EMANUELE VIOLA

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Blog: https://emanueleviola.wordpress.com

Contents

RESEARCH INTERESTS

Is the computer ever slow?
I want to know why.
But I am not interested in explanations grounded in human choice.
I want to know if there is an intrinsic, mathematical reason why some tasks take longer than others.

POSITIONS

Northeastern University, Boston, MA

Professor	Fall 2021 – present
Associate professor	Spring 2014 – Spring 2021
Assistant professor	Fall 2008 – Spring 2014
Visiting Scientist at Simons Institute	Fall 2018
Visiting Scientist at Simons Institute	Fall 2015
Visiting scholar at Harvard University	2014 – 2015

Columbia University, New York, NY — Fall 2007 – Summer 2008
Postdoctoral fellow; Sponsor: Rocco Servedio

Institute for Advanced Study, Princeton, NJ — Fall 2006 – Summer 2007
Postdoctoral fellow; Sponsor: Avi Wigderson

EDUCATION

Harvard University, Cambridge, MA — Fall 2001 – Summer 2006
Ph.D. Computer Science; Advisor: Salil Vadhan

La Sapienza University, Rome, Italy — Fall 1995 – Spring 2000
B.S. Computer Science, *summa cum laude*

AWARDS AND DISTINCTIONS

Best Paper Award, IEEE Conf. on Computational Complexity, for the paper [13] 2008

SIAM Student Paper Prize, for the paper [7] 2006

Six papers selected for STOC/FOCS special issues

Four papers selected for CCC/ICALP/RANDOM/CSR special issues

RESEARCH PAPERS

All of the conferences (and journals) below are peer reviewed.

72. Communication complexity of pointer chasing via the fixed-set lemma
To appear in Theory of Computing

71. Pseudorandom bits for non-commutative programs
With Chin Ho Lee
In Conf. on Computational Complexity (CCC), 2025

70. Boosting uniformity in quasirandom groups: fast and simple
With Harm Derksen and Chin Ho Lee
In IEEE Symp. on Foundations of Computer Science (FOCS), 2024

69. Pseudorandomness, symmetry, smoothing: I
With Harm Derksen and Peter Ivanov and Chin Ho Lee
In Conf. on Computational Complexity (CCC), 2024

68. Quasirandom groups enjoy interleaved mixing
With Harm Derksen
Discrete Analysis, 2023

67. On correlation bounds against polynomials
With Peter Ivanov and Liam Pavlovic
In Conf. on Computational Complexity (CCC), 2023

66. New sampling lower bounds via the separator
In Conf. on Computational Complexity (CCC), 2023

65. Efficient resilient functions
With Peter Ivanov and Raghu Meka
In ACM-SIAM Symp. on Discrete Algorithms (SODA), 2023

64. Fooling polynomials using invariant theory
With Harm Derksen
In IEEE Symp. on Foundations of Computer Science (FOCS), 2022

63. Affine extractors and AC0-Parity
With Xuangui Huang and Peter Ivanov
In Workshop on Randomization and Computation (RANDOM), 2022

62. Pseudorandom bits and lower bounds for randomized Turing machines
Theory of Computing, vol. 18, num. 10, pp. 1–12, 2022

61. On Hardness Assumptions Needed for "Extreme High-End" PRGs and Fast Derandomization
With Ronen Shaltiel
In ACM Innovations in Theoretical Computer Science conf. (ITCS), 2022

60. Mixing in non-quasirandom groups
With W. T. Gowers
In ACM Innovations in Theoretical Computer Science conf. (ITCS), 2022

59. Approximate Degree-Weight and Indistinguishability
With Xuangui Huang
To appear in ACM Trans. Computation Theory

58. Fourier growth of structured F2-polynomials and applications
With Jaroslaw Blasiok and Peter Ivanov and Yaonan Jin and Chin Ho Lee and Rocco A. Servedio
In Workshop on Randomization and Computation (RANDOM), 2021

57. Fourier conjectures, correlation bounds, and Majority
In Coll. on Automata, Languages and Programming (ICALP), 2021

56. Average-case rigidity lower bounds
With Xuangui Huang
In Computer Science Symp. in Russia (CSR), 2021

55. New lower bounds for probabilistic degree and AC0 with parity gates
To appear in Theory of Computing

54. AC0 unpredictability
To appear in ACM Trans. Computation Theory

53. More on bounded independence plus noise: Pseudorandom generators for read-once polynomials
With Chin Ho Lee
Theory of Computing, vol. 16, pp. 1–50, 2020

