Junpeng Lao, PhD

Bayesian computation & probabilistic programming — core developer of PyMC, contributor to TensorFlow Probability, sole developer and curator of the BlackJAX ecosystem.

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Bio

Junpeng Lao works on Bayesian computation and probabilistic programming. He is a core developer of PyMC, a contributor to TensorFlow Probability (tfp.mcmc), and the sole developer and curator of the BlackJAX ecosystem for composable Bayesian inference in JAX.

He co-authored Bayesian Modeling and Computation in Python (Martin, Kumar & Lao; CRC Press, 2021), a hands-on guide to modern Bayesian workflow.

He trained as a cognitive scientist — a PhD at the University of Glasgow and a postdoc at the University of Fribourg studying how culture shapes visual perception — before moving into industry data science at Google, where he is now a Staff Data Scientist. He is increasingly preoccupied with how knowledge gets made when working with AI agents — knowledge as process.

Experience

Staff Data Scientist, Google 2018–present
Zurich, Switzerland

Forecasting for Trust & Safety (Bayesian structural time series, linear-Gaussian state-space models); leading a small data-science team.

Postdoctoral Researcher, University of Fribourg 2014–2018
Fribourg, Switzerland

Eye-movement, EEG and fMRI studies of cultural diversity in visual perception (iBMLab).

Education

PhD , Psychology / Cognitive Neuroscience 2009–2014
University of Glasgow · Glasgow, UK

Thesis: Tracking the temporal dynamics of cultural perceptual diversity.

BSc , Psychology –2009
Sun Yat-sen University · Guangzhou, China

Books

Martin, O. A., Kumar, R., & Lao, J. (2021). Bayesian Modeling and Computation in Python . Chapman and Hall/CRC.

Software

BlackJAX — Sole developer & curator. The BlackJAX ecosystem — composable, fast Bayesian inference in JAX, samplers as building blocks.

PyMC — Core developer. A leading probabilistic programming library in Python for Bayesian modeling.

TensorFlow Probability — Contributor. Probabilistic reasoning and statistical analysis — contributions to tfp.mcmc.

iMap4 — Creator. Open-source toolbox for statistical fixation mapping of eye-movement data.

tuningfork — Creator. A sampler-benchmark suite in the BlackJAX ecosystem — captures the failure path, not just the result.

Preprints & Working Papers

Cabezas, A., Corenflos, A., Lao, J., Louf, R., Carnec, A., Chaudhari, K., et al. (2024). BlackJAX: composable Bayesian inference in JAX. arXiv preprint arXiv:2402.10797. [arXiv]

Biswas, B., Lao, J., Aubourg, E., Boucaud, A., Guinot, A., Ishida, E. E., & Roucelle, C. (2023). Bayesian multi-band fitting of alerts for kilonovae detection. arXiv preprint arXiv:2311.04845. [arXiv]

Liu, L., Vikram, S., Lao, J., Ben, X., D'Amour, A., O'Banion, S., ... & Hoffman, M. D. (2020). Estimating the Changing Infection Rate of COVID-19 Using Bayesian Models of Mobility. medRxiv. doi:10.1101/2020.08.06.20169664. doi:10.1101/2020.08.06.20169664 [medRxiv]

Lao, J., Suter, C., Langmore, I., Chimisov, C., Saxena, A., Sountsov, P., Moore, D., Saurous, R. A., Hoffman, M. D., et al. (2020). tfp.mcmc: Modern Markov Chain Monte Carlo Tools Built for Modern Hardware. arXiv preprint arXiv:2002.01184. [arXiv]

Kochurov, M., Carroll, C., Wiecki, T., & Lao, J. (2019). PyMC4: Exploiting Coroutines for Implementing a Probabilistic Programming Framework. NeurIPS Workshop on Program Transformations for Machine Learning. [PDF]

Lao, J. (2016). Reproducible Research with End-to-end Machine Inference Using Deep Learning and Bayesian Statistics. Journal of Brief Ideas. doi:10.5281/zenodo.203086. doi:10.5281/zenodo.203086 [Brief Ideas]

Publications

35 peer-reviewed journal articles.

