

SÜHA TUNA, PhD

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Research Profile & Expertise

Associate Professor of Computational Science and Engineering specializing in tensor decomposition methodologies. Aims to apply developed tensor frameworks to diverse scientific fields via machine learning and numerical optimization techniques. Possesses extensive expertise in hyperspectral imagery, gene network analysis, and multidimensional applications across various engineering domains. Proficient in integrating deep learning frameworks and big data analytics for large-scale multiway datasets.

Publications

- **Tuna, S.**, Başar, Ü., “Convolution-Free Holistic Multivariance Decomposition Layer for Efficient Hyperspectral Image Classification Tensor Networks”, *arXiv preprint arXiv:2608.16241*.
- **Tuna, S.**, “Efficient Spatial-Spectral Feature Extraction in Hyperspectral Images via Holistic Multivariance Decomposition”, *arXiv preprint arXiv:2607.22272*.
- **Tuna, S.**, “Holistic Multivariance Decomposition: Adapting Mode Interrelations in Low-Rank Tensor Approximations”, *arXiv preprint arXiv:2606.26965*.
- **Tuna, S.**, “Improving sparse coding based hyperspectral image classification via tensor decomposition and oversegmentation”, *AIP Conference Proceedings*, 3489(1), 280024.
- Salamah, S., Seckin, C., **Tuna, S.**, “Performance optimization in thermoelectric coolers using physical data-driven artificial neural networks”, *International Journal of Refrigeration*, 182, 114-125.
- Kahraman, E., **Tuna, S.**, “Enhancing hyperspectral and multispectral image fusion using high dimensional model representation”, *2025 9th International Symposium on Innovative Approaches in Smart Technologies*.
- Yilmaz, B., **Tuna, S.**, “Compression of Convolutional Neural Networks Employing Tensor Train and High Dimensional Model Representation”, *2025 9th International Symposium on Innovative Approaches in Smart Technologies*.
- **Tuna, S.**, “Refining Sparse Coding Dictionaries Using High Dimensional Model Representation for Hyperspectral Imagery”, *Kocaeli Journal of Science and Engineering*, 8(2), 121-132.
- İnanç, B. M., Şahin, Z. B., **Tuna, S.**, Benli, B., Eyidoğan, B., Töreyn, B. U., “Analysis of Microscopic Data on the Behavior of Metallic Nickel Ore During Magnetic Enrichment Using SAM2 and Tensor Decomposition-Based Zero-Shot Image Segmentation”, *2025 33rd Signal Processing and Communications Applications Conference (SIU)*.
- Şen, M. E., **Tuna, S.**, “A new feature extraction scheme based on support optimization in Enhanced Multivariance Products Representation for Hyperspectral Imagery”, *Journal of the Franklin Institute*, 362(2), 107464.
- Ergün, E., **Tuna, S.**, “Enhancing Travel Experience: Predicting Flight Delays for Informed Journey Planning”, *International Journal of Applied Methods in Electronics and Computers*, 12.

