Yiannis Koutis

Professor of Computer Science
New Jersey Institute of Technology

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Education

2007 **PhD**, Carnegie Mellon University, Pittsburgh
Thesis: *Combinatorial and algebraic tools for optimal multilevel algorithms*
Advisor: Gary L. Miller

1998 **BSc/Diploma**, Computer Engineering and Informatics Department, University of Patras
Engineering School Valedictorian
Thesis: *Parallel algorithms for the computation of pseudospectra*
Advisor: Efstratios Gallopoulos

Appointments

Current

2026–present **Professor**, New Jersey Institute of Technology

2022–present **Associate Chair of Graduate Studies**, Department of Computer Science, NJIT

Past

2017–2026 **Associate Professor**, New Jersey Institute of Technology

2010–2020 **Adjunct Faculty**, Carnegie Mellon University

2014–2018 **Associate Professor**, University of Puerto Rico–Rio Piedras

2010–2014 **Assistant Professor**, University of Puerto Rico–Rio Piedras

2008–2010 **Systems Scientist**, Special Faculty, Carnegie Mellon University

2007–2008 **Postdoctoral Researcher**, Carnegie Mellon University

Visiting

Sep–Dec 2014 **Visiting Scientist**, Simons Institute

Feb–May 2014 **Visiting Professor**, ICERM, Brown University

Awards and Honors

2022 William J. McCalla ICCAD Best Paper Award (back end)

2020 Ying Wu College of Computing Excellence in Teaching Award

2017 ICALP – Track A: Best Paper Award

2012 NSF CAREER Award

2002 SIAM Student Travel Award

1999 Best Engineering Student Award, Technical Chamber of Greece

1998 University of Patras Engineering School Valedictorian

1993–1998 Yearly awards from the Greek State Scholarships Foundation

Grants

2023–2025	NSF: Cybertraining: Pilot: Cyberinfrastructure-Enabled Machine Learning for Understanding and Forecasting Space Weather co-PI	$190K
2020–2022	NSF: Spectral Network Alignment	$150K
2018–2021	NSF: Practice-Friendly Theory and Algorithms for Linear Regression Problems	$250K
2012–2018	NSF CAREER: Fast algorithms via a spectral theory for graphs with a prescribed cut structure	$500K
2012–2014	UPR – Institute of Functional Nanomaterials (IFN): Computational analysis of neural images via spectral methods	$50K
2010–2013	NSF: Algorithm Design Using Spectral Graph Theory co-PI	$500K
2008–2009	University of Pittsburgh Medical Center (UPMC) grant for the development of new medical imaging methods based on spectral approaches co-investigator	$700K

Refereed Conference and Workshop Publications

[31] M. Dindoost, O. Alvarado Rodriguez, B. Bryg, I. Koutis, D. A. Bader. HiperMotif: Novel parallel subgraph isomorphism in large-scale property graphs. *IEEE High Performance Extreme Computing, HPEC 2025*

[30] A. Moradi Karkaj, M. J. Nelson, I. Koutis, A. Hoover. Prompt Wrangling: On replication and generalization in large language models for PCG levels. *Proceedings of the 15th Workshop on Procedural Content Generation, FDG 2024* workshop

[29] I. Bustany, G. Gasparyan, A. Kahng, I. Koutis, B. Pramanik, Z. Wang. TritonPart: An Open-Source Constraints-Driven General Partitioning Multi-Tool for VLSI Physical Design. *42nd International Conference on Computer-Aided Design, ICCAD 2023*

[28] I. Koutis, M. Wlodarczyk, M. Zehavi. Sidestepping Barriers for Dominating Set in Parameterized Complexity. *18th International Symposium on Parameterized and Exact Computation, IPEC 2023*

[27] E. Beikihassan, A. Parviz, N. Aghaieabiane, A. Hoover, I. Koutis. Resource-constrained knowledge diffusion processes inspired by human peer learning. *26th European Conference on Artificial Intelligence, ECAI 2023* full oral presentation

[26] I. Bustany, A. Kahng, I. Koutis, B. Pramanik, Z. Wang. SpecPart: A supervised spectral framework for hypergraph partitioning solution improvement. *41st International Conference on Computer-Aided Design, ICCAD 2022* best paper award

