

List of Publications

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Conference Papers

- 2024
- [1] M. Bai, W. Huang, T. Li, A. Wang, J. Gao, C. F. Caiafa, and Q. Zhao, "Diffusion models demand contrastive guidance for adversarial purification to advance," in *Forty-first International Conference on Machine Learning (ICML)*, 2024.
 - [2] H. Huang, G. Zhou, Y. Zheng, Y. Qiu, A. Wang, and Q. Zhao, "Adversarially robust deep multi-view clustering: A novel attack and defense framework," in *Forty-first International Conference on Machine Learning (ICML)*, 2024.
 - [3] P. Wang, L. Shen, Z. Tao, S. He, and D. Tao, "Generalization analysis of stochastic weight averaging with general sampling," in *Forty-first International Conference on Machine Learning (ICML)*, 2024.
 - [4] J. Zeng, C. Li, Z. Sun, Q. Zhao, and G. Zhou, "Tngps: Discovering unknown tensor network structure search algorithms via large language models (llms)," in *Forty-first International Conference on Machine Learning (ICML)*, 2024.
 - [5] W. Zhou, S. Bai, S. Yu, Q. Zhao, and B. Chen, "Jacobian regularizer-based neural granger causality," in *Forty-first International Conference on Machine Learning (ICML)*, 2024.
 - [6] J. Zhang, Y. Hong, D. Cheng, L. Zhang, and Q. Zhao, "Hierarchical attacks on large-scale graph neural networks," in *ICASSP 2024-2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2024, pp. 7635–7639.
 - [7] Y. Zheng, X. Zhao, J. Zeng, C. Li, Q. Zhao, H. Li, and T. Huang, "SVDinsTN: A tensor network paradigm for efficient structure search from regularized modeling perspective," in *IEEE / CVF Computer Vision and Pattern Recognition Conference (CVPR)*, 2024.
 - [8] Y. Qiu, G. Zhou, A. Wang, Z. Huang, and Q. Zhao, "Towards multi-mode outlier robust tensor ring decomposition," in *Proceedings of the 38th AAAI Conference on Artificial Intelligence (AAAI)*, 2024.
 - [9] Z. Tao, T. Tanaka, and Q. Zhao, "Efficient nonparametric tensor decomposition for binary and count data," in *Proceedings of the 38th AAAI Conference on Artificial Intelligence (AAAI)*, 2024.
 - [10] S. Bai, M. Zhang, W. Zhou, S. Huang, Z. Luan, D. Wang, and B. Chen, "Prompt-based distribution alignment for unsupervised domain adaptation," in *Proceedings of the 38th AAAI Conference on Artificial Intelligence (AAAI)*, 2024.
 - [11] G. Lin, C. Li, J. Zhang, T. Tanaka, and Q. Zhao, "Adversarial training on purification (AToP): Advancing both robustness and generalization," in *The Twelfth International Conference on Learning Representations (ICLR)*, 2024.

- [12] C. Ju, R. J. Kobler, L. Tang, C. Guan, and M. Kawanabe, "Deep geodesic canonical correlation analysis for covariance-based neuroimaging data," in *The Twelfth International Conference on Learning Representations (ICLR)*, 2024.
- [13] A. Wang, Y. Qiu, M. Bai, Z. Jin, G. Zhou, and Q. Zhao, "Generalized tensor decomposition for understanding multi-output regression under combinatorial shifts," in *Thirty-eighth Conference on Neural Information Processing Systems (NeurIPS)*, 2024.
- 2023 [14] C. Li, J. Zeng, C. Li, C. F. Caiafa, and Q. Zhao, "Alternating local enumeration (tnale): Solving tensor network structure search with fewer evaluations," in *International Conference on Machine Learning (ICML)*, PMLR, 2023, pp. 20 384–20 411.
- [15] Z. Tao, T. Tanaka, and Q. Zhao, "Scalable bayesian tensor ring factorization for multi-way data analysis," in *International Conference on Neural Information Processing (ICONIP)*, Springer, 2023, pp. 490–503.
- [16] C. Ju, R. J. Kobler, and C. Guan, "Score-based data generation for eeg spatial covariance matrices: Towards boosting bci performance," in *Proceedings of the 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)*, 2023, pp. 1–7.
- [17] J. Zhang, Y. Hong, and Q. Zhao, "Memorization weights for instance reweighting in adversarial training," in *Proceedings of the AAAI Conference on Artificial Intelligence (AAAI)*, vol. 37, 2023, pp. 11 228–11 236.
- [18] S. Mo, Z. Sun, and C. Li, "Multi-level contrastive learning for self-supervised vision transformers," in *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2023, pp. 2778–2787.
- [19] S. Mo, Z. Sun, and C. Li, "Representation disentanglement in generative models with contrastive learning," in *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, 2023, pp. 1531–1540.
- [20] Z. Lin, H. Huang, Y. Yu, G. Zhou, and Q. Zhao, "Consistent anchor induced multi-view deep matrix factorization," in *The 42nd Chinese Control Conference (CCC)*, IEEE, 2023, pp. 7633–7637.
- [21] Z. Tao, T. Tanaka, and Q. Zhao, "Undirected probabilistic model for tensor decomposition," in *Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS)*, 2023.
- [22] A. Wang, C. Li, M. Bai, Z. Jin, G. Zhou, and Q. Zhao, "Transformed low-rank parameterization can help robust generalization for tensor neural networks," in *Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS)*, 2023.
- 2022 [23] H. Takayama and T. Yokota, "Fast signal completion algorithm with cyclic convolutional smoothing," in *2022 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, IEEE, 2022, pp. 364–371.
- [24] R. Yamamoto, H. Hontani, A. Imakura, and T. Yokota, "Consistent mdt-tucker: A hankel structure constrained tucker decomposition in delay embedded space," in *2022 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, IEEE, 2022, pp. 137–142.

