Computational Intelligence for Signal and Image Processing in Industrial and Environmental Applications

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Abstract
Adaptability and advanced services for industrial manufacturing require an intelligent technological support for understanding the production process characteristics also in complex situations. Quality control is specifically one of the activities in manufacturing which is very critical for ensuring high-quality products and competitiveness on the market.
Similarly, environmental monitoring increasingly needs adaptive approaches to deal with variability and evolvability of the environmental phenomena. Earth observation and pollution monitoring are very demanding in this perspective.
Computational intelligence can provide additional flexible techniques for designing and implementing monitoring and control systems, which can be configured from behavioral examples or by mimicking approximate reasoning processes to achieve adaptable systems.
This talk will analyze the opportunities offered by computational intelligence technologies to support signal and image processing for adaptable operations and intelligent services both in industrial applications, specifically focusing on manufacturing processes and quality control, and in environmental monitoring, focusing on Earth observation and pollution monitoring.

Biography
Vincenzo Piuri has received his Ph.D. in computer engineering at Politecnico di Milano, Italy (1989). He is Full Professor in computer engineering at the Università degli Studi di Milano, Italy (since 2000). He has been Associate Professor at Politecnico di Milano, Italy and Visiting Professor at the University of Texas at Austin and at George Mason University, USA.
His main research interests are: computational intelligence, signal and image processing, intelligent systems, machine learning, pattern analysis and recognition, theory and industrial applications of neural networks, intelligent measurement systems, industrial applications, biometrics, fault tolerance, digital processing architectures, and cloud computing infrastructures. Original results have been published in more than 350 papers in international journals, proceedings of international conferences, books, and book chapters.
He is Fellow of the IEEE, Distinguished Scientist of ACM, and Senior Member of INNS. He is IEEE Past Vice President for Technical Activities (2016) and has been IEEE Vice President for Technical Activities, IEEE Director, President of the IEEE Computational Intelligence Society, Vice President for Education of the IEEE Biometrics Council, Vice President for Publications of the IEEE Instrumentation and Measurement Society and the IEEE Systems Council, and Vice President for Membership of the IEEE Computational Intelligence Society. He is Editor-in-Chief of the IEEE Systems Journal (2013-17), and has been Associate Editor of the IEEE Transactions on Neural Networks and the IEEE Transactions on Instrumentation and Measurement.
He received the IEEE Instrumentation and Measurement Society Technical Award (2002) for the contributions to the advancement of theory and practice of computational intelligence in measurement systems and industrial applications. He is Honorary Professor at the Obuda University, Budapest, Hungary (since 2014), Guest Professor at Guangdong University of Petrochemical Technology, China (since 2014), and Guest Professor at the Muroran Institute of Technology, Japan (since 2016).
More information are available at http://www.di.unimi.it/piuri
Deterministic and Bayesian Sparsity enforcing models in signal and image processing
by Ali Mohammad-Djafari, Centrale-Supélec, France

Abstract
In this talk, first examples of sparse signals and images are presented. Then, different deterministic ways of
modeling and sparse representation methods and algorithms (MP, OMP, LASSO, IHT, ADMM ...) are
summarized. The Bayesian Maximum A Posteriori (MAP) approach and its link with regularization is
mentioned. The prior models which enforce sparsity are classified in four main classes:
- Heavy tailed: Double Exponential, Generalized Gaussian, Student-t, Cauchy;
- Mixture models: Finite mixture of Gaussians,
- Infinite Scaled Gaussian mixture model and its relation to Student-t and their
  equivalent hierarchical models with hidden variables;
- General Gauss-Markov-Potts models.
Using these priors in a Bayesian approach needs appropriate Computational tools which are summarized as:
Joint Maximum A Posteriori (JMAP), MCMC and Variational Bayesian Approximation (VBA). Finally, the
applications of these prior models in Inverse Problems such as
X ray Computed Tomography and Microwave inverse scattering imaging systems are presented.
Research Director in CNRS, France

Abstract
Ali Mohammad-Djafari received the B.Sc. degree in electrical engineering from
Polytechnic of Teheran, in 1975, the diploma degree (M.Sc.) from Ecole Supérieure
d’Electricité (SUPELEC), Gif sur Yvette, France, in 1977, the “Docteur-Ingénieur”
(Ph.D.) degree and “Doctorat d’Etat” in Physics, from the University of Paris Sud 11
(UPS), Orsay, France, respectively in 1981 and 1987.

He was Assistant Professor at UPS for two years (1981-1983). Since 1984, he has a
permanent position at “Centre national de la recherche scientifique (CNRS)” and works
at “Laboratoire des signaux et systèmes (L2S)” at Centrale-Supélec. He was a visiting
Associate Professor at University of Notre Dame, Indiana, USA during 1997-1998. From 1998 to 2002, he
has been at the head of Signal and Image Processing division at this laboratory. Presently, he is “Directeur de
recherche” and his main scientific interests are in developing new probabilistic methods based on Bayesian
inference, Information Theory and Maximum Entropy approaches for Inverse Problems in general in all
aspects of data processing, and more specifically in imaging and vision systems: image reconstruction, signal
and image deconvolution, blind source separation, sources localization, data fusion, multi and hyper spectral
image segmentation. The main application domains of his interests are Medical imaging, Computed
Tomography (X rays, PET, SPECT, MRI, microwave, ultrasound and eddy current imaging) either for
medical imaging or for Non Destructive Testing (NDT) in industry, multivariate and multi-dimensional data,
space-time signal and image processing, data mining, clustering, classification and machine learning
methods for biological or medical applications. He has supervised more than 20 Ph.D. Thesis, more than 20
Post-doc research activities and more than 50 M.Sc. Student research projects. He has more than 60 full
journal papers and more than 300 papers in national and international conferences. He has organized or co-
organized more than 10 international workshops and conferences. He has been expert for a great number of
French national and international projects. Since 1988 he has many teaching activities in M.Sc. and Ph.D.
Level in SUPELEC, University of Paris sud, ENSTA and Ecole centrale de Paris.