Kostas Tsampourakis

ML Researcher

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Professional Summary

ML Researcher with a PhD in Statistics and a strong foundation in probabilistic modelling, Bayesian inference, and state-space models. Research focuses on novel methodology for Bayesian inference in complex dynamical systems, including Bayesian filters, simulation-based inference, and normalizing flow models, with work published at ICASSP and JMLR, and preprints under review. Experienced in the full methodological research pipeline: from problem formulation and algorithm design, through theoretical analysis, to prototyping, empirical evaluation, and publication. Proficient in developing research code in Python and JAX, with open-source contributions, and in benchmarking novel algorithms against state-of-the-art methods. Experienced mentor and collaborator, with a track record of translating theoretical advances into reproducible computational methods.

Publications & Preprints

- **Tsampourakis, K.**, & Elvira, V. (*preprint*). Truncated Neural Likelihood Estimation for Simulation-Based Inference in State-Space Models. *arXiv:2605.21805*. Submitted to *Statistics and Computing*.
- **Tsampourakis, K.**, & Elvira, V. (*preprint*). A Gaussian Sum Filter for Unifying Gaussian and Particle Filters. *arXiv:2605.21698*. Submitted to *IEEE Transactions on Signal Processing*.
- **Tsampourakis, K.**, & Elvira, V. (2023). An Augmented Gaussian Sum Filter Through a Mixture Decomposition. *2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. DOI: 10.1109/ICASSP49357.2023.10095899.
- Kaul, A., Zhang, H., **Tsampourakis, K.**, & Michailidis, G. (2023). Inference on the Change Point under a High Dimensional Covariance Shift. *Journal of Machine Learning Research*, 24.
- **Tsampourakis, K.**, & Elvira, V. (2022). Approximating the Likelihood Ratio in Linear-Gaussian State-Space Models for Change Detection. *2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. DOI: 10.1109/ICASSP46778.2022.9746881.
- **Tsampourakis, K.**, & Kominis, I. K. (2015). Quantum Trajectory Tests of Radical-Pair Quantum Dynamics in CIDNP Measurements of Photosynthetic Reaction Centers. *Chemical Physics Letters*, 640.

Professional Experience

2020–2025 **PhD Researcher in Statistics**, *University of Edinburgh*, Edinburgh, UK

- Developed novel methodology for Bayesian inference in complex dynamical systems; proposed a framework unifying classical algorithms to achieve improved accuracy and robustness.
- Designed, implemented, and benchmarked novel ML algorithms against state-of-the-art methods on curated and simulated datasets.
- Designed and implemented neural simulation-based inference pipelines; trained normalizing flow models for likelihood-free posterior estimation.
- Published and presented work in top peer-reviewed conferences; contributed code to the *dynamax* package.
- Mentored MSc Statistics with Data Science students on applied ML projects; tutored Bayesian Theory, Time-Series, and Statistical Methodology.

2022 **Research Placement**, *indigo.ai*, Remote (Milan, Italy)
- Explored different approaches for intent detection in LLMs.
- Designed experiments to test the textual entailment approach and implemented it on a pre-trained BERT model; curated appropriate datasets and fine-tuned the models.
- Successfully addressed the research questions and informed the engineering team of the trade-offs.

2018–2020 **Graduate Research Assistant**, *Washington State University*, Pullman, WA, USA
- Co-developed a statistical framework for change-point inference in high-dimensional dynamic graphical models; published in JMLR vol. 24 (2023).
- Conducted research in statistical learning, advanced linear algebra, matrix computations, and nonlinear optimization.
- Participated in the Mathematics of Machine Learning summer school (Seattle, 2019).
- Tutored Statistics, Calculus, and Linear Algebra.

2014–2016 **MSc Researcher**, *University of Crete*, Heraklion, Greece
- Applied numerical methods to quantum-mechanical datasets from photosynthetic reaction centers.
- Co-authored peer-reviewed publication in *Chemical Physics Letters* (2015).

Key Research Projects

- **Truncated Neural Likelihood Estimation for Simulation-Based Inference** — Developed a method for simulation-based inference in state-space models using truncated neural likelihood estimation. Submitted to *Statistics and Computing* (arXiv:2605.21805).
- **Gaussian Sum Filter: Unifying Gaussian and Particle Filters** — Proposed a novel framework that unifies Gaussian sum with particle filtering algorithms to achieve improved accuracy and robustness in complex dynamical systems. Submitted to *IEEE Transactions on Signal Processing* (arXiv:2605.21698).
- **Likelihood Ratio Approximation in State-Space Models** — Designed a principled method for approximating likelihood ratios in linear-Gaussian state-space models for sequential change detection. Published at ICASSP 2022.
- **Change-Point Inference in High-Dimensional Graphical Models** — Validated an inference framework for detecting structural changes in dynamic graphical models under high-dimensional covariance shift. Published in *Journal of Machine Learning Research*, vol. 24 (2023).

Technical Skills

Probabilistic & Statistical Modelling: Bayesian inference, Monte Carlo methods (MCMC, importance sampling), graphical models (Bayesian networks, correlation networks), change-point detection, state-space models, time-series analysis, signal processing, nonlinear and convex optimization
Machine Learning: Statistical learning, supervised and unsupervised methods, ML algorithm design and evaluation, normalizing flows, simulation-based inference, benchmarking frameworks, experimental design, model validation
Programming & Tools: Python (JAX, NumPy, pandas, scikit-learn, Matplotlib), R, MATLAB, Mathematica, Fortran, Git, Bash, Jupyter
Open Source: `cpgraph` (R), `dynamax` (Python/JAX)
Communication: Research writing and publication, teaching and mentoring, knowledge transfer across technical and non-technical audiences

Education

2020–2024 **PhD in Statistics**, *University of Edinburgh*, Edinburgh, UK

2018–2020 **MS in Mathematics**, *Washington State University*, Pullman, WA, USA

2014–2016 **MS in Theoretical Physics**, *University of Crete*, Heraklion, Greece

2008–2014 **BS in Physics**, *University of Crete*, Heraklion, Greece

Conferences & Schools

- SMC 2024 — Poster Presentation, ICMS Edinburgh (2024)
- Bayes@CIRM, Marseille (2023)
- MCM 2023 — Poster Presentation, Paris (2023)
- BayesComp 2023 — Poster Presentation, Levi, Finland (2023)
- Probabilistic Numerics Spring School, Tübingen (2023)
- IEEE ICASSP 2023 — Poster Presentation, Rhodes (2023)
- IEEE ICASSP 2022 — Oral Presentation, Singapore (2022)
- Greek Stochastics μ', Corfu (2022)
- APTS Advanced Training in Statistics, UK (2020–2021)
- Mathematics of Machine Learning, Seattle (2019)
- 24th Summer School-Conference on Dynamical Systems and Complexity, Volos (2017)
- Quantum Photonics, Heraklion (2015)

Awards

- Poster Award, Bayes@CIRM, Marseille (2023)
- Principal's Career Development Scholarship, University of Edinburgh (2020–2023)

Languages

- **Greek:** Native
- **English:** Professional Proficiency
- **French:** Intermediate