

# David Watson

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## PERSONAL STATEMENT

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I am an accomplished and motivated early career researcher with a long, interdisciplinary publication track record. I bring expertise and enthusiasm to all my courses, whether I am lecturing on causality in machine learning or leading seminars on the foundations of social data science. I am passionate about the theory and practice of artificial intelligence – from the ethical impact of algorithms to their efficient design and deployment. My experience has prepared me to lead cutting edge research projects, teach students at the undergraduate and postgraduate level, and collaborate with colleagues from all sectors of the academy.

## EDUCATION

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<b>University of Oxford</b> DPhil in Information, Communication, and the Social Sciences	<b>October 2017–January 2021</b> <b>Oxford, UK</b>
<b>University of Oxford</b> MSc in Social Science of the Internet	<b>October 2014–August 2015</b> <b>Oxford, UK</b>
<b>Dartmouth College</b> BA in Philosophy	<b>September 2007–June 2011</b> <b>Hanover, NH</b>

## PROFESSIONAL EXPERIENCE

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<b>Lecturer in Artificial Intelligence, King's College London</b> <ul style="list-style-type: none"><li>• Researching causal inference and interpretability in systems biology</li><li>• Advising doctoral candidates in the Department of Informatics</li><li>• Lecturing on machine learning and pattern recognition</li></ul>	<b>September 2022–</b> <b>London, UK</b>
<b>Postdoctoral Research Fellow, University College London</b> <ul style="list-style-type: none"><li>• Conducted original research on causality and machine learning</li><li>• Co-supervised doctoral candidates at the Centre for Artificial Intelligence</li><li>• Lectured on graphical models in the Department of Statistical Science</li></ul>	<b>January 2021–August 2022</b> <b>London, UK</b>
<b>Director of R&amp;D, ThermoAI Inc.</b> <ul style="list-style-type: none"><li>• Oversaw NSF-funded research on combustion simulation and optimization</li><li>• Drafted articles and grant applications with academic partners</li><li>• Coordinated with chief executives on strategic vision</li></ul>	<b>January 2020–December 2020</b> <b>New York, NY</b>
<b>Teaching Assistant, University of Oxford</b> <ul style="list-style-type: none"><li>• Lectured on the philosophy and ethics of information</li><li>• Led seminars on the foundations of social data science</li><li>• Developed curricula for future MSc cohorts</li></ul>	<b>October 2018–December 2020</b> <b>Oxford, UK</b>
<b>Research Assistant, Int'l Assoc for Computing &amp; Philosophy</b> <ul style="list-style-type: none"><li>• Developed formal models of explanation in artificial intelligence</li><li>• Conducted literature review on philosophical foundations of machine learning</li><li>• Drafted articles on the epistemology of data science</li></ul>	<b>March 2019–April 2020</b> <b>Oxford, UK</b>

**Data Scientist, Queen Mary University of London****November 2015—December 2018****London, UK**

- Conducted exploratory and inferential analytics for bioinformatics projects
- Developed unsupervised learning algorithms for genomic data integration
- Created visualization software for gene expression studies

**Freelance Contributor, *The Economist*****March 2016—October 2017****London, UK**

- Wrote articles for the Graphic Detail section and Game Theory blog
- Built simulations to estimate the probability of global events
- Collaborated with editorial staff to research and develop new stories

**Assistant Editor, HarperCollins Publishers****December 2011—September 2014****New York, NY**

- Read and reviewed manuscripts for publication
- Launched and managed e-book classics program
- Appointed Editorial Director of the National Poetry Series