Biswas, B., Aubourg, E., Boucaud, A., Guinot, A., Lao, J., & Roucelle, C. (2025). MADNESS deblender: Maximum A posteriori with Deep NEural networks for Source Separation. Astronomy & Astrophysics, 700, A129. doi:10.1051/0004-6361/202451887. doi:10.1051/0004-6361/202451887 **[PDF]**

Richoz, A-R., Stacchi, L., Schaller, P., Lao, J., Papinutto, M., Ticcinelli, V., & Caldara, R. (2024). Recognizing facial expressions of emotion amid noise: A dynamic advantage. Journal of Vision, 24(1):7. doi:10.1167/jov.24.1.7. doi:10.1167/jov.24.1.7 **[PDF]**

Abril-Pla, O., Andreani, V., Carroll, C., Dong, L., Fonnesbeck, C. J., Kochurov, M., Kumar, R., Lao, J., Luhmann, C. C., Martin, O. A., & Osthege, M. (2023). PyMC: a modern, and comprehensive probabilistic programming framework in Python. PeerJ Computer Science, 9:e1516. doi:10.7717/peerj-cs.1516. doi:10.7717/peerj-cs.1516 **[PDF]**

Rodger, H., Sokhn, N., Lao, J., Liu, Y., & Caldara, R. (2023). Developmental eye movement strategies for decoding facial expressions of emotion. Journal of Experimental Child Psychology, 229. doi:10.1016/j.jecp.2022.105622. doi:10.1016/j.jecp.2022.105622 **[PDF]**

Spînu, N., Cronin, M. T., Lao, J., Bal-Price, A., Campia, I., Enoch, S. J., ... & Worth, A. P. (2022). Probabilistic Modelling of Developmental Neurotoxicity based on a Simplified Adverse Outcome Pathway Network. Computational Toxicology, 100206. doi:10.1016/j.comtox.2021.100206. doi:10.1016/j.comtox.2021.100206 **[PDF]**

Rodger, H., Lao, J., Stoll, C., Richoz, A-R., Pascalis, O., Dye, M., & Caldara, R. (2021). The recognition of facial expressions of emotion in deaf and hearing individuals. Heliyon, 7(5). doi:10.1016/j.heliyon.2021.e07018. doi:10.1016/j.heliyon.2021.e07018 **[PDF]** (joint first authors)

Papinutto, M., Lao, J., Lalanne, D., & Caldara, R. (2020). Watchers do not follow the eye movements of Walkers. Vision Research, 176, 130–140. doi:10.1016/j.visres.2020.08.001. doi:10.1016/j.visres.2020.08.001 [PDF]

Stoll, C., Rodger, H., Lao, J., Richoz, A-R., Pascalis, O., Dye, M., & Caldara, R. (2019). Quantifying Facial Expression Intensity and Signal Use in Deaf Signers. Journal of Deaf Studies and Deaf Education, 24, 346–355. doi:10.1093/deafed/enz023. doi:10.1093/deafed/enz023 [PDF] (joint first authors)

Stacchi, L., Ramon, M., Lao, J., & Caldara, R. (2019). Neural Representations of Faces are Tuned to Eye Movements. Journal of Neuroscience, 2968(18). doi:10.1523/JNEUROSCI.2968-18.2019. doi:10.1523/JNEUROSCI.2968-18.2019 [PDF]

Nicholls, V. I., Jean-Charles, G., Lao, J., de Lissa, P., Caldara, R., & Miellet, S. (2019). Developing attentional control in naturalistic dynamic road crossing situations. Scientific Reports, 9(4176). doi:10.1038/s41598-019-39737-7. doi:10.1038/s41598-019-39737-7 [PDF]

Luisier, A-C., Petitpierre, G., Bérod, A. C., Richoz, A-R., Lao, J., Caldara, R., & Bensafi, M. (2019). Visual and Hedonic Perception of Food Stimuli in Children with Autism Spectrum Disorders and their Relationship to Food Neophobia. Perception. doi:10.1177/0301006619828300. doi:10.1177/0301006619828300 [PDF]

