

Deniz Gencaga

Assistant Professor

Electrical and Electronic Engineering Department
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RESEARCH INTERESTS

Signal and Image Processing

Machine Learning

Knowledge Discovery and Data Mining

Bayesian Statistics

Information Theory

Causality and Uncertainty analysis

Speech Processing

Source Separation

Heavy-Tailed processes

Chaos Theory

Remote Sensing

System Identification and Acoustic Echo Cancellation

EXPERIENCE

Assistant Professor, Antalya Bilim University, Department of Electrical and Electronics Engineering 2017-present.

Visiting member, Machine Learning for Signal Processing Group, Carnegie Mellon University 2016, 2017.

Special Faculty Member/ Postdoctoral Fellow, Robotics Institute, Carnegie Mellon University, Pittsburgh, U.S.A. 2014–2016.

Senior Statistical Scientist, Alcoa Inc., New Kensington, U.S.A. 2012–2014.

Research Associate, Center for Space Sciences at the University of Texas at Dallas, Richardson, U.S.A. 2011–2012.

Postdoctoral Scientist, Middle Tennessee State University, Department of Physics and Astronomy, TN, U.S.A. 2011.

Research Associate, National Oceanic and Atmospheric Administration (NOAA) and Cooperative Remote Sensing and Technology Center at the City University of New York, New York, U.S.A. 2009–2011.

Senior Research Support Specialist, University at Albany (SUNY), Department of Physics, NY, U.S.A. 2007–2009.

Research and Teaching Assistant, Bogazici University, Department of Electrical and Electronic Engineering, 2000–2007.

Visiting Ph.D. Student, National Research Institute of Italy (Consiglio Nazionale delle Ricerche), Italy, 2003–2004.

EDUCATION

Ph.D. Electrical and Electronic Engineering, Bogazici University, 2007.

Ph.D. Dissertation: *Sequential Bayesian Modeling of Non-Gaussian Non-Stationary Processes*

Visiting Ph.D. student Consiglio Nazionale delle Ricerche, 2003,2004.

M.S. Electrical and Electronic Engineering, Bogazici University, 2000.

M.S. Thesis: *Adaptive Escalator Algorithms for System Identification and Their Application to Acoustic Echo Cancellation*

B.S. Electronics and Telecommunication Engineering, Yildiz Technical University, 1997.

AWARDS

Best Paper Award, 4th International Workshop on Biometrics and Forensics, Cyprus, 2016.

Senior Member of IEEE, 2012.

NATO-TUBITAK Research Fellowship, Consiglio Nazionale delle Ricerche, Italy, 2004.

Best Student Paper Award, 13th IEEE Conference on Signal Processing and Communications Applications, May 2005.

The European Research Consortium for Informatics and Mathematics (ERCIM) "**Alain Bensoussan**" **Postdoctoral Fellowship**, 2006 (preferred another offer).

Nomination and selection to the **Sigma Xi** Scientific Research Honor Society.

INVITED TALKS

NASA Jet Propulsion Laboratory, "Identification of Relevant Climate Variables using Information-Theoretic Approaches", October 2008.

Clarkson University, Int. Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering, "A Brief Look at Modeling and Learning Dynamical Systems", July, 2015.

Carnegie Mellon University, Machine Learning for Signal Processing Group, "Particle Filters and Modeling Heavy-tailed processes", 2015.

Columbia University, Machine Learning Group, "Comparison of Information-Theoretic methods to estimate the information flow in a dynamical system", April 2011.

University at Albany (SUNY), "Alpha Stable Processes and their Application to Seismic Data Modeling", November 2007.

Consiglio Nazionale delle Ricerche (CNR), Italy, "Dependent Component Analysis of Non-Stationary Gaussian Signals", October 2005.

PROFESSIONAL ACTIVITIES

IEEE Chair, IEEE Pittsburgh Chapter, Signal Processing and Control Systems Societies, Pittsburgh, U.S.A. 2013–2017.

Guest Editor, Special Issue on Transfer Entropy (16 papers), Entropy Journal.

General Chair, 1st International Electronic Conference on Entropy and its Applications, Nov, 2014.

Machine Learning Session Chair, 2nd International Electronic Conference on Entropy and its Applications, Nov, 2015.

Machine Learning Session Chair, 3rd International Electronic Conference on Entropy and its Applications, Nov, 2016.

Editorial Board Member, Entropy Journal.