**SELECT PUBLICATIONS (>900 citations, h-index: 16)**

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- Watson, D. & Silva, R. (2022). Causal discovery under a confounder blanket. In *Proceedings of the 38<sup>th</sup> Conference on Uncertainty in Artificial Intelligence*. Eindhoven, Netherlands.
- Watson, D. (2022). Rational Shapley values. In *Proceedings of the ACM Conference on Fairness, Accountability, and Transparency* (pp. 1083-1094). Seoul, South Korea.
- Watson, D., Gultchin, L., Taly, A., & Floridi, L. (2022). Local explanations via necessity and sufficiency: Unifying theory and practice. *Minds & Machines*, 32(1), 185-218.
- Watson, D. (2022). Conceptual challenges for interpretable machine learning. *Synthese*, 200(2), 65-98.
- Watson, D. (2021). Interpretable machine learning for genomics. *Human Genetics*, 141(9), 1499-1513.
- Marchal, N. & Watson, D. (2021). The paradox of poor representation: How voter-party incongruence curbs affective polarisation. *The British Journal of Politics and International Relations*, 1-18.
- Watson, D. & Wright, M. (2021). Testing conditional independence in supervised learning algorithms. *Machine Learning*, 110(8), 2107-2129.
- Gultchin, L., Watson, D., Kusner, M., & Silva, R. (2021). Operationalizing complex causes: A pragmatic view of mediation. In *Proceedings of the 38<sup>th</sup> International Conference on Machine Learning* (pp. 3875-3885). Vienna, Austria.
- Watson, D. & Floridi, L. (2020). The explanation game: A formal framework for interpretable machine learning. *Synthese*, 198(10), 9211-9242.
- Kinney, D. & Watson, D. (2020). Causal feature learning for utility-maximizing agents. In *International Conference on Probabilistic Graphical Models* (pp. 257-268). Skørping, Denmark.
- Nicholls, H.L., John, C.R., Watson, D., Munroe, P.B., Barnes, M.R., & Cabrera, C.P. (2020). Reaching the end-game for GWAS: Machine learning approaches for the prioritization of complex disease loci. *Frontiers in Genetics*, 11, 350.
- John, C.R., Watson, D., Russ, D., Goldmann, K., Ehrenstein, M., Pitzalis, C., ... Barnes, M. (2020). M3C: Monte Carlo reference-based consensus clustering. *Scientific Reports*, 10(1), 1816.
- Watson, D. (2019). The rhetoric and reality of anthropomorphism in artificial intelligence. *Minds & Machines*, 29(3), 417-440.
- John, C.R., Watson, D., Barnes, M.R., Pitzalis, C., & Lewis, M. (2019). Spectrum: Fast density-aware spectral clustering for single and multi-omic data. *Bioinformatics*, 36(4), 1159-1166.
- Watson, D. (2019). The price of discovery: A model of scientific research markets. In Öhman, C. & Watson, D. (Eds.), *The 2018 Yearbook of the Digital Ethics Lab* (pp. 51-63). Heidelberg: Springer.
- Öhman, C. & Watson, D. (Eds.) (2019). *The 2018 Yearbook of the Digital Ethics Lab*. Heidelberg: Springer.

- Öhman, C. & Watson, D. (2019). Are the dead taking over Facebook? A big data approach to the future of death online. *Big Data & Society*, 6(1), 1-13.
- Watson, D., Krutzinna, J., Bruce, I.N., Griffiths, C.E.M., McInnes, I.B., Barnes, M.R., & Floridi, L. (2019). Clinical applications of machine learning algorithms: Beyond the black box. *BMJ*, 364.
- O'Toole, S.M., Watson, D., Novoselova, T.V., Romano, L.E.L., King, P., Bradshaw, T.Y., ... Chapple, J.P. (2019). Oncometabolite induced primary cilia loss in pheochromocytoma. *Endocrine-Related Cancer*, 26(1), 165-180.
- Foulkes, A.C., Watson, D., Carr, D.F., Kenny, J.G., Slidel, T., Parslew, R., ... Barnes, M.R. (2018). A framework for multi-omic prediction of treatment response to biologic therapy for psoriasis. *Journal of Investigative Dermatology*, 139(1), 100–107.
- Foulkes, A.C., Watson, D., Griffiths, C.E.M., Warren, R.B., Huber, W., & Barnes, M.R. (2017). Research techniques made simple: Bioinformatics for genome-scale biology. *Journal of Investigative Dermatology*, 137(9), e163–e168.
- Watson, D. & Floridi, L. (2016). Crowdsourced science: Sociotechnical epistemology in the e-research paradigm. *Synthese*, 195(2), 741–764.

## PREPRINTS

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- Watson, D., Blesch, K., Kapar, J. & Wright, M. (2022). Smooth densities and generative modeling with unsupervised random forests. *arXiv preprint*, 2205.09435.
- Padh, Kirtan, Zeitler, J., Watson, D., Kusner, M., Silva, R., & Kilbertus, N. (2022). Stochastic causal programming for bounding treatment effects. *arXiv preprint*, 2202.10806.
- Desai, J., Watson, D., Wang, V., Taddeo, M., & Floridi, L. (2022). The epistemological foundations of data science: A critical analysis. *SSRN preprint*, 4008316.

## FUNDING

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- Co-Investigator on pending application for the UK Medical Research Council's Multimodal Methods call. Title: Modelling interferon signalling at single-cell resolution in immune mediated inflammatory diseases using causal machine learning. Value: £1 million.
- Co-Investigator on ThermoAI Inc.'s US National Science Foundation's Phase I Small Business Technology Transfer project. Duration: January 2020–December 2020. Title: Industrial combustion optimization using machine learning to reduce emissions and increase fuel efficiency. Value: \$225,000.
- Recipient of The Alan Turing Institute's Doctoral Enrichment Studentship Grant. Duration: October 2018–September 2019. Value: £6,700.
- Recipient of Microsoft Research PhD Fellowship Grant. Duration: October 2017–September 2018. Value: \$15,000.

