

# Curriculum Vitae

## Personal details and date of CV

- Bharti
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- 15 January, 2024

## Degree

June 2021 **PhD**

Department of Electronic Systems, Aalborg University, Denmark

Thesis: Calibrating stochastic radio channel models: an approximate Bayesian computation approach

June 2017 **Master of Science in Signal Processing and Computing**

Aalborg University, Denmark

GPA: 10.5/12.0

Thesis: Heading estimation of ships based on GPS signals

May 2015 **Bachelor of Engineering in Electrical and Electronics**

Birla Institute of Technology and Sciences, Pilani, India

GPA: 7.8/10.0

Thesis: Comparative assessment of ICA and PCA algorithms in signal processing of human EEG

## Current employment

April 2021—March 2025 **Postdoctoral researcher**, stage II

Department of Computer Science, Aalto University, Finland

## Previous work experience

October 2022—November 2022 **Visiting researcher**

Department of Statistical Science, University College London, United Kingdom

## Research funding and grants

1. Research Council of Finland thematic project grant no. 358958 (€247,428); ICT 2023: Secure Use of Data in Health; PI Samuel Kaski; Funding period: 01.01.2024 - 31.12.2026. **Role:** I was the coordinating postdoc for the application, in charge of one of the work packages. The work package focusses on developing machine learning for meta-learning of user models, which are generative models of users' behaviours, such that they can generalise to previously unseen new users.

2. Research Council of Finland Proof of Concept funding grant no. 359567 (€298,447); PI Samuel Kaski; Funding period 01.01.2024 - 31.12.2025. **Role:** I was in charge of the task that focusses on developing machine learning algorithms that go beyond being robust to shifts in the data distribution, and include robustness to unseen covariates or confounders.

## Research output

### *Publications:*

Total number of publications: **15 (11 as first author)**

The 6 most representative outputs of my research are listed below:

1. **A. Bharti\***, D. Huang\*, A. Souza, L. Acerbi, and S. Kaski. “Learning Robust Statistics for Simulation-based Inference under Model Misspecification”. In: Advances in Neural Information Processing Systems (2023). [Link](#)
  - This paper proposes a general method for tackling misspecification of simulators in **simulation-based inference (SBI)** by casting it as a statistics selection problem. This is now the state-of-the-art in terms of robust SBI methods, and is the starting point for WP-2 of the research proposal. During this project, I co-supervised Daolang Huang, who is a PhD student working with Prof. Samuel Kaski.
2. **A. Bharti**, M. Naslidnyk, O. Key, S. Kaski, and F.-X. Briol. “Optimally-weighted Estimators of the Maximum Mean Discrepancy for Likelihood-Free Inference”. In: International Conference on Machine Learning (2023). [Link](#)
  - This paper proposes a sample efficient estimator for a commonly used distance in SBI called maximum mean discrepancy. Using the proposed distance estimator in SBI allows to perform inference with fewer data points from the simulator, thus being computationally efficient. This paper is relevant for WP-3.
3. **A. Bharti**, L. Filstroff, and S. Kaski. “Approximate Bayesian Computation with Domain Expert in the Loop”. In: International Conference on Machine Learning (2022). [Link](#)
  - This paper tackles both the misspecification and the computational complexity problem in SBI by incorporating the domain expert in the inference procedure.
4. **A. Bharti**, F.-X. Briol, and T. Pedersen. “A General Method for Calibrating Stochastic Radio Channel Models With Kernels”. In: IEEE Transactions on Antennas and Propagation 70.6 (2022), pp. 3986–4001. [Link](#)
  - This is key outcome of my PhD, which proposes a general method for inferring parameters of wireless communication simulators using SBI. The existing inference methods in this field were specialised to the specific simulator at hand, while we were the first to show that different simulators can be learned using the same procedure. The issue of misspecification was first noticed in this work, when applying the proposed method on real data.
5. **A. Bharti**, R. Adeogun, and T. Pedersen. “Learning parameters of stochastic radio channel models from summaries”. In: IEEE Open Journal of Antennas and Propagation 1 (2020), pp. 175–188. [Link](#)
  - This is the first journal paper that applied SBI methods in wireless communications field. Prior to this, inference in this field was carried out in an ad hoc manner, without any uncertainty quantification.
6. **A. Bharti** and T. Pedersen, “Calibration of stochastic channel models using approximate Bayesian computation,” in Proceedings of IEEE Global Communications Conference Workshops (Globecom), pp. 1-6, 2019. [Link](#)
  - This is the first paper during my PhD that uses SBI method, specifically approximate Bayesian computation, to perform inference for a seminal simulator used in wireless communications.

#### **Other research outputs:**

- F.-X. Briol and **A. Bharti**. Using machine learning to improve the reliability of wireless communication systems. Blog post on The Alan Turing Institute’s website, 2021. [Link](#)

## **Research supervision and leadership experience**

### **PhD co-supervision**

- Daolang Huang, PhD student at Aalto University, supervised by Prof. Samuel Kaski: Worked together on “Learning Robust Statistics for Simulation-based Inference under Model Misspecification”, which was accepted to NeurIPS 2023.
- Elena Shaw, PhD student at Aalto University, supervised by Prof. Samuel Kaski: Working on AI assistance for contextually fair machine learning models (ongoing).

#### Summer internship project co-supervision with Prof. Samuel Kaski:

- (2023) Zachris Björkman, Masters student at Aalto University, worked on sample efficient simulation-based inference.
- (2022) Daniel Wohlrath, Masters student at Aalto University, worked on detecting model misspecification in simulation-based inference.
- (2022) Amir Pouya Moeini, Bachelors student from Iran, worked on outlier-robust approximate Bayesian computation.

#### Student project supervision

- Mathias Eriksson (Masters student): seminar project on neural posterior estimation, 2023
- Jana Fischer (Masters student): seminar project on “Comparative analysis of likelihood-free model selection methods”, 2023 (**top grade**).
- Group semester projects for Mathematical Technology bachelors and masters students from Aalborg University on the topic "Calibration of directional radio channel model using approximate Bayesian computation".

#### Teaching merits

I have been involved as a teaching assistant for conducting exercise sessions with students of the following courses during my PhD at Aalborg University:

- **Stochastic Processes** (Master level): Fall semester 2018-2020
- **Probability and Statistics** (Bachelor level): Spring semester 2019 and 2020
- **Mathematics for Electronics Engineering** (Bachelor level): Fall semester 2019

#### Awards and honours

Best student paper award from the American Statistical Association’s section on Bayesian statistical science for: M. Naslidnyk, **A. Bharti**, J. Knoblauch, F-X. Briol. “Robust empirical Bayes for Gaussian processes”. *preprint under review* (2023).

#### Other key academic merits, such as

**Referee for scientific publications:** AISTATS, JMLR, Pattern Recognition letters

#### Invited talks:

- Bayes Comp 2023, Finland: Invited session on “Likelihood-free inference with kernel distances” (March 2023)
- Indian Institute of Technology, Delhi, India (July 2023)
- Indraprastha Institute of Information Technology, Delhi, India (June 2023)
- Department of Statistical Science, University College London, UK (November 2022)
- Centre for Artificial Intelligence, University College London, UK (October 2022)

**Organised FCAI-Turing meetup:** An online workshop to bring together researchers from The Alan Turing Institute (UK) and Finnish Center of Artificial Intelligence (Finland). [Website](#)