Curriculum Vitae for Ata Karakci

Personal information

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Born:	25 December 1980	Nationality:	Turkish

Summary

I have a PhD in physics with specialisation in astrophysics and have worked as a researcher at various international institutions for over a decade. I have expertise in machine learning, statistical analysis of big data sets, numerical modelling, signal processing, imaging, and programming, which, together with a demonstrated ability to learn complex material, provide me with an excellent foundation for contributing to the development of artificial intelligence systems for the next generation of big data analysis. I consider myself as a motivated, self-driven, result oriented and creative problem solver with strong analytic skills.

Technical skills

Frameworks	TensorFlow, Keras, Scikit-learn, Numpy, Scipy, Pandas, MPI, jQuery
Languages	Python, C/C++, IDL/GDL, JavaScript
Tools	Git, Linux, LaTeX, Vim

Education

2008 - 2014	PhD in physics from Brown University, thesis titled "Bayesian Analysis of Systematic Effects in Interferometric Observations of the Cosmic Microwave Background Polarization"
2002 - 2004	Masters in physics from Boğaziçi University, thesis titled "S-duality in String Gas Cosmology"

Professional experience

2019 –	Consultant, Expert Analytics. Built a bayesian convolutional neural network for object detection and image classification. Collaborated in developing a web-based application for Flexi Lås & Gitter.
2016 – 2019	Postdoctoral researcher, Institute of Theoretical Astrophysics, University of Oslo. Developed a PCA-based source separation software for CMB signal analysis in spherical wavelet domain. Applied a Gibbs sampling / MCMC method for CMB component separation. Collaborated in constructing a 3D model of the Galactic dust polarisation. Gave lectures and supervised master student projects.
2014 – 2016	Postdoctoral researcher, Laboratoire AstroParticule et Cosmologie, Université de Paris. Developed simulations of gravitationally lensed CMB signal and extragalactic microwave emissions. Collaborated in developing a PCG based imaging software for CMB polarisation from Planck satellite data. Collaborated in developing a Bayesian source separation method for cosmological hydrogen line signal.
2014 – 2014	Visiting researcher, Lawrence Berkeley National Laboratory, UC Berkeley. Collaborated in joint analysis of ground-based BICEP2/Keck Array and satellite-based Planck data. Developed simulations of Galactic microwave emissions.
2008 – 2014	PhD student, Brown University, Providence, RI. Developed a Gibbs sampling image reconstruction software for interferometric observations of polarised CMB signal. Collaborated in maximum likelihood analysis of systematic errors in microwave interferometers. Taught undergraduate laboratory classes.

Languages

English	Fluent
French	Intermediate
Norwegian	Intermediate
Turkish	Native

Personal skills

Analytical skills	Strong skills for understanding and formulating the problem in a solvable way.
Bayesian statistics	Parameter optimization, model selection, Monte Carlo Markov Chains (MCMC)
Creative problem solving	Demonstrated the ability to learn new and complicated material within a reasonable timescale

Machine learning	Bayesian Convolutional Neural Networks, computer vision, object detection, image recognition, regression, classification, support vector machines (SVM), K-means clustering, principal/independent component analysis (PCA/ICA)

Some interests and hobbies

Music	Violin
Sports and nature	Running, hiking, mountain biking, skiing

Extended descriptions of selected projects

Activity	Bayesian Convolutional Neural Networks for Image Classification
Period	2019 - 2020
Role	Developer
Staffing	Independent project
Volume	Part time
Description	Convolutional neural networks (CNN) have been extensively used in image recognition algorithms and work well on large datasets with labelled data which, in general, is hard to collect in larger amounts for training. CNNs with frequentist approach use single point estimates for weights and tend to overfit when the data space is not substantially large. A Bayesian CNN, on the other hand, has its parameters sampled from a probability distribution which intrinsicly regularizes the network by averaging across many models during training and prevents overfitting even with few examples per class. To implement the Bayesian CNN, I have employed "Bayes by Backprop" for learning the probability distribution of the weights and used variational inference to approximate the posterior probability distrubution.
Tools	Image classification, Bayes by Backprop, variational Inference, TensorFlow, Python

Activity	Needlet Internal Linear Combination Analysis for CMB Data
Period	2016 - 2019
Role	Researcher
Staffing	Independent project in a mid-size international collaboration
Volume	Full time

Description	The project was aimed at developing a Principal Component Analysis based source separation software for CMB signal analysis in spherical wavelet domain from multi-frequency observations while minimizing the contamination from instrumental noise. The method performs localized analysis in both harmonic space and pixel space via needlet decomposition and as such it adapts component separation to local conditions of contamination both over the sky and over angular scale, and it uses not only spectral information, but also spatial information of the non-Galactic components in order to disentangle the CMB from the Galactic signal and noise contamination.
Tools	Signal processing, source separation, numerical modeling, statistical data analysis, image analysis, scientific writing, Python

Activity	A 3-D model of polarised dust emission in the Milky Way
Period	2014 - 2016
Role	Researcher
Staffing	Team of 3
Volume	Full time
Description	The project was aimed at constructing a three-dimensional model of polarised galactic dust emission that takes into account the variation of the dust density, spectral index and temperature along the line of sight, and contains randomly generated small scale polarisation fluctuations. The model is constrained to match observed dust emission on large scales, and match on smaller scales extrapolations of observed intensity and polarisation power spectra. The model was used to investigate the impact of plausible complexity of the polarised dust foreground emission on the analysis and interpretation of CMB polarisation observations.
Tools	Analytical modeling, statistical data analysis, signal analysis, scientific writing, IDL

Activity	Interferometric Gibbs Sampling
Period	2010 - 2014
Role	Researcher
Staffing	Team of 7
Volume	Full time
Description	The project was aimed at detection of B-mode polarization of the cosmic microwave background radiation with a Bayesian inference method for power spectra and signal reconstruction from interferometric data by using the technique of Gibbs sampling. The validity of the method was demonstrated in the flat-sky approximation for a simulation of an interferometric observation on a finite patch with incomplete coverage, a finite beam size and a realistic noise model.
Tools	Statistical modeling, statistical data analysis, image analysis, MCMC, scientific writing, C++