Anurag Umbarkar   *Curriculum Vitae*

Address: 21 Lynx Lane
East Setauket, NY, 11733
Phone: 703-659-5603
Email: anurag.umbarkar@gmail.com
Web: www.ece.sunysb.edu/~aumbarkar

EDUCATION

Ph.D. in Computer Engineering   **May 2014** *(Scheduled)*

Stony Brook University, Stony Brook, New York

- Dissertation Title: *Performance-Optimized Detection, Tracking and Modeling of Physical Phenomena in Distributed Sensing Environments*
- Advisor: Prof. Alex Doboli

M.S. in Computer Engineering   **August 2010**

Stony Brook University, Stony Brook, New York

- Thesis Title: *Improved Sound-based Localization Through a Network of Reconfigurable Mixed-Signal Nodes*
- Advisor: Prof. Alex Doboli

B.Tech. in Electronics and Telecommunication   **May 2008**

Government College of Engineering (COEP), Pune University, India

RESEARCH INTERESTS

- VLSI design
- Electronic Design Automation (EDA)
- Hardware-software co-design of embedded systems
- Performance-optimized data modeling in distributed sensing environments
- Reliable detection and accurate tracking of physical phenomena in cyber-physical systems

RESEARCH EXPERIENCE

Research Assistant, Stony Brook University   **September 2010 to present**

Mixed-Domain Embedded Systems Laboratory
- Developed techniques using causal reasoning for identification and characterization of hidden sources of error in any system such as 3-dimensional integrated circuits (3D-IC).
- Proposed a linear-programming-based optimization scheme for robust modeling of thermal data in 3D-ICs that reduces error by up to 76% and delay by up to 57%.
- Implemented a network simulator using SystemC to emulate the sensing, processing and communication between distributed embedded nodes connected in a grid topology.
- Developed algorithms and optimization models for reliable data acquisition and efficient tracking of physical phenomena such as gas clouds and sound sources, using a resource-constrained network of reconfigurable embedded systems.
- Developed performance metrics and used statistical analysis to study creativity in design of embedded systems.

Graduate Research, Stony Brook University   **September 2008 to September 2010**

Department of Electrical and Computer Engineering

- Awarded fellowship by Cypress semiconductors in Fall 2010 to develop a laboratory manual for their next-generation System-on-Chip (SoC) device (PSoC3).
- Implemented low-cost sound-localization system on a wireless network of reconfigurable SoCs using PSoC1 and PSoC3 embedded nodes.
- Published innovative sound-localization algorithm that exploited dynamic reconfigurability of PSoC to reduce memory requirements by up to 37% and execution time by up to 92% compared to existing technique.

TEACHING and MENTORING EXPERIENCE

Graduate Research Supervisor, Stony Brook University   **September 2010 to present**

- Coordinated and advised three graduate students working to develop algorithms for computational auditory scene analysis in vehicular-traffic scenarios
  - Devised techniques for feature extraction and fingerprinting of sound sources using support vector machines (SVM)
  - Developed ontological models for classification and prediction of traffic scenarios

Teaching Assistant, Stony Brook University   **Fall 2010 to present**

- Embedded Microprocessor Systems Design
  - Assignments included supervising laboratory work, grading and lecturing
  - Aided in development and verification of laboratory modules using AVR microcontrollers and a vast range of peripheral devices
- Digital Design using VHDL and PLDs

- Supervised students during laboratory activities which included simulation and prototyping of designs using SPLDs, CPLDs and FPGAs
  - Design using Programmable Mixed-Signal Systems-on-Chip
    - Developed and managed laboratory activities and project work
    - Prototyped, debugged and tested various designs using PSoC microcontrollers with M8C, 8051 and ARM cores

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GRADUATE COURSES COMPLETED

- VLSI Physical and Logic Design Automation
- Advanced VLSI Systems Design
- HW-SW Co-design of Embedded Systems
- Advanced VLSI Signal Processing
- Pattern Recognition
- Computer Architecture
- System Spec and Modeling
- Computer Communication networks
- Local and Wide area networks
- Computational Models
- Multi-agent systems
- Auto-ID Technologies
- Solid-State Electronics
- Computer-Aided Design

MAJOR GRADUATE PROJECTS

- System Modeling: Developed and implemented obstacle-avoidance algorithms for underwater navigation of swarms of robots using SystemC
- VLSI Design Automation: Simulated floor-planning, placement and routing algorithms using data structures in C
- Modeling of the SPU Architecture: Used Verilog to implement a model of the SPU Architecture powering the Cell Processor in Sony Playstation-3
- Data Mining Techniques: Studied pattern recognition and machine learning methods for embedded system applications
- VLSI Design of RISC Processor: Designed and implemented the schematic and layout of RISC processor using Cadence tools and Verilog

LIST of PUBLICATIONS

Journal Papers

[1] **A. Umbarkar**, A. Doboli, "*Linear Programming based Optimization for Robust Data Modeling in a Distributed Sensing Platform*", IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, (under review) , Jan 2014.

[2] **A. Umbarkar**, A. Doboli, S. Doboli, J. Betz, "*Modeling Semantic Knowledge Structures for Creative Problem Solving: Six Studies on Expressing Concepts, Categories, Associations, Goals and Context*", Knowledge-Based Systems, (under review), Dec 2013.

[3] A. Doboli, **A. Umbarkar**, "*The Role of Precedents in Increasing Creativity during Iterative Design of Electronic Embedded Systems*'', Design Studies, Elsevier, (accepted for publication), Dec 2013.

