Swarnendu Kar

CONTACT

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SUMMARY

- Electrical Engineering Ph.D. student with research focus on resource optimization, beamforming and sensor fusion algorithms
- Strong analytical skills with demonstrated scientific excellence (4 journal, 6 conference publications/presentations, 1 technical report)
- Two-semester internship experience on research and development of audio enhancement and speech processing algorithms for smartphone applications
- Two-year software engineering experience with image/video codecs using DSP
- Strong programming skills in C, Java, Android, Matlab and Mathematica

OBJECTIVE

Seeking a career where my skills on signal processing algorithms and DSP programming will lead to innovation on smart device platforms

EDUCATION

- Ph.D., Electrical Engineering, GPA 3.86 (Expected) Apr. 2013
  Syracuse University, Syracuse, New York
  Advisor: Pramod K. Varshney
  Dissertation: Power efficient design of wireless sensor networks
- M.S., Mathematics, GPA 3.8 May 2009
  Syracuse University, Syracuse, New York
- B.Tech., Electronics and Electrical Communications Engineering, GPA 8.4/10 May 2004
  Indian Institute of Technology (IIT), Kharagpur, India

INDUSTRIAL EXPERIENCE

- Graduate Technical Intern, Smart Devices Innovation group Sept. 2012 – ongoing
  Intel Corporation, Hillsboro, OR, USA
- Engineer, Video Processing Systems group July 2004 – July 2006
  Ittiam Systems, Bangalore, India

SKILLS

- *Audio enhancement and processing:* Acoustic Echo cancellation, Keyphrase detection
- *Algorithms:* Estimation, Kalman filtering, convex optimization, Dynamic programming
- *Embedded software:* Android, DSP programming, H.264 video codecs
- *Programming:* C, Java, R, MATLAB, Mathematica
- *Developer environment:* Eclipse, Code Composer Studio, MS Visual C++ IDE

ACADEMIC POSITIONS

- Research Assistant, Sensor Fusion Laboratory Sept. 2006 – Aug. 2012
  Syracuse University, Syracuse, New York
- Visiting Student, Dept. of Electrical and Electronic Engineering Oct. 2009 – Dec. 2009
  The University of Melbourne, Victoria, Australia

INDUSTRIAL PROJECTS (INTEL CORPORATION)

Research and development of acoustic signal processing algorithms

- Developed and tested complex audio processing algorithms for possible incorporation in Intel's next generation of reference smartphones
- Work involved developing proof-of-concept android applications to demonstrate the feasibility of advanced audio-related features in the smartphone
- Extensive experience with algorithms like LMS-type adaptive filtering (in the context of echo cancellation) and dynamic time warping (in the context of voice command detection)

INDUSTRIAL PROJECTS (ITTIAM SYSTEMS)

Design, development and testing of video codecs on DSP

- Platform-optimized implementation of H.264 Main Profile video decoder on Texas Instruments' TMS320DM64x DSP platforms
- Developed cycle-critical motion-compensation and deblocking modules in assembly
- Developed software APIs for abstracting the DMA module of DM6446 (DaVinci series)
- Implemented the OpenMAX codec abstraction layer (CAL) API for Ittiam

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RESEARCH PROJECTS (SYRACUSE UNIVERSITY)

Power efficient design of wireless sensor networks

- *Problem:* Multiple battery operated sensor nodes for cooperative monitoring
- *Goal:* Power-efficient beamforming to minimize the receiver MMSE
- Performed Bayesian estimation
- *Novelty:* Sparse collaboration among sensors before beamforming
- *Impact:* Upto 20% conservation of battery power (typical setups)

Relevant Publications: (3 journal, 3 conference)

