral talk)
Eusipco 2008, Lausanne (poster presentation)

Seminars

Convex optimization
Compressive sensing

Memberships

Member of EURASIP

Member of the Technical Chamber of Greece

Languages

Greek (native), English (fluently), German (decent), French (decent)

Phd thesis

K. E. Themelis, “Bayesian signal processing techniques for hyperspectral image unmixing”, Department of Informatics and Telecommunications, University of Athens, Jan. 2012.
http://goo.gl/mkbswl

Referees

Athanasios A. Rontogiannis, Senior researcher NOA, email: tronto@noa.gr

Sergios Theodoridis, Professor UOA, email: stheodor@di.uoa.gr

Konstantinos K. Koutroumbas, Senior researcher, NOA, email: koutroum@noa.gr

Jean-Luc Starck, head of the Cosmostat lab, CEA, Saclay,

email: jean-luc.starck@cea.fr

Research statement

In my research, I have the pleasure of delving into statistical estimation methods, especially those emanating from a probabilistic viewpoint. During my PhD studies I have focused on developing Bayesian models and inference techniques for the problem of semi-supervised learning, with application to hyperspectral image unmixing. A major contribution in this field, back in 2008, was to cast the problem of spectral unmixing as a sparse signal estimation problem and tackle it with the LARS algorithm. Since then, a plethora of sparse unmixing methods have been proposed in the literature. Capitalizing on this idea and addressing the same task from a Bayesian perspective, we have proposed a sparsity-imposing Bayesian model based on a scale mixture of truncated Gaussian distributions to account for the physical nonnegativity constraint of the model parameters. Simultaneously, I have cultivated an interest in lightweight, approximate Bayesian inference techniques, which operate as alternative to MCMC sampling and are well-suited for large scale problems. Such a method is the iterative conditional expectations method we have proposed, that has been shown to serve as an approximation to variational Bayesian inference.

As a postdoc researcher, I have continued my line of research by introducing variational Bayes inference in the field of time-adaptive/online signal estimation. Tracking a time-varying signal using a Bayesian estimator was a cumbersome task, usually involving sequential MCMC sampling or particle filtering. My work entailed the development of an RLS-type variational Bayes algorithm for the adaptive estimation of sparse time-varying signals (the proposed framework is similar to the celebrated stochastic variational inference). This work has been also extended to treat group-sparse signals, by utilizing a conditional autoregressive model (CAR) that captures spatial signal correlation.

Another highlight in my experience as a postdoc researcher was the cooperation with Prof. S. Theodoridis in the preparation of his book "Machine Learning, A Bayesian and Optimization Perspective". I helped particularly in the preparation of the Bayesian chapters of the book, and in this time I had the priviledge to learn and implement many algorithms, probabilistic or not, and build up my knowledge and skills.

Finally, my current research interests are in the area of robust, sparse and low-rank matrix/tensor decomposition. For example, recent methods for sparse and

low rank matrix approximation do not take into account the spatial information of the observed data. Such information is prominent e.g. in remote sensing data. Hence, it would be meaningful to extent the recently proposed CAR model in the 2D-domain, so as to exploit the intrinsic spatial correlation of the sparse matrix component.

Peer reviewed publications

Journals

1. P. V. Giampouras, A. A. Rontogiannis, K. E. Themelis, K. D. Koutroumbas, “Online sparse and low-rank subspace learning from incomplete data: A Bayesian view”, Signal Processing, vol. 137, pp. 199-212, Aug. 2017.
2. P. V. Giampouras, K. E. Themelis, A. A. Rontogiannis, K. D. Koutroumbas, “Simultaneously sparse and low-rank abundance matrix estimation for hyperspectral image unmixing”, IEEE Transactions on Geoscience and Remote Sensing, vol. 54, no. 8, pp. 4775-4789, Aug. 2016
3. K. E. Themelis, A. A. Rontogiannis, K. D. Koutroumbas, “Variational Bayes group sparse time-adaptive parameter estimation with either known or unknown sparsity pattern", IEEE Transactions on Signal Processing, vol.64, no.12, pp.3194-3206, June 2016.
4. A. Belehaki, I. Tsagouri, I. Kutiev, P. Marinov, B. Zolesi, M. Pietrella, K. E. Themelis, P. Elias, K. Tziotziou, “The European Ionosonde Service: nowcasting and forecasting ionospheric conditions over Europe for the ESA Space Situational Awareness services”, Journal of Space Weather and Space Climate, 5 A25, 2015.
5. K. E. Themelis, A. A. Rontogiannis, K. D. Koutroumbas, “A variational Bayes framework for sparse adaptive estimation”, *IEEE Transactions on Signal Processing*, 62(18), 4723-4736, Sept. 2014.
6. K.E. Themelis, A.A. Rontogiannis, K.D. Koutroumbas, “A Novel Hierarchical Bayesian Approach for Sparse Semi-Supervised Hyperspectral Unmixing”, *IEEE Transactions on Signal Processing*, 60(2), 585-599, Feb. 2011.
7. K.E. Themelis, F. Schmidt, O. Sykioti, A.A. Rontogiannis, K.D. Koutroumbas, I.A. Daglis, “On the Unmixing of MEx/OMEGA Hyperspectral Data”, *Planetary and Space Science*, 68, 34-41, 2012.

