IEEE Signal Processing Society
15th DSP Workshop & 7th SPE Workshop

2013 DSP/SPE Workshop

Program Guide

August 11–14, 2013
Napa, California, USA

Sponsored by
Institute of Electrical and Electronics Engineers
IEEE Signal Processing Society
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## Schedule at a Glance

Locations:
- Plenary presentation and invited talks: Chardonnay Room
- Posters, exhibitors, breaks: Fountain Court
- Training and tutorial Sessions: Cabernet Room

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<th>Sunday</th>
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<tr>
<td>10:30</td>
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<td>7:00</td>
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<th>Monday</th>
<th>August 12</th>
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| 8:30   | 8:40      | Opening and Welcome  
Sally Wood, Santa Clara University |
| 8:40   | 9:00      | Program Overview and Workshop Retrospective  
John Treichler, Raytheon Applied Signal Technology |
| 9:00   | 10:00     | **Plenary: Large-scale video processing for YouTube**  
Michele Covell, Senior Staff Research Scientist at Google Research |
| 10:00  | 10:20     | Break |
| 10:20  | 11:50     | Poster Session 1  
1A DSP Classification and Segmentation  
1B DSP Compressive Sensing  
1C DSP Embedded System and Testbed Design  
1D SPE Novel Methods: Laboratory, Computer-based, Distance Learning |
| 12:00  | 1:00      | Lunch |
| 1:15   | 2:15      | **Plenary: DSP System Design Challenges**  
James Truchard, President, CEO, and Cofounder of National Instruments |
| 2:15   | 4:00      | Poster Session 2  
2A DSP Estimation  
2B DSP Biomedical Signal Processing  
2C DSP Graphical Models |
| 2:45   | 3:00      | Break |
| 4:00   | 4:30      | **Invited Talk: Predictable Impacts of the Development of Effective Signal Processing MOOCS**  
C.S. Burrus, Dean emeritus, Rice University |
| 4:30   | 5:00      | **Invited Talk: Signal Processing Initiatives from the SPS Education Committee**  
Douglas B. Williams, Georgia Institute of Technology |
| 5:20   |           | Depart for banquet |
| Time   | Tuesday 8:30 - 9:30 Plenary: Intelligent hyperspectral imaging and remote sensing from space using onboard digital signal processing  
Jeff Puschell, Principal Engineering Fellow at Raytheon Space and Airborne Systems  
9:30 - 9:45 Break  
9:45 - 11:15 Poster Session 3  
9:45 - 11:15 Poster Session 3A DSP Image Processing  
9:45 - 11:15 Poster Session 3B DSP Blind Separation and Identification  
9:45 - 11:15 Poster Session 3C SPE Signal Processing Across the Engineering Curriculum  
11:15 - 11:45 Invited Talk: Digital pre-distortion of power amplifiers in cellular wireless systems  
Chris Dick, DSP Chief Architect, Communications and Signal Processing Group, Xilinx, Inc.  
11:45 - 12:15 Invited Talk: Large data, stream processing & project-based learning  
Dr. Darel Linebarger, Sr. Manager, SPC System Design, The Mathworks, Inc.  
7:00 - 8:00 Panel: Signal Processing at the University: Still an Active Research Area or ‘Just’ an Undergraduate Service Course?  
Panelists: Ronald Schafer, Lawrence Rabiner, Gene Frantz  
8:00 - 8:15 Break  
8:15 - 9:45 Poster Session 4  
8:15 - 9:45 Poster Session 4A DSP Communication Systems  
8:15 - 9:45 Poster Session 4B DSP Adaptive Filtering  
8:15 - 9:45 Poster Session 4C DSP Denoising and Artifact Removal  
8:15 - 9:45 Poster Session 4D SPE Signal Processing Education in Digital Communications  
| Time   | Wednesday 8:30 - 9:30 Plenary: Computers that understand speech: Where are we? Where are we going?  
Roberto Pieraccini, CEO International Computer Science Institute  
9:30 - 9:45 Break  
9:45 - 11:15 Poster Session 5  
9:45 - 11:15 Poster Session 5A DSP Acoustic Analysis and Processing  
9:45 - 11:15 Poster Session 5B DSP Coding and Decoding  
9:45 - 11:15 Poster Session 5C DSP Filter and Equalizer Design  
11:15 - 11:45 Invited Talk: Transitions  
Gene Frantz, Rice University  
11:45 - 12:00 Closing  
Sally Wood, Santa Clara University  
12:00 - Box lunches |
Welcome Message from the Chair

Professor Sally Wood, Santa Clara University

With great pleasure I welcome you all to the 2013 IEEE Digital Signal Processing and Signal Processing Education Workshops in scenic Napa, California. This is the 15th DSP Workshop and the 7th SPE Workshop. The goal of the two workshops is to bring together leading engineers, researchers, and educators in signal processing from around the world to discuss novel signal processing theories, methods, applications, and implementation techniques, as well as the best methods to educate both specialists and a growing population of those who need to use signal processing techniques in their work. The beautiful Napa Valley is within two hours of heart of Silicon Valley as well as the many well-known universities in the San Francisco Bay area.

The technical program includes four plenary presentations, five invited talks, a panel, and two special workshops exploring emerging signal processing topics in speech understanding, image and video processing, communications, energy, system design, MOOCS, and on-line education tools. Contributed poster presentations are organized into 17 poster sessions.

We thank the workshop Program Chair, Dr. John Treichler (Raytheon, Applied Signal Technology) and the workshop Plenary Chair, Dr. Marcia Bush (Raytheon, Applied Signal Technology) for organizing an exciting technical program. They were supported in this effort by DSP Technical Program Chairs Prof. Tulay Adali (University of Maryland) and Prof. Kenneth Hild (University of California, San Francisco) and by SPE Technical Program Chair, Prof. Roxana Saint-Nom (Instituto Tecnologico de Buenos Aires). We are grateful to the reviewers from the Signal Processing Society’s Technical Committee on Signal Processing Theory and Methods and the Education Committee for their contributions to the quality of the program.

A number of people made important contributions to the success of this workshop. On the workshop committee Dr. Michael Larimore (Raytheon, Applied Signal Technology) served as Finance Chair and Ms. Cathy Wicks (Texas Instruments) served as Chair for Social Programs and Publicity. We are especially thankful to Tony and Jo Ann Truchard for allowing us to have our banquet at their vineyard on Monday night and to Linda Carr of Truchard Vineyards for her great assistance in arranging the workshop banquet. We also thank the staff of the Embassy Suites in Napa for their many efforts in support of our workshop.

Special thanks and appreciation are extended to our industrial sponsors, National Instruments, Texas Instruments, and The MathWorks for their broad based support of our workshops including financial support, technical exhibitions, running training sessions, and contributing to the technical program. We are especially grateful to National Instruments for support of the workshop banquet at Truchard Vineyards. We also thank Raytheon, Applied Signal Technology and Santa Clara University for their support through the workshop committee members.