[25] E. Beikihassan, A. Hoover, I. Koutis, A. Parviz. Ensemble Learning as a Peer Process. *Agent Learning in Open-Endedness Workshop (ALOE), ICLR 2022* workshop

[24] I. Koutis, B. Pramanik. Spectral Hypergraph Partitioning Revisited. *SIAM Conference on Applied and Computational Discrete Algorithms, ACDA 2021*

[23] D. Wei, I. Koutis, S. Basu-Roy. Peer Learning Through Targeted Dynamic Groups Formation. *37th IEEE International Conference on Data Engineering, ICDE 2021*

[22] I. Koutis, H. Le. Spectral Graph Modification for Improved Spectral Clustering. *33rd Conference on Neural Information Processing Systems, NeurIPS 2019*

[21] D. Calandriello, I. Koutis, A. Lazaric, M. Valko. Improved Large-Scale Graph Learning through Ridge Spectral Sparsification. *35th International Conference on Machine Learning, ICML 2018*

[20] A. Kolla, I. Koutis, V. Madan, A. K. Sinop. Spectrally Robust Graph Isomorphism. *45th International Colloquium on Automata, Languages, and Programming, ICALP 2018*

[19] A. Björklund, P. Kaski, I. Koutis. Directed Hamiltonicity and Out-Branchings via Generalized Laplacians. *44th International Colloquium on Automata, Languages, and Programming, ICALP 2017* BEST PAPER AWARD

[18] I. Abraham, D. Durfee, I. Koutis, S. Krinninger, R. Peng. On fully dynamic graph sparsifiers. *57th Annual IEEE Symposium on Foundations of Computer Science, FOCS 2016*

[17] M. Cucuringu, I. Koutis, S. Chawla, G. Miller, R. Peng. Simple and Scalable Constrained Clustering: A Generalized Spectral Method. *19th International Conference on Artificial Intelligence and Statistics, AISTATS 2016*

[16] C. Mavroforakis, R. Garcia-Lebron, I. Koutis, E. Terzi. Spanning edge centrality: large-scale computation and applications. *Proceedings of the 24th International World Wide Web Conference, WWW 2015*

[15] I. Koutis. Simple parallel and distributed algorithms for spectral graph sparsification. *Proceedings of the 26th Annual Symposium on Parallelism in Algorithms and Architectures, SPAA 2014*

[14] L. Brueggeman, M. Fellows, R. Fleischer, M. Lackner, C. Komusiewicz, I. Koutis, A. Pfandler, F. Rosamond. Train Marshalling Is Fixed Parameter Tractable. *Proceedings of Fun with Algorithms, FUN 2012*

[13] I. Koutis, A. Levin, R. Peng. Improved spectral sparsification and numerical algorithms for SDD matrices. *Proceedings of the 29th Annual Symposium on Theoretical Aspects of Computer Science, STACS 2012*

[12] I. Koutis, G. Miller, R. Peng. A nearly-$m \log n$ solver for SDD linear systems. *Proceedings of the 52nd Annual IEEE Symposium on Foundations of Computer Science, FOCS 2011*

[11] G. Blelloch, I. Koutis, A. Gupta, G. Miller, R. Peng, K. Tangwongsan. Near linear-work parallel SDD solvers, low-diameter decomposition and low-stretch subgraphs. *Proceedings of the 23rd Annual Symposium on Parallelism in Algorithms and Architectures, SPAA 2011*

[10] I. Koutis, G. Miller, R. Peng. Approaching optimality for solving symmetric diagonally dominant systems. *Proceedings of the 51st Annual IEEE Symposium on Foundations of Computer Science, FOCS 2010*

[9] G. Blelloch, I. Koutis, G. Miller, K. Tangwongsan. Hierarchical Diagonal Blocking with precision reduction applied to combinatorial multigrid. *Proceedings of the 23rd ACM/IEEE Conference on High Performance Computing, SC 2010*

[8] I. Koutis, G. Miller, D. Tolliver. Combinatorial preconditioners and multilevel solvers for problems in computer vision and image processing. *Proceedings of the 5th International Symposium on Visual Computing, ISVC 2009*

[7] I. Koutis, R. Williams. Limits and applications of group algebras for parameterized problems. *Proceedings of the 35th International Colloquium on Automata, Languages and Programming, ICALP 2009*

