DR. CLAIRE BIRNIE

Geophysicist | Data Scientist

PROFILE

Specializing in the energy sector, my role as a data scientist blends expertise in geophysics with a strong foundation in physics, statistics, and computer science. Leveraging cloud solutions, I've contributed to the successful deployment of multiple ML products and efficiently scaled their integration across the business. As a skilled project manager and lead investigator, I secured over $800k USD in funding, satisfying internal and external stakeholders. My primary objective is crafting practical solutions to tackle current business challenges by integrating traditional methods with innovative data science techniques.

PROFESSIONAL EXPERIENCE

Jan 2021 – Present

Research Scientist – KAUST

Leading projects, I procured over $800k USD in funding and managed multi-disciplinary teams, ensuring alignment with internal and external stakeholders. I address critical research gaps obstructing widespread AI adoption, including utilisation of unlabelled datasets and fostering trust through explainable ML solutions. In addition, I actively contribute to educational initiatives through mentorship, organizing summer schools and delivering tutorials.

Jan 2018 – Dec 2020

Data Scientist / Senior Data Scientist – Equinor (ne. Statoil)

Skilled in agile methodologies, I oversaw the complete cycle of cloud-based ML solution development, from ideation to MVP to first use and subsequent scaling across various business assets. Utilised technologies such as NLP, knowledge graphs, computer vision techniques, time series analysis and distributed deep learning. Additionally, devised training programs for the data science team and delivered education to other departments.

Prior roles:

R&D Intern at Nanometrics, 2017; *Visiting Researcher* at The University of Western Australia, 2016; *Geophysics Intern* at Pinnacle Halliburton, 2015; *Geophysics Intern* at VSFusion (Baker Hughes–Halliburton), 2013; *BASI Snowboard Instructor* at Midlothian Snowsports Center, 2011-13.

EDUCATION

2014 –18

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

Funded by Microsoft Codess scholarship. Relevant modules: statistical data analysis; data cleansing and transformation; feature selection; dimensionality reduction; machine learning methods and optimisation.

2010 –14

B.Sc. with Hons. Geophysics and Meteorology – University of Edinburgh, UK

CONTACTS

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SKILLS

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

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

Others:
Microsoft Azure, Amazon AWS, Kubernetes, Docker, 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
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Sep 2023   ◆   **[2023 Vice-Chair] SEG Advanced Modelling Co-operation**

PUBLICATIONS

Google H-Index of 11 and I10-Index of 13. Over 20 publications on deep learning applications. 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.*

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
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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
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Present   ◆   **Member of organising committee for multiple SEG and EAGE workshops.**

Oct 2020
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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**

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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.

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.