Neelanchal Joshi

Résumé

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Summary

Astrophysics doctoral researcher with a solid engineering background and hands-on experience in satellite development. Skilled in machine learning and image processing, looking for challenges at the intersection of engineering and space science.

Education

PhD (Physics) *MPI for Solar System Research, Uni. Goettingen*
IMPRS on Physical Processes in the Solar System and Beyond *Aug 2022 – Mar 2026 (exp)*
Thesis: Measuring multiscale solar flows using Local Correlation Tracking
Advisors: Prof. Dr. Laurent Gizon, Dr. Zhi-Chao Liang

MSc (Physics), BE (Electrical and Electronics Engineering) *BITS Pilani*
Dual degree program, CGPA: 8.28/10 *Aug 2017 – May 2022*
Master's Thesis: Solar Magnetogram Generation using Deep Learning
Bachelor's Thesis: Estimating structural and dynamical parameters for Red Giants using MCMC Simulations

Research Experience

Max Planck Insitute for Solar System Research *Aug 2022 – Present*
Doctoral Researcher *Goettingen, Germany*
- Developed a parallelized LCT pipeline to detect, extract and characterize Solar Inertial Modes in the **SDO/HMI** image dataset
- Integrated signal and image-processing and big-data workflows to analyse ∼**1TB of solar image data** per year since 2010
- Performed a comprehensive study to establish the sensitivity and resolution limits of ESA's upcoming **Vigil/PMI** instrument

Tata Institute of Fundamental Research *Aug 2021 – Jun 2022*
Research Intern *Mumbai, India*
- Developed **cGANs** to translate **historical Ca II K images to magnetograms** enabling long-term study of the solar dynamo
- Applied Bayesian inference via **MCMC** to optimize probabilistic models of the stellar frequency spectra from the **Kepler** data
- Extracted the structural and dynamical parameters for red giant stars from Power Spectral Density observations from Kepler

Team Anant *Mar 2018 – May 2020*
Lead, On-Board Computing Subsystem *Pilani, India*
- Led a team of highly skilled undergraduates **developing a 3U CubeSat's OBC**, as part of the ISRO Student Satellite Program
- Implemented a lossless compression algorithm on a **Zynq-7000 FPGA** in **Verilog** and contributed to the OBC system design
- Designed the **TTC-OBC interfacing architecture** under tight data-rate constraints alongside other system engineering tasks

Publications

- **Joshi, N.**, Liang, Z.C., Fournier, D., Gizon, L., "Observations of eigenfunctions of solar inertial modes using local correlation tracking of magnetic features", *International Conference on Mathematical and Numerical Aspects of Wave Propagation*, 2024.
- Prasad, A., Jain, Y., **Joshi, N.**, Gupta, N., Singhania, V., and Sreedharan, Y., "Interfacing Architecture between Telemetry and On-Board Computer for a Nanosatellite", *IEEE Aerospace Conference*, 2020.
- **Joshi, N.**, Kalgaonkar, P., "Implementation of CCSDS Hyperspectral Image Compression Algorithm on FPGA on-board a nanosatellite", *European Conference on AeroSpace Sciences*, 2019.
- **Joshi, N.**, Liang, Z.C., Gizon, L., "A synthetic parameter analysis of correlation tracking of granulation and magnetic features for the PMI instrument", *Astronomy and Astrophysics, in prep*.

Technical skills

Programming Languages Python, C, C++, JavaScript, HTML, MATLAB, Verilog, Linux/Unix Shell, Julia
Frameworks Tensorflow, PyTorch, Astropy, Pandas, NumPy, OpenCV, Pillow, SciPy, Matplotlib, Jupyter, Spyder, SLURM, MPI, LaTeX, Simulink, LTspice, Microwind, ModelSim, Xilinx Vivado

Leadership and Outreach

PhDNet Student Representative Represented interests of the MPS students at the PhDNet *2024-25*
Coordinator, PEP Organised several events at APOGEE, technical fest at BITS Pilani *2017-18*

Awards and Scholarships

INSPIRE Scholar Department of Science and Technology, Government of India *2017-22*
Sakura Science Scholar Japan Science and Technology Agency, Government of Japan *2016*
Travel Grant Carl-Zeiss Stiftung Summer School on Machine Learning in Astrophysics *2023*