A workshop is made successful by it attendees, and we thank all who submitted technical papers and all who attend the workshop to participate in discussions. We hope you will have a productive engagement in the workshops’ technical events and that you will also enjoy some of the many activities available here in Napa and the surrounding area.
Technical Program Overview

Dr. John Treichler, Raytheon, Applied Signal Technology

In the early days of ‘discrete time signal processing’ in the 1950s it was of mostly theoretical interest owing the cost and complexity of the electronics needed to implement it. It was first used in defense applications, such as radar signal processing, where the performance improvements it offered offset that cost and complexity, and in sonar and audio applications where the signal bandwidth was low enough to match the low speed at which digitizers and computers could run. The world is wildly different now. We note regularly that signal processing ‘is everywhere’ and that ‘DSP inside’ stickers should be applied to virtually every device that you own, including your car and refrigerator. This radical shift over the past 50 years is the focus of the technical program for this joint DSP and Signal Processing Education workshop.

The early theoretical fascination with the field through roughly the year 2000, coupled with rare and/or expensive implementation, has seemingly been replaced with ubiquitous application of DSP, enabled by the incredible improvement in semiconductors, coupled with declining interest in DSP as a research area. We examine this paradoxical situation via the technical program for this workshop by viewing it from three perspectives —

• Plenary talks which highlight state-of-the-art applications of signal processing in commercial applications, making it clear that signal processing, both analog and digital, will continue to be an integral part of our world and, in fact, become ever more important.

• Panel discussions addressing signal processing education, from the perspective of folks who have been on both sides of the equation — both professors at universities for parts of their careers and also researchers in the very industries that first developed and used DSP.

• Poster sessions at which new technical results are presented to evoke technical interaction regarding the current state of the signal processing art.

By providing all three of these perspectives, the intent of the technical program is to provoke examination of the field and its future by the participants of the workshop. The fact that signal processing is going to be ‘inside’ of virtually everything means that signal processing education must remain vibrant and improve, and that SP-based solutions need to be developed for a wide range of the world’s problems and for an even wider range of commercial opportunities. How to do that best is in our hands.
Organizing Committee

General Chair
   Sally Wood, Santa Clara University

Technical Program Chair
   John Treichler, Raytheon AST, Inc.

Plenary Chair
   Marcia Bush, Raytheon AST, Inc.

Finance Chair
   Michael Larimore, Raytheon AST, Inc.

Social Programs and Publicity
   Cathy Wicks, Texas Instruments

Technical Program Committee

DSP Technical Program Chairs
   Tulay Adali, University of Maryland, Baltimore County
   Kenneth Hild, University of California, San Francisco

SPE Technical Program Chair
   Roxana Saint-Nom, Instituto Tecnologico de Buenos Aires
Sponsors

**NATIONAL INSTRUMENTS**
- Exhibitor and workshop supporter
- Training sessions
- Support for workshop banquet

**TEXAS INSTRUMENTS**
- Exhibitor and workshop supporter
- Training sessions
- Workshop committee

**The MathWorks**
- Exhibitor and workshop supporter
- Training sessions

**Raytheon**
- Raytheon, Applied Signal Technology: Workshop committee

**Santa Clara University**
- Workshop committee
History

The first ICASSP was held in 1976 with just a few hundred attendees. By the early 1980s more than 1000 engineers and educators were coming to ICASSP, and it had turned into a multi-day event with many parallel sessions. As the ICASSPs became larger, there was no way to see everything happening in the field and little time to interact with other investigators. Some remembered fondly ‘the early days’ when a few workshops with many fewer attendees were held at Arden House, a small conference facility at the Harriman estate in rural New York. Noting the value of this type of meeting, the DSP Technical Committee, the largest in the Society at the time, instigated the first ‘DSP workshop’ in October of 1984. It was held in Chatham Bar, Massachusetts, and established several precedents that continue to this day – it was ‘small’ in the sense that only 100 or so folks attended, the number of parallel sessions was limited to at most two in order to encourage personal interaction, and it was held in a nice, but out of the way, place so that the attendees would be able to focus on each other and their work. A scan through the accompanying list indicates the range of locations and venues, all adhering to this approach.

The first workshop was adjudged a total success, which led to a second, and then one roughly every two years, through this one, the fifteenth. In 2000, for the first time, the scope of the workshop was extended to explicitly include Signal Processing Education, with the support of the SP Education Technical Committee. The workshops have continued jointly since then. As is typical in IEEE workshops, each one reflected both the character of the organizing committee and the ever evolving nature of field of signal processing. Featured at the first workshop in 1984 were plenary talks on speech recognition and noise cancellation in the cockpits of fighter aircraft. In 1990 the focus was on digital television and wavelets, and so it has gone of the years that the newest applications of signal processing, and the newest theoretical approaches are first aired at the DSP workshop.

The workshop is now ‘co-owned’ by the Signal Processing Techniques and Methods (SPTM) technical committee of the SP Society and the Education Committee, both direct ancestors of the technical committees that started and then evolved the workshop into its current form.

It would be nice to include pictures that attendees of the previous meetings might still have, as well as any thoughts folks might have about which workshops made particular contributions to the direction of signal processing theory and practice. If you have such thoughts or opinions, please send them to John. Treichler@ieee.org, as well as any pictures or other memorabilia you might be willing to share.
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<tr>
<th>Workshop</th>
<th>Dates</th>
<th>Venue</th>
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<tr>
<td>1st DSP</td>
<td>1984: October 8-10</td>
<td>Chatham Bars Inn, Chatham, Massachusetts</td>
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<td>2nd DSP</td>
<td>1986: October 20-22</td>
<td>Chatham Bars Inn, Chatham, Massachusetts</td>
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<td>3rd DSP</td>
<td>1988: September 15-19</td>
<td>Stanford Sierra Camp, South Lake Tahoe, California</td>
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<td>4th DSP</td>
<td>1990: September 16-19</td>
<td>Mohonk Mountain House, New Paltz, New York</td>
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<td>5th DSP</td>
<td>1992: September 13-16</td>
<td>Starved Rock State Park, Utica, Illinois</td>
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<td>6th DSP</td>
<td>1994: October 2-5</td>
<td>Yosemite National Park, California</td>
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<td>7th DSP</td>
<td>1996: September 1-4</td>
<td>Loen, Norway</td>
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<td>8th DSP</td>
<td>1998: August 9-12</td>
<td>Bryce Canyon, Utah</td>
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<td>9th DSP, 1st SPE</td>
<td>2000: October 15-18</td>
<td>Hunt, Texas</td>
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<td>10th DSP, 2nd SPE</td>
<td>2002: October 13-16</td>
<td>Pine Mountain, Georgia</td>
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<td>11th DSP, 3rd SPE</td>
<td>2004: August 1-4</td>
<td>Taos Ski Valley, New Mexico</td>
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<td>13th DSP, 5th SPE</td>
<td>2009: January 4-7</td>
<td>Marco Island, Florida</td>
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<td>14th DSP, 6th SPE</td>
<td>2011: January 4-7</td>
<td>Enchantment Resort, Sedona, Arizona</td>
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<td>15th DSP, 7th SPE</td>
<td>2013: August 11-14</td>
<td>Napa, California</td>
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**Venue**

**Hotel Information**
The workshop will be held at the Embassy Suites Hotel – Napa Valley
1075 California Boulevard, Napa, California

The Mediterranean inspired, resort-like setting of the Embassy Suites Napa Valley hotel is set on seven acres of landscaped grounds. The surroundings include palm trees, rose gardens and a mill pond with resident swans. Located in the heart of Napa Valley one mile from downtown Napa, California, the hotel is the perfect gateway to Napa wineries, dining, and excursions. Ask for the code for free internet service when you register.