- Öztürk, S., Kösemen, A., Şen, Z., **Tuna, S.**, Bayazit, S. S., Kılınc, N., “Highly sensitive and selective detection of dimethyl methyl phosphonate with copolymer-based QCM sensors”, *Macromolecular Materials and Engineering*, 309(5), 2300346.
- Aydın, F., **Tuna, S.**, “Variant Analysis in Human Genome Sequences Using Surrogate Modelling and Machine Learning”, *V. International Applied Statistics Congress (UYIK)*, 739-748.
- Şen, M. E., **Tuna, S.**, “Exploiting optimal supports in enhanced multivariate products representation for lossy compression of hyperspectral images”, *2023 14th International Conference on Electrical and Electronics Engineering (ELECO)*.
- **Tuna, S.**, Gulec, C., Yucesan, E., Cirakoglu, A., Tarkan Arguden, Y., “Gene Teams are on the Field: Evaluation of Variants in Gene-Networks Using High Dimensional Modelling”, *IEEE/ACM Transactions on Computational Biology and Bioinformatics*.
- Heydarov, S., Aydın, M., Faydaci, C., **Tuna, S.**, Ozturk, S., “Low-cost VIS/NIR range hand-held and portable photospectrometer and evaluation of machine learning algorithms for classification performance”, *Engineering Science and Technology, an International Journal*, 37, 101302.
- **Tuna, S.**, Korkmaz Özey, E., Tunga, B., Gürvit, E., Tunga, M. A., “An efficient feature extraction approach for hyperspectral images using Wavelet High Dimensional Model Representation”, *International Journal of Remote Sensing*, 43(19-24), 6899-6920.
- **Tuna, S.**, Töreyn, B. U., Demiralp, M., Ren, J., Marshall, S., Demiralp, M., “Iterative Enhanced Multivariate Products Representation for Effective Compression of Hyperspectral Images”, *IEEE Transactions on Geoscience and Remote Sensing*, **2020**, DOI: 10.1109/TGRS.2020.3031016
- **Tuna, S.**, Demiralp, M., “Zero Interval Limit Perturbation Expansion for the Spectral Entities of Hilbert-Schmidt Operators Combined with Most Dominant Spectral Component Extraction: Convergence and Confirmative Implementations”, *J. Math. Chem.*, **2017**, 55(6), DOI: 10.1007/s10910-017-0740-1
- Demiralp, M., **Tuna, S.**, “Zero Interval Limit Perturbation Expansion for the Spectral Entities of Hilbert-Schmidt Operators Combined with Most Dominant Spectral Component Extraction: Formulation and Certain Technicalities”, *J. Math. Chem.*, **2017**, 55(6), DOI: 10.1007/s10910-017-0739-7
- **Tuna, S.**, Demiralp, M., “On Autonomy Imposition in Zero Interval Limit Perturbation Expansion for the Spectral Entities of Hilbert-Schmidt Integral Operators”, *Mathematics*, **2017**, 5(1), 2, DOI: 10.3390/math5010002
- **Tuna, S.**, Demiralp, M., “Validity and Failure of the Autonomy Imposition on the Eigenfunctions in Zero Interval Limit Perturbation Expansion for Hilbert-Schmidt Integral Operators”, *International Journal of Applied Physics*, **2016**, 1, 42–48
- Sukhanov, A., **Tuna, S.**, Töreyn, B. U., “Lossy Compression of Hyperspectral Images by Using Enhanced Multivariate Products Representation (EMPR) Method”, in Turkish, *24th. IEEE Congress on Signal Processing and Communication Applications, SIU’16*, **2016**, DOI: 10.1109/SIU.2016.7496142
- **Tuna, S.**, Demiralp, M., “Bivariate enhanced multivariate products representation (EMPR) at zero volume limit via geometric separation”, *AIP Conf. Proc., Int. Conf. Comp. Meth. Sci. Eng.*, **2015**, DOI: 10.1063/1.4938944
- **Tuna, S.**, Tunga, B., “A Novel Piecewise Multivariate Function Approximation Method via Universal Matrix Representation”, *J. Math. Chem.*, **2013**, 51(7), DOI:10.1007/s10910-013-0179-y

- **Tuna, S.**, Tunga, B., “Node Optimization Through Enhanced Multivariate Product Representation (EMPR)”, *Procs. of 13th Int. Conf. Comp. and Math. Meth. in Sci. and Eng. (CMMSE’13)*, 1322-1330, **2013**
- **Tuna, S.**, Demiralp, M., “Probabilistic Evolution Approach for Initial Value Problems over Fourier Basis Set”, *AIP Conf. Proc., 9th Int Conf. on Math. Prob. in Eng., Aerospace and Sci.*, **2012**, DOI: <http://dx.doi.org/10.1063/1.4765618>
- **Tuna, S.**, Demiralp, M., “Certain Validations of Probabilistic Evolution Approach for Initial Value Problems”, *WSEAS Conf. on Advances in Systems Theory, Signal Processing and Comp. Sci.*, **2012**
- **Tuna, S.**, Baykara, N. A. , Demiralp, M., “Weighted Singular Value Decomposition for Folded Matrices”, *AICT’11 Proc. of the 2nd Int. Conf. on App. Inf. and Comp. Theory*, **2011**, ISBN: 978-1-61804-034-3
- **Tuna, S.**, Demiralp, M., “Effects of the Weight Function Choices on Single-Node Fluctuation Free Integration”, *Procs. of 11th Int. Conf. Comp. and Math. Methods in Sci. and Eng.*, **2011**
- **Tuna, S.**, Demiralp, M., “Matrix High Dimesional Model Representation (MHDMR) with the Weight Matrices Generated by Subspace Construction”, *AIP Conf. Proc., Int. Conf. on Num. Anal. and App. Math.*, **2011**, DOI: <http://dx.doi.org/10.1063/1.3637829>
- **Tuna, S.**, Baykara, N. A., Demiralp, M., “Roles of the Basis Functions on the Weight Function Generating Subspace Construction”, *AIP Conf. Proc., Int. Conf. on Num. Anal. and App. Math.*, **2010**, DOI: <http://dx.doi.org/10.1063/1.3498302>
- **Tuna, S.**, Baykara, N. A., Demiralp, M., “Taylor Series Based Integration With The Fluctuation Freely Approximated Remainder Over Gauss Wave Type Basis Functions”, *AIP Conf. Proc., Int. Conf. of Comp. Meth. in Sci. and Eng.*, **2009**, DOI:<http://dx.doi.org/10.1063/1.4771815>
- **Tuna, S.**, Tunga, B., Baykara, N. A., Demiralp, M., “Fluctuation Free Matrix Representation Based Univariate Integration in Hybrid High Dimensional Model Representation (HHDMR) Over Plain and Factorized HDMMR”, *WSEAS Transactions on Mathematics*, **2009**, ISSN: 1109-2769

