

Jiajia Sun

Assistant Professor of Geophysics
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EDUCATION

- 2015 **Ph.D. in Geophysics with minor in Mathematical and Computer Sciences**
Colorado School of Mines, CO, USA
- 2008 **B.S. in Geophysics**
China University of Geosciences, Wuhan, China

PROFESSIONAL EXPERIENCES

- 2017-Present **Assistant Professor of Geophysics**
University of Houston, Department of Earth and Atmospheric Sciences
- 2015-2017 **Post-Doctoral Fellow**
Colorado School of Mines, Department of Geophysics

RESEARCH INTERESTS

- Inversion of geophysical data set (e.g., gravity, gravity gradiometry, magnetics, DC, IP, MT, EM, seismic traveltimes) constrained by geological prior information.
- Joint inversion of multiple geophysical data sets based on structural similarity and prior petrophysical measurements.
- Sparse inversion using L1 and L0 norm regularization.
- Magnetization vector inversion with clustering constraints.
- Machine learning, such as neural networks and deep learning, applied to geophysical problems.
- Sparse signal processing of geophysical data.

RESEARCH EXPERIENCES

- 2015-2017 **Post-Doctoral Research**
- **Reservoir imaging and monitoring using 3D CSEM**
Integrated controlled source electromagnetic (CSEM) data and reservoir simulation for monitoring CO₂ movement. Performed 3D CSEM forward modeling to understand the sensitivity of EM data to CO₂ movement.
 - **Joint inversion of 3D gravity, magnetic and petrophysical data**
Studying the use of joint inversion of potential field and petrophysical data as a hypothesis testing tool for better understanding the geological structures and compositions in the subsurface, using field data sets from Canada and Sweden.

- **Joint inversion of 3D gravity gradiometry and magnetic data**
Investigating the use of structure-based joint inversion for lithology differentiation using airborne potential field data collected over an iron deposit in Brazil.
- **3D magnetization clustering inversion and uncertainty analysis**
Developed an efficient algorithm for magnetization vector inversion with clustering constraints, and an empirical and effective approach to the uncertainty assessment of the recovered magnetization directions. Investigated its application to geology differentiation using field data set from Carajas Mineral Province in Brazil.

2011-2015 **Ph.D. thesis research**

Focused on joint inversion of multiple geophysical data sets and its application to differentiation and segmentation of geological units.

- **Joint inversion of potential field and seismic traveltime data**
Developed a series of algorithms for joint inversion of gravity and seismic data constrained by petrophysical measurements, allowing for simultaneous imaging and segmentation of the subsurface geological bodies.
- **Inversion of full waveform induced polarization (IP) data**
Developed a 4D inversion algorithm for full waveform IP data, and established a practical workflow for differentiating geological units based on distinct electrical chargeability decaying behaviors recovered from 4D IP inversion.

2008-2015 **Graduate research outside thesis' scope**

Integrated gravity, magnetic, direct current and induced polarization data into the development of novel inversion algorithms and integrated interpretation workflows.

- **3D magnetization vector inversion**
Developed a highly constrained inversion algorithm for magnetic data affected by remanent magnetization, and investigated the feasibility of geology differentiation based on recovered magnetization directions.
- **Joint interpretation of magnetic and direct current (DC) data**
Performed inversions of magnetic and DC data, interpreted recovered models based upon rock physics, and developed a workflow for differentiating lithologic units based on multiple geophysical data sets.
- **Joint inversion of magnetic and induced polarization (IP) data**
Investigated different strategies for inverting magnetic and IP data, and demonstrated the significant improvement from joint inversion for exploration of massive sulfide deposits.
- **Joint inversion of surface and borehole gravity**
Developed an innovative and practically useful inversion algorithm based on iterative thresholding and geological dip constraints.

TEACHING EXPERIENCES

Colorado School of Mines

2016, 2017 **Inversion Theory**

Co-instructor for graduate-level class Inversion Theory in Department of Geophysics. Designed and gave lectures on solving nonlinear inverse problem using

Gauss-Newton method, bound constrained inverse problems, general L_p norm inversions and joint inversions of multi-modal geophysical data.

2011-2014 **Inversion Theory**

Lectured on nonlinear inverse problems, bound constrained inverse problems, general L_p norm inversions and joint inversions for a total of 17 lecture hours.