**Directions**

**From San Francisco (across Golden Gate Bridge)** — Highway 101 North to Highway 37 East. Exit at Sonoma/Napa. Turn left at the stoplight onto Highway 121 at Infineon Raceway. Highway 121 intersects with Hwy 29. Turn left onto Hwy 29N. Exit at First Street/Downtown Napa, veer right. Get in the far left lane. Make a left on California Blvd. We are on the left side.

**From San Francisco (Across Bay Bridge)** — Hwy 80E to Hwy 37W, at Marine World Parkway. Turn right at intersection of Hwy 29, continue north toward Calistoga. Exit at First Street, turn right at the stop sign and left at California Blvd.

**From Sacramento** — From Hwy 80W to Hwy 12W continue on Hwy 12 pass the Chardonnay Golf Club. Turn right at the 2nd stoplight onto Hwy 29N. Exit at First Street/Downtown Napa, veer right, get in far left lane. Make a left on California Blvd. We are on the left side.
Local Attractions

Napa Valley, one of the premier wine regions of the world, is also the home of the Culinary Institute of America and a wide range of cuisine. Wine tasting and olive oil tasting tours can be arranged. Other attractions include cycling and canoeing tours, hot air balloons, spas, and numerous local interest museums and parks. Expect dry, sunny days and cool evenings.

Registration

Sunday, August 11: 10:00 am to 6:00 pm in Fountain Court
Monday, August 12: 7:30 to 8:30am and during poster sessions
Tuesday, August 13: 8:00 to 8:30am and during poster sessions
Wednesday, August 14: 8:00 to 8:30am and during poster sessions

Social Events

Workshop Reception
Sunday, August 11th from 7-8pm at the Fountain Courtyard

Workshop Banquet
Monday, August 12th at Truchard Vineyards

Begin boarding the bus to the vineyard at 5:15. It will depart at 5:30.

Before dinner, the winery staff will assist guests in self-guided tours of the vineyards and caves.

Heirloom Tomato Carpaccio, Truffle Vinaigrette
Piedmontese Rib-eye Steak
Crispy Brunoise Potatoes

Roasted Vinegar Chicken
Free-ranch Chicken, Round
Pond EVOO & Cabernet Vinegar
‘Creamed’ Corn, Zucchini, Gypsy Peppers

Wild Mushroom Risotto
Mushrooms, Grana Padano, Crème Fraîche, Garlic Flowers

Presentation
Perspectives from 30 years in the Vineyard
Truchard Vineyards is a small, family-owned winery in the Carneros region of Napa Valley. Proprietors Tony and Jo Ann Truchard have managed a successful vineyard and grown exceptional grapes for over 30 years. The vineyard encompasses 383 contiguous acres, of which 270 acres are planted. It is a series of hills and valleys which contains a variety of soils: clay, shale, sandstone, volcanic rock and ash. The various combinations of terrain, geology, and marine-moderated temperatures provide unique winegrowing conditions. Currently the vineyard grows 10 different grape varieties, making it one of the most diverse estate vineyards in California. Truchard wines have garnered much critical appreciation. Wines from the 1994, 1996, and 1997 vintages have been included in the Wine Spectator’s Top 100 wines of the world. The winery was selected as the “Estate Winery of the Year” by Wine & Spirits in 1997 and 1998.

http://www.truchardvineyards.com/
Plenary Presentations

Large-scale video processing for YouTube

Dr. Michele Covell, Senior Staff Research Scientist at Google Research

Monday, August 12 at 9:00 am in the Chardonnay Room

Abstract

Every minute of the day, more than 100 hours of video is added to YouTube. This large inflow of footage presents several difficulties. The two that I will discuss are copyright detection and recommendation generation.

Youtube must remove copyrighted material, preferably before it is ever posted, without slowing down the upload process. In parallel, more and more copyright owners are providing us with footage to protect against upload. The combination of massive numbers of uploads along with years worth of content to protect make any pairwise comparison completely intractable. To make matters worse, we need to detect copying of content when the content is “mashed up”, re-cropped, overlayed, recompressed, and color or brightness shifted. I will describe one version of the feature set that we have used for this task as well as the subsequent processing that allows us to efficiently treat this as an approximate nearest neighbor retrieval problem. The resulting system has excellent identification capabilities for small snippets of audio or video that have been degraded in a variety of manners, including competing noise, poor recording quality, cell-phone playback (for audio), and camcorder recapture (for video). To make the system work in production, we have also explicitly developed methods to limit memory usage, and computation with minimal degradation in detection performance. The system is more accurate than the previous state-of-the-art system while being more efficient and flexible in memory usage and computation.
Another process that must happen with new material on Youtube is to make that new content discoverable. A large part of this is to correctly add new content to the recommendation lists for established related videos. For videos that have some previous traffic, we can do this by treating the video database as a weighted graph with connections being made between videos that were “co-viewed” in the same user session. For videos that are completely new, we need to rely on connections formed between videos with similar user-provided text data and or similar visual and audio features. I will discuss how we can use these connections to create better video recommendation lists, by treating each possible recommendation as a label. As with previous work, we have found that graph-based propagation can be very effective at finding a good label distribution across nodes, starting from partial information. With videos as nodes and recommended videos as labels, this results in recommendations that are stronger than alternative approaches. I will also discuss how to make this graph propagation process efficient, by moving all re-normalization scaling to a pre-processing step, allowing the use of linear algebra techniques (e.g., Gaussian elimination, stabilized bi-conjugate gradient descent) for the solution of the system of equations. Finally, I will discuss techniques that allow incremental update of the recommendation labels, in order to handle the characteristics of the Youtube database. If time allows, I will also discuss research into learning visual distances that are context dependent, to allow better initial connections between videos.

**Biography**

Michele Covell received the BS in electrical engineering from the University of Michigan. She received the MS and PhD from MIT in signal processing, for her research with Jae Lim and Alan Oppenheim, respectively. She joined SRI International, in the area of active acoustic-noise control, and then Interval Research Corporation, where her research covered a wide range of topics in audio, image, and video processing. In 2000, she joined YesVideo and worked on faster-than-real-time video analysis. She moved to the Mobile Streaming Media group in HP Labs, as a key contributor in streaming-video services in 3G telephony networks. This work is listed as one of the top-40 accomplishments from HP Labs’ 40-year history. She moved to Google, in the research group, in 2005, where she focused for several years on large-scale audio and video fingerprinting, identification, and retrieval. For this work, she received two Google awards – one for innovation and one for financial impact. More recently, she has been working in image and texture analysis and in large-scale graph labeling problems. In addition to her extensive publications, she has 45 granted US patents and 10 published US-patent applications.
Abstract
Modern electronic systems are ubiquitous in the world around us. From cyber-physical systems, RF/Wireless and transportation to health care and energy, these are becoming increasingly real-time, parallel and heterogeneous. All versions of these systems have to incorporate essential elements of engineering to function properly and signal processing and analysis is one of them. Future engineers will be challenged to rapidly incorporate highly sophisticated signal processing algorithms as part of the system design process. Graphical system design enables them to achieve this goal. In this talk, we will explore how this approach enables integration of highly sophisticated signal processing algorithms to build real-world systems that solve challenges from building the future wireless standards or detecting cancer to regulating the next generation smart grid.
Dr. James Truchard, National Instruments president and CEO, cofounded the company in 1976 while working at The University of Texas at Austin. Under Truchard’s leadership, NI has pioneered the development of virtual instrumentation software and hardware that revolutionizes the way engineers design and develop test and measurement applications.