Organizing Committee Assistant, 31st International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering (MaxEnt 2011), Canada, 2011.

Local Organizer, 27th International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering (MaxEnt 2007), NY, 2007.

Reviewer, 31st International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering (MaxEnt 2011), Canada, 2011.

Reviewer, 27th International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering (MaxEnt 2007)

Reviewer, 15th European Signal Processing Conference (EUSIPCO 2007), Poland, 2007.

Reviewer, 14th European Signal Processing Conference (EUSIPCO 2006), Italy, 2006.

Reviewer, IEEE Int. Conference on Acoustics, Speech and Signal Processing (ICASSP 2006), France, 2006.

Reviewer, 13th European Signal Processing Conference (EUSIPCO 2005), Turkey, 2005.

JOURNAL REVIEWING

IEEE Transactions on Signal Processing

Digital Signal Processing

IEEE Transactions on Image Processing

Entropy Journal

IEEE Transactions on Information Theory

Journal of the Acoustical Society of America

IEEE Transactions on Neural Networks

IEE Proc.Vision, Image and Signal Processing

PUBLICATIONS

Journals

- [1] Deniz Gencaga, Kevin H Knuth, and William B Rossow. “A Recipe for the Estimation of Information Flow in a Dynamical System”. In: *Entropy* 17.1 (2015), pp. 438–470.
- [2] Deniz Gencaga, Ercan E Kuruoglu, and Aysin Ertuzun. “Modeling non-Gaussian time-varying vector autoregressive processes by particle filtering”. In: *Multidimensional Systems and Signal Processing* 21.1 (2010), p. 73.
- [3] Deniz Gencaga, Aysin Ertuzun, and Ercan E Kuruoglu. “Modeling of non-stationary autoregressive alpha-stable processes by particle filters”. In: *Digital signal processing* 18.3 (2008), pp. 465–478.
- [4] Deniz Gencaga, Ercan E Kuruoglu, Aysin Ertuzun, and Sinan Yildirim. “Estimation of time-varying AR SαS processes using Gibbs sampling”. In: *Signal Processing* 88.10 (2008), pp. 2564–2572.

Conference Proceedings

- [5] Rita Singh, Deniz Gencaga, and Bhiksha Raj. “Formant manipulations in voice disguise by mimicry (BEST PAPER AWARD)”. In: *Biometrics and Forensics (IWBF), 2016 4th International Workshop on*. IEEE. 2016, pp. 1–6.
- [6] Rita Singh, Joseph Keshet, Deniz Gencaga, and Bhiksha Raj. “The relationship of voice onset time and voice offset time to physical age”. In: *Acoustics, Speech and Signal Processing (ICASSP), 2016 IEEE International Conference on*. IEEE. 2016, pp. 5390–5394.
- [7] Rita Singh, Bhiksha Raj, and Deniz Gencaga. “Forensic anthropometry from voice: an articulatory-phonetic approach”. In: *Information and Communication Technology, Electronics and Microelectronics (MIPRO), 2016 39th International Convention on*. IEEE. 2016, pp. 1375–1380.
- [8] D. Gencaga, N. K. Malakar, and D. J. Lary. “Survey on the estimation of mutual information methods as a measure of dependency versus correlation analysis”. In: *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*. Vol. 1636. American Institute of Physics Conference Series. Dec. 2014, pp. 80–87. DOI: 10.1063/1.4903714. arXiv: 1401.3358 [stat.ML].
- [9] N. K. Malakar, D. J. Lary, D. Gencaga, A. Albayrak, and J. Wei. “Towards identification of relevant variables in the observed aerosol optical depth bias between MODIS and AERONET observations”. In: *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*. Ed. by U. von Toussaint. Vol. 1553. American Institute of Physics Conference Series. Aug. 2013, pp. 69–76. DOI: 10.1063/1.4819985. arXiv: 1302.2969 [stat.ML].
- [10] Nabin K Malakar, David J Lary, A Moore, D Gencaga, B Roscoe, Arif Albayrak, and Jennifer Wei. “Estimation and bias correction of aerosol abundance using data-driven machine learning and remote sensing”. In: *Intelligent Data Understanding (CIDU), 2012 Conference on*. IEEE. 2012, pp. 24–30.
- [11] Deniz Gencaga. “Comparison of Information-Theoretic Methods to estimate the information flow in a dynamical system”. In: *NASA GISS New York Workshop on Computer, Earth and Space Science*. Ed. by M. Way and C. Naud. 2011, p. 72.
- [12] D. Gencaga, D. F. Carbon, and K. H. Knuth. “Characterization of Interstellar Organic Molecules”. In: *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*. Ed. by M. D. S. Lauretto, C. A. D. B. Pereira, and J. M. Stern. Vol. 1073. American Institute of Physics Conference Series. Nov. 2008, pp. 286–293. DOI: 10.1063/1.3039011.
- [13] Deniz Gencaga, Kevin H Knuth, and William B Rossow. “Information-Theoretic Methods for Identifying Relationships among Climate Variables”. In: *NASA Earth-Sun Systems Technology Conference*. 2008. URL: <https://esto.nasa.gov/2012test/conferences/estc2008/>.