- [25] M. Bai, J. Chen, Q. Zhao, C. Li, J. Zhang, and J. Gao, "Tensor neural controlled differential equations," in *2022 International Joint Conference on Neural Networks (IJCNN)*, IEEE, 2022, pp. 1–9.
- [26] H. Huang, Y. Luo, G. Zhou, and Q. Zhao, "Multi-view data representation via deep autoencoder-like nonnegative matrix factorization," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2022, pp. 3338–3342.
- [27] K. Konstantinidis, Y. L. Xu, Q. Zhao, and D. P. Mandic, "Variational Bayesian tensor networks with structured posteriors," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2022, pp. 3638–3642.
- [28] W. Wang, L. Niu, J. Zhang, X. Yang, and L. Zhang, "Dual-path image inpainting with auxiliary GAN inversion," in *IEEE/CVF Conference on Computer Vision and Pattern Recognition CVPR 2022*, 2022, pp. 11 411–11 420.
- [29] J. Tang, K. Li, M. Hou, X. Jin, W. Kong, Y. Ding, and Q. Zhao, "Mmt: Multi-way multi-modal transformer for multimodal learning," in *IJCAI*, 2022.
- [30] C. Li, J. Zeng, Z. Tao, and Q. Zhao, "Permutation search of tensor network structures via local sampling," in *International Conference on Machine Learning (ICML)*, PMLR, 2022, pp. 13 106–13 124.
- [31] R. J. Kobler, J.-i. Hirayama, Q. Zhao, and M. Kawanabe, "Spd domain-specific batch normalization to crack interpretable unsupervised domain adaptation in eeg," in *NeurIPS 2022*, 2022.
- [32] R. Yamamoto, H. Hontani, A. Imakura, and T. Yokota, "Fast algorithm for low-rank tensor completion in delay-embedded space," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2022, pp. 2058–2066.
- [33] Y. Li, Z. Sun, and C. Li, "Are we pruning the correct channels in image-to-image translation models," in *The 33rd British Machine Vision Conference (BMVC) Proceedings*, 2022.
- [34] S. Mo, Z. Sun, and C. Li, "Rethinking prototypical contrastive learning through alignment, uniformity and correlation," in *The 33rd British Machine Vision Conference (BMVC) Proceedings*, 2022.
- [35] Y. Hong, L. Niu, and J. Zhang, "Shadow generation for composite image in real-world scenes," in *Thirty-Sixth AAAI Conference on Artificial Intelligence, AAAI 2022*, 2022, pp. 914–922.
- 2021 [36] X. Zhao, S. Takata, K. Fukumori, and T. Tanaka, "Infant posture assessment based on rotational keypoint detection," in *2021 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, IEEE, 2021, pp. 1546–1550.
- [37] X. Zhao, J. Solé-Casals, Q. Zhao, J. Cao, and T. Tanaka, "Multi-feature fusion for epileptic focus localization based on tensor representation," in *2021 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, IEEE, 2021, pp. 1323–1327.

- [38] Z. Huang, Y. Qiu, Q. Zhao, and G. Zhou, "Bayesian robust Tucker decomposition for multiway data analysis," in *2021 China Automation Congress (CAC)*, IEEE, 2021, pp. 5559–5564.
- [39] Q. Jiang, Y. Yu, Q. Zhao, and W. Sun, "Semi-supervised robust dual-graph concept factorization via $L_{2,1}$ norm," in *2021 Chinese Automation Congress (CAC)*, 2021.
- [40] M. Bai, Q. Zhao, and J. Gao, "Tensorial time series prediction via tensor neural ordinary differential equations," in *2021 International Joint Conference on Neural Networks (IJCNN)*, IEEE, 2021, pp. 1–8.
- [41] Z. Huang, C. Li, F. Duan, and Q. Zhao, "Multi-distorted image restoration with tensor 1×1 convolutional layer," in *2021 International Joint Conference on Neural Networks (IJCNN)*, IEEE, 2021, pp. 1–8.
- [42] J. Zhang, Z. Tao, L. Zhang, and Q. Zhao, "Tensor decomposition via core tensor networks," in *ICASSP 2021-2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2021, pp. 2130–2134.
- [43] Z. Sun, C. Li, and Q. Zhao, "Hide chopin in the music: Efficient information steganography via random shuffling," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2021, pp. 2370–2374.
- [44] W. Wang, J. Zhang, L. Niu, H. Ling, X. Yang, and L. Zhang, "Parallel multi-resolution fusion network for image inpainting," in *IEEE/CVF International Conference on Computer Vision, ICCV 2021*, IEEE, 2021, pp. 14 539–14 548.
- [45] H. Qiu, C. Li, Y. Weng, Z. Sun, X. He, and Q. Zhao, "On the memory mechanism of tensor-power recurrent models," in *International Conference on Artificial Intelligence and Statistics (AISTATS'21)*, PMLR, 2021, pp. 3682–3690.
- [46] Z. Tao, X. Zhao, T. Tanaka, and Q. Zhao, "Bayesian latent factor model for higher-order data," in *Proceedings of The 13th Asian Conference on Machine Learning (ACML)*, ser. Proceedings of Machine Learning Research, vol. 157, PMLR, 2021, pp. 1285–1300.
- [47] J. Tang, K. Li, X. Jin, A. Cichocki, Q. Zhao, and W. Kong, "CTFN: Hierarchical learning for multimodal sentiment analysis using coupled-translation fusion network," in *Proceedings of the 59th Annual Meeting of the Association for Computational Linguistics and the 11th International Joint Conference on Natural Language Processing (Volume 1: Long Papers)*, 2021, pp. 5301–5311.
- [48] Z. Pan, L. Niu, J. Zhang, and L. Zhang, "Disentangled information bottleneck," in *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 35, 2021, pp. 9285–9293.
- [49] Y.-B. Zheng, T.-Z. Huang, X.-L. Zhao, Q. Zhao, and T.-X. Jiang, "Fully-connected tensor network decomposition and its application to higher-order tensor completion," in *Proceedings of the AAAI Conference on Artificial Intelligence (AAAI'21)*, vol. 35, 2021, pp. 11 071–11 078.
- [50] C. F. Caiafa, Z. Wang, J. Sole-Casals, and Q. Zhao, "Learning from incomplete features by simultaneous training of neural networks and sparse coding," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*, 2021, pp. 2621–2630.