- S. Kar and P. K. Varshney, "Linear Coherent Estimation with Spatial Collaboration," under review in *IEEE Transactions on Information Theory*
- S. Kar and P. K. Varshney, " Controlled Collaboration for Linear Coherent Estimation in Wireless Sensor Networks," *Proc. 50th Annual Allerton Conference on Communication, Control and Computing 2012*, Monticello, IL, October 1–5, 2012
- S. Kar, P. K. Varshney and M. Palaniswami, " Cramér-Rao Bounds for Polynomial Signal Estimation Using Sensors With AR(1) Drift," Signal Processing, IEEE Transactions on, vol. 60, no. 10, pp. 5494–5507, Oct. 2012
- S. Kar and P. K. Varshney, "On Linear Coherent Estimation with Spatial Collaboration," *Proc. IEEE Intl. Symposium on Information Theory (ISIT 2012)*, July 1–6, 2012, Cambridge, MA, USA
- S. Kar, H. Chen and P. K. Varshney, "Optimal Identical Binary Quantizer Design for Distributed Estimation," *Signal Processing, IEEE Transactions on*, vol. 60, no. 7, pp. 3896–3901, July 2012
- S. Kar, H. Chen and P. K. Varshney, "Spatial Whitening Framework for Distributed Estimation," *Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP 2011), Proc. 4th Intl. Workshop on*, San Juan, Puerto Rico, Dec 13–16, 2011

Building automation for indoor environment quality improvement

- *Goal:* Instrumentation of ICUBE lab at SU, with capabilities for personalized IEQ control
- *Hands-on hardware experience:* As part of a multidisciplinary team, I led the design, prototyping and development of 40 CO_2 /temperature/relative-humidity sensor modules and their wireless data-acquisition systems using IRIS radio motes

- *Signal processing role:* Estimation of number of occupants and feed the IEQ controller
- *Novelty:* Method-of-moments (MoM) approach for non-linear estimation
- *Impact:* Reduction of instrumentation cost by 50% (compared to Kalman filtering)

Relevant Publications: (1 journal, 3 conference)

- S. Kar and P. K. Varshney, "Accurate Estimation of Gaseous Strength using Transient Data," *Instrumentation and Measurement, IEEE Transactions on*, vol. 60, no. 4, pp. 1197-1205, April 2011
- S. Kar and P. K. Varshney, "Accurate Estimation of Indoor Occupancy using Gas Sensors," *Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP 2009), Proc. 5th Intl. Conference on*, pp. 355–360, Melbourne, Australia, Dec 7–10, 2009
- Kar, S. and Varshney, P. K., "Intelligent Sensor Networks for Improved IAQ," *IEEE Upstate NY Workshop on Communications, Sensors and Networking*, Syracuse, NY, 2007
- M. Koni, S. Kar, P. Ray, O. Ozdemir, C. Isik, H. E. Khalifa, H. J. P. Madapusi, and P. K. Varshney, "Enabling Technologies for Monitoring IAQ Parameters of Built Environments," *Annual Symposium of Environmental and Energy Systems*, Syracuse, NY, 2008

Sensor fusion for change detection applications

- *Background:* Moving average/difference algorithms widely used for data analytics (financial, industrial) or image analysis (edge detection)
- *Goal:* To fuse data from heterogeneous sensors (acoustic and seismic)
- *Approach:* CDF (uniform) transformation followed by 2-span processing
- *Novelty:* Derived the frequency of false positives
- *Impact:* Enabling framework for multi-modal sensor fusion

Relevant Publications: (1 technical report)

- S. Kar, K. G. Mehrotra, and P. K. Varshney, "Average Run Length of Two-Span Moving Sum Algorithms," Syracuse University EECS Technical Report No. SYR-EECS-2010-02, Mar 3, 2010

Professional Activities

- Student volunteer at International Symposium of Information Theory, ISIT-2012
- Student member of the IEEE Signal Processing Society
- Reviewer of journals IEEE Transactions on Wireless Communications, ACM Transactions on Sensor Networks

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Graduate Courses

Electrical Engineering

Wireless Communications, Digital Communications, Network Information Theory, Electromagnetic Fields, Random Processes, Detection and Estimation Theory, Smart Antennas

Mathematics/ Statistics

Probability and Statistics, Linear (Regression) Models, Fundamentals of Analysis – 1 and 2, Methods of Numerical Analysis – 1 and 2, (Abstract) Algebra – 1 and 2, Time Series Econometrics, Spatial and Panel Data

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References

- **Pramod K. Varshney** *Email:* varshney@syr.edu *Phone:* 315-443-1060
  Professor, Dept of Electrical Engineering and Computer Science
  Syracuse University, Syracuse, New York
- **M. Palaniswami** *Email:* palani@unimelb.edu.au *Phone:* +61-3-9035 4795
  Professor, Dept of Electrical and Electronic Engineering
  The University of Melbourne, Parkville, Victoria 3010, Australia

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