- [14] D. Gencaga, E. E. Kuruoglu, and A. Ertuzun. “Bayesian Separation of Non-Stationary Mixtures of Dependent Gaussian Sources”. In: *Bayesian Inference and Maximum Entropy Methods in Science and Engineering*. Ed. by K. H. Knuth, A. E. Abbas, R. D. Morris, and J. P. Castle. Vol. 803. American Institute of Physics Conference Series. Nov. 2005, pp. 257–265. DOI: 10.1063/1.2149803.
- [15] D Gencaga, EE Kuruoglu, and A Ertuzun. “Time-varying autoregressive parameter estimation of Cauchy processes by particle filters (BEST STUDENT PAPER AWARD)”. In: *Signal Processing and Communications Applications Conference, 2005. Proceedings of the IEEE 13th*. IEEE. 2005, pp. 408–411.
- [16] Deniz Gencaga and Aysin Ertuzun. “On the performance comparison of gradient-type joint process estimators in adaptive signal processing”. In: *Signal Processing Conference, 2005 13th European*. EU-SIPCO. 2005, pp. 1371–1374. ISBN: 9781604238211.
- [17] Deniz Gencaga, E Kuruoglu, and E Aysin. “Synthetic aperture radar image enhancement using particle filters”. In: *ESA-EUSC 2005: Image Information Mining Theory and Application to Earth Observation*. European Space Agency, ESRIN. 2005. URL: <http://wiki.services.eoportal.org/tiki-index.php?page=ESA-EUSC-2005>.
- [18] Deniz Gencaga, Ercan E Kuruoglu, and Aysin Ertuzun. “Estimation of time-varying autoregressive symmetric alpha stable processes by particle filters”. In: *Signal Processing Conference, 2005 13th European*. EUSIPCO. 2005, pp. 1363–1366. ISBN: 9781604238211.
- [19] D Gencaga and A Ertuzun. “Online Independent Component Analysis (English), Cevrimici Bagimsiz Bilesen Ayristirilmesi”. In: *Signal Processing and Communications Applications Conference, 2003. Proceedings of the SIU 11th*. 2003, pp. 7–10.
- [20] D Gencaga, L Arslan, and A Ertuzun. “Real-time Formant Frequency Estimator for Speech Signals (English), Konusma Isaretleri icin Gercek Zamanli Bir Formant Frekans Kestiricisi”. In: *Signal Processing and Communications Applications Conference, 2002. Proceedings of the SIU 10th*. 2002, pp. 471–475.
- [21] D Gencaga and A Ertuzun. “Adaptive Escalator Filter for Acoustic Echo Cancellation (English), Akustik Yanki Giderimi icin Merdiven Tipi Uyarlanir Suzgec Yapisi”. In: *Signal Processing and Communications Applications Conference, 2002. Proceedings of the SIU 10th*. 2002.
- [22] D Gencaga and A Ertuzun. “Adaptive Escalator Filter for System Identification (English), Sistem Belirlenmesi icin Merdiven Tipi Uyarlanir Suzgec Yapisi”. In: *Signal Processing and Communications Applications Conference, 2002. Proceedings of the SIU 10th*. 2002.

Patent

- [23] J. Weaver, K. Crum, J. Nichols, D. Iwig, S. Orkis, G. Carkin, D. Gencaga, S. Sunday, I. Harrison, R. Smith, S. Parks, and M. Gershenzon. “Fertilizer compositions and methods of making and using the same”. United States Patent 9,527,779. 2016.

Technical Report

- [24] D. Gencaga, E. Kuruoglu, and A. Ertuzun. *Estimation of TimeVarying Autoregressive Symmetric Alpha Stable Processes by Particle Filters*. Tech. rep. ISTI-CNR-2006-TR-45. Istituto di Scienza e Technologie dell’Informazione, Consiglio Nazionale delle Ricerche, 2006.