- 2020 [51] X. Zhao, J. Solé-Casals, B. Li, Z. Huang, A. Wang, J. Cao, T. Tanaka, and Q. Zhao, "Classification of epileptic iEEG signals by CNN and data augmentation," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2020, pp. 926–930.
- [52] C. Li and Z. Sun, "Evolutionary topology search for tensor network decomposition," in *International Conference on Machine Learning (ICML)*, PMLR, 2020, pp. 5947–5957.
- [53] X. Zhao, L. Sui, T. Tanaka, J. Cao, and Q. Zhao, "Epileptic focus localization based on iEEG plot images by using convolutional neural network," in *Proceedings of the 12th International Conference on Bioinformatics and Computational Biology*, vol. 70, 2020, pp. 173–181.
- [54] B. Li, C. Li, F. Duan, N. Zheng, and Q. Zhao, "TPFN: Applying outer product along time to multimodal sentiment analysis fusion on incomplete data," in *The 2020 European Conference on Computer Vision (ECCV-20)*, 2020.
- [55] C. Li, M. E. Khan, Z. Sun, G. Niu, B. Han, S. Xie, and Q. Zhao, "Beyond unfolding: Exact recovery of latent convex tensor decomposition under reshuffling," in *Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20)*, 2020, pp. 4602–4609.
- [56] Q. Shi, J. Yin, J. Cai, A. Cichocki, T. Yokota, L. Chen, M. Yuan, and J. Zeng, "Block hankel tensor arima for multiple short time series forecasting.," in *Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20)*, 2020, pp. 5758–5766.
- [57] A. Wang, C. Li, Z. Jin, and Q. Zhao, "Robust tensor decomposition via orientation invariant tubal nuclear norms," in *Thirty-Fourth AAAI Conference on Artificial Intelligence (AAAI-20)*, 2020, pp. 6102–6109.
- 2019 [58] B. Li, X. Zhao, Q. Zhao, T. Tanaka, and J. Cao, "A one-dimensional convolutional neural network model for automated localization of epileptic foci," in *2019 Asia-Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*, IEEE, 2019, pp. 741–744.
- [59] F. Aminmansour, A. Patterson, L. Le, Y. Peng, D. Mitchell, F. Pestilli, C. Caiafa, R. Greiner, and M. White, "Learning macroscopic brain connectomes via group-sparse factorization," in *Advances in Neural Information Processing Systems 32 (NeurIPS 2019)*, 2019, pp. 8847–8857.
- [60] M. Hou, J. Tang, J. Zhang, W. Kong, and Q. Zhao, "Deep multimodal multilinear fusion with high-order polynomial pooling," in *Advances in Neural Information Processing Systems 32 (NeurIPS 2019)*, 2019, pp. 12 113–12 122.
- [61] L. Sui, X. Zhao, Q. Zhao, T. Tanaka, and J. Cao, "Localization of epileptic foci by using convolutional neural network based on iieeg," in *Artificial Intelligence Applications and Innovations (AIAI)*, Springer International Publishing, 2019, pp. 331–339.
- [62] J. Yu, C. Li, Q. Zhao, and G. Zhao, "Tensor-ring nuclear norm minimization and application for visual : Data completion," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2019, pp. 3142–3146. DOI: 10.1109/ICASSP.2019.8683115.
- [63] W. He, L. Yuan, and N. Yokoya, "Total-variation-regularized tensor ring completion for remote sensing image reconstruction," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2019, pp. 8603–8607.

- [64] C. Li, Z. Sun, J. Yu, M. Hou, and Q. Zhao, "Low-rank embedding of kernels in convolutional neural networks under random shuffling," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2019, pp. 3022–3026.
- [65] A. Wang, X. Song, X. Wu, Z. Lai, and Z. Jin, "Generalized dantzig selector for low-tubal-rank tensor recovery," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2019, pp. 3427–3431.
- [66] A. Wang, X. Song, X. Wu, Z. Lai, and Z. Jin, "Latent Schatten TT norm for tensor completion," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2019, pp. 2922–2926.
- [67] A. Wang, X. Song, X. Wu, Z. Lai, and Z. Jin, "Robust low-tubal-rank tensor completion," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2019, pp. 3432–3436.
- [68] L. Yuan, C. Li, J. Cao, and Q. Zhao, "Randomized tensor ring decomposition and its application to large-scale data reconstruction," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2019, pp. 2127–2131.
- [69] Q. Zhao, M. Sugiyama, L. Yuan, and A. Cichocki, "Learning efficient tensor representations with ring-structured networks," in *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2019, pp. 8608–8612.
- [70] Q. Chen, L. Yuan, Y. Miao, Q. Zhao, T. Tanaka, and J. Cao, "Quasi-brain-death eeg diagnosis based on tensor train decomposition," in *International Symposium on Neural Networks (ISNN)*, Springer, 2019, pp. 501–511.
- [71] L. Yuan, C. Li, D. Mandic, J. Cao, and Q. Zhao, "Tensor ring decomposition with rank minimization on latent space: An efficient approach for tensor completion," in *Proceedings of the AAAI Conference on Artificial Intelligence (AAAI)*, vol. 33, 2019, pp. 9151–9158.
- [72] P. P. Liang, Z. Liu, Y.-H. H. Tsai, Q. Zhao, R. Salakhutdinov, and L.-P. Morency, "Learning representations from imperfect time series data via tensor rank regularization," in *Proceedings of the Annual Meeting of the Association for Computational Linguistics (ACL)*, 2019, pp. 1569–1576.
- [73] W. He, Q. Yao, C. Li, N. Yokoya, and Q. Zhao, "Non-local meets global: An integrated paradigm for hyperspectral denoising," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2019, pp. 6868–6877.
- [74] C. Li, W. He, L. Yuan, Z. Sun, and Q. Zhao, "Guaranteed matrix completion under multiple linear transformations," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2019, pp. 11 136–11 145.
- [75] T. Yokota, K. Kawai, M. Sakata, Y. Kimura, and H. Hontani, "Dynamic pet image reconstruction using nonnegative matrix factorization incorporated with deep image prior," in *The IEEE International Conference on Computer Vision (ICCV)*, 2019, pp. 3126–3135.
- 2018 [76] L. Yuan, Q. Zhao, and J. Cao, "High-order tensor completion for data recovery via sparse tensor-train optimization," in *2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, IEEE, 2018, pp. 1258–1262.