Conferences

1. K. E. Themelis, A. A. Rontogiannis, and K. D. Koutroumbas, “Online Bayesian group sparse parameter estimation using a Generalized Inverse Gaussian Markov chain”, in Proceedings of the 23th European Signal Processing Conference (EUSIPCO), Nice, France, Sep. 2015.
2. P. V. Giampouras, A. A. Rontogiannis, K. E. Themelis and K. D. Koutroumbas, “Online Bayesian Low-Rank Subspace Learning from Partial Observations”, in Proceedings of the 23th European Signal Processing Conference (EUSIPCO), Nice, France, Sep. 2015
3. P. V. Giampouras, A. A. Rontogiannis, K. D. Koutroumbas and K. E. Themelis, “A sparse reduced-rank regression approach for hyperspectral image unmixing”, in Proceedings of the 3rd International Workshop on Compressed Sensing Theory and its Application to Radar,Sonar and Remote Sensing (CoSeRa), Pisa,Italy, June 2015.
4. P. V. Giampouras, K. E. Themelis, A. A. Rontogiannis and K. D. Koutroumbas, “Hyperspectral image unmixing via silultaneously sparse and low rank abundance matrix estimation”, in Proceedings of the 7th Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing (IEEE WHISPERS), Tokyo, June 2015.
5. G, Papageorgiou, P. Bouboulis, S. Theodroridis, K.E. Themelis, “Robust Linear Regression Analysis - The Greedy Way”, In Proceedings of the 22th European Signal Processing Conference (EUSIPCO), Lisbon, Portugal, Sep. 2014.
6. K.E. Themelis, A.A. Rontogiannis, and K.D. Koutroumbas, “Group-sparse adaptive variational Bayes estimation”, In Proceedings of the 22th European Signal Processing Conference (EUSIPCO), Lisbon, Portugal, Sep. 2014.
7. P.V. Giampouras, K.E. Themelis, A.A. Rontogiannis, and K.D. Koutroumbas, “A

variational Bayes algorithm for joint-sparse abundance estimation", In Proceedings of the 6th Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing (IEEE WHISPERS), Lausanne, June 2014.
8. K.E. Themelis, A.A. Rontogiannis, and K.D. Koutroumbas,"Adaptive variational sparse Bayesian estimation," Acoustics, Speech and Signal Processing (ICASSP), IEEE International Conference on, May 2014.
9. K.E. Themelis, A.A. Rontogiannis, and K.D. Koutroumbas,"Variational Bayesian sparse adaptive filtering using a Gauss-Seidel recursive approach," In Proceedings of the 21th European Signal Processing Conference (EUSIPCO), Marocco, Sep. 2013.
10. A.A. Rontogiannis, K.E. Themelis, O. Sykioti and K.D. Koutroumbas, "A fast variational Bayes algorithm for sparse semi-supervised unmixing of OMEGA/Mars data", In Proceedings of the 5th Workshop on Hyperspectral Image and Signal Processing: Evolution in Remote Sensing (IEEE WHISPERS), Florida, June 2013.
11. A.A. Rontogiannis, K.E. Themelis, K.D. Koutroumbas, "A Fast Algorithm for the Bayesian Adaptive Lasso", *In Proceedings of the 20th European Signal Processing Conference (EUSIPCO)*, Bucharest, Aug. 2012.
12. K.E. Themelis, A.A. Rontogiannis, K.D. Koutroumbas, "Sparse Semi-Supervised Hyperspectral Unmixing Using a Novel Iterative Bayesian Inference Algorithm", *In Proceedings of the 19th European Signal Processing Conference (EUSIPCO)*, Barcelona, Sept. 2011.
13. K.E. Themelis, A.A. Rontogiannis, O. Sykioti, K.D. Koutroumbas, I.A. Daglis, F. Schmidt, "On the Unmixing of MEx/OMEGA Hyperspectral Data", *In Proceeding of the European Planetary Science Congress (EPSC)* , Rome, Sept. 2010.
14. K.E. Themelis, A.A. Rontogiannis, O. Sykioti, K.D. Koutroumbas, I.A. Daglis, F. Schmidt, "On the unmixing of MEx/OMEGA hyperspectral data using a MAP Estimator", Geophysical Research Abstracts, 12, *PS7.1 Spectroscopy and radiative transfer in Planetary atmospheres*, EGU General Assembly, Vienna, April 2010.
15. K.E. Themelis, A.A. Rontogiannis, K.D. Koutroumbas, "Semi-Supervised Hyperspectral Unmixing via the Weighted Lasso", *In Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Dallas, TX, March 2010.
16. K.E. Themelis, A.A. Rontogiannis, "A Soft Constrained MAP Estimator for Supervised Hyperspectral Signal Unmixing", *In Proceedings of the 16th European Signal Processing Conference (EUSIPCO)*, Lausanne, Aug. 2008.
17. Anogianakis G., Kapritsos E., Makris C., Mpaltas N., Themelis A., Perdikuri K., Tsakalidis A., "Idenitification of protein patterns in nucleic acid sequences and exploration of synonymous codons in tissue differentiation", Computational Biology and Genome Information Conference, 2005.