Top Downloads in IEEE *Xplore*

Each "Reader's Choice" column focuses on a different publication of the IEEE Signal Processing Society (SPS). This month we are highlighting articles in *IEEE Signal Processing Magazine* (*SPM*).

SPM publishes tutorial-style articles on signal processing research and applications, as well as columns and forums on issues of interest. Its coverage ranges from fundamental principles to practical implementation, reflecting the multidimensional facets of interests and concerns of the community. The magazine's mission is to bring up-to-date, emerging, and active technical developments, issues, and events to the research, educational, and professional communities. It is also the main Society communication platform addressing important issues concerning all members.

We usually list the top ten most downloaded articles for the past two years at the time of the print deadline. To give readers a sense of timeliness and an awareness of newer published articles in *SPM*, we include five more articles in this issue's "Reader's Choice" column. Of the five additional articles, three of them are the most downloaded articles in 2015, and two are the most downloaded articles in 2016. Your suggestions and comments are welcome and should be sent to Associate Editor Chungshui Zhang (zcs@mail.tsinghua.edu.cn).

An Introduction to Compressive Sampling

Candes, E.J.; Wakin, Michael B.

This article surveys the theory of compressive sampling, also known as compressed sensing (CS), which is a new sensing/sampling paradigm that goes against the common methods in data acquisition. The CS theory asserts that one can recover certain signals and images from far fewer samples or measurements than traditional methods use.

March 2008

Deep Neural Networks for Acoustic Modeling in Speech Recognition: The Shared Views of Four Research Groups

Hinton, G.; Deng, L.; Yu, D.; Dahl, G.E.; Mohamed, A.-R.; Jaitly, N.; Senior, A.; Vanhoucke, V.; Nguyen, P.; Sainath, T.N.; Kingsbury, B.

Deep neural networks (DNNs) that are trained using new methods have been shown to outperform Gaussian mixture models on a variety of speech recognition benchmarks, sometimes by a large margin. This article provides an overview of this progress and represents the shared views of four research groups that have had recent successes in using DNNs for acoustic modeling in speech recognition.

November 2012

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Date of publication: 3 March 2017

Scaling Up MIMO: Opportunities and Challenges with Very Large Arrays

Rusek, F.; Persson, D.; Lau, B.K.; Larsson, E.G.; Marzetta, T.L.; Edfors, O.; Tufvesson, F.

In this article, the authors report that very large multiple-input, multiple-output (MIMO) offered the unique prospect within wireless communication of saving an order of magnitude, or more, in transmit power. This article points out a fundamental challenge of a very large MIMO system design and surveys some related algorithms.

January 2013

OFDM versus Filter Bank Multicarrier

Farhang-Boroujeny, B.

This article addresses the shortcomings of orthogonal frequency-division multiplexing in some applications and shows that a filter bank multicarrier could be a more effective solution.

May 2011

Super-Resolution Image Reconstruction: A Technical Overview

Park, S.C.; Park, M.K.; Kang, M.G.

One promising approach to increasing spatial resolution of an image is to use signal processing techniques to obtain a high-resolution image (or sequence) from observed multiple low-resolution images. This article introduces the concept of super-resolution algorithms to readers who are unfamiliar with this area and to provide the technical review of various existing super-resolution methods for experts.

May 2003

Modulation Formats and Waveforms for 5G Networks: Who Will be the Heir of OFDM? An Overview of Alternative Modulation Schemes for Improved Spectral Efficiency

Banelli, P.; Buzzi, S.; Colavolpe, G.; Modenini, A.; Rusek, F.; Ugolini, A.

This article provides a review of some modulation formats suited to fifth-generation (5G) cellular communications, enriched by a comparative analysis of their performance in a cellular environment, and

by a discussion of their interactions with specific 5G ingredients.

November 2014

Modeling and Optimization for Big Data Analytics: (Statistical) Learning Tools for Our Era of Data Deluge

Slavakis, K.; Giannakis, G.B.; Mateos, G.

This article contributes to the ongoing cross-disciplinary efforts in data science, by putting forth encompassing models, capturing a wide range of signal processing relevant data analytic tasks. It offers scalable architectures and optimization algorithms for decentralized and online learning problems, while revealing fundamental insights into the various analytic and implementation tradeoffs involved. The close connections of the presented framework with several big data tasks are highlighted.

September 2014

Locating the Nodes: Cooperative Localization in Wireless Sensor Networks

Patwari, N.; Ash, J.N.; Kyperountas, S.; Hero, O.; Moses, R.L.; Correal, N.S.

This article provides a window into cooperative localization, which has found considerable applications in ad hoc and wireless sensor networks. It presents measurement-based statistical models of time of arrival, angle of arrival, and received signal strength and uses them to generate localization performance bounds. It also surveys a large and growing body of sensor localization algorithms. This article is intended to emphasize the basic statistical signal processing background, necessary to understand the state-of-the-art methods, and to make progress in the new and largely open areas of sensor network localization research.