- [77] J. Yu, G. Zhou, Q. Zhao, and K. Xie, "An effective tensor completion method based on multi-linear tensor ring decomposition," in *APSIPA-ASC 2018*, 2018, pp. 1244–1349.
- [78] L. Yuan, J. Cao, X. Zhao, Q. Wu, and Q. Zhao, "Higher-dimension tensor completion via low-rank tensor ring decomposition," in *APSIPA-ASC 2018*, 2018, pp. 1071–1076.
- [79] X. Zhao, T. Tanaka, W. Kong, Q. Zhao, J. Cao, H. Sugano, and N. Yoshida, "Epileptic focus localization based on iEEG by using positive unlabeled (PU) learning," in *APSIPA-ASC 2018*, 2018, pp. 493–497.
- [80] T. M. Rutkowski, Q. Zhao, M. S. Abe, and M. Otake, "AI neurotechnology for aging societies—task-load and dementia EEG digital biomarker development using information geometry machine learning methods," in *NeurIPS Workshop*, 2018.
- [81] M. Hou, B. Chaib-draa, C. Li, and Q. Zhao, "Generative adversarial positive-unlabeled learning," in *Proceedings of the Twenty-Seventh International Joint Conference on Artificial Intelligence (IJCAI-18)*, 2018, pp. 2255–2261.
- [82] Q. Zhao, M. Sugiyama, L. Yuan, and A. Cichocki, "Learning efficient tensor representations with ring structure networks," in *Sixth International Conference on Learning Representations (ICLR Workshop)*, 2018.
- [83] X. Zhao, Q. Zhao, T. Tanaka, J. Cao, W. Kong, H. Sugano, and N. Yoshida, "Detection of epileptic foci based on interictal iEEG by using convolutional neural network," in *The 23rd International Conference on Digital Signal Processing (DSP)*, 2018.
- [84] X. Kong, W. Kong, Q. Fan, Q. Zhao, and A. Cichocki, "Task-independent EEG identification via low-rank matrix decomposition," in *The IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, 2018, pp. 412–419.
- [85] X. Cao, X. Zhao, and Q. Zhao, "Tensorizing generative adversarial nets," in *The Third International Conference On Consumer Electronics (ICCE) Asia*, 2018, pp. 206–212.
- [86] X. Zhao, G. Cui, L. Yuan, T. Tanaka, Q. Zhao, and J. Cao, "A hybrid brain computer interface based on audiovisual stimuli p300," in *The Third International Conference On Consumer Electronics (ICCE) Asia*, 2018, pp. 206–212.
- 2017** [87] Y. Xin, Q. Wu, Q. Zhao, and Q. Wu, "Semi-supervised regularized discriminant analysis for EEG-based BCI system," in *International Conference on Intelligent Data Engineering and Automated Learning (IDEAL)*, Springer, 2017, pp. 516–523.
- [88] G. Cui, L. Zhu, Q. Zhao, J. Cao, and A. Cichocki, "A graph theory analysis on distinguishing EEG-based brain death and coma," in *International Conference on Neural Information Processing (ICONIP)*, ser. Lecture Notes in Computer Science, Springer, vol. 10637, 2017, pp. 589–595.
- [89] L. Yuan, Q. Zhao, and J. Cao, "Completion of high order tensor data with missing entries via tensor-train decomposition," in *International Conference on Neural Information Processing (ICONIP)*, ser. Lecture Notes in Computer Science, Springer, vol. 10634, 2017, pp. 222–229.

- [90] Q. Shi, Y.-m. Cheung, and Q. Zhao, "Feature extraction for incomplete data via low-rank Tucker decomposition," in *Joint European Conference on Machine Learning and Knowledge Discovery in Databases (ECML PKDD)*, ser. Lecture Notes in Computer Science, IEEE, vol. 10534, 2017, pp. 564–581.
- [91] L. Gui, Q. Zhao, and J. Cao, "Brain image completion by Bayesian tensor decomposition," in *Proceedings of 22nd International Conference on Digital Signal Processing (DSP)*, IEEE, 2017, pp. 1–4.

