DR. CLAIRE BIRNIE

Geophysicist | Data Scientist

PROFILE

Data scientist in the energy sector with expertise in geophysics and a strong background in physics, statistics and computer science. Experienced project manager having achieved over $800k USD in funding. Passionate about devising new solutions to current business problems by combining established physics-based approaches with emerging data science techniques.

PROFESSIONAL EXPERIENCE

Jan 2021 – Present
Research Scientist - KAUST
Obtained over 800k USD in funding. Project manager for internal and external funded projects. Main areas of research include ML-assisted seismic noise suppression and microseismic monitoring from the lab- to field-scale.

Jan 2018 – Dec 2020
Data Scientist / Senior Data Scientist - Equinor (ne. Statoil)
Combine signal processing and ML for predictive maintenance and microseismic detection. Utilise NLP, ML, and knowledge graphs for improving offshore safety.

Apr 2017 – Aug 2017
R&D Intern - Nanometrics
Develop and document incorporation of noise suppression procedures into production toolbox.

Oct 2016 – Jan 2017
Visiting Researcher – University of Western Australia
Quantify and reduce uncertainties in microseismic imaging for CCS and subsurface reservoir utilisation.

May 2015
Geophysics Intern - Pinnacle, Halliburton
Microseismic imaging.

Jun 2013 – Aug 2013
Geophysics Intern - VSFusion, Baker Hughes
VSP modelling and processing.

EDUCATION

2014 – 2018
Ph.D. Geophysics - University of Leeds, UK
Title: Statistical methods for ambient noise characterisation, modelling and suppression: theory and applications f or surface microseismic monitoring.

2017
Microsoft Professional Program in Data Science - Remote
Relevant modules: statistical data analysis; data cleansing and transformation; feature selection; dimensionality reduction; machine learning methods and optimisation.

2010 – 2014
B.Sc. with Hons. Geophysics and Meteorology - University of Edinburgh, UK
Project 1 (self-proposed): Effect of Gardner's relation on uncertainties in synthetic seismogram production
Project 2: Using a nearest-neighbour analysis for clustering of supra-glacial lake drainage in Greenland.

CONTACTS

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SKILLS

Languages:
English – mother tongue, Italian – basic, Norwegian - basic.

Programming Languages:
Python (tensorflow, keras, pytorch, scikit-learn, nltk, plotly, pytest, sphinx), Neo4j, MATLAB, SQL, Unix shell scripting, LaTeX.

Others:
Microsoft Azure, Amazon AWS, Git, Bitbucket, JIRA.

AWARDS

Sep 2019 - Finalist for best application of AI, The DataSci & AI Awards

Jun 2017 - Subsurface Machine Learning Hackathon, Best Presentation Award.

Dec 2016 - Codess and Microsoft Scholarship for Professional Program in Data Science.

Aug 2016 - Australian Bicentennial Scholarship Award.

BOARD EXPERIENCE

Jan 2022 – Sep 2023 ♦ **[2023 Vice-Chair] SEG Advanced Modelling Co-operation**

PUBLICATIONS

For a detailed list of publications see the attached publication list or visit my Google Scholar.

SELECTED INVITED TALKS

Sep 2023 ♦ **[Keynote] British Geophysical Association New Advances in Geophysics**
Title: *Self-supervised seismic denoising: Deep learning without labels*

Sep 2023 ♦ **KAUST Earth Science and Engineering Seminar**
Title: *Deep learning without labels: An application to seismic denoising*

Jun 2022 ♦ **AI in Geoscience and Geophysics: Current Trends and Future Prospects**
Title: *Advances in Self-Supervised, Blindspot Denoising*

Mar 2022 ♦ **[Keynote] Women in Data Science – KFUPM Chapter**
Title: *Natural Language Processing for sorting geoscientific documents*

Mar 2021 ♦ **Second EAGE Workshop on Machine Learning**
Title: *The key ingredients for scaling ML solutions in geoscience: explainability and infrastructure*

Dec 2019 ♦ **UiO Data Science M.Sc. guest lecture**
Title: *Giving context to unstructured data.*

Dec 2016 ♦ **Curtin/CSIRO Geophysics seminar**
Title: *An introduction to Isolated Covariance-based Noise Modelling and Whitening.*

SELECTED OPEN-SOURCE CONTRIBUTIONS

eNLP- A python library of commonly used NLP routines
Original developer. Wrote pytests and documentation, as well as building CI pipeline.

Transform2022 Self-Supervised Denoising - Tutorial Material
Wrote course material in easy-to-follow Jupyter Notebooks, alongside some python utility files.

TEACHING EXPERIENCE

Apr 2022 ♦ **Transform 2022 – Instructor**
Prepared course material and taught 1.5 hour hands-on tutorial on self-supervised denoising.

Jun 2021 ♦ **Utilising Unstructured Data in Geoscience Summer School – Instructor**
Prepared course material and taught virtual summer school hosted by KAUST--Iraya Energies.

Sep 2019 – Dec 2020 ♦ **Python for Data Science – Instructor**
Prepared syllabus and material and taught course internally within Equinor.

Jul 2019 ♦ **IGSC A mini-hackathon on data from the continental shelf – Organizer**
Prepared and hosted a hackathon for geoscience students. Open-sourced course material.