2011 **Advanced Gravity and Magnetic Exploration**

Lectured on modeling and analysis of potential field data in Fourier domain for geophysics undergraduates.

PEER-REVIEWED PUBLICATIONS

6. Melo, A., **J. Sun** and Y. Li, 2017, Geophysical inversions applied to 3D geology characterization of an iron oxide copper gold deposit in Brazil: *Geophysics*, 82(5), K1-K13.
5. **Sun, J.**, and Y. Li, 2017, Joint inversion of multiple geophysical and petrophysical data using generalized fuzzy clustering algorithms: *Geophys. J. Int.*, 208(2), 1201-1216.
4. Li, Y., and **J. Sun**, 2016, 3D magnetization inversion using fuzzy c-means clustering with application to geology differentiation: *Geophysics*, 81(5), J61-J78.
3. **Sun, J.**, and Y. Li, 2016, Joint inversion of multiple geophysical data using guided fuzzy c-means clustering: *Geophysics*, 81(3), ID37-ID57.
2. **Sun, J.**, and Y. Li, 2015, Multidomain petrophysically constrained inversion and geology differentiation using guided fuzzy c-means clustering: *Geophysics*, 80(4), ID1-ID18.
1. **Sun, J.**, and Y. Li, 2014, Adaptive L_p inversion for simultaneous recovery of both blocky and smooth features in a geophysical model: *Geophys. J. Int.*, 197(2), 882-899.

CONFERENCE PROCEEDINGS

18. **Sun, J.**, and Y. Li, 2017, Assessing the uncertainty of magnetization directions from clustering inversion and its effect on geology differentiation: 87th Annual International Meeting, SEG Expanded Abstracts, 2435-2439.
17. **Sun, J.**, and Y. Li, 2017, Integration of geophysical and petrophysical data through joint inversion, in Proceedings of Exploration 17: Sixth Decennial International Conference on Mineral Exploration, accepted.
16. **Sun, J.**, and Y. Li, 2016, Joint clustering inversion of gravity and magnetic data applied to the imaging of a gabbro intrusion: 86th Annual International Meeting, SEG Expanded Abstracts, 2175-2179, Dallas, US.
15. Li, Y., and **J. Sun**, 2016, Geology differentiation with uncertainty estimation using inverted magnetization directions: 86th Annual International Meeting, SEG Expanded Abstracts, 2159-2164, Dallas, US.
14. Rapstine, T., **J. Sun**, and Y. Li, 2016, Integrating a spatial salt likelihood map and prior petrophysical data into a gravity gradiometry inversion through fuzzy c-means clustering: 86th Annual International Meeting, SEG Expanded Abstracts, 1622-1626, Dallas, US.
13. **Sun, J.**, and Y. Li, 2015, Advancing the understanding of petrophysical data through joint inversion: A sulfide deposit example from Bathurst Mining Camp: 85th Annual International Meeting, SEG Expanded Abstracts, 2017-2021, New Orleans, US.
12. Melo, A. T., **J. Sun**, and Y. Li, 2015, Geophysical inversions applied to geological

differentiation and deposit characterization: A case study at an IOCG deposit in Carajás Mineral Province, Brazil: 85th Annual International Meeting, SEG Expanded Abstracts, 2012-2016, New Orleans, US.