Journal Papers

- 2025 [92] J. Zhang, Y. Hong, D. Cheng, L. Zhang, and Q. Zhao, "Defending adversarial attacks in graph neural networks via tensor enhancement," *Pattern Recognition*, vol. 158, p. 110954, 2025.
- 2024 [93] Y. Qiu, Y. Liang, X. Chen, Z. Zhang, S. Xie, and G. Zhou, "Lightweight tensorial convolutional neural network for lunar impact crater detection," *Advances in Space Research*, vol. 74, no. 1, pp. 518–527, 2024.
- [94] J. Zeng, Y. Qiu, Y. Ma, A. Wang, and Q. Zhao, "A novel tensor ring sparsity measurement for image completion," *Entropy*, vol. 26, no. 2, p. 105, 2024.
- [95] M. Bai, D. Zhou, and Q. Zhao, "Tendiffpure: A convolutional tensor-train denoising diffusion model for purification," *Frontiers of Information Technology and Electronic Engineering*, vol. 25, no. 1, pp. 160–169, 2024.
- [96] C. Xiao, Y. Huang, H. Huang, Q. Zhao, and G. Zhou, "Consistency and diversity induced tensorized multi-view subspace clustering," *IEEE Transactions on Emerging Topics in Computational Intelligence*, pp. 1–12, 2024. DOI: 10.1109/TETCI.2024.3412999.
- [97] J. Lin, T.-Z. Huang, X.-L. Zhao, T.-Y. Ji, and Q. Zhao, "Tensor robust kernel pca for multidimensional data," *IEEE Transactions on Neural Networks and Learning Systems*, 2024.
- [98] Y. Qiu, G. Zhou, A. Wang, Q. Zhao, and S. Xie, "Balanced unfolding induced tensor nuclear norms for high-order tensor completion," *IEEE Transactions on Neural Networks and Learning Systems*, 2024.
- [99] Z. Huang, Y. Qiu, X. Chen, W. Sun, and G. Zhou, "Bayesian robust tensor ring decomposition for incomplete multiway data," *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 2024.
- [100] D. Li, B. Cheng, L. Shi, S. Xiang, and Q. Zhao, "An automated measurement method for the fatigue crack propagation based on decorrelated digital image correlation," *International Journal of Fatigue*, vol. 183, p. 108265, 2024.
- [101] S. Han, Z. Sun, K. Zhao, F. Duan, C. F. Caiafa, Y. Zhang, and J. Solé-Casals, "Early prediction of dementia using fmri data with a graph convolutional network approach," *Journal of Neural Engineering*, vol. 21, no. 1, p. 016013, 2024.

- [102] X. Jin, X. Yang, W. Kong, L. Zhu, J. Tang, Y. Peng, Y. Ding, and Q. Zhao, "Tsfn: Tensorized spatial-frequency attention network with domain adaptation for cross-session eeg-based biometric recognition," *Journal of Neural Engineering*, 2024.
- [103] Z. Tao, T. Tanaka, and Q. Zhao, "Nonparametric tensor ring decomposition with scalable amortized inference," *Neural Networks*, vol. 169, pp. 431–441, 2024.
- [104] J. Zeng, G. Zhou, Y. Qiu, C. Li, and Q. Zhao, "Bayesian tensor network structure search and its application to tensor completion," *Neural Networks*, vol. 175, p. 106 290, 2024.
- [105] D. Zhang, H. Huang, Q. Zhao, and G. Zhou, "Generalized latent multi-view clustering with tensorized bipartite graph," *Neural Networks*, p. 106 282, 2024.
- [106] F. Ling, Z. Lu, J.-J. Luo, L. Bai, S. K. Behera, D. Jin, B. Pan, H. Jiang, and T. Yamagata, "Diffusion model-based probabilistic downscaling for 180-year east asian climate reconstruction," *npj Climate and Atmospheric Science*, vol. 7, no. 1, p. 131, 2024.
- [107] Y. Qiu, W. Sun, G. Zhou, and Q. Zhao, "Towards efficient and accurate approximation: Tensor decomposition based on randomized block krylov iteration," *Signal, Image and Video Processing*, pp. 1–11, 2024.
- 2023 [108] X. Zhao, Q. Zhao, T. Tanaka, J. Solé-Casals, G. Zhou, T. Mitsunashi, H. Sugano, N. Yoshida, and J. Cao, "Classification of the epileptic seizure onset zone based on partial annotation," *Cognitive Neurodynamics*, vol. 17, no. 3, pp. 703–713, 2023.
- [109] J. Wang, A. Qu, Q. Wang, Q. Zhao, J. Liu, and Q. Wu, "Tt-net: Tensorized transformer network for 3d medical image segmentation," *Computerized Medical Imaging and Graphics*, vol. 107, p. 102 234, 2023.
- [110] S. Shan, Z. Ding, K. Zhang, H. Wei, C. Li, and Q. Zhao, "Acgl-tr: A deep learning model for spatio-temporal short-term irradiance forecast," *Energy Conversion and Management*, vol. 284, p. 116 970, 2023.
- [111] H. Takayama and T. Yokota, "A new model for tensor completion: Smooth convolutional tensor factorization," *IEEE Access*, vol. 11, pp. 67 526–67 539, 2023.
- [112] J. Zeng, G. Zhou, Y. Qiu, Y. Ma, and Q. Zhao, "Hyperspectral and multispectral image fusion via bayesian nonlocal cp factorization," *IEEE Geoscience and Remote Sensing Letters*, vol. 21, 2023.
- [113] H. Wang, J. Peng, X. Cao, J. Wang, Q. Zhao, and D. Meng, "Hyperspectral image denoising via nonlocal spectral sparse subspace representation," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, vol. 16, pp. 5189–5203, 2023.
- [114] Y. Miao, H. Suzuki, H. Sugano, T. Ueda, Y. Iimura, R. Matsui, and T. Tanaka, "Causal connectivity network analysis of ictal electrocorticogram with temporal lobe epilepsy based on dynamic phase transfer entropy," *IEEE Transactions on Biomedical Engineering*, 2023.
- [115] J. Tang, D. Liu, X. Jin, Y. Peng, Q. Zhao, Y. Ding, and W. Kong, "BAFN: Bi-direction attention based fusion network for multimodal sentiment analysis," *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 33, no. 4, pp. 1966–1978, Apr. 2023.

