Shakir Showkat Sofi

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Education

February, 2023 – Present | **KU Leuven, ESAT, STADIUS, Campus Kulak Kortrijk, Belgium**
Ph.D. Engineering Science (EE) : Computational Maths, Signal Processing, and Data Mining
Advisor : Prof. Lieven De Lathauwer (ESAT, STADIUS and Group Science, E & T)
› **Topic :** "Numerical algorithms for tensor decompositions and applications."
Data mining, Tensor completion, Dimensionality reduction, Modeling, and identification.

September, 2020 – June, 2022 | **Skolkovo Institute of Science and Technology, Moscow, RU**
MSc Data Science **GPA :** 4.7/5 Advisor : Prof. Ivan Oseledets (Skoltech & RAS)
› **Thesis :** "Spatiotemporal forecasting with application to the weather forecast"
Matrix and tensor completion, Spatiotemporal forecasting, Data-driven weather forecast, ML/DL

August, 2015 – August, 2019 | **Islamic University Of Science And Technology, Srinagar, J&K, India**
Btech Electric Engineering **GPA :** 9.18/10 Advisor : Dr. Shahkar A. Nahvi (IUST & IIT-Delhi)
› **Thesis :** "Energy-Based Modeling of Dc-Dc Power Converters"
Dc-Dc power converters, Euler-Lagrangian modelling, Simulation

December, 2013 – November, 2014 | **Govt. Hr. Sec. School, B.K Pora, Srinagar, J&K, India**
Associate Degree **Percentage :** 83.6%
› Specialization in Science, Maths, and Informatics practices

Relevant coursework : Introduction to Artificial Intelligence and Data Science, Mathematical Methods in Engineering and Applied Science, Probability & Statistics, Optimization, Numerical Linear Algebra, Signal Processing and Advanced Control Systems, Power Electronics, Circuit Simulations, Machine Learning, Deep Learning, Geometrical Methods of Machine Learning, Models of Sequential Data, Tensor Decomposition and Tensor Networks in Artificial Intelligence.

Research Interests

My current research focuses on matrix and tensor decompositions for machine learning : data completion, dimensionality reduction, time-series analysis, and predictive modeling with applications to temporally evolving geospatial systems (weather forecast, traffic forecast, etc.).

Experience

Summer 2021 | **Skolkovo Institute of Science and Technology and TENSOR FIELD, Moscow, RU**
Research Internship
› Data-driven weather forecasting
› Multivariate time series forecasting for long range Geo-spatial grid points.

Summer 2021 | **Global Quantum Network, QWorld, Virtual**
Quantum Computing Summer School
› Quantum Computing and Programming : Qiskit, QFT and Shor's Algorithm, etc.

August 2019 – June 2020 | **Jamkash Vehicleades Kashmir Pvt. Ltd, Maruati-Suzuki, Srinagar, J&K, India**
Engineer Intern
› Worked in Logistic Electrical.

Summer 2018 | Power Grid Corporation Of India Limited, J&K, India
Field internship
- Transmission and distribution of electrical energy.
- Hydro power generation : Turbo-generators, Turbine, Water-dam, Steam generators, etc.
- Control room, Power station management, Transformer repairing.

Projects

Auto-regressive matrix and tensor completion for spatiotemporal imputation and predictions.

Implementation of spatiotemporal constrained matrix and tensor factorization based algorithms for imputation and forecasting of weather data. Basically, autoregressive constraints on temporal dimensions and smoothness constraints on spatial dimensions were imposed during learning process. The results showed that imposing constraints separately on the temporal and spatial dimensions of spatiotemporal weather data has significantly improved the forecasting and imputation performance.

Tensorizing dynamic model decomposition

Tensor train decomposition enabled fast, efficient and stable implementation of dynamic mode decomposition in the tensor framework. This work was successfully completed under the supervision of Dr. Ivan Oseledets. https://github.com/ShakirSofi/TensorizingDMD.git

Comparing integer and fractional order NN for tree-species classification

The main idea was to implement fractional-order back-propagation algorithms and compare that with integer-based neural networks for multi-spectral image classification.

Shaping filter response with fractional order models

We have employed fractional-order differential and integral operators to design frequency domain filters. The results showed that this technique is significantly better, offers greater simultaneous control over time and frequency responses, and is basically a generalization of integer-order filters. Presentation

Image segmentation with topological priors

We incorporated topological priors before and in the deep neural network training procedure for improving segmentation accuracy for fine-scale structures. The results demonstrated that incorporating topological information into the classical UNet model performed significantly better. Code

De novo drug design with conditional 1DCNN variational autoencoders

The main aim of the project was to generate chemically valid novel drug candidates. We utilise conditional variational autoencoders to design novel drugs with user-defined properties. Most importantly, in this study we looked into effective techniques to condition encoders and decoders architectures. Code

Energy-based modeling of Dc-Dc power converters

Undergraduate thesis research project under the guidance of Dr. S.A Nahvi. Development of models based on the Euler-Lagrangian framework, due to ease of energy-based (scalar) modeling rather than force-based (vector) based, was awarded an excellent mark.

State-space modeling of power converters

The basic idea was to develop and simulate the state-space mathematical models of Power electronics converters so that we can create new ones and improve the performance of existing converters.

Submitted Papers

IJF preprint — Sofi, Shakir Showkat and Oseledets, Ivan. “A case study of spatiotemporal forecasting techniques for weather forecasting.” https://doi.org/10.48550/arXiv.2209.14782

ArXiv preprint — Sofi, Shakir Showkat and Nadezhda Alsahanova. “Image Segmentation with Topological Priors.” https://doi.org/10.48550/arXiv.2205.06197

Skills

Programming and Writing :	C, V.B, HTML, SQL, LaTeX, LyX, Ms Office.
Computational :	Matlab, Mathematica, Octave, Python, Scikit-learn, Numpy, Pandas, Pytorch, Keras, Tensorly, Tensor Toolbox, etc.
Other :	Arduino Uno, μP-8085, μC-8051, Atmel 328P.
Languages :	English, Urdu, Kashmiri.
Leadership :	Responsibility, Adaptability, Team-work, Communication, Management, and Decisiveness.

Memberships and Affilations

- American Association of Mechanical Engineers (ASME)
- International Association of Engineers (IAENG)
- World Academy of Science,Engineering and Technology (WASET)
- Institute of Research Engineers and Doctors (theIRED)

Teaching and Mentoring

T.A — **KU Leuven, Campus Kulak Kortrijk, Belgium**

- Applied AI : Academic Perspectives.
- System and Control Theory.

Prepared and conducted theoretical and coding exercise sessions, assessments, etc.

Private tutoring — **Srinagar, Jammu and Kashmir, India**

- Course Instructor : Python programming (Foundations & Applications) [KIMS, Quantum AI Lab]
- Private Tutor : Tutored 9 students in Differential Equations.
- Private and Group Tutor : Provided private tutoring for high school and college-level calculus course.

Certifications and Scholarships

Rank certificate	Among top two students in Bachelor's degree, at Islamic University of Science and Technology, 2015-EE
2015-2019	Merit-Cum Means Scholarship during Undergrad. by MHRD, Govt. of India.
2020	Graduate fellowship at Skolkovo Institute of Science and Technology, Moscow, RU
2023	Doctoral scholarships at KU Leuven, Belgium.

References

Dr. Lieven De Lathauwer
Professor, ESAT, STADIUS and Group Science, E & T, KU Leuven
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Dr. Ivan Oseledets
Professor, Director of the CAIT, Skolkovo Institute of Science and Technology
@ I.Oseledets@skoltech.ru

Mr. Muzaffar Ahmad Sofi
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