As NI has grown from a three-man team to a multinational organization with more than 6,100 employees, Truchard continues to lead the company with the same entrepreneurial mindset that led to its inception more than 35 years ago. He focuses on ensuring employees have a working environment that fosters innovation, and as a result, NI has seen 33 years of growth in its 35-year history.

Truchard also is an active supporter of the NI academic program which focuses on growing students’ science, technology, engineering and math (STEM) skills through hands-on, project-based learning. Before founding NI, Truchard worked as managing director of the acoustical measurements division at Applied Research Laboratories at The University of Texas at Austin. Truchard holds a doctorate in electrical engineering, as well as a master’s degree and bachelor’s degree in physics, all from The University of Texas at Austin.
Intelligent hyperspectral imaging and remote sensing from space using onboard digital signal processing

Dr. Jeff Puschell, Principal Engineering Fellow at Raytheon Space and Airborne Systems

Tuesday, August 13 at 8:30 am in the Chardonnay Room

Abstract
Future space-based systems for imaging the Earth in thousands of colors are expected to collect raw data at rates exceeding 100 Gbps. Onboard real time digital signal processing of these raw samples to application-specific products is required to provide insight and understanding of what’s happening or perhaps more importantly what will happen in a scene and avoid the difficulty and expense of sending all of this data to the surface and processing it there. This talk will describe the “big data” associated with hyperspectral imaging from space and discuss requirements, approaches and associated challenges for timely digital signal processing onboard small, limited power platforms in a hostile radiation environment.
**BIography**

Dr. Jeff Puschell is Principal Engineering Fellow at Raytheon Space and Airborne Systems in El Segundo, California. He is an internationally recognized expert in the system engineering of space-based imaging and remote sensing systems. His 31+ years of experience is broadly based and includes leading and making major contributions toward development of visible-infrared instruments for space-based operational environmental remote sensing, development and field testing of laser-based communication and remote sensing systems and building and using millimeter, infrared, visible and ultraviolet wavelength instrumentation for ground-based astronomy. Dr. Puschell has authored or co-authored 120+ papers on a variety of topics in astrophysics, imaging, remote sensing and optical communication. He is co-editor and co-author for the leading reference book Space Mission Engineering: The New SMAD.
Computers that understand speech: Where are we? Where are we going?

Dr. Roberto Pieraccini, CEO International Computer Science Institute

Wednesday, August 14 at 8:30 am in the Chardonnay Room

Abstract

Popular science fiction of the past century brought to us visions that have been abundantly surpassed by today’s technology, except for machines that understand speech. The speech recognition technology used today was invented in the 1970s, and refined through the following 40 years to bring us popular applications like Google Voice Search and Siri. Compared with the early systems, speech recognition today is orders of magnitude more capable and accurate, to the point that a multi-billion dollar industry emerged from it. However, speech recognition is still brittle and far from human-like capabilities. On the one hand, recognizing speech is a surprisingly difficult problem, since it involves decoding many layers of abstraction combined into a highly variable one-dimensional signal. On the other hand we have not yet achieved a full understanding of how humans perform speech recognition, and the simplifying assumptions we make in our models impose severe limitations on the achievement of higher performance. While the industry is placing a lot of emphasis on larger and larger amounts of data, some researchers are going back to the fundamental problems of speech modeling and are trying to approach them from a different perspective. In this talk I will present the general problem of speech recognition, the solutions that pushed the envelope of the digital signal processing technology towards today’s successes, and the problems that we still need to solve.
Roberto Pieraccini is currently the CEO of the International Computer Science Institute in Berkeley, CA. Prior to that he was the CTO of SpeechCycle, a research manager at IBM T.J. Watson Research and SpeechWorks International, and a member of technical staff at Bell Labs and AT&T Shannon Laboratories. He started his career in the 1980s as a researcher at CSELT, the research laboratories of the Italian telephone company. His research interests range from speech recognition to spoken language understanding and dialog, multimodal interaction, and machine learning. He is a fellow of IEEE and ISCA, a member of the AVIOS board, and a member of the editorial board of several scientific and technology magazines. He is the author of more than 120 papers and articles in the field and of “The Voice in the Machine”, a general-audience book published in 2012 by MIT Press on the history of “computers that understand speech.”
Invited Talks

Invited Talk: Predictable Impacts of the Development of Effective Signal Processing MOOCS

C.S. Burrus, Dean emeritus, Rice University

Monday, August 12, 2013 at 4:00 pm

The rapid rise of Massive Open On-Line Courses has evoked considerable interest and controversy regarding their applicability to signal processing education. Sidney Burrus will report on recent efforts to bring laboratory experience to a DSP MOOC and then will extend the discussion to extrapolate the long term impacts of this educational approach. MOOCs will be presented as one element in the expanding array of Open Educational Resources (OER). General discussion and moderated debate will follow his presentation.

Invited Talk: Signal Processing Initiatives from the SPS Education Committee,

Professor Douglas B. Williams, Georgia Institute of Technology

Monday, August 12, 2013 at 4:00 pm

As part of the IEEE Signal Processing Society’s Membership Board, the Education Committee is associated with several projects aimed at providing educational materials for the Society’s members as well as the general public. This talk will overview those projects and provide information on how to become involved. Current projects include the IEEE-CNX Connexions Project, SigPort, SigView (aka the SPS Tutorial Project), and the SP WikiProject.

Special attention will be paid to the Society’s WikiProject. Wikipedia has become one of the most widely accessed resources on signal processing, used frequently by researchers, teachers, and students. Maintaining a high quality standard for signal processing articles on Wikipedia is important in defining how our field is viewed by the public. However, the freelance-editing model of Wikipedia makes quality control and maintenance of these articles a real challenge. As researchers in the field, there is much that we can do towards improving and maintaining the quality of such articles without too much effort. Moreover, editing an article in Wikipedia can be expected to have markedly more impact and visibility than writing a paper on the topic; for example, the page on Nyquist–Shannon sampling theorem is viewed on average a 1000 times a day.

The Education Committee’s action plan will be presented for building a Wikiproject on Signal Processing comprising a group of volunteers working together to improve SP articles on Wikipedia. There will then be opportunities later in the workshop to participate in sessions for evaluating and modifying signal processing content in Wikipedia.
Invited talk: Digital pre-distortion of power amplifiers in cellular wireless systems  
Dr. Chris Dick, DSP Chief Architect, Communications Signal Processing Group, Xilinx  
Tuesday, August 13, 2013 at 11:15 am

In the last 4 years there has been explosive growth in mobile IP usage. ITU ICT statistics report that in the period from 2000 to 2010 the number of mobile cellular subscriptions increased by 8 fold, a rate that astonishingly exceeds the growth in the number of internet users over the same period. In response to the insatiable demand for wireless capacity, network operators are rapidly deploying wideband waveforms such as multi-carrier LTE-A, for example 4-carrier LTE signals occupying 100MHz of transmission bandwidth. But capacity is not the only dimension of the problem, cost and power efficiency are key parameters. With the RF-shelf comprising a large fraction of the bill-of-materials, the task of the designer naturally falls to reducing the cost of the RF processing sub-system. With the power amplifier at the center of the tradeoff between efficiency, linearity, transmission bandwidth and transmission power, digital pre-distortion (DPD) has become a core technology in every basestation, and is very active area of research of commercial wireless radio labs.