- [116] X. Jin, N. Li, W. Kong, Q. Zhao, J. Tang, L. Zhu, and J. Cao, "Disentangled adversarial generalization network for cross-session task-independent brainprint recognition," *IEEE Transactions on Cognitive and Developmental Systems*, 2023.
- [117] Y. Yu, G. Zhou, N. Zheng, Y. Qiu, S. Xie, and Q. Zhao, "Graph-regularized non-negative tensor-ring decomposition for multiway representation learning," *IEEE Transactions on Cybernetics*, vol. 53, no. 5, pp. 3114–3127, 2023.
- [118] H. Huang, G. Zhou, Q. Zhao, L. He, and S. Xie, "Comprehensive multiview representation learning via deep autoencoder-like nonnegative matrix factorization," *IEEE Transactions on Neural Networks and Learning Systems*, 2023.
- [119] H. Qiu, C. Li, Y. Weng, Z. Sun, and Q. Zhao, "Fractional tensor recurrent unit (ftru): A stable forecasting model with long memory," *IEEE Transactions on Neural Networks and Learning Systems*, 2023.
- [120] Y. Yu, A. Bezerianos, A. Cichocki, and J. Li, "Latent space coding capsule network for mental workload classification," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 31, pp. 3417–3427, 2023.
- [121] H. Huang, G. Zhou, N. Liang, Q. Zhao, and S. Xie, "Diverse deep matrix factorization with hypergraph regularization for multiview data representation," *IEEE/CAA Journal of Automatica Sinica*, vol. 10, no. JAS-2022-0135, p. 2154, 2023.
- [122] H. Huang, G. Zhou, Y. Zheng, Z. Yang, and Q. Zhao, "Exclusivity and consistency induced nmf for multi-view representation learning," *Knowledge-Based Systems*, vol. 281, p. 111 020, 2023.
- [123] A. Wang, G. Zhou, Z. Jin, and Q. Zhao, "Noisy tensor completion via orientation invariant tubal nuclear norm," *Pacific Journal of Optimization*, vol. 19, no. 2, pp. 273–313, 2023.
- [124] L. Shi, B. Cheng, D. Li, S. Xiang, T. Liu, and Q. Zhao, "A cnn-based lamb wave processing model for field monitoring of fatigue cracks in orthotropic steel bridge decks," *Structures*, vol. 57, p. 105 146, 2023.
- [125] J. Tang, M. Hou, X. Jin, J. Zhang, Q. Zhao, and W. Kong, "Tree-based mix-order polynomial fusion network for multimodal sentiment analysis," *Systems*, vol. 11, no. 1, p. 44, 2023.
- 2022 [126] X. Zhao, Y. Yu, G. Zhou, Q. Zhao, and W. Sun, "Fast hypergraph regularized nonnegative tensor ring decomposition based on low-rank approximation," *Applied Intelligence*, pp. 1–24, 2022.
- [127] K. Takahashi, Z. Sun, J. Solé-Casals, A. Cichocki, A. H. Phan, Q. Zhao, H.-H. Zhao, S. Deng, and R. Micheletto, "Data augmentation for convolutional LSTM based brain computer interface system," *Applied Soft Computing*, p. 108 811, 2022.
- [128] Y. Luo, A. Wang, G. Zhou, and Q. Zhao, "A hybrid norm for guaranteed tensor recovery," *Frontiers in Physics*, p. 447, 2022.
- [129] W.-J. Zheng, X.-L. Zhao, Y.-B. Zheng, and Z.-F. Pang, "Nonlocal patch-based fully connected tensor network decomposition for multispectral image inpainting," *IEEE Geoscience and Remote Sensing Letters*, vol. 19, pp. 1–5, 2022.

- [130] Y. Qiu, G. Zhou, Z. Huang, Q. Zhao, and S. Xie, "Efficient tensor robust PCA under hybrid model of tucker and tensor train," *IEEE Signal Processing Letters*, vol. 29, pp. 627–631, 2022.
- [131] X. Chen, G. Zhou, Y. Wang, M. Hou, Q. Zhao, and S. Xie, "Accommodating multiple tasks' disparities with distributed knowledge-sharing mechanism," *IEEE Transactions on Cybernetics*, vol. 52, no. 4, pp. 2440–2452, 2022.
- [132] Y.-C. Miao, X.-L. Zhao, X. Fu, J.-L. Wang, and Y.-B. Zheng, "Hyperspectral denoising using unsupervised disentangled spatio-spectral deep priors," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 60, pp. 1–16, 2022.
- [133] Y.-S. Luo, X.-L. Zhao, T.-X. Jiang, Y. Chang, M. K. Ng, and C. Li, "Self-supervised nonlinear transform-based tensor nuclear norm for multi-dimensional image recovery," *IEEE Transactions on Image Processing*, 2022.
- [134] Y. Qiu, G. Zhou, Q. Zhao, and S. Xie, "Noisy tensor completion via low-rank tensor ring," *IEEE Transactions on Neural Networks and Learning Systems*, pp. 1–15, 2022.
- [135] T. Yokota, H. Hontani, Q. Zhao, and A. Cichocki, "Manifold modeling in embedded space: An interpretable alternative to deep image prior," *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*, vol. 33, no. 3, pp. 1022–1036, 2022.
- [136] W. He, Q. Yao, C. Li, N. Yokoya, Q. Zhao, H. Zhang, and L. Zhang, "Non-local meets global: An iterative paradigm for hyperspectral image restoration," *IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, vol. 44, no. 4, pp. 2089–2107, 2022.
- [137] T. Li, G. Zhou, Y. Qiu, and Q. Zhao, "Toward understanding convolutional neural networks from volterra convolution perspective," *Journal of Machine Learning Research (JMLR)*, vol. 23, no. 311, pp. 1–50, 2022.
- [138] S. Liu, J. Zhang, A. Wang, H. Wu, Q. Zhao, and J. Long, "Subject adaptation convolutional neural network for eeg-based motor imagery classification," *Journal of Neural Engineering*, 2022.
- [139] Y. Zheng, T. Huang, X. Zhao, and Q. Zhao, "Tensor completion via fully-connected tensor network decomposition with regularized factors," *Journal of Scientific Computing*, vol. 92, no. 8, pp. 1–35, 2022.
- [140] Y. Yu, G. Zhou, H. Huang, S. Xie, and Q. Zhao, "A semi-supervised label-driven auto-weighted strategy for multi-view data classification," *Knowledge-Based Systems*, p. 109 694, 2022.
- [141] Y. Qiu, G. Zhou, J. Zeng, Q. Zhao, and S. Xie, "Imbalanced low-rank tensor completion via latent matrix factorization," *Neural Networks*, 2022.
- [142] W. He, Y. Chen, N. Yokoya, C. Li, and Q. Zhao, "Hyperspectral super-resolution via coupled tensor ring factorization," *Pattern Recognition*, vol. 122, p. 108 280, 2022.
- [143] A. Wang, Q. Zhao, Z. Jin, C. Li, and G. Zhou, "Robust tensor decomposition via orientation invariant tubal nuclear norms," *Science China Technological Sciences*, pp. 1–18, 2022.

