

# Bayesian Inference and Maximum Entropy Methods in Science and Engineering—MaxEnt 2019 <sup>†</sup>

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As key building blocks for modern data processing and analysis methods—ranging from AI, ML and UQ to model comparison, density estimation and parameter estimation—Bayesian inference and entropic concepts are in the center of this rapidly growing research area. Beyond the general interest in the underlying foundations of inference, the relevance of this subject is due to the demonstrated success of these concepts in areas like pattern recognition, optimization, experimental design or event prediction. Devoted to the development and application of new and innovative concepts the 39th International Workshop on Bayesian Inference and Maximum Entropy Methods in Science and Engineering took place in Garching near Munich, Germany, from June 30th to July 5th 2019. The Max-Planck-Institute for Plasma Physics was hosting this conference for the fourth time after 1998, 2004 and 2012. About 60 participants from Europe and the US, but also from Brasil, South Africa, Australia, Russia and China, attended the conference and had intense discussions about the ongoing development. In this volume, 33 contributed papers are presented.

The workshop invited contributions on all aspects of probabilistic inference, including novel techniques and applications, and work that sheds new light on the foundations of inference. The scientific topics of the conference have been:

1. Inverse problems
2. Uncertainty quantification (UQ)
3. Gaussian process (GP) regression
4. Optimal experimental design
5. Data assimilation and Causal Inference
6. Data mining, ML algorithms
7. Numerical integration
8. Information geometry
9. Real world applications in various fields of science and engineering (e.g., earth science, astrophysics, material and plasma science, imaging in geophysics and medicine, nondestructive testing, density estimation, remote sensing)

The conference started on Sunday, June 30th with a tutorial by Romke Bontekoe titled “Bayes’ Theorem, a toolbox for data analysis”, followed on Monday, July 1st by a tutorial from Ariel Caticha about “Where do Hamiltonians come from”. After that a total of 39 talks were presented by 35 participants till Friday, July 5th. In the poster session on Tuesday, July 2nd two poster prizes were awarded to

1st place: Martino Trassinelli, CNRS, Institute of NanoSciences, Sorbonne Univ., Paris, France, “Nested sampling for atomic physics data: the nested\_fit program”.

2nd place: Scott Cameron, Stellenbosch University, South Africa, “A Sequential Marginal Likelihood Approximation Using Stochastic Gradients”.

The follow-up conference MaxEnt2020 will take place in Graz in July 2020. It will be organized by Prof. Dr. Wolfgang von der Linden, Institute for Theoretical Physics, Technical University Graz, Austria, [vonderlinden@tugraz.at](mailto:vonderlinden@tugraz.at).

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