[6] C. Tsourakakis, P. Drineas, E. Michelakis, I. Koutis, C. Faloutsos. Spectral counting of triangles in power-law networks via element-wise sparsification. *Proceedings of the 2009 International Conference on Advances in Social Networks Analysis and Mining, ASONAM 2009*

[5] I. Koutis. Faster algebraic algorithms for path and packing problems. *Proceedings of the 35th International Colloquium on Automata, Languages and Programming, ICALP 2008*

[4] I. Koutis, G. Miller. Graph partitioning into isolated, high conductance clusters: theory, computation and applications to preconditioning. *Proceedings of the 20th Symposium on Parallelism in Algorithms and Architectures, SPAA 2008*

[3] I. Koutis, G. L. Miller. A linear work, $O(n^{1/6})$ time, parallel algorithm for solving planar Laplacians. *Proceedings of the 18th ACM-SIAM Symposium on Discrete Algorithms, SODA 2007*

[2] I. Koutis. On the hardness of multivariate integration. *Proceedings of the 6th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems, APPROX 2003*, pp. 122–128

[1] C. Bekas, E. Kokiopoulou, I. Koutis, E. Gallopoulos. Parallel computation of matrix pseudospectra. *Proceedings of the 15th ACM International Conference on Supercomputing, ICS 2001*, pp. 260–269

Journal Publications

[18] S. Rajendra Patil, A. Parmanand Pandey, I. Koutis, M. Xu. Hierarchical Mamba Meets Hyperbolic Geometry: A New Paradigm for Structured Language Embeddings. *Transactions on Machine Learning Research*, 2026

[17] N. Aghaieabiane, I. Koutis. SGCP: A spectral self-learning method for clustering genes in co-expression networks. *BMC Bioinformatics*, 2024

[16] I. Bustany, A. Kahng, I. Koutis, B. Pramanik, Z. Wang. K-SpecPart: Supervised Embedding Algorithms and Cut Overlay for Improved Hypergraph Partitioning. *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems*, 2023

[15] I. Koutis, G. Miller, R. Peng. A generalized Cheeger inequality. *Linear Algebra and Its Applications*, 2023

[14] N. Aghaieabiane, I. Koutis. A novel calibration step in gene co-expression network construction. *Frontiers in Bioinformatics*, 2021

[13] I. Koutis, S. C. Xu. Simple parallel and distributed algorithms for spectral graph sparsification. *ACM Transactions on Parallel Computing*, 2016

[12] I. Koutis, R. Williams. Limits and applications of group algebras for parameterized problems. *ACM Transactions on Algorithms (TALG)*, 2016

[11] I. Koutis. Multilinear Monomial Detection. *Encyclopedia of Algorithms*, 2016 INVITED

[10] I. Koutis, R. Williams. Algebraic Fingerprints for faster algorithms. *Communications of the ACM*, January 2016

[9] I. Koutis, A. Levin, R. Peng. Faster spectral sparsification and numerical algorithms for SDD matrices. *ACM Transactions on Algorithms (TALG)*, 2015

[8] I. Koutis, G. Miller, R. Peng. Approaching optimality for solving symmetric diagonally dominant systems. *SIAM Journal on Computing, special issue FOCS 2010*, Vol. 43, No. 1, pp. 337–354, 2014 INVITED

[7] G. Blelloch, I. Koutis, A. Gupta, G. Miller, R. Peng, K. Tangwongsan. Near linear-work parallel SDD solvers, low-diameter decomposition and low-stretch subgraphs. *Theory of Computing Systems*, March 2013 INVITED

[6] I. Koutis, G. Miller, R. Peng. A fast solver for a class of linear systems. *Communications of the ACM*, October 2012 INVITED

[5] I. Koutis. Constrained multilinear detection for faster functional motif discovery. *Information Processing Letters*, Vol. 112, No. 22, pp. 889–892, 2012

[4] I. Koutis, G. Miller, D. Tolliver. Combinatorial preconditioners and multilevel solvers for problems in computer vision and image processing. *Computer Vision and Image Understanding*, 115(12), pp. 1638–1646, 2011 INVITED