[4] **A. Umbarkar**, V. Subramanian, A. Doboli, S. Doboli, "*Two Experimental Studies on Creative Concept Combinations in Modular Design of Electronic Embedded Systems*'', Design Studies, Elsevier, Jan 2014.

[5] **A. Umbarkar**, V. Subramanian, A. Doboli, "*Low-Cost Sound-based Localization using Programmable Mixed-Signal Systems-on-Chip*", Microelectronics Journal, Elsevier, May 2010.

Technical Reports and Lab Manuals

[6] A. Doboli, **A. Umbarkar**, "*Experiments, Analysis and Observations on Creativity in Iterative Design of Electronic Embedded Systems*", Technical Report, College of Engineering and Applied Science, Stony Brook University, June 2011.

[7] **A. Umbarkar**, V. Subramanian, A. Doboli, "*Laboratory Manual for Mixed-Signal, Embedded Design using PSoC3*", Jan 2011.

Conference and Workshop Papers

[8] **A. Umbarkar**, V. Subramanian, A. Doboli, "*A Multi-Level Variable Lumping Scheme for Robust Data Modeling in Distributed Sensing Environments*'', Design Automation Conference, Work-in-progress (poster), 2013.

[9] **A. Umbarkar**, S. Kodasara, A. Doboli, "*Online Construction of Analytical Prediction Models for Physical Environments: Application to Traffic Scene Modeling*", AVICPS Workshop, IEEE Real-Time Systems Symposium, 2012.

[10] V. Subramanian, **A. Umbarkar**, A. Doboli, "*Decentralized detection and tracking of emergent kinetic data for wireless grids of embedded sensors*", NASA/ESA Conference on Adaptive Hardware and Systems, 2012.

[11] V. Subramanian, **A. Umbarkar**, A. Doboli, "*Maximizing the Accuracy of Sound Based Tracking via a Low-Cost Network of Reconfigurable Embedded Nodes*", NASA/ESA Conference on Adaptive Hardware and Systems, 2011.

[12] **A. Umbarkar**, V. Subramanian, A. Doboli, "*Improved Sound-based Localization through a Network of Reconfigurable Mixed-Signal Nodes*", IEEE International Workshop on Robotic and Sensor Environments (ROSE), 2010.

LIST of PRESENTATIONS

Conference and Professional Presentations

[1] Online Construction of Analytical Prediction Models for Physical Environments: Application to Traffic Scene Modeling
   − Paper presentation at the *AVICPS Workshop as part of the IEEE Real-Time Systems Symposium (RTSS)*, 2012.

[2] Decentralized Event Detection using Distributed Interrupts in Cyber Physical Systems
   − Paper presentation at the *IEEE International Systems Conference (SysCon)*, 2012.

[3] Sound Localization project for tracking applications using heterogeneous PSoC nodes to demonstrate hardware-software partitioning using reconfigurable architectures
   − Presentation at *MIT-Lincoln Laboratories* on November 30, 2010.

[4] Improved Sound-based Localization using Reconfigurable Mixed-Signal Nodes
   − Paper presentation at the *Graduate Council Lecture Series in Stony Brook University*, 2010.

[5] Hands-on Introduction to configuring real-world applications using PSoC Technology
   − Presentation sponsored by Cypress University Alliance*,* in the *American Society for Engineering Education (ASEE) workshop,* 2010.

Teaching Presentations

[6] Serial Peripheral Interface (SPI) in ATMega16
   − Lecture at Stony Brook University for the *Embedded Microprocessor Systems Design* undergraduate level course, Fall 2013

[7] Classification using Support Vector Machines (SVM)
   − Lecture at Stony Brook University for the *Pattern Recognition* graduate level course, Fall 2011

[8] Sound Localization Theory and Implementation on PSoC
   − Lecture at Stony Brook University for the *Hardware/Software Co-Design of Embedded Systems* graduate level course, Fall 2012 and Fall 2010

[9] Implementation of Sound Localization on PSoC and logging data into Android application
   − Lecture at Stony Brook University for the *Design Using Programmable Mixed-Signal Systems-on-Chip* undergraduate level course, Spring 2012, Spring 2011 and Spring 2010

PROFESSIONAL SKILLS

Technical Skills

- Hands on experience with Atmel AVR microcontrollers, Cypress PSoC1/PSoC3/PSoC5 (M8C, 8051 and ARM cores), Microchip PIC processors, SPLDs, CPLDs and FPGAs.
- Design/Validation experience using tools such as AVR Studio, PSoC Creator, PSoC Designer, Aldec Active-HDL, ModelSim, Xilinx, Cadence, Eclipse (with Android SDK) and Microsoft Visual Studio.
- Proficient in languages such as Assembly languages, Embedded C, C, C++, SystemC, MATLAB, Verilog and VHDL.
- Advanced knowledge of embedded communication interfaces, sensors, and peripheral devices.
- Windows and UNIX systems experience.
- Technical writing experience with LaTeX and Microsoft Word.

Management Skills

- Management and supervision of Master's degree thesis projects for three graduate students
- Teaching and tutoring of undergraduate and graduate students at a university level
- Active collaboration with other members of the laboratory
- Analysis and presentation of data at international conferences and workshops

LANGUAGE SKILLS

- English   - full professional proficiency
- Hindi   - native language
- Marathi   - native language

AFFILIATIONS

IEEE – *Institute of Electrical and Electronics Engineers*

- Graduate student member since 2011
- Member of IEEE Computer Society