Randomized algorithms in exploration seismology

Petroleum keynote paper

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SUMMARY

As in several other industries, progress in exploration seismology relies on the collection and processing of massive data volumes that grow exponentially in size as the survey area and desired resolution increase. This exponential growth—in combination with the increased complexity of the next generation of iterative wave equation-based inversion algorithms—puts strain on our acquisition systems and computational back ends, impeding progress in our field. During this talk, I will review how recent randomized algorithms from Compressive Sensing and Machine Learning can be used to overcome some of these challenges by fundamentally rethinking how we sample and process seismic data. The key idea here is to reduce acquisition and computational costs by deliberately working on small randomized subsets of the data at a desired accuracy. I will illustrate these concepts using a variety of compelling examples on realistic synthetics and field data.