- [144] D. Zhang, Y. Luo, Y. Yu, Q. Zhao, and G. Zhou, "Semi-supervised multi-view clustering with dual hypergraph regularized partially shared non-negative matrix factorization," *SCIENCE CHINA: Technological Sciences*, 2022.
- [145] H. Takayama, Q. Zhao, H. Hontani, and T. Yokota, "Bayesian tensor completion and decomposition with automatic cp rank determination using mgp shrinkage prior," *SN Computer Science*, vol. 3, no. 3, pp. 1–17, 2022.
- 2021 [146] A. Wang, G. Zhou, Z. Jin, and Q. Zhao, "Tensor recovery via $*_l$ -spectral k -support norm," *IEEE Journal of Selected Topics in Signal Processing*, vol. 15, no. 3, pp. 522–534, 2021. DOI: 10.1109/JSTSP.2021.3058763.
- [147] Z. Chen, G. Zhou, and Q. Zhao, "Hierarchical factorization strategy for high-order tensor and application for data completion," *IEEE Signal Processing Letters*, vol. 28, pp. 1255–1259, 2021.
- [148] J. Yu, G. Zhou, C. Li, Q. Zhao, and S. Xie, "Low tensor-ring rank completion by parallel matrix factorization," *IEEE transactions on neural networks and learning systems (TNNLS)*, vol. 32, no. 7, pp. 3020–3033, 2021.
- [149] X. Jin, J. Tang, X. Kong, Y. Peng, J. Cao, Q. Zhao, and W. Kong, "CTNN: A convolutional tensor-train neural network for multi-task brainprint recognition," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 29, pp. 103–112, 2021.
- [150] L. Sui, X. Zhao, Q. Zhao, T. Tanaka, and J. Cao, "Hybrid convolutional neural network for localization of epileptic focus based on iEEG," *Neural Plasticity*, vol. 2021, 2021.
- [151] B. Li, Z. Zhang, F. Duan, Z. Yang, Q. Zhao, Z. Sun, and J. Solé-Casals, "Component-mixing strategy: A decomposition-based data augmentation algorithm for motor imagery signals," *Neurocomputing*, vol. 465, pp. 325–335, 2021.
- [152] A. Wang, G. Zhou, and Q. Zhao, "Guaranteed robust tensor completion via L-SVD with applications to remote sensing data," *Remote Sensing*, vol. 13, no. 18, p. 3671, 2021.
- [153] Y. Qiu, G. Zhou, X. Chen, D. Zhang, X. Zhao, and Q. Zhao, "Semi-supervised non-negative tucker decomposition for tensor data representation," *Science China Technological Sciences*, vol. 64, no. 9, pp. 1881–1892, 2021.
- 2020 [154] C. Caiafa, J. Solé-Casals, P. Marti-Puig, S. Zhe, and T. Tanaka, "Decomposition methods for machine learning with small, incomplete or noisy datasets," *Applied Sciences*, vol. 10, no. 23, p. 8481, 2020.
- [155] R. Li, Q. Wu, J. Liu, Q. Wu, C. Li, and Q. Zhao, "Monitoring depth of anesthesia based on hybrid features and recurrent neural network," *Frontiers in neuroscience*, vol. 14, p. 26, 2020.
- [156] Z. Sun, B. Li, F. Duan, H. Jia, S. Wang, Y. Liu, A. Cichocki, C. F. Caiafa, and J. Solé-Casals, "Wlnet: Towards an approach for robust workload estimation based on shallow neural networks," *IEEE Access*, vol. 9, pp. 3165–3173, 2020.