[3] C. Tsourakakis, P. Drineas, E. Michelakis, I. Koutis, C. Faloutsos. Spectral counting of triangles in power-law networks via element-wise sparsification and triangle-based link recommendation. *Social Network Analysis and Mining*, Vol. 1, No. 2, pp. 75–81, 2011

[2] I. Koutis. Parameterized complexity and improved inapproximability for computing the largest j-simplex in a V-polytope. *Information Processing Letters*, 1, No. 1, pp. 8–13, 2006

[1] I. Koutis. A faster parameterized algorithm for set packing. *Information Processing Letters*, No. 1, pp. 4–7, 2005

Other Publications and Preprints

[3] I. Koutis. Dimensionality restrictions on sums over $\mathbb{Z}_p^d$. *CMU-CS-07-103 Technical Report*, 2007

[2] I. Koutis. Spectrum through pseudospectrum. *arXiv Report No. 0701368*, 2001

[1] I. Koutis, E. Gallopoulos. Iterations on domains for computing the matrix pseudospectrum. *Manuscript*, 1999

Patents

2014 *Method and apparatuses for solving weighted planar graphs.* I. Koutis, G. L. Miller. US 8711146

2013 *Methods for solving graph Laplacians.* I. Koutis, G. L. Miller. US 8516029

Invited Talks

2019 *Spectral Graph Modification for Improved Spectral Clustering*
The New York Colloquium on Algorithms and Complexity, CUNY, New York, NY, November 15

2019 *Pragmatic Ridge Spectral Sparsification for Large-Scale Graph Learning*
DIMACS Workshop on Randomized Numerical Linear Algebra, Statistics, and Optimization, Rutgers University, New Brunswick, NJ, September 18

2018 *Spectrally Robust Graph Isomorphism*
Simons Institute, Berkeley, CA, September 25

2018 *Directed Hamiltonicity and Out-Branchings via Generalized Laplacians*
Rutgers Business School, Newark, NJ, February 22

2017 *A survey of provably fast linear system solvers*
Alan Turing Institute, London, UK, November 1

2017 *Improved algebraic algorithms for out-branchings problems*
Randomization in Parameterized Complexity, Schloss Dagstuhl, Germany, January

2016 *On fully dynamic graph sparsifiers*
Algebraic and Spectral Graph Theory, Banff International Research Station, Banff, Canada, August 4

2016 *On fully dynamic graph sparsifiers*
Recent Advances on Randomized Numerical Linear Algebra, NII Shonan Meeting, Shonan Village, Japan, July 26

2014 *Spectral algorithms for graph mining and analysis*
Workshop on Algorithms for Modern Massive Data Sets, MMDS 2014, Berkeley, CA, June 17

2014 *Spectral algorithms for graph mining and analysis*
Workshop on Eigenvectors in graph theory and related problems in numerical linear algebra, ICERM, Providence, RI, May 7

2014 *Spectral graph sparsification and fast Laplacian solvers*
Boston University, May 5

2014 *Segmenting neurons in 3D EM images*
IBDR PI workshop, Washington, DC, May 2

2013 *Spectral sparsification of graphs: an overview of theory and practical methods*
Workshop on Large Scale Matrix Analysis and Inference, NIPS 2013, Lake Tahoe, NV, December 9

2013 *Algebraization in parameterized algorithms and complexity*
AMS Special Session on the Mathematical Underpinnings of Multivariate Complexity and Algorithm Design, and its frontiers, and the field of Incrementalization, San Diego, CA, January 12

2012 *Laplacian Solvers: Theory and Practice*
Workshop on Randomized Numerical Linear Algebra: Theory and Practice, FOCS 2012, New Brunswick, NJ, October 20

2012 *SDD Solvers: Bridging the Gap Between Theory and Practice*
Workshop on Algorithms for Modern Massive Data Sets, MMDS 2012, Stanford, CA, July 13

2012 *Spectral graph theory, matrix sums and near-optimal SDD solvers*
SIAM Applied Linear Algebra Conference, Valencia, Spain, June 18

2010 *The power of group algebras in constrained monomial detection problems*
Seminar on the Exact Complexity of NP-hard Problems, Schloss Dagstuhl, Germany, November 10

2010 *Graph Sparsification p.2: An $O(m \log^2 n)$ algorithm for solving SDD systems*
Microsoft Research, Redmond, WA, September 2