ORGANISATIONAL EXPERIENCE

Jan 2020 – Present ♦ **Member of organising committee for multiple SEG and EAGE workshops.**

Oct 2020 – Jun 2021 ♦ **EAGE 2021 Workshop 'Development of ML Solutions at Scale: Going from proof of concepts to integrated workflows'**
Convenor

Mar 2018 – Dec 2019 ♦ **Data Science Team Training**
Identified core-areas of competence for data science team; sourced instructors; and, organised training courses.

VOLUNTEERING

2021 - 23 ♦ **Associate Editor of SEG Geophysics Journal**

2019 - 21 ♦ **Founding Committee member of EAGE AI special community**

2019 - 21 ♦ **Reverse Mentor of Equinor COO**

2019 - pres. ♦ **Reviewer for geophysics journals and conferences**

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FULL PUBLICATION LIST

For a detailed list of publications and citation statistics visit my Google Scholar. This section summarises some select publications over my different research topics.

THESIS

Birnie, C.E. [2018], Statistical methods for ambient noise characterisation, modelling and suppression: theory and applications for surface microseismic monitoring. Doctoral dissertation, University of Leeds.

BOOK CHAPTERS

Ravasi, M., Romero, J., Corrales, M., Luiken, N. and **Birnie, C.**, 2024. Striking a balance: Seismic inversion with model- and data-driven priors. In Developments in Structural Geology and Tectonics (Vol. 6, pp. 153-200). Elsevier.

SELECT JOURNAL PUBLICATIONS

Birnie, C. and Ravasi, M., 2024. Explainable artificial intelligence driven mask design for self-supervised seismic denoising. Geophysical Prospecting. [Accepted]

Anikiev, D., **Birnie, C.**, bin Waheed, U., Alkhalifah, T., Gu, C., Verschuur, D.J. and Eisner, L., 2023. Machine learning in microseismic monitoring. Earth-Science Reviews, p.104371.

Luiken, N., Ravasi, M. and **Birnie, C.**, 2023. Integrating self-supervised denoising in inversion-based seismic deblending. Geophysics, 89(1), pp.WA39-WA51.

Liu, S., **Birnie, C.** and Alkhalifah, T., 2023. Trace-wise coherent noise suppression via a self-supervised blind-trace deep-learning scheme. Geophysics, 88(6), pp.V459-V472.

Zhang, H., Alkhalifah, T., Liu, Y., **Birnie, C.** and Di, X., 2022. Improving the generalization of deep neural networks in seismic resolution enhancement. IEEE Geoscience and Remote Sensing Letters, 20, pp.1-5.

Birnie, C. and Alkhalifah, T., 2022. Transfer learning for self-supervised, blind-spot seismic denoising. Frontiers in Earth Science, 10, p.1053279.

Birnie, C. and Hansteen, F., 2022. Bidirectional recurrent neural networks for seismic event detection. Geophysics, 87(3), pp.KS97-KS111.

Birnie, C.E., Ravasi, M., Alkhalifah, T., Liu, S. [2021], The potential of self-supervised networks for random noise suppression in seismic data, Artificial Intelligence in Geoscience.

Wang, H., Alkhalifah, T., bin Waheed, U., **Birnie, C.E.,** [2021], Data-driven Microseismic Event Localization: an Application to the Oklahoma Arkoma Basin Hydraulic Fracturing Data, IEEE Transactions on Geoscience and Remote Sensing

Ravasi, M., **Birnie, C.E.**, [2021], A joint inversion-segmentation approach to assisted seismic interpretation, Geophysical Journal International.

Schuberth, M.G, Bakka, H.S. **Birnie, C.E.**, Dümmong, S., Haavik, K.E., Li, Q., Synnevåg, J.F., Saadallah, Y., Vinje, L., Constable, K. [2021] A Real-Time Fiber Optical System for Wellbore Monitoring: A Johan Sverdrup Case Study, SPE Offshore Europe Conference & Exhibition

Birnie, C.E., Jarraya, H., Hansteen, F. [2020], An introduction to distributed training of deep neural networks for segmentation tasks with large seismic datasets.

Birnie, C.E., Ravasi, M. [2020], Generating Custom Word Embeddings for Geoscientific Corpi, First Break.

Birnie, C.E., Chambers, K., Angus, D., and Stork, A. [2020], On the importance of benchmarking algorithms under realistic noise conditions, Geophysical Journal International.

Birnie, C.E., Sampson, J., Sjaastad, E., Johansen, B., Obrestad, L., Larsen, R., Khamassi, A. [2019], Improving the quality and efficiency of operational planning with risk management with ML and NLP, SPE Offshore Europe.

Stork, A.L., Nixon, C.G., Hawkes, C.D., **Birnie, C.,** White, D.J., Schmitt, D.R. and Roberts, B. [2018], Is CO2 injection at Aquistore aseismic A combined seismological and geomechanical study of early injection operations. International Journal of Greenhouse Gas Control.

Birnie, C., Chambers, K., and Angus, D. [2017], Seismic arrival enhancement through the use of noise whitening. Physics of the Earth and Planetary Interiors.

Birnie, C., Chambers, K., Angus, D., and Stork, A. [2016], Analysis and models of pre-injection surface seismic array noise recorded at the Aquistore carbon storage site. Geophysical Journal International.