July 2005

Big Data Analysis with Signal Processing on Graphs: Representation and Processing of Massive Data Sets With Irregular Structure

Sandryhaila, A.; Moura, J.M.F.

This article reviews fundamental concepts of discrete signal processing on graphs, including graph signals and graph filters, graph Fourier transform, graph frequency, and spectrum ordering, and compares them with their counterparts from the classical signal processing theory. It considers product graphs as a graph model that helps extend the application to large data sets through efficient implementation based on parallelization and vectorization. The article also relates the presented framework to existing methods for large-scale data processing.

September 2014

Communicating While Computing: Distributed Mobile Cloud Computing Over 5G Heterogeneous Networks

Barbarossa, S.; Sardellitti, S.; Lorenzo, P.D.

In this article, the authors proposed a system perspective of the next fifth-generation (5G) systems centered on the need to empower energy-hungry mobile terminals with computation offloading capabilities via proximity to radio access through small-cell base stations, endowed with cloud functionalities. They also showed how the optimal resource allocation involves a joint allocation of radio and computation resources, within a fully cross-layer approach.

November 2014

Speaker Recognition by Machines and Humans: A Tutorial Review

Hansen, J.H.L.; Hasan, T.

In this article, the authors review the literature on speaker recognition by machines and humans, with an emphasis on prominent speaker-modeling techniques that have emerged in the last decade for automatic systems. They conclude this review with a comparative study of human versus machine speaker recognition and attempt to point out strengths and weaknesses of each.

November 2015

(continued on page 122)

social makes automating vehicles an ultrahard problem to tackle. We observe cues from vehicles while we drive that suggest we should drive more cautiously (e.g., a pedestrian looking at his smartphone while walking toward an intersection) or even avoid certain driving scenarios (e.g., an overzealous driver swerving through lanes). While it's unreasonable to expect that self-driving cars could make the same social observations that we make as humans, what we can expect is that technology will assist us in being as aware and informed as possible. Already there have been advancements made by the signal processing community to estimate driver distraction using in-vehicle sensors and cue the driver to focus on the road. However, there are many other opportunities for signal processing engineers to analyze human behavior data associated with driving, which will be essential for improving driver and pedestrian safety.

The future of vehicular systems is data and sensor driven. Vehicles will become increasingly networked and outfitted with sensors and share their data with a variety of in-vehicle and cloud-based computing services. The societal benefits associated with improved vehicular systems range from energy efficiency resulting from swarm driving to the potential for saving many lives should the technology mature. While this future is exciting, engineers, researchers, and technologists must quickly act to develop the new signal and information processing innovations required to make future vehicular systems safe.

Author note

Some parts of this article originally appeared on Robotic Tips website; http://www.robotictips.com.

Author

Wade Trappe (trappe@winlab.rutgers.edu) received his B.A. degree in mathematics from the University of Texas at Austin and his Ph.D. degree in applied mathematics and scientific computing from the University of Maryland. He is an IEEE Fellow, and a professor of electrical and computer engineering at Rutgers University, New Brunswick, New Jersey.

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READER'S CHOICE

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Tensor Decompositions for Signal Processing Applications: From Two-Way to Multiway Component Analysis

Cichocki, A.; Mandic, D.; Lathauwer, L. De; Zhou, G.; Zhao, Q.; Caiafa, C.; Phan, H.A.

The authors have shown that tensor decompositions are a good match for exploratory analysis of multifaceted data sets and have illustrated their applications in multisensor and multimodal signal processing. Their emphasis has shown that tensor decompositions and multilinear algebra open up completely new possibilities for component analysis, as compared with the flat view of standard two-way methods.

March 2015

Euclidean Distance Matrices: Essential Theory, Algorithms, and Applications

Dokmanic, I.; Parhizkar, R.; Ranieri, J.; Vetterli, M.

This article reviews the fundamental properties of Euclidean distance matrices (EDMs) and shows how the various EDM properties can be used to design algorithms for completing and denoising distance data. Some directions are given for further research.

November 2015

Bayesian Machine Learning: EEG/MEG Signal Processing Measurements

Wu, W.; Nagarajan, S.; Chen, Z.

To review recent advances and to foster new research ideas, this article provides a tutorial on several important emerging Bayesian machine learning research topics in electroencephalography (EEG)/magnetoencephalography (MEG) signal processing and presents representative examples in EEG/MEG applications.

January 2016

Compressive Covariance Sensing: Structure-Based Compressive Sensing Beyond Sparsity

Romero, D.; Arianandа, D.D.; Tian, Z.; Leus, G.

This article is concerned with the reconstruction of second-order statistics, such as covariance and power spectrum, instead of the reconstruction of signals in compressed sensing, even in the absence of sparsity priors.

January 2016

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