This presentation begins with a review of the motivation behind the extreme focus that every manufacturer of cellular wireless equipment, from small-cell to macro-cell, has on DSP-based signal conditioning of LTE-A, W-CDMA, CDMA2000, GSM and multi-protocol transmission waveforms. We then provide an overview of DSP-based DPD and describe how DPD is realized in a basestation. Linearization results are presented for multi-carrier LTE-A signals based on a real-time DPD implementation on a Xilinx Zynq SoC device using a basestation class Doherty power amplifier.

Invited Talk: Large data, stream processing & project-based learning  
Dr. Darel Linebarger, Sr. Manager, SPC System Design, The Mathworks, Inc.  
Tuesday, August 13, 2013 at 11:45 am

In this talk we provide an overview of the latest trends for signal processing in MATLAB which includes new features to handle large data, to facilitate processing of real-time streaming signals, and to enhance project-based learning by targeting low-cost hardware. We will showcase MATLAB test benches that make it easier to connect to hardware and stream real-time data for processing into MATLAB. For example, the Microsoft Kinect can be used as a recording device for audio and video testbenches. We will also highlight new features in MATLAB for authoring dynamic systems and algorithms that operate on streaming data, including system objects that provide the algorithmic components as well as tools to visualize execution of dynamic systems.

Darel Linebarger joined MathWorks, Inc. in May of 2000, where he now manages their Signal Processing and Communications System Design group. Prior to that, he was on the electrical engineering faculty of the University of Texas at Dallas for twelve years. While at UT Dallas, he consulted for Texas Instruments’ wireless communications group on the topic of fixed-point modeling for communications systems. He has authored or co-authored numerous papers and patents and is a Senior Member of the IEEE. He holds an M.S. and Ph.D. from Rice University.
Panel: Signal Processing at the University: Still an Active Research Area or ‘Just’ an Undergraduate Service Course?

Professor Ronald Schafer, Stanford University
Professor Lawrence Rabiner, Rutgers University
Professor Gene Franz, Rice University
Tuesday, August 13, 2013 at 7:00 pm

Gene, Larry, and Ron all have both academic and industry experience. Armed with these dual perspectives and given their long and successful careers from the dawn of DSP to now, they will discuss the future of signal processing, both analog and digital, in the university education process, ranging from a focus on ground-breaking research to the need for broad SP education to support other technical fields and the engineers entering industry. Their initial presentations will be followed by modulated (moderated?) discussion, debate, and questions from the workshop attendees.

Invited Talk: Transitions

Professor Gene Franz, Rice University
Wednesday, August 14, 2013 at 11:15 am

Reflections on the transition, after 39 year in industry, to Professor in the Practice at Rice University in the context of the birth, development, and maturation of DSP.
# Training Sessions

Unless otherwise noted, all training and tutorial sessions will be held in the Cabernet Room. Registration information for each session can be found in the detail description for each.

## Sunday, August 11, 2013

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<td>10:30 a.m. - 12:20 p.m.</td>
<td>National Instruments</td>
<td>An Introduction to Software Defined Radio with NI LabVIEW and NI USRP</td>
<td>Presented by Anthony Fuller</td>
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<tr>
<td>12:30 p.m. - 4:20 p.m.</td>
<td>Texas Instruments</td>
<td>Hands on Workshop: Real-time DSP for educators - Bridging Theory to Practice Using the TI LCDK DSP Kit</td>
<td>Presented by Thad Welch and Mike Morrow <strong>Lunch Included</strong></td>
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<tr>
<td>4:30 p.m. - 6:20 p.m.</td>
<td>MathWorks</td>
<td>Real-Time DSP System Simulations in MATLAB</td>
<td>Presented by Houman Zarrinkoub</td>
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## Tuesday, August 13, 2013

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<tr>
<td>12:30 p.m. - 2:20 p.m.</td>
<td>Texas Instruments</td>
<td>Hands on Workshop: Moving Beyond DSP and Teaching Embedded Processors Using the BeagleBone</td>
<td>Presented by Mark Yoder <strong>Lunch Included</strong></td>
</tr>
<tr>
<td>2:30 p.m. - 4:20 p.m.</td>
<td>MathWorks</td>
<td>Accelerating Communications System Simulations in MATLAB and Simulink</td>
<td>Presented by Houman Zarrinkoub</td>
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<td>National Instruments</td>
<td>An Introduction to Software Defined Radio with NI LabVIEW and NI USRP</td>
<td>Presented by Anthony Fuller</td>
</tr>
</tbody>
</table>
Descriptions of Training and Tutorial Sessions

An Introduction to Software Defined Radio with NI LabVIEW and NI USRP

Presented by Anthony Fuller

Discover how to use LabVIEW system design software to easily acquire, analyze, and record wireless signals from the NI Universal Software Radio Peripheral (USRP) software defined radio. Learn how to prototype a wireless communication receiving algorithm using this flexible, scalable radio. Advance registration is required, but there is no registration fee.

Biography

Anthony Fuller is a product marketing engineer at National Instruments in Austin, Texas. He started as an applications engineer ensuring customer success and educating users of National Instrument data acquisition products around the United States. Fuller joined the academic marketing department where he evangelizes the use and adoption of software defined radio as a research and education medium for wireless communications. Fuller received his bachelor’s with honors in electrical engineering from The University of Texas at San Antonio.

Hands on Workshop: Real-Time DSP for educators - Bridging Theory to Practice Using the TI LCKD DSP Kit

Presented by

Thad Welch, Boise State University and
Mike Morrow, Boise State University

Attend this comprehensive hands on free workshop introducing real-time DSP for academics using TI’s latest OMAP138/C6748 LCKD taught by authors/professors Welch and Wright. Bridging the gap from theory to practice is easily done w/ well developed resources and instructors who will lead everyone to incorporate these topics into an academic course. Discussions and implementation of talk through systems, FIR filters, sinusoidal signal generators, and follow on projects/systems will be provided. Introduction to winDSK8 and Code Composer Studio software with DSP hardware will be utilized. (Each participant will leave the workshop with a fully functional real-time DSP development system: DSP board, software development tools, getting started kit, and RT-DSP textbook, a $400+ value). Advance registration is preferred but not required. There is no registration fee. Includes Lunch.
Thad Welch, Ph.D., P.E., received the B.E.E., M.S.E.E., E.E., and Ph.D. degrees from the Georgia Institute of Technology, Naval Postgraduate School, Naval Postgraduate School, and the University of Colorado in 1979, 1989, 1989, and 1997, respectively. He was commissioned in the U.S. Navy in 1979 and has been assigned to three submarines and a submarine repair tender. He has deployed in the Atlantic Ocean, Mediterranean Sea, and Arctic Ocean. From 1994 – 1997 he was an Instructor and Assistant Professor teaching in the Electrical Engineering Department at the U.S. Air Force Academy, Colorado Springs, CO. From 1997 – 2007 he was an Assistant Professor, Associate Professor, and Permanent Military Professor teaching in the Electrical Engineering Department at the U.S. Naval Academy, Annapolis, MD. In 2006 he co-authored “Real-time Digital Signal Processing, from MATLAB to C with the TMS320C6x DSK.” He is currently a Professor of the Electrical and Computer Engineering Department at Boise State University, Boise, ID. His research interests include real-time digital signal processing (DSP), the implementation of DSP-based systems, communication systems analysis, IED defeat, efficient simulation of communication systems, spread-spectrum techniques, and ultra-wideband systems.