2010 *Graph Sparsification p.1: The Combinatorial Multigrid Solver*
Microsoft Research, Redmond, WA, September 2

2009 *How to make a computer see better?*
University of Puerto Rico, Rio Piedras, September 15

2009 *Fast detection of square-free terms in multivariate polynomials: one algo-stone, many algo-birds*
University of Puerto Rico, Rio Piedras, September 14

2009 *M-matrix systems and solvers in Computer Science*
University of Wyoming, March 30

2009 *Spectral Graph Theory meets Practice: The Combinatorial Multigrid Solver*
Yale University, January 23

2002 *Advances in the Theory and Computation of Pseudospectra*
SIAM 50th Anniversary and Annual Meeting, Matrix Spectra and Pseudospectra Minisymposium, Philadelphia, PA, July 8–12

Conference and Workshop Presentations

2016 Theoretical Foundations of Data Science: Algorithmic, Mathematical, and Statistical (TFoDS), April 28–30

2013 *Fast SDD solvers via sampling by approximate leverage scores*
6th International ERCIM Conference on Computational and Methodological Statistics

2011 *Spectral Algorithms for Segmenting Neurons in their Three-dimensional Space*
Neuroscience 2011 · with R. Garcia, J. Farrington, J. Serrano-Velez, E. Rosa-Molinar

2009 *The Combinatorial Multigrid Solver*
The 14th Copper Mountain Conference on Multigrid Methods · with Gary L. Miller

2008 *Unassisted segmentation of multiple retinal layers via spectral rounding*
Association for Research in Vision and Ophthalmology, ARVO 2008 Annual Meeting · with D. Tolliver, H. Ishikawa, J. S. Schuman, G. L. Miller

2007 *A Linear Work, Parallel Algorithm for Solving Planar Laplacians*
Combinatorial Scientific Computing (CSC07), Costa Mesa, CA · with Gary L. Miller

2006 *Efficiently Solving Linear Systems using Support Tree Preconditioners*
Parallel Processing for Scientific Computing (PP06), San Francisco, CA, February · with Gary L. Miller

2001 *Hermitian Methods for Computing Eigenvalues*
5th IMACS Conference on Iterative Methods in Scientific Computing, May · with E. Gallopoulos

1999 *Iterations on Domains for the Computation of Matrix (Pseudo)-Spectrum*
Conference on the Foundations of Computational Mathematics (FOCM), Oxford, July · with E. Gallopoulos

Teaching

Course design	Online courses for NJIT: Machine Learning (DS 675), Deep Learning (DS 677)	
NJIT	Machine Learning (CS/DS 675)	S20, F20, F21, Su21, F22, S22, Su22, S23, S24, S26
	Deep Learning (CS/DS 677)	F21, S21, F22, S23, Su23, F23, S24, Su24, Su25, Su26
	Data Structures and Algorithms (CS 610)	F19, Su20, Su21, S26
	Computational Complexity (CS 611)	S18, S19, S20, S21
	Advanced Data Structures and Algorithm Design (CS 435)	F17, F18
	Introduction to Data Science (CS 301)	F26
	Foundations of Computer Science I (CS 241)	F26
UPRRP	Theory of Computability	F15, F16
	Fun with programming interview questions	S15
	Theory of Computation	F13
	Design and Analysis of Algorithms	S12, S17
	High Level Programming Languages	S12, S15
	Undergraduate Machine Learning	F11, F12, F13
	Numerical Analysis	S11, S13
	Linear Algebra for Computer Scientists	F10
CMU	Teaching Assistant, Principles of Programming	S02
	Teaching Assistant, Formal Languages, Automata and Computation	S01
Patras	Teaching Assistant, Advanced Scientific Computing	F99

Advising

PhD Students

Current	Soroush Vahidi, Azadeh Naderi, Arash Moradi Karkaj	
2025	Ali Parviz	First position: Visiting Researcher at Google
2024	Ehsan Beikihassan	First position: CCC Intelligent Solutions
2023	Niloofar Aghaieabiane	First position: JP Morgan
2021	Huong Le	First position: Lecturer at NJIT

MS Students

2025	Kadir Altunel
2014	Richard Garcia-Lebron

Former Undergraduate Students

Richard Garcia-Lebron, Jose Farrington, Karlo Martinez, Leonardo Cardona, Carlos Feliciano, Idalyn Mirabal, Alejandro Vientos, Alberto Ruiz, Gustavo Gratacos