## SOFTWARE

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- Mayer, M. & Watson, D. (2022). kernelshap: Feature attributions for explainable artificial intelligence. URL: <https://cran.r-project.org/web/packages/kernelshap/index.html>.
- Watson, D. (2022). cbl: Causal discovery under a confounder blanket. URL: <https://cran.r-project.org/web/packages/cbl/index.html>.
- Wright, M. & Watson, D. (2022). forger: Smooth density estimation and generative modeling with unsupervised random forests. URL: [https://github.com/bips-hb/generative\\_rf](https://github.com/bips-hb/generative_rf).
- Wright, M. & Watson, D. (2022). cpi: Testing conditional independence in supervised learning algorithms. URL: <https://cran.r-project.org/web/packages/cpi/index.html>.

- Watson, D. (2022). biplotr: Pretty, simple, optionally interactive plots for bioinformatics analysis pipelines. URL: <https://github.com/dswatson/biplotr>.
- Watson, D. & Tansey, W. (2021). smoothFDR: An empirical Bayes method for exploiting spatial structure in large multiple-testing problems. URL: <https://github.com/dswatson/smoothFDR>.
- John, C.R. & Watson, D. (2021). M3C: Monte Carlo reference-based consensus clustering. URL: <https://bioconductor.org/packages/release/bioc/html/M3C.html>.
- John, C.R. & Watson, D. (2021). Spectrum: Fast adaptive spectral clustering for single and multi-view data. URL: <https://cran.r-project.org/package=Spectrum>.

## SELECT PRESENTATIONS

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- ‘Causal discovery under a confounder blanket.’ Conference on Uncertainty in Artificial Intelligence. Eindhoven, August, 2022.
- ‘Testing condition independence in supervised learning algorithms.’ European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases. Bilbao, September 2021.
- ‘Local explanations via necessity and sufficiency: Unifying theory and practice.’ Conference on Uncertainty in Artificial Intelligence. July, 2021.
- ‘Interpretable machine learning for genomics: Opportunities, challenges, and future directions.’ Understanding and Explaining in Healthcare. Cambridge, May 2021.
- ‘No explanation without inference: Algorithmic opacity and severe testing.’ AISB Symposium on Opacity in Machine Learning. London, April 2021.
- ‘Pragmatic causal feature learning.’ International Conference on Probabilistic Graphical Models. Skørping, September 2020.
- ‘Conceptual challenges for interpretable machine learning.’ ACM Conference on Fairness, Accountability, and Transparency in Machine Learning, Doctoral Consortium. Barcelona, January 2020.
- ‘Information ethics: Theories, problems, strategies.’ Learn, develop & design: Ethics principles through cross-disciplinary collaboration. Royal College of Art, London, September 2019.
- ‘The explanation game: A formal framework for interpretable machine learning.’ 12<sup>th</sup> Annual MuST Conference on Statistical Reasoning and Scientific Error. Ludwig Maximilian University, Munich, July 2019.
- ‘Interpretable machine learning for clinical medicine.’ Mining Data for Medicine Workshop. University of Manchester, April 2019.
- ‘Attention economies and the ethics of design.’ London Doctoral Design Centre, Royal College of Art, London, November 2018.
- ‘Measuring the epistemological and social impact of citizen science.’ St. Anne’s College, University of Oxford, December 2016.

## SERVICE

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- Associate Editor, *Philosophy & Technology*
- Peer reviewer for The MIT Press
- Peer reviewer for computer science conferences including NeurIPS, ICML, and UAI
- Peer reviewer for technical journals including *Machine Learning* and *Bioinformatics*
- Peer reviewer for philosophy journals including *British Journal of Philosophy of Science* and *Synthese*

## HONOURS AND AWARDS

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- Doctoral Dissertation Award Shortlist (top 2% of entries). European Association for Artificial Intelligence, 2021.
- Edith McMorran Verse Translation Prize. St Hugh's College, Oxford, 2015.
- Avril Gilchrist Bruton Award for Creative Writing. St. Hugh's College, Oxford, 2015.
- Francis W. Gramlich Prize for outstanding achievement in philosophy. Dartmouth College, 2011.
- James O. Freedman Presidential Scholar. Dartmouth College, 2008—2011.