Michael G. Morrow, M.Eng.E.E., P.E., is a Lecturer in the Department of Electrical and Computer Engineering at Boise State University. He previously taught at the University of Wisconsin-Madison and the U.S. Naval Academy. He is the founder and president of Educational DSP (eDSP), LLC, developing affordable DSP education solutions. He is a member of the Technical Committee on Signal Processing Education for the Institute of Electrical and Electronic Engineers (IEEE) Signal Processing Society, and is a senior member of the IEEE and a member of the American Society for Engineering Education (ASEE).
Real-Time DSP System Simulations in MATLAB

Presented by Houman Zarrinkoub, PhD. MathWorks Product Manager, Signal Processing & Communications

In this session, we show how you can use MATLAB to develop real-time DSP algorithms and test benches with the latest features in DSP System Toolbox. We showcase an acoustic tracking system that uses the acoustic sensors in Microsoft Kinect. Through demonstrations, you will learn how to:

- Use a library of efficient algorithm components (System objects) to develop your real-time DSP IP
- Automatically generate C code to accelerate simulation or to integrate your design with other software tools
- Easily discover and interface to your signal processing hardware
- Test your design with real-time streaming data

No advance registration is required.

Biography

Houman Zarrinkoub is a senior product manager responsible for Communications System Toolbox. He joined MathWorks in 2001 as a development manager for signal processing products. Prior to MathWorks, he spent six years at Nortel Networks as a research engineer specializing in speech processing for wireless systems. He holds a B.S.E.E. from McGill University and an M.S.E.E. and a Ph.D. from the Institut Nationale de la Recherche Scientifique, Universite du Quebec.

Hands on Workshop: Moving Beyond DSP and Teaching Embedded Processors Using BeagleBone

Presented by Mark Yoder, Professor of Electrical and Computer Engineering, Rose-Hulman Institute of Technology

Get up and running in 5 mins! This hands-on workshop is BYOL (Bring Your Own Laptop) or use one of ours! You will take a BeagleBone Black (BBB) from out-of-the-box to blinking an LED in under 5 minutes. In under an hour you will see how you can embed your favorite signal processing applications. The BBB is a $45 community-supported development platform for developers, hobbyists and educators. The BBB is 1) more powerful and has more I/O than a Raspberry Pi, 2) is as easy to use as an Arduino and 3) has a thriving Open Source Software community. The workshop activities will include 1) Several hands-on exercises to get participants familiar with using the BBB using BoneScript and Linux commands. 2) discussions of the wide variety courses where it could be used: from freshman programming to senior design and graduate projects courses and 3) demonstrations of what the BBB can do 4) resources available to help you get started today Participants will receive a BeagleBone Black to take home.

Advance registration is preferred but not required. There is no registration fee. Lunch Included.
Mark Yoder, likes teaching Digital Signal Processing (DSP). It’s an area rich with everyday examples that can be used to motivate students. He is co-author of two award-winning texts, “Signal Processing First” and “DSP First: A Multimedia Approach”, both with Jim McClellan and Ron Schafer. These texts, published by Pearson, Prentice-Hall in 1998 and 2003, have been used in about 160 schools in the USA and in 60 different countries. They have been translated into Japanese, Korean, Chinese (both simplified and traditional) and Greek. He is also a co-author for the Infinity Project, an engineering curriculum for high school students and has co-authored the text for this project, “Engineering Our Digital Future”. Dr. Yoder is a professor of Electrical and Computer Engineering at Rose-Hulman Institute of Technology. He received the school’s Board of Trustees Outstanding Scholar Award in 2003. Prof. Yoder received the BS degree in 1980 and the Ph.D. in 1984 in Electrical Engineering from Purdue University, West Lafayette, Indiana, USA. His research interests include investigating ways to use technology to teach engineering more effectively. He pioneered, at Rose, the use of Computer Algebra Systems (such as Maple and Mathematica) in teaching electrical engineering. He also helped pioneering the teaching of digital signal processing (DSP) early in the curriculum. Dr. Yoder served as General Co-Chair of the 2000 IEEE Digital Signal Processing in Education Workshop.

Accelerating Communications System Simulations in MATLAB and Simulink

Presented by Houman Zarrinkoub, PhD. MathWorks Product Manager, Signal Processing & Communications

In this session, you will learn various techniques you can use to accelerate your communications system simulations in MATLAB and Simulink. We showcase a series of six types of optimizations applied to accelerate the simulation of a 4G LTE control channel processing algorithm. We start with a baseline algorithm and through successive profiling and code updates introduce the following optimizations:

- Better MATLAB serial programming techniques (vectorization, preallocation)
- Use of System objects
- MATLAB to C-code generation (MEX)
- Parallel computing (parfor, spmd)
- GPU-optimized System objects
- Rapid Accelerator mode for simulation in Simulink

Through demonstrations we also show that you can further accelerate your simulations by combining two or more of these techniques.

No advance registration is required.

Biography

See biography and photo of Houman Zarrinkoub on opposite page.
Special Workshops

Tuesday Afternoon

Distributed Special Interactive Sessions: Signal Processing Wikipedia

Doug Williams

Help us to improve the signal processing content in Wikipedia. Small group participation in evaluation of current content, assessment of needs, generation of new content in:

- Basic signal processing theory and methods
- Implementations
- Audio and Speech
- Image Processing

Please contact Professor Doug Williams (doug.williams@ece.gatech.edu) with questions about the workshop.

Wikipedia has become one of the most widely used resources for signal processing, used frequently by researchers, teachers, and students. As experts in the field, there is much that we can do towards improving and maintaining the quality of such articles without too much effort. Moreover, editing an article on Wikipedia can be expected to have far more impact and visibility than a paper one may write on the topic; e.g., the page on Nyquist–Shannon sampling theorem is viewed on average 1000 times a day.

Signal Processing Society members have recently created a Signal Processing WikiProject to help improve Wikipedia’s coverage of signal processing topics. For those who would like to participate, there will be opportunities during the workshop to join the project, identify articles that need to be created or improved, and/or edit articles that are within your areas of expertise.

Understanding Learning Difficulties in Continuous-time Signals and Systems Courses and Making These Courses More Accessible

Mario Simoni and Maurice Aburdene

This workshop will be an engaging opportunity to address two questions:

1. Why do students struggle so much with concepts in continuous-time signals and systems (CTSS) courses?
2. What are some methods that instructors can use to help the students grasp the fundamental concepts?

The introductory CTSS course is one of the most difficult courses that students encounter in an electrical and computer engineering (ECE) curriculum, as evidenced by well-above-average drop/failure rates. To help explore the problem, we will spark discussion by presenting data from surveys, focus groups, historical data, the CTSS concept inventory, and the Index of Learning Styles. To demonstrate effective methods for engaging students, hands-on activities that were developed at Rose-Hulman and Bucknell will be presented.