Wyssen, A., Lao, J., Rodger, H., Humbel, N., Lennertz, J., Schuck, K., Isenschmid, B., Milos, G., Trier, S., Whinyates, K., & Assion, H. J. (2019). Facial Emotion Recognition Abilities in Women Experiencing Eating Disorders. Psychosomatic Medicine, 81(2), 155–164. doi:10.1097/PSY.0000000000000664. doi:10.1097/PSY.0000000000000664 [PDF]

Lüthold, P., Lao, J., He, L., Zhou, X., & Caldara, R. (2019). Waldo reveals cultural differences in return fixations. Visual Cognition, 26(10), 817–830. doi:10.1080/13506285.2018.1561567. doi:10.1080/13506285.2018.1561567 [PDF]

Han, C., Wang, H., Fasolt, V., Hahn, A., Holzleitner, I. J., Lao, J., ... & Jones, B. (2018). No clear evidence for correlations between handgrip strength and sexually dimorphic acoustic properties of voices. American Journal of Human Biology, e23178. doi:10.1002/ajhb.23178. doi:10.1002/ajhb.23178 [PDF]

Eulerich, M., Theis, J. C., Lao, J., & Ramon, M. (2018). Do Fine Feathers Make a Fine Bird? The Influence of Attractiveness on Fraud-Risk Judgments by Internal Auditors. International Journal of Auditing, 1–13. doi:10.1111/ijau.12137. doi:10.1111/ijau.12137 [PDF]

Richoz, A-R., Lao, J., Pascalis, O., & Caldara, R. (2018). Tracking the recognition of static and dynamic facial expressions of emotion across the life span. Journal of Vision, 18(9), 5. doi:10.1167/18.9.5. doi:10.1167/18.9.5 [PDF] [Supplementary]

Jones, B. C., Hahn, A. C., Fisher, C. I., Wang, H., Kandrik, M., Lao, J., Han, C., ... & DeBruine, L. M. (2018). No compelling evidence that more physically attractive young adult women have higher estradiol or progesterone. Psychoneuroendocrinology, 98, 1–5. doi:10.1016/j.psyneuen.2018.07.026. doi:10.1016/j.psyneuen.2018.07.026 [PDF]

Vizioli, L., Bratch, A., Lao, J., Ugurbil, K., Muckli, L., & Yacoub, E. (2018). Temporal multivariate pattern analysis (tMVPA): A single trial approach exploring the temporal dynamics of the BOLD signal. Journal of Neuroscience Methods, 308, 74–87. doi:10.1016/j.jneumeth.2018.06.029. doi:10.1016/j.jneumeth.2018.06.029 [PDF] (equal contribution)

Rodger, H., Lao, J., & Caldara, R. (2018). Quantifying facial expression signal and intensity use during development. Journal of Experimental Child Psychology, 174, 41–59. doi:10.1016/j.jecp.2018.05.005. doi:10.1016/j.jecp.2018.05.005 [PDF]

Ramon, M., Sokhn, N., Lao, J., & Caldara, R. (2018). Decisional space determines saccadic reaction times in healthy observers and acquired prosopagnosia. Cognitive Neuropsychology. doi:10.1080/02643294.2018.1469482. doi:10.1080/02643294.2018.1469482 [PDF]

Malaspina, M., Albonico, A., Lao, J., Caldara, R., & Daini, R. (2018). Mapping self-face recognition strategies in congenital prosopagnosia. Neuropsychology, 32(2), 123–137. doi:10.1037/neu0000414. doi:10.1037/neu0000414 [PDF]

Lakens, D., Adolfi, F. G., ..., Lao, J., ..., Zwaan, R. A. (2018). Justify Your Alpha. Nature Human Behaviour, 2, 168–171. doi:10.1038/s41562-018-0311-x. doi:10.1038/s41562-018-0311-x [PDF] [preprint v1]

Turano, M. T., Lao, J., Richoz, A-R., de Lissa, P., Degosciu, S. B., Viggiano, M. P., & Caldara, R. (2017). Fear boosts the early neural coding of faces. Social Cognitive and Affective Neuroscience, 12(12), 1959–1971. doi:10.1093/scan/nsx110. doi:10.1093/scan/nsx110 [PDF] (joint first authors)