- [157] F. Duan, Z. Huang, Z. Sun, Y. Zhang, Q. Zhao, A. Cichocki, Z. Yang, and J. Solé-Casals, "Topological network analysis of early alzheimer's disease based on resting-state eeg," *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 28, no. 10, pp. 2164–2172, 2020.
- [158] G. Cui, L. Zhu, L. Gui, Q. Zhao, J. Zhang, and J. Cao, "Multidimensional clinical data denoising via Bayesian CP factorization," *Science China Technological Sciences*, vol. 63, no. 2, pp. 249–254, 2020.
- 2019 [159] L. A. Suad, C. F. Caiafa, S. Cichowolski, and E. M. Arnal, "Galactic hi supershells: Kinetic energies and possible origin," *Astronomy and Astrophysics*, vol. 624, no. A&A, pp. 1–11, 2019.
- [160] M. Iwata, L. Yuan, Q. Zhao, Y. Tabei, F. Berenger, R. Sawada, S. Akiyoshi, M. Hamano, and Y. Yamanishi, "Predicting drug-induced transcriptome responses of a wide range of human cell lines by a novel tensor-train decomposition algorithm," *Bioinformatics*, vol. 35, no. 14, pp. i191–i199, 2019.
- [161] W. He, N. Yokoya, L. Yuan, and Q. Zhao, "Remote sensing image reconstruction using tensor ring completion and total variation," *IEEE Transactions on Geoscience and Remote Sensing*, vol. 57, no. 11, pp. 8998–9009, 2019.
- [162] Q. Shi, Y. Cheung, Q. Zhao, and H. Lu, "Feature extraction for incomplete data via low-rank tensor decomposition with feature regularization," *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)*, vol. 30, no. 6, pp. 1803–1817, 2019.
- [163] W. Kong, X. Kong, Q. Fan, Q. Zhao, and A. Cichocki, "Task-free brainprint recognition based on low-rank and sparse decomposition model," *International Journal of Data Mining and Bioinformatics (IJDMB)*, vol. 22, no. 3, pp. 280–300, 2019.
- [164] L. Sui, X. Zhao, J. Cao, and Q. Zhao, "Localization of epileptic foci from ieeg via mixed convolutional neural network," *International Journal of Latest Trends in Engineering and Technology*, vol. 14, no. 4, pp. 8–13, 2019.
- [165] L. Yuan, J. Cao, and Q. Zhao, "Tensor ring decomposition for visual data denoising via tensor random projection," *International Journal of Latest Trends in Engineering and Technology*, vol. 13, no. 2, pp. 102–107, 2019.
- [166] X. Zhao, L. Gui, J. Cao, and Q. Zhao, "Epileptic focus localization based on entropy and convolutional neural network," *International Journal of Latest Trends in Engineering and Technology*, vol. 14, no. 4, pp. 14–17, 2019.
- [167] L. Yuan, C. Li, J. Cao, and Q. Zhao, "Rank minimization on tensor ring: An efficient approach for tensor decomposition and completion," *Machine Learning*, pp. 1–20, 2019.
- [168] L. Zhu, G. Cui, J. Cao, A. Cichocki, J. Zhang, and C. Zhou, "A hybrid system for distinguishing between brain death and coma using diverse eeg features," *Sensors*, vol. 19, no. 6, p. 1342, 2019.
- [169] L. Yuan, Q. Zhao, L. Gui, and J. Cao, "High-order tensor completion via gradient-based optimization under tensor train format," *Signal Processing: Image Communication*, vol. 73, pp. 53–61, 2019.

- [170] S. Al-Baddai, P. Marti-Puig, E. Gallego-Jutglà, K. Al-Subari, A. M. Tomé, B. Ludwig, E. W. Lang, and J. Solé-Casals, "A recognition–verification system for noisy faces based on an empirical mode decomposition with green's functions," *Soft Computing*, pp. 1–19, 2019.
- 2018 [171] Y. Qiu, G. Zhou, Q. Zhao, and A. Cichocki, "Comparative study on the classification methods for breast cancer diagnosis," *Bulletin of the Polish Academy of Sciences. Technical Sciences*, vol. 66, no. 6, pp. 841–848, 2018.
- [172] J. Solé-Casals, C. F. Caiafa, Q. Zhao, and A. Cichocki, "Brain-computer interface with corrupted EEG data: A tensor completion approach," *Cognitive Computation*, vol. 10, no. 6, pp. 1062–1074, 2018.
- [173] Y. Kumagai, R. Matsui, and T. Tanaka, "Music familiarity affects EEG entrainment when little attention is paid," *Frontiers in Human Neuroscience*, vol. 12, p. 444, 2018.
- [174] Y. Zhang, D. Guo, F. Li, *et al.*, "Correction to "correlated component analysis for enhancing the performance of SSVEP-based brain-computer interface"," *IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE)*, vol. 26, no. 8, pp. 1645–1646, 2018.
- [175] Y. Zhang, D. Guo, F. Li, *et al.*, "Correlated component analysis for enhancing the performance of SSVEP-based brain-computer interface.," *IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE)*, vol. 26, no. 5, pp. 948–956, 2018.
- [176] Y. Zhang, E. Yin, F. Li, *et al.*, "Two-stage frequency recognition method based on correlated component analysis for SSVEP-based BCI," *IEEE Transactions on Neural Systems and Rehabilitation Engineering (TNSRE)*, vol. 26, no. 7, pp. 1314–1323, 2018.
- [177] L. Gui, X. Zhao, Q. Zhao, and J. Cao, "Image and video completion by using Bayesian tensor decomposition," *International Journal of Computer Science Issues (IJCSI)*, vol. 15, no. 5, pp. 1–8, 2018.
- [178] L. Gui, X. Zhao, Q. Zhao, and J. Cao, "Non-local image denoising by using Bayesian low-rank tensor factorization on high-order patches," *International Journal of Computer Science Issues (IJCSI)*, vol. 15, no. 5, pp. 16–25, 2018.
- [179] J. Lin, W. Chen, C. Shen, M. Chiu, Y. Kao, F. Lai, Q. Zhao, and A. Cichocki, "Visualization and sonification of long-term epilepsy electroencephalogram monitoring," *Journal of Medical and Biological Engineering*, vol. 38, no. 6, pp. 943–952, 2018.
- [180] W. Kong, L. Wang, J. Zhang, Q. Zhao, and J. Sun, "The dynamic EEG microstates in mental rotation," *Sensors*, vol. 18, no. 9, p. 2920, 2018.

Book Chapter

- 2022 [181] T. Yokota, C. F. Caiafa, and Q. Zhao, "Tensor methods for low-level vision," in *Tensors for Data Processing*. Elsevier, 2022, pp. 371–425.

Book

- 2017** [182] A. Cichocki, A. Phan, Q. Zhao, N. Lee, I. Oseledets, M. Sugiyama, and D. Mandic, *Tensor networks for dimensionality reduction and large-scale optimization: Part 2 applications and future perspectives* (Foundations and Trends® in Machine Learning 6). Now Publishers, Inc., 2017, vol. 9, pp. 431–673.
- 2016** [183] A. Cichocki, N. Lee, I. Oseledets, A. Phan, Q. Zhao, and D. Mandic, *Tensor networks for dimensionality reduction and large-scale optimization: Part 1 low-rank tensor decompositions* (Foundations and Trends® in Machine Learning 4-5). Now Publishers, Inc., 2016, vol. 9, pp. 249–429.