Please contact Professor Mario Simoni (simoni@rose-hulman.edu) with questions about the workshop.
Classified and Segmentation

**1A.1** BILINEAR VECTOR QUANTIZATION  
Qian Zhang, Zhvoran Li, Jianji Wang, Xi’an Jiaotong University, China

**1A.2** DIACRITIZATION, AUTOMATIC SEGMENTATION AND LABELING FOR LEVANTINE ARABIC SPEECH  
Yousef Alotaibi, Ali Meftah, King Saud University, Saudi Arabia; Sid-Ahmed Selouani, Université de Moncton, Canada

**1A.3** PERFORMANCE IMPROVEMENT OF THE COMPRESSIVE CLASSIFIER USING EQUI-NORM TIGHT FRAMES  
Hailong Shi, Hao Zhang, Xiqin Wang, Intelligent Sensing Lab, China

**1A.4** EMPIRICAL MODE DECOMPOSITION BASED SPARSE DICTIONARY LEARNING WITH APPLICATION TO SIGNAL CLASSIFICATION  
Muhammad Kaleem, Aziz Guergachi, Sridhar Krishnan, Ryerson University, Canada

Compressive Sensing

**1B.1** ANALOG FILTER BANKS FOR SAMPLING: DISCRETIZATION, POLYPHASE FORM, AND ROLE IN COMPRESSIVE SENSING  
PP Vaidyanathan, California Institute of Technology, United States

**1B.2** FURTHER RESULTS ON MULTIANTEENA SPECTRUM SENSING IN COLORED NOISE  
Jitendra Tugnait, Auburn University, United States

**1B.3** MULTI-SCALE DICTIONARY LEARNING FOR COMPRESSIVE SENSING ECG  
Luisa Polania, Kenneth Barner, University of Delaware, United States

Embedded System and Testbed Design

**1C.1** DESIGN OF A HIGH EFFICIENCY RECONFIGURABLE PIPELINE PROCESSOR ON NEXT GENERATION PORTABLE DEVICE  
Yuan-Chu Yu, Southern Taiwan University of Science and Technology, Taiwan; Yuan-Tse Yu, National Kaohsiung Normal University, Taiwan

**1C.2** A REAL-TIME WARP-BASED DATA CAPTURE AND PLAYBACK TEST BED FOR DSP APPLICATIONS  
Jeremy Hershberger, Elizabeth Thompson, Indiana University Purdue University Fort Wayne, United States; Timothy Loos, Raytheon Company (retired), United States

Novel methods: Laboratory, Computer-based, Distance Learning

**1D.1** TEACHING A “MOOC:” EXPERIENCES FROM THE FRONT LINE  
Don Johnson, Rice University, United States

**1D.2** COMPARISON OF DSP BOARDS FOR CLASSROOM USE  
Cameron Wright, University of Wyoming, United States; Michael Morrow, University of Wisconsin-Madison, United States; Thad Welch, Boise State University, United States

**1D.3** FROM FIXED-POINT PROCESSORS TO ANDROID: A HYBRID COURSE FOR REAL-TIME DSP LABORATORY  
David Jun, Douglas Jones, Minh Do, University of Illinois, United States

**1D.4** REAL-TIME ENERGY EFFICIENT EMBEDDED SYSTEM DEVELOPMENT METHODOLOGY  
Neeraj Magotra, Kevin Gorman, Western New England University, United States; Aleena Cusson, Raytheon, United States; Alex Lukomskiy, Prima Electro, United States
Estimation

2A.1 ADAPTIVE WINDOWED ESTIMATION OF ELECTROMAGNETIC FREQUENCY SPECTRA AND RADIATION PATTERNS TO A SPECIFIED UNCERTAINTY
Edmund Miller, Los Alamos National Laboratory (retired), United States

2A.2 PARAMETRIC HAMMERSTEIN-WIENER MODEL ESTIMATION VIA DUAL HAMMERSTEIN IDENTIFICATION
Jianrui Long, Geoffrey Williamson, Illinois Institute of Technology, United States

2A.3 COMPARISON OF CENTERED DISCRETE FRACTIONAL FOURIER TRANSFORMS FOR CHIRP PARAMETER ESTIMATION
Daniel Peacock, Balu Santhanam, University of New Mexico, United States

2A.4 ON A MATRIX FRAMEWORK FOR THE TEAGER-KAISER ENERGY OPERATOR
Balu Santhanam, University of New Mexico, United States

2A.5 CO-PILOTS IN CHANNEL ESTIMATION
Chih-Hao Liu, P. P. Vaidyanathan, California Institute of Technology, United States

2A.6 IMPROVED SPECTROGRAMS USING DISCRETE FRACTIONAL FOURIER TRANSFORM
Oktay Agcaoglu, Balu Santhanam, Majeed Hayat, University of New Mexico, United States

2A.7 A CONTRACTION MAPPING BASED TWO-DIMENSIONAL EQUALIZER AND ITS APPLICATION TO HOLOGRAPHIC DATA STORAGE SYSTEMS
Sunho Kim, Woosik Moon, Sehwang Park, Sungbin Im, Soongsil University, Republic of Korea

Biomedical Signal Processing

2B.1 ROBUST APPROACH FOR EVALUATING PERIODICITY IN HUMAN ATRIAL FIBRILLATION BIPOLAR ELECTROGRAMS
Lakshmi Sugavaneswaran, Ryerson University, Canada; Rupin Dalvi, University Health Network, Canada; Sridhar Krishnan, Ryerson University, Canada; Vijay Chauhan, University Health Network, Canada

2B.2 HIGH PERFORMANCE HEART SOUND SEGMENTATION ALGORITHM BASED ON MATCHING PURSUIT
Carlos I. Nieblas, Miguel A. Alonso, Roberto Conte, Salvador Villarreal, CICESE, Mexico

2B.3 ANALYSIS OF VOCAL-FOLD MOTION FROM LARYNGEAL IMAGE SEQUENCES
Jasmin Gonzalez, Sally Wood, Yuling Yan, Santa Clara University, United States

Graphical Models

2C.1 MESSAGE PASSING SOFT DECODING OF LINEAR BLOCK CODES OVER ARBITRARY FINITE FIELDS
Todd K. Moon, Jacob H. Gunther, Utah State University, United States

2C.2 MULTITRESOLUTION GRAPH SIGNAL PROCESSING VIA CIRCULANT STRUCTURES
Venkatesan Ekambaram, Giulia Fanti, Babak Ayazifar, Kannan Ramchandran, University of California Berkeley, United States

2C.3 A NEW SERIES-WOUND FRAMEWORK FOR GENERATING 1D CHAOTIC MAPS
Zhongyun Hua, Yicong Zhou, C.L.Philip Chen, University of Macau, China
Image Processing

3A.1 RECONSTRUCTING IMAGE DIFFERENCES FROM TOMOGRAPHIC POISSON DATA
Joseph A. O'Sullivan, Yaqi Chen, Washington University, United States

3A.2 AN IMAGE SUPER-RESOLUTION ALGORITHM BASED ON WIENER FILTERING AND WAVELET TRANSFORM
Erica Takemura, Mariane Petraglia, Antonio Petraglia, Federal University of Rio de Janeiro, Brazil

3A.3 BACKGROUND RECOVERY FROM MULTIPLE IMAGES
Aditee Shrotre, Arizona State University, United States; Lina J. Karam, Arizona State University, United States

3A.4 ROBUST LANE LOCALIZATION USING MULTIPLE CUES ON THE ROAD
Sumanth Pavuluri, Santa Clara University, United States; Kikuo Fujimura, Honda Research Institute, United States; Sally Wood, Santa Clara University, United States