PhD Committee Member, NJIT

Current	Mehtab Sidhu, Yupeng Xu, Chunhui Xu, Hongyang Zhang, Mohammad Dindoost, Zhibo Ye, Swastik Biswas, Zhenduo Wang, Hamideh Sabaei, Yiran Huang
2026	Shen Fan, Haotian Yin, Siqi Jiang
2025	Oliver Alvarado Rodriguez, Fuhuan Li, Jingyi Gu, Haoran Liu
2024	Wenlu Du, Minjuan Zhang
2023	Mojtaba Zaheri, Mahsa Asadi, Hessam Mohammadi, Sepideh Nikookar, Md Moinul Islam, Xiang Lin
2022	Shibo Yao, Cavidan Yakupoglu, Gerges Firas, Yasser Abduallah
2021	Zhihang Hu, Yunzhe Xue, Dong Wei
2020	Xin Yin
2019	Abdulrhman Fahad Aljouie

PhD Committee Member, External

2025	Jingbang Chen (University of Waterloo)
2024	Yixuan He (University of Oxford), Tijn de Vos (University of Salzburg)
2017	Shen Chen Xu (CMU)

MS Committee Member, NJIT

2026	Ritwik Reddy Kolan
2022	Joseph Patchett
2020	Rahul Basu, Sanyamee Patel, Sarvesh Shukla

Professional Service

Panels	NSF Funding Panels (CCF/AF, IIS/RI) · DoE Funding Panel · European Research Council (ERC)

PC member	PKDD-Nectar 2014, 2015; WSDM 2016; WWW 2015–2018; WebConf 2019–2022; KDD 2017; KDD-Applied Track 2018; LATIN 2018; CIKM 2018; AAAI 2019–2020; ICCAD 2024–2026; DAC 2025–2027; SOSFEM 2027; ACDA 2027
Referee	Conferences: STOC, FOCS, SODA, SPAA, STACS, ESA, MFCS Journals, including: JACM, ACM TALG, JCSS, Algorithmica, TOPC, IPL, SIMAX
Organizer	Workshop "Electrical Flows, Graph Laplacians and Algorithms: Spectral Theory and Beyond", ICERM, 2014

Service at NJIT

Department Leadership

2022–present **Associate Chair of Graduate Studies**, Department of Computer Science

- Established Barclays–NJIT MS in Computer Science partnership program (2025)
- Co-designed three BS program concentrations: AI: Learning and Reasoning, AI: Systems and Infrastructure, and Cybersecurity and Privacy (2026)
- Developed merit-based faculty salary framework, adopted by CS Department (Spring 2024), advancing fairness and transparency in compensation decisions
- Redesigned department workflows for course assignments, scheduling, and TA allocation (2023–2026); developed supporting software adopted college-wide for all scheduling operations
- Updated graduate program catalogs and created Certificate-to-MS pathways
- Established Graduate Certificate in Hyperscale Computing

2022–present **MS Committee Chair**, Department of Computer Science

Department Committees & Administration

2024–present	Committee on Lecturers
2023–2024	Co-administered the Data Structures & Algorithms PhD Qualifying Exam
2022–present	Organizer of Spring Department Retreats (2023, 2024, 2025)
2018–2022	Administered the Computational Complexity PhD Qualifying Exam
2022	CAREER Mentoring Committee Member
2019, 2022–24	Faculty Search Committee Member

University Service

2024–2026	Center for Educational Innovation and Excellence, Advisory Board
2024–2026	Member of the AI Teaching/Learning Group (charged by the Provost)
2024–2025	Member of the NJIT group participating in AAC&U's Institute for AI, Pedagogy, and the Curriculum
2023–2025	CS representative, Faculty Senate Committee on Academic Assessment
2021–2025	YWCC representative, Faculty Senate Committee on Research, Scholarship and Creative Academic Activity
2019–2024	CS representative, Committee on Information Technology, Library, and Academic Resources (CITLAR)

Service at UPRRP

2016–2017	Department Coordinator for Student Learning Assessment
2012–2014	Member of the committee for the creation of an MS program in Computer Science
2011	Undergraduate Research Coordinator, Computer Science Department