Professional Experience

İstanbul Technical University

Associate Professor of Computational Science and Engineering (Informatics Institute)

İstanbul, Türkiye

July 2021 – Present

The University of Strathclyde

Postdoctoral Researcher (Hyperspectral Imaging Centre)

Glasgow, UK

February 2019 – November 2019

Fatih Sultan Mehmet Vakıf University

Assistant Professor of Computer Engineering

İstanbul, Türkiye

September 2017 – June 2021

İstanbul Technical University

Research Assistant

İstanbul, Türkiye

December 2010 – September 2016

Education

İstanbul Technical University, İstanbul, Türkiye
Ph.D. in Computational Science and Engineering

September 2010 – March 2017

- **Thesis:** A New Support Function Determination Method in Enhanced Multivariate Products Representation
- **Advisor:** Prof. Dr. Metin Demiralp

Marmara University, İstanbul, Türkiye
M.Sc. in Applied Mathematics

September 2007 – July 2010

- **Thesis:** Evaluation of the Multivariate Integrals in Hybrid High Dimensional Model Representation Method Using Fluctuationlessness Approximation
- **Advisor:** Prof. Dr. N. A. Baykara

İstanbul Kültür University, İstanbul, Türkiye
B.Sc. in Mathematics and Computing

September 2003 – June 2007

Technical Skills

Programming:	Python, MATLAB, C/C++, Java, PySpark, Octave
Machine Learning & AI:	TensorFlow, Keras, PyTorch, XGBoost, Retrieval-Augmented Generation (RAG)
HPC & Big Data:	Apache Spark, OpenMP, Message Passing Interface (MPI), Hadoop, GPU Acceleration
Systems & Tools:	Linux (System Administration), Bash Scripting, L ^A T _E X, TikZ, Git

Grants, Awards & Projects

Ongoing Projects

- **TÜBİTAK 1001 Project:** A Grid-Based Representation and Generative Artificial Intelligence Framework for the Mechanical Design of Shell Structures.
- **TÜBİTAK 1002 Project:** Development of an Electronic Nose System for the Detection of Residual Anesthetic Gases in Post-Anesthesia Care Units.
- **TÜBİTAK 1707 Project:** Development of an Image Processing-Based Automated Monitoring and Decision Support Platform for Blueberry Cultivation.
- **TENMAK Project:** Research and Development of Next-Generation Solid-State Detectors within the Framework of the CERN DRD3 Collaboration.

Completed Grants & Fellowships

- **TÜBİTAK BİDEB 2219 Grant:** International Postdoctoral Research Scholarship Programme for “Data reduction and feature extraction in hyperspectral imagery”(February 2019 – November 2019).

Teaching Experience

Graduate Courses: Computational Methods for Tensor Decomposition and Low-Rank Approximation, Mathematical Methods in Data Analysis and Machine Learning, Scientific Computing I-II, Parallel and Distributed Computing (MPI/OpenMP), Digital Image Processing.

Undergraduate Courses: Numerical Methods, Image Processing, Parallel Programming, C/C++ Programming.

Administrative Duties

- Coordinator of the Big Data and Business Applications Master's Program (August 2025 – Present)
- Coordinator of the University Rankings Coordinatorship (December 2024 – Present)
- Vice Head of the Department of Computer Engineering (October 2017 – January 2019).