Signal Processing Across the Engineering Curriculum

3C.1 PROGRAMS FOR SUPPORTING THE TEACHING OF DIGITAL SPEECH PROCESSING
Lawrence Rabiner, Rutgers University, United States; Ronald Schafer, Stanford University, United States

3C.2 SIGNAL PROCESSING USING VECTOR SPACE METHODS: AN INTROSPECTIVE
Todd K Moon, Jacob H. Gunther, Utah State University, United States

3C.3 INTEGRATIVE HANDS-ON PROJECTS IN CONTINUOUS AND DISCRETE TIME SIGNAL PROCESSING
A. A. (Louis) Beex, Avik Dayal, Virginia Tech, United States

3C.4 WORKSHOP: UNDERSTANDING LEARNING DIFFICULTIES IN CONTINUOUS-TIME SIGNALS AND SYSTEMS COURSES AND MAKING THESE COURSES MORE ACCESSIBLE
Mario Simoni, Rose-Hulman Institute of Technology, United States; Maurice Aburdene, Bucknell University, United States; Farrah Fayyaz, Purdue University, United States

Blind Separation and Identification

3B.1 IMPULSIVE SOURCE SEPARATION WITH APPLICATION TO SPERM WHALE CLICKS
Jeremy Young, Anders Host-Madsen, Eva-Marie Nosal, University of Hawaii at Manoa, United States

3B.2 USING REVERBERATION TIME ESTIMATES IN BLIND SEPARATION OF ACOUSTIC SOURCES
Diego Haddad, Mariane Petraglia, Federal University of Rio de Janeiro, Brazil; Paulo Batalheiro, State University of Rio de Janeiro, Brazil

3B.3 BLIND IDENTIFICATION OF QAM SIGNALS USING A LIKELIHOOD-BASED ALGORITHM
Daimei Zhu, V. John Mathews, University of Utah, United States
Communication Systems

4A.1 ON THE IF SPECTRAL PLACEMENT OF BANDPASS SAMPLED SIGNALS
Sunil Ramlall, University of California, Irvine, United States

4A.2 EXPLORING FREQUENCY MODULATION FEATURES AND RESOLUTION IN THE MODULATION SPECTRUM
Nashlie Sephus, Aaron Lanteman, David Anderson, Georgia Institute of Technology, United States

4A.3 INFORMATION THEORETIC CAPACITY BOUNDS FOR BURST TRANSMISSIONS WITH IMPERFECT CARRIER SYNCHRONIZATION
Balasubramanian Ramakrishnan, Viasat Inc., United States

Adaptive Filtering

4B.1 A COMPARATIVE STUDY OF KERNEL ADAPTIVE FILTERING ALGORITHMS
Steven Van Vaerenbergh, Ignacio Santamaria, University of Cantabria, Spain

4B.2 LIMITATIONS OF THE UNSCENTED KALMAN FILTER FOR THE ATTITUDE DETERMINATION ON AN INERTIAL NAVIGATION SYSTEM
Jean-Baptiste Lacambre, Michel Narozny, Jean-Marie Louge, iXBlue, France

Denoising and Artifact Removal

4C.1 A NEW SELECTIVE FILTERING ALGORITHM FOR IMAGE DENOISING
Licheng Liu, Yicong Zhou, C. L. Philip Chen, University of Macau, Macao SAR of China

4C.2 A NOVEL VARIABLE-FILTER BAND DISCRETE WAVELET TRANSFORM AND ITS APPLICATION ON FETAL ELECTROCARDIOGRAM
Zhong Zhang, Jin Ohtaki, Hiroshi Toda, Takashi Imamura, Tetsuo Miyake, Toyohashi University of Thechnology, Japan

Signal Processing Education in Digital Communications

4D.1 SYNCHRONIZATION AND DEMODULATION PROGRAMMING PROJECTS TO ACCOMPANY A FIRST COURSE ON DIGITAL COMMUNICATIONS
Jacob Gunther, Todd Moon, Utah State University, United States

4D.2 RADIO RECEIVER SIGNAL PROCESSING USING HANDS ON HARDWARE EXPERIMENTS
Mark Wickert, Les Tekam, University of Colorado, Colorado Springs, United States

4D.3 DEVELOPMENT OF MOBILE SENSING APPS FOR DSP APPLICATIONS
Deepta Rajan, Girish Kalyanasundaram, Shuang Hu, Mahesh Banavar, Andreas Spanias, Arizona State University, United States
Acoustic Analysis and Processing

5A.1 INVESTIGATION OF EMOTION CLASSIFICATION USING SPEECH RHYTHM METRICS
Yousef Alotaibi, Ali Meftah, King Saud University, Saudi Arabia; Sid-Ahmed Selouani, Université de Moncton, Canada

5A.2 JOINT LINEAR PREDICTION AND EPOCH ESTIMATION OF VOICED SPEECH USING A BASIS WHERE THE PREDICTION RESIDUAL CAN BE SPARSELY REPRESENTED
Jacob Gunther, Todd Moon, Utah State University, United States

5A.3 3D SOUND IMAGING WITH HEAD TRACKING
William Fitzpatrick, Mark Wickert, Sudhanshu Semwal, University of Colorado, Colorado Springs, United States

5A.4 ON THE TRANSCRIPTION OF MONOPHONIC MELODIES IN AN INSTANCE-BASED PITCH CLASSIFICATION SCENARIO
Fatemeh Pishdadian, Jill Nelson, George Mason University, United States

Coding and Decoding

5B.1 LOW-DELAY JOINT SOURCE-CHANNEL CODING WITH SIDE INFORMATION AT THE DECODER
Mojtaba Vaezi, Alice Combernoux, Fabrice Labeau, McGill University, Canada

5B.2 A NOVEL APPLICATION OF ARMA MODELLING TO AUDIO CODING
Frédéric Mustière, Integrated Device Technology, Canada; Martin Bouchard, University of Ottawa, Canada

5B.3 NON-ADAPTIVE DISTRIBUTED COMPRESSION IN NETWORKS
Mahdy Nabaee, Fabrice Labeau, ECE Dept, McGill University, Canada

5B.4 ADAPTIVE ENERGY-AWAREENCODING FOR DWT-BASED WIRELESS EEG TELE-MONITORING SYSTEM
Ramy Hussein, Alexandria University, Egypt; Alaa Awad, Qatar University, Qatar; Amr El-Sherif, Alexandria University, Egypt; Amr Mohamed, Qatar University, Qatar; Masoud Alghoniemy, Alexandria University, Egypt

Filter and Equalizer Design

5C.1 AN IMPROVEMENT OF CONVERGENCE PERFORMANCE OF IRWLS-BASED ALL-PASS IIR FILTERS
Taisaku Ishiwata, Yoshinao Shiraki, Toho University, Japan

5C.2 REVIVING THE MAXIMUM LIKELIHOOD METHOD FOR DETECTING DOMINANT PERIODICITIES FROM NEAR-PERIODIC SIGNALS
Rupin Dalvi, University Health Network, Canada; Lakshmi Sugavaneswaran, Ryerson University, Canada; Vijay Chauhan, University Health Network, Canada; Sridhar Krishnan, Ryerson University, Canada

5C.3 PERFORMANCE EVALUATION ON A POLYPHASE FILTER BANK STRUCTURE BASED ANTI-JAMMING SYSTEM
Woosik Moon, Sehwang Park, Jieun Lee, Sungbin Im, Soongsil University, Republic of Korea
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