52. Lower bounds for data structures with space close to maximum imply circuit lower bounds
Theory of Computing, vol. 15, pp. 1-9, 2019

51. Sampling lower bounds: boolean average-case and permutations
SIAM J. on Computing, vol. 49, num. 1, 2020

50. How to Store a Random Walk
With Omri Weinstein and Huacheng Yu
In ACM-SIAM Symp. on Discrete Algorithms (SODA), 2020

49. Constant-error pseudorandomness proofs from hardness require majority
ACM Trans. Computation Theory, vol. 11, num. 4, pp. 19:1–19:11, 2019

48. What do humans perceive in asset returns?
With Jasmina Hasanhodzic and Andrew Lo
Journal of Portfolio Management, vol. 45, num. 4, pp. 49-60, 2019

47. Indistinguishability by adaptive procedures with advice, and lower bounds on hardness amplification proofs
With Aryeh Grinberg and Ronen Shaltiel
In IEEE Symp. on Foundations of Computer Science (FOCS), 2018

46. Revisiting Frequency Moment Estimation in Random Order Streams
With Vladimir Braverman and David P. Woodruff and Lin F. Yang
In Coll. on Automata, Languages and Programming (ICALP), 2018

45. The coin problem for product tests
With Chin Ho Lee
ACM Trans. Computation Theory, vol. 10, num. 3, 2018

44. Local Expanders
With Avi Wigderson
Computational Complexity, vol. 27, num. 2, pp. 225-244, 2018

43. Bounded independence plus noise fools products
With Elad Haramaty and Chin Ho Lee
SIAM J. on Computing, vol. 47, num. 2, pp. 295-615, 2018
Preliminary version in Conf. on Computational Complexity (CCC), 2017

42. Block-symmetric polynomials correlate with parity better than symmetric
With Frederic Green and Daniel Kreymer
Computational Complexity, vol. 26, num. 2, pp. 323-364, 2017

41. Some limitations of the sum of small-bias distributions
With Chin Ho Lee
Theory of Computing, vol. 13, 2017

40. Interleaved group products
With W. T. Gowers
SIAM J. on Computing, vol. 48, num. 3, pp. 554–580, 2019
Preliminary version in IEEE Symp. on Foundations of Computer Science (FOCS), 2016
FOCS Special Issue. The journal version includes the results appearing in the STOC 2015 and FOCS 2016 conference versions

39. Bounded Independence versus Symmetric Tests
With Ravi Boppana and Johan Håstad and Chin Ho Lee
ACM Trans. Computation Theory, vol. 11, num. 4, pp. 21:1–21:27, 2019
Preliminary version in Workshop on Randomization and Computation (RANDOM), 2016

38. Bounded indistinguishability and the complexity of recovering secrets
With Andrej Bogdanov and Yuval Ishai and Christopher Williamson
In Int. Cryptology Conf. (CRYPTO), 2016

37. Quadratic maps are hard to sample
ACM Trans. Computation Theory, vol. 8, num. 4, 2016

36. Local reductions
With Hamid Jahanjou and Eric Miles
Information and Computation, vol. 261, num. 2, 2018
Preliminary version in Coll. on Automata, Languages and Programming (ICALP), 2015
ICALP Special issue

35. The communication complexity of interleaved group products
With W. T. Gowers
In ACM Symp. on the Theory of Computing (STOC), 2015

34. On Randomness Extraction in AC0
With Oded Goldreich and Avi Wigderson
In IEEE Conf. on Computational Complexity (CCC), 2015

33. 3SUM, 3XOR, Triangles
With Zahra Jafargholi
Algorithmica, pp. 1-18, 2014

32. Short PCPs with projection queries
With Eli Ben-Sasson
In Coll. on Automata, Languages and Programming (ICALP), 2014

31. Real advantage
With Alexander Razborov
ACM Trans. Computation Theory, vol. 5, num. 4, pp. 17, 2013

30. Shielding circuits with groups
With Eric Miles
In ACM Symp. on the Theory of Computing (STOC), 2013

29. On the complexity of information spreading in dynamic networks
With Chinmoy Dutta and Gopal Pandurangan and Rajmohan Rajaraman and Zhifeng Sun
In ACM-SIAM Symp. on Discrete Algorithms (SODA), 2013

28. The communication complexity of addition
Combinatorica, pp. 1-45, 2014
Preliminary version in ACM-SIAM Symp. on Discrete Algorithms (SODA), 2013

27. Extractors for Turing-machine sources
In Workshop on Randomization and Computation (RANDOM), 2