

Nicholas Smirnov

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Education	Stony Brook University , Stony Brook, NY, USA B.S. in Computer Science (Honors) and Mathematics <i>Relevant Coursework:</i> Analysis of Algorithms (Honors), Cryptography, Probability and Statistics, Logic (Classical and Nonclassical), Data Structures, Discrete Mathematics, Combinatorics, Linear Algebra, Real/Complex Analysis, Abstract Algebra, and Differential Equations	August 2024–May 2027 (Expected) GPA: 3.86/4.00
Preprints & Manuscripts	N. Smirnov. <i>Boolean Derivative Certificates and Maximal ANF Terms.</i> <i>Electronic Colloquium on Computational Complexity</i> , TR26-083, 2026. [ECCC] N. Smirnov. <i>A Small Counterexample to a Conjecture on the Complementary Diminished Sombor Index.</i> Revise and resubmit at <i>Discrete Mathematics Letters</i> , 2026. N. Smirnov. <i>Deletion and Palette Size in the Domatic Number Game.</i> Revise and resubmit at <i>Ars Combinatoria</i> , 2026.	
Posters	A. Sherbatov, G. Abreu-Vigil, N. Smirnov , G. Tan, F. Khanom, M. Azarderakhsh, H. Norouzi, and R. Blake. <i>Detection of Harmful Algal Blooms in Lakes at the Regional Scale Using Satellite Remote Sensing and Machine Learning Techniques.</i> Poster presented at AGU Fall Meeting 2023 [abstract] and the 104th AMS Annual Meeting 2024 [abstract].	
Research Experience	Research Assistant , Algorithms Lab, Stony Brook University <i>Advisor: Professor Michael Bender; collaboration with Abiyaz Chowdhury</i> - Investigate how Longest Common Subsequence algorithms respond to memory that changes during execution, comparing Hirschberg’s linear-space dynamic program with the Chowdhury–Ramachandran recursive cache-oblivious algorithm. - Built a variable-capacity cache simulator and work-indexed memory profiles, then reproduced the same memory regimes using RAM caps, swap, and hardware cache partitioning. - Found a sharp row-fit threshold for Hirschberg: once its DP rows no longer fit, cache misses increase by orders of magnitude, whereas the recursive algorithm degrades gradually on smaller subproblems. Research Fellow , File Systems and Storage Lab, Stony Brook University <i>Advisor: Professor Erez Zadok; collaboration with Maliha Tabassum</i> - Develop a Rust crate for estimating storage failure rates, modeling redundancy, and computing share-loss probabilities for threshold secret-sharing schemes used in archival storage. - Wrote end-to-end tests for encoding, reconstruction, verification, corruption, partial share loss, and threshold boundary cases; integrated the tooling into the lab’s archival evaluation pipeline. - Built Python scripts for reproducible failure-distribution plots and reviewed coding- and information-theoretic work on repair bandwidth, reliability bounds, and regenerating codes. Research Assistant , Stony Brook University <i>Advisor: Professor Pramod Ganapathi</i> - Analyze and reconstruct 20+ algorithms from research papers, writing formal pseudocode, correctness proofs, recurrence analyses, and asymptotic bounds. - Compare formulations based on divide-and-conquer, dynamic programming, and parallel computation, including their work, depth, and running-time tradeoffs. - Contribute to an algorithms book manuscript with Professor Ganapathi, developing proofs, examples, and exercises for classical and advanced techniques. Research Assistant , DIENS Lab, Stony Brook University <i>Advisor: Professor Jian Li</i> - Studied convergence of first- and zeroth-order methods on nonconvex objectives, with particular attention to SGD and adaptive methods. - Implemented PyTorch experiments comparing SGD, Adam, and AdaGrad variants and analyzed their empirical convergence across nonconvex objectives.	Jun 2026–Present Dec 2025–Present Jan 2025–Present Sep 2024–Dec 2025

	REU Researcher , Arlington Computational Linguistics Lab, UT Arlington Mar 2025–Aug 2025 <i>Advisor: Professor Kenny Zhu</i> • Built an end-to-end pipeline over 100+ GB of video for feline vocalization classification, covering audio extraction, denoising, segmentation, and spectrogram generation. • Formulated call intensity as an ordinal classification problem and adapted the training objective to preserve the ordering of labels. • Implemented Frank–Hall and cumulative-link models and compared them with softmax baselines in terms of decision boundaries, calibration, and classification performance.
	Research Intern , NASA Goddard Institute for Space Studies Jun 2023–Aug 2023 <i>Advisors: Dr. Hamid Norouzi and Dr. Reginald Blake</i> • Built a remote-sensing pipeline using Sentinel-2 imagery to monitor harmful algal blooms across 35+ New York State lakes. • Evaluated spectral band-ratio methods for chlorophyll-<i>a</i> estimation and found substantial variation across lakes, motivating a shift to supervised ensemble models. • Trained gradient-boosting models that achieved $R^2 = 0.85$ on Lake Champlain and contributed to the resulting AGU 2023 and AMS 2024 poster.
Teaching	Teaching Assistant, Discrete Mathematics , Stony Brook University Aug 2025–Present • Lead weekly recitations and hold office hours for standard and honors sections, focusing on proof construction, combinatorial reasoning, and problem-solving strategies. • Students in my two recitation sections earned the highest and second-highest average grades among four sections; 77% earned a B– or higher, compared with 52% in the other two sections. • Collaborate with instructors on homework, exam questions, and solution keys, and give students detailed feedback on mathematical writing. Instructor / Teaching Assistant , School Nova, Stony Brook University Aug 2020–May 2023 • Taught Python and game development through lessons on algorithmic thinking, debugging, and problem decomposition; also assisted in CS 101/201 laboratory sections. • Supported Russian 2/3 courses through small-group instruction in reading, writing, and conversation.
Talks	<i>“Is $P = NP$? An Expository Introduction to Complexity Theory”</i> Apr 2026 Hudson River Undergraduate Mathematics Conference (HRUMC 2026) • Developed an expository introduction to P, NP, $PSPACE$, and EXP through canonical complete problems and reductions, including a proof of Savitch’s theorem. • Explained why standard proof techniques fall short on P versus NP, focusing on relativization, natural proofs, and algebrization.
Awards	2025 Grumman Engineering Scholarship Endowment , Stony Brook University \$4,750 <i>Awarded in support of undergraduate research in engineering and applied sciences.</i>
Selected Projects	QBF Turing Machine Simulator [GitHub] 2026 • Implemented a deterministic multi-tape Turing machine deciding the $PSPACE$-complete QBF problem with 35,000+ explicit transitions, translating recursive formula evaluation into a fully specified transition system. • Built Python tools to check transition consistency and run reproducible tests on quantified formulas. Calculus Questions: 250+ Challenging Questions [Link] 2026 • Authored and self-published 250+ original problems designed to develop nonroutine reasoning beyond standard Calculus I–II exercises. ECIES Cryptosystem [GitHub] Oct 2025 • Implemented ECIES over NIST P-256 from scratch in Python, including finite-field arithmetic, point addition, scalar multiplication, and modular inversion. • Combined ECDH, HKDF, AES-GCM, and HMAC into an authenticated-encryption workflow and validated the implementation against published test vectors.
Technical Skills	Languages: Python, C++, Rust, Java, $\text{\LaTeX}$ Libraries & Tools: PyTorch, NumPy, scikit-learn, Git, GCP