

IEEE Signal Processing Magazine Call for Papers

Special Issue on Subsurface Exploration: Recent Advances in Geo Signal Processing, Interpretation, and Learning

For centuries, humans have been exploring the subsurface structure of planet Earth. Several Earth geophysical applications, such as mining, earthquake studies, and oil and gas exploration, have produced over the years ground breaking theories and innovative technologies that can accurately image the Earth’s subsurface. The pursuit is ongoing with an increasing desire to have higher resolution subsurface models and images. Signal processing, data interpretation, and modeling have been the cornerstones of such innovations. Imaging of the Earth’s subsurface typically consists of three major steps: acquisition, processing, and interpretation. In each step, signal processing has played and continues to play a fundamental role within a geophysical umbrella.

In recent years, there have been advances in technologies and requirements that demand the utilization of advanced signal processing and machine learning theories and algorithms. For example, the wide and full azimuth acquisition technologies have proven to be instrumental in providing high resolution subsurface images. Similarly, geophones and hydrophones are becoming smaller, cableless, wireless, mobile and soon with processing capabilities. Further, recent experiments to deploy autonomous nodes have proven the viability of automating part or the entire acquisition process. This becomes necessary when the number of sensors increases rapidly to be in the range of hundreds of thousands per survey. Deploying such dense sensors requires these sensors to be wireless and more intelligent with limited processing in the field.

Another major challenge is the exploration of deeper target reservoirs. In such cases, the goal is to efficiently acquire very long offsets, acquire better low frequency content, and create better seismic images in areas prone to poor target illumination and complex wave propagation effects.

A third challenge is in the area of interpretation and reservoir engineering. In interpretation, the role of machine learning combined with cognitive and perception-based algorithms is very promising given the complexity of the task. Moreover, the integration of seismic data in the reservoir inversion workflow, and the analysis of uncertainties require new advances in both signal processing and information theory.

We envision that this special issue is timely where automation and learning are being deployed in Earth exploration. Furthermore, we envision such technologies to become essential for the exploration of other planets including Mars.

Topics of Interest include (but are not limited to):

- emerging seismic data acquisition
- automated interpretation
- learning-based methods for interpretation
- autonomous nodes for exploration
- Sensor networks and IoT
- in-field processing of seismic data
- compression of seismic data
- machine learning for seismic data characterization
- optimized, compact and sparse seismic data representations
- signal enhancement
- simultaneous acquisition and source separation
- tomography for seismic data
- hardware and software algorithmic breakthroughs
- novel applications of signal and image processing to geophysics

| Important Dates | |
|-------------------------------|--------------------|
| White paper due: | February 20, 2017 |
| Invitation notification: | March 15, 2017 |
| Manuscript submission due: | May 10, 2017 |
| 1 st review round: | June 30, 2017 |
| Revised manuscript due: | August 5, 2017 |
| Final decision notification: | September 20, 2017 |
| Final material from authors: | September 30, 2017 |
| Tentative publication date: | January 2018 |

White papers are required, and full articles are invited based on the review of white papers. The white paper format is up to 4 pages in length, including proposed article title, motivation and significance of the topic, an outline of the proposed paper, and representative references; an author list, contact information and short bios should also be included. Articles submitted to this issue must be of tutorial and overview/survey nature and in an accessible style to a broad audience, and have significant relevance to the scope of the special issue. Submissions will be reviewed according to the IEEE Signal Processing Magazine guidelines, and should not have been published or under review elsewhere. Submissions should be made online at <http://mc.manuscriptcentral.com/sps-ieee>. For guidelines and information on paper submissions, visit <http://signalprocessingsociety.org/publications-resources/ieee-signal-processing-magazine/information-authors-spm>

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