Published Abstract

- [25] D. Gencaga, M. Tse, W. Rossow, and K. Knuth. *Estimating Entropies and Mutual Information with Error Bars*. 9th World Conference of the Int. Soc. for Bayesian Analysis (ISBA 2008). 2008. URL: <http://old.bayesian.org/events/isba2008/documents/ISBA2008AbstractBooklet.pdf>.

PROJECTS

Speech and Audio Biometrics (2016-2017)

Analysis of micro features of speech, such as the Voice Onset Time and Voice Offset Time, in the prediction of human properties such as height and age.

Digital forensics applications using computer vision and machine learning (2014-2016)

Research for the development of a software package on Cyber Mission Readiness and Expertise Evaluation. It has been designed to provide an automated evaluation of cyber-security personnel at mission critical positions.

Design of experiments and analysis of industrial data using advanced analytics (2012-2014)

Design of experiments for the research and development activities on Aluminum processing and manufacturing and analysis of industrial data sets pertaining to tribology, milling and ingot casting processes obtained in the research facilities of Alcoa Inc.

Applications of machine learning for remote sensing of aerosols (2011-2012)

Identification of the reasons of biases in the Aerosol Optical Depth (AOD) measurements obtained by the satellite based Moderate Resolution Imaging Spectroradiometer (MODIS) instrument and the ground-based Aerosol Robotic Network (AERONET) system.

The assessment of climate feedback processes (2009-2011)

Design and test of advanced statistical tools to better understand climate feedback processes using information-theoretical concepts, such as Mutual Information and Transfer Entropy.

Identifying relationships among Earth climate data (2007-2009)

Development of information-theoretical techniques to identify relevant climate variables and to quantify spatial and temporal aspects of their interactions and application of these techniques on data taken from the International Satellite Cloud Climatology Project (ISCCP).

Characterization of interstellar organic molecules (2007-2009)

Development of Bayesian source separation techniques to identify complex organic molecules in interstellar clouds by analyzing their infrared spectra.

Sequential Bayesian modeling of non-stationary non-Gaussian processes and its application to seismic signal modeling (2002-2007)

Design and test of flexible Bayesian methods to model heavy-tailed processes and to denoise Synthetic Aperture Radar images.

System identification: Acoustic echo cancellation (1999-2000)

Research on parallel adaptive filters to remove acoustic echoes in closed environments.

TEACHING EXPERIENCE

Assistant Professor

"EE341 Feedback and Control Systems", Fall 2017 semester, Department of Electrical and Electronic Engineering, Antalya Bilim University.

"EE201 Circuit Theory", Fall 2017 semester, Department of Electrical and Electronic Engineering, Antalya Bilim University.

Guest Lecturer

"Bayesian Data Analysis and Signal Processing", Fall 2007 semester, Dept. of Physics, SUNY Albany.

"Computational Physics", Spring 2008 semester, Department of Physics, SUNY Albany.

"Computational Physics", Spring 2009 semester, Department of Physics, SUNY Albany.

"Numerical Methods in Physics", Department of Physics, University of Texas at Dallas, 2012.

Teaching Assistant (2000-2007)

Digital Signal Processing

Introduction to Speech processing

Introduction to Information Theory

Numerical methods in Electrical Engineering

Signals and Systems

Electrical Circuits Laboratory

Communication Systems

Communication Laboratory

PROFESSIONAL MEMBERSHIPS

The Institute of Electrical and Electronics Engineers (IEEE), 1999-present

Association for Computing Machinery (ACM), 2012-2017

American Statistical Association (ASA), 2012-2017

International Society for Bayesian Analysis (ISBA), 2008, 2016

Assoc. for the Advancement of Artificial Intelligence (AAAI), 2013-2014

The American Assoc. for the Advancement of Science (AAAS), 2011-2014

Society for Industrial and Applied Mathematics (SIAM), 2012-2013

American Society of Mechanical Engineers (ASME), 2012-2014

Institute of Industrial Engineers (IIE), 2013-2014

Institute of Mathematical Statistics (IMS), 2012-2014

The New York Academy of Sciences (NYAS), 2010-2013

American Geophysical Union (AGU), 2008-2012

American Meteorological Society (AMS), 2010-2013

The European Association for Signal and Image Processing, 2005

References are available upon request.