11. Li, Y., and **J. Sun**, 2015, Towards geology differentiation using magnetization inversions: International workshop on gravity, electrical & magnetic methods and their application, 350-353, Chengdu, China.
10. **Sun, J.**, and Y. Li, 2014, Exploration of a sulfide deposit using joint inversion of magnetic and induced polarization data: 84th Annual International Meeting, SEG Expanded Abstracts, 1780-1784, Denver, US.
9. Li, Y., and **J. Sun**, 2014, Total magnetization vector inversion using guided fuzzy c-means clustering: 84th Annual International Meeting, SEG Expanded Abstracts, 1285-1290, Denver, US.
8. **Sun, J.**, and Y. Li, 2013, A general framework for joint inversion with petrophysical information as constraints: 83rd Annual International Meeting, SEG Expanded Abstracts, 3093-3097, Houston, US.
7. **Sun, J.**, and Y. Li, 2013, Petrophysically constrained geophysical inversion using Parzen window density estimation: 83rd Annual International Meeting, SEG Expanded Abstracts, 3051-3056, Houston, US.
6. **Sun, J.**, and Y. Li, 2012, Joint inversion of multiple geophysical data: A petrophysical approach using guided fuzzy c-means clustering: 82nd Annual International Meeting, SEG Expanded Abstracts, 1-5, Las Vegas, US.
5. **Sun, J.**, Y. Li, and M. Nabighian, 2012, Lithology differentiation based on inversion of full waveform induced polarization data from Newmont Distributed IP Data Acquisition System (NEWDAS): 82nd Annual International Meeting, SEG Expanded Abstracts, 1-5, Las Vegas, US.
4. **Sun, J.**, and Y. Li, 2012, Joint inversion of seismic traveltimes and gravity data using petrophysical constraints with application to lithology differentiation: 22nd ASEG International Geophysical Conference and Exhibition, 1-4, Brisbane, Australia.
3. **Sun, J.**, and Y. Li, 2011, Geophysical inversion using petrophysical constraints with application to lithology differentiation: 81st Annual International Meeting, SEG Expanded Abstracts, 30, 2644-2648, San Antonio, US.
2. **Sun, J.**, and Y. Li, 2010, Adaptive Lp inversion to recover both blocky and smooth features: 80th Annual International Meeting, SEG Expanded Abstracts, 29, 4297-4301, Denver, US.
1. **Sun, J.**, and Y. Li, 2010, Inversion of surface and borehole gravity with thresholding and density constraints: 80th Annual International Meeting, SEG Expanded Abstracts, 29, 1798-1803, Denver, US.

INVITED TALKS

- 12/2012 **Sun, J.**, and Y. Li, A new joint inversion strategy using a priori petrophysical information as constraints in Session: Joint Inversions and Other Strategies to Integrate Multidisciplinary Geophysical Data II at American Geophysical Union (AGU) Fall Meeting, San Francisco, United States.

- 11/2012 **Sun, J.**, and Y. Li, Joint inversion using physical property constraints at SEG Workshop: A Working Guide to 3D Inversion Methods in Mining Geophysics, SEG Annual Meeting, Las Vegas, United States.
- 07/2012 **Sun, J.**, and Y. Li, A new approach to joint inversion using statistical petrophysical constraints: Application to joint seismic travel time and gravity inversion at Bureau of Geophysical Prospecting (BGP) workshop, Zhuozhou, China.

HONORS & AWARDS

Society of Exploration Geophysicists (SEG)

- 2016 **Best Paper in the Mining sessions** at the 2016 SEG Annual Meeting for *Geology differentiation with uncertainty estimation using inverted magnetization directions* (co-authored with Yaoguo Li)
- 2016 **Honorable Mention of Best Paper in GEOPHYSICS**
Multidomain petrophysically constrained inversion and geology differentiation using guided fuzzy c-means clustering (co-authored with Yaoguo Li)
- 2015 **Best Student Paper** in the Mining and Geothermal sessions at the 2015 SEG Annual Meeting for *Geophysical inversions applied to geological differentiation and deposit characterization: A case study at an IOCG deposit in Carajás Mineral Province, Brazil* (co-authored with Aline Melo and Yaoguo Li)
- 2011 SEG/Denver Geophysical Society Scholarship

Colorado School of Mines

- 2015 Mendenhall Prize for Outstanding Graduating Doctor of Philosophy Student (who, throughout their graduate program, have demonstrated outstanding academic performance, the ability to conduct cutting-edge research, and the highest standards of integrity and professional conduct)
- 2008 Meng Ersheng Geophysics Student Award

China University of Geosciences (Wuhan)

- 2007 National Encouragement Scholarship
- 2006 Zhongkai Mining Geophysics Scholarship

PROFESSIONAL SERVICE

Reviewer

- 2011-Present Pure and Applied Geophysics
- 2013-Present Geophysics
- 2015-Present Exploration Geophysics
- 2016-Present Journal of Applied Geophysics
- 2016-Present Geophysical Prospecting

2016-Present Geophysical Journal International
2016-Present Interpretation
2016-Present Journal of Geophysical Research – Solid Earth

PROFESSIONAL AFFILIATIONS

2008-Present Society of Exploration Geophysicists (SEG)
2009-Present American Geophysical Union (AGU)
2017-Present European Association of Geoscientists & Engineers (EAGE)

CERTIFICATIONS

09/2014 **Machine Learning**
Certificate signed by Prof. Andrew Ng upon successfully completing the online machine learning course provided by Stanford University through Coursera Inc.