Stoll, C., Palluel-Germain, R., Caldara, R., Lao, J., Dye, M. W. G., Aptel, F., & Pascalis, O. (2017). Face Recognition is Shaped by the Use of Sign Language. Journal of Deaf Studies and Deaf Education, 23(1), 62–70. doi:10.1093/deafed/enx034. doi:10.1093/deafed/enx034 [PDF]

Papinutto, M., Lao, J., Ramon, M., Caldara, R., & Miellet, S. (2017). The Facespan — the perceptual span for face recognition. Journal of Vision, 17(5), 16. doi:10.1167/17.5.16. doi:10.1167/17.5.16 [PDF] [Supplementary]

Garcia-Burgos, D., Lao, J., Munsch, S., & Caldara, R. (2017). Visual attention to food cues is differentially modulated by gustatory-hedonic and post-ingestive attributes. Food Research International, 97, 199–208. doi:10.1016/j.foodres.2017.04.011. doi:10.1016/j.foodres.2017.04.011 [**PDF**]

Lao, J., Miellet, S., Pernet, C., Sokhn, N., & Caldara, R. (2017). iMap4: An Open Source Toolbox for the Statistical Fixation Mapping of Eye Movement data with Linear Mixed Modeling. Behavior Research Methods, 49, 559–575. doi:10.3758/s13428-016-0737-x. doi:10.3758/s13428-016-0737-x [**PDF**]

Ruffieux, N., Ramon, M., Lao, J., Colombo, F., Stacchi, L., Borruat, F-X., Accolla, E., Annoni, J-M., & Caldara, R. (2016). Residual Perception of Biological Motion in Cortical Blindness. Neuropsychologia, 93, 301–311. doi:10.1016/j.neuropsychologia.2016.11.009. doi:10.1016/j.neuropsychologia.2016.11.009 [**PDF**] (joint first authors)

Geangu, E., Ichikawa, H., Lao, J., Kanazawa, S., Yamaguchi, M. K., Caldara, R., & Turati, C. (2016). Culture shapes 7-month-olds' perceptual strategies in discriminating facial expressions of emotion. Current Biology, 26, R663–R664. doi:10.1016/j.cub.2016.05.072. doi:10.1016/j.cub.2016.05.072 [**PDF**] [**Supplementary**] (joint first authors and joint last authors)

Bovet, J., Lao, J., Bartholomée, O., Caldara, R., & Raymond, M. (2016). Mapping female bodily features of attractiveness. Scientific Reports, 6, 18551. doi:10.1038/srep18551. doi:10.1038/srep18551 [**PDF**] [**Supplementary**]

Miellet, S., Lao, J., & Caldara, R. (2014). An appropriate use of iMap produces correct statistical results: a reply to McManus (2013). Perception, 43, 451–457. doi:10.1068/p7682. doi:10.1068/p7682 [**PDF**]

Lao, J., Vizioli, L., & Caldara, R. (2013). Culture modulates the temporal dynamics of global/local processing. Culture and Brain, 1(2), 158–174. doi:10.1007/s40167-013-0012-2. doi:10.1007/s40167-013-0012-2 [**PDF**]

Romeo, M., Vizioli, L., Breukink, M., Aganloo, K., Lao, J., Cotrufo, S., Caldara, R., & Morley, S. (2013). A Functional Magnetic Resonance Imaging Paradigm to Identify Distinct Cortical Areas of Facial Function: A Reliable Localizer. Plastic and Reconstructive Surgery, 131(4), 527e–533e. doi:10.1097/PRS.0b013e3182818b68. doi:10.1097/PRS.0b013e3182818b68 [**PDF**]

Miellet, S., Zhou, X., He, L., Lao, J., & Caldara, R. (2012). When East meets West: gaze-contingent Blindspots abolish cultural diversity in eye movements for faces. Journal of Eye Movement Research, 5, 1–12. doi:10.16910/jemr.5.2.5. doi:10.16910/jemr.5.2.5 [**PDF**]

Zhou, X., He, L., Yang, Q., Lao, J., & Baumeister, R. F. (2012). Control deprivation and styles of thinking. Journal of Personality and Social Psychology, 102(3), 460. doi:10.1037/a0026316. doi:10.1037/a0026316 [**PDF**]