

NIKOLAUS SALVATORE

Ph.D. Student in Computer Science | Rutgers University-New Brunswick

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RESEARCH PROFILE

Ph.D. student in Computer Science working at the intersection of machine learning, computational cognitive science, and human memory. Current research examines how memory-retrieval demands and cognitive memory architectures shape neural-network behavior, including sequence-to-sequence attention mechanisms and positional biases in large language models. Prior research spans event-based computer vision, neuromorphic computing, spiking neural networks, adaptive sensing, and space-domain awareness.

Research interests: human memory-inspired AI; computational cognitive modeling; large language models; sequence modeling and attention; event-based vision; neuromorphic computing; spiking neural networks; space-domain awareness; adaptive sensing.

EDUCATION

Ph.D. in Computer Science, Rutgers University-New Brunswick Expected completion: 7/28 Advisor: Qiong Zhang	2023-present
Master of Engineering in Computer Engineering, University of Pittsburgh	2020
Bachelor of Science in Biological Sciences (minor in Computer Science), Cornell University	2016

RESEARCH AND PROFESSIONAL APPOINTMENTS

Doctoral Researcher, Department of Computer Science Rutgers University-New Brunswick Develop interpretable neural-network models of human memory search, connecting sequence-to-sequence architectures and attention mechanisms to context-based cognitive models. Investigate positional biases in large language models as emergent adaptations to short-term and long-term information-retrieval demands. Design computational experiments, model-training pipelines, and analyses that compare neural-network behavior with human free-recall patterns.	2023-present
Technical Advisor, Data Science KBR, Inc. Conducted research and development of machine-learning methods for object detection in space-domain awareness applications. Developed dynamic vision sensor simulations and synthetic imaging workflows for algorithm development and evaluation. Investigated reinforcement-learning methods for adaptive sensing and improved sensor-imaging capabilities. Supported the development and delivery of deep learning-based object-detection methods for event-driven sensing systems.	2020-2024
Student Researcher Air Force Research Laboratory Developed machine-learning methods for satellite detection and identification using advanced imaging sensors. Investigated object-detection approaches for space-domain awareness.	2019-2020
Graduate Student Researcher NSF Center for Space, High-Performance, and Resilient Computing (SHREC) Investigated radiation-hardened and resilient processors for space-based computational workloads. Contributed to the Spacecraft Supercomputing for Image and Video Processing (SSIVP) experiment deployed to the International Space Station. Benchmarked deep-learning models across GPU and neuromorphic computing platforms.	2018-2020

PEER-REVIEWED PUBLICATIONS

- Salvatore, N., & Zhang, Q. (2025). Sequence-to-sequence models with attention mechanistically map to the architecture of human memory search. *Communications Psychology*, 3, Article 146. [doi:10.1038/s44271-025-00322-6](https://doi.org/10.1038/s44271-025-00322-6)
- Salvatore, N., & Zhang, Q. (2024). Parallels between neural machine translation and human memory search: A cognitive modeling approach. *Proceedings of the 46th Annual Conference of the Cognitive Science Society*.
- Salvatore, N., & Fletcher, J. (2023). Dynamic vision-based satellite detection: A time-based encoding approach with spiking neural networks. *Computer Vision Systems (ICVS 2023), Lecture Notes in Computer Science*, 14253, 285-298. [doi:10.1007/978-3-031-44137-0_24](https://doi.org/10.1007/978-3-031-44137-0_24)
- Salvatore, N., & Fletcher, J. (2022). Learned event-based visual perception for improved space object detection. *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision*, 2888-2897. [doi:10.1109/WACV51458.2022.00336](https://doi.org/10.1109/WACV51458.2022.00336)
- Salvatore, N., Mian, S., Abidi, C., & George, A. D. (2020). A neuro-inspired approach to intelligent collision avoidance and navigation. *2020 AIAA/IEEE 39th Digital Avionics Systems Conference (DASC)*, 1-9. [doi:10.1109/DASC50938.2020.9256492](https://doi.org/10.1109/DASC50938.2020.9256492)
- Salvatore, N., & George, A. D. (2020). Event-based noise filtration with point-of-interest detection and tracking for space situational awareness. *Proceedings of the 2nd International Conference on Intelligent Medicine and Image Processing*, 29-39. [doi:10.1145/3399637.3399656](https://doi.org/10.1145/3399637.3399656)

PREPRINTS

1. Salvatore, N., Wang, H., & Zhang, Q. (2025). Lost in the middle: An emergent property from information retrieval demands in LLMs. *arXiv preprint arXiv:2510.10276*.

CONFERENCE PRESENTATIONS

2026. Understanding serial position effects in large language models through cognitive psychology approaches. Context and Episodic Memory Symposium (CEMS), Philadelphia, Pennsylvania.

2024. A neural network model of free recall and its connection to neural machine translation. 57th Annual Meeting of the Society for Mathematical Psychology and 22nd International Conference on Cognitive Modeling (MathPsych/ICCM), Tilburg, Netherlands.

2024. Parallels between neural machine translation and human memory search: A cognitive modeling approach. 46th Annual Conference of the Cognitive Science Society, conference presentation.

2024. Parallels between neural machine translation and human memory search: A cognitive modeling approach. Context and Episodic Memory Symposium (CEMS), Philadelphia, Pennsylvania; poster presentation.

2023. Dynamic vision-based satellite detection: A time-based encoding approach with spiking neural networks. International Conference on Computer Vision Systems (ICVS), conference presentation.

2022. Learned event-based visual perception for improved space object detection. IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), conference presentation.

2020. A neuro-inspired approach to intelligent collision avoidance and navigation. AIAA/IEEE 39th Digital Avionics Systems Conference (DASC), conference presentation.

2020. Event-based noise filtration with point-of-interest detection and tracking for space situational awareness. 2nd International Conference on Intelligent Medicine and Image Processing, conference presentation.

TEACHING EXPERIENCE

Teaching Assistant, Department of Computer Science Rutgers University-New Brunswick	2023-present
01:198:211 - Computer Architecture	
01:198:440 - Introduction to Artificial Intelligence	
01:198:213 - Software Methodology	

SELECTED RESEARCH CONTRIBUTIONS

Human memory and neural architectures: identified and modeled mechanistic correspondences between attention-based sequence-to-sequence networks and context-based models of human memory search.

Long-context language modeling: studied how mixed information-retrieval demands can produce primacy, recency, and lost-in-the-middle behavior in language models.

Event-based vision for space-domain awareness: developed methods for satellite detection, identification, denoising, encoding, and tracking using dynamic vision sensor data.

Neuromorphic and adaptive sensing: evaluated spiking neural networks and neuromorphic platforms and investigated reinforcement-learning methods for sensor optimization.

Space and resilient computing: benchmarked deep-learning workloads across GPU and neuromorphic systems and contributed to an International Space Station experiment.

TECHNICAL SKILLS

Programming	Python, C++, C, Java, MATLAB, R
Machine Learning	PyTorch, TensorFlow, scikit-learn, CUDA, reinforcement learning
Scientific Computing	NumPy, pandas, statistical analysis, experiment design
Computing Platforms	AWS, GPU computing, neuromorphic computing, high-performance computing
Research Methods	Computational cognitive modeling, large language models, sequence modeling, object detection, event-based vision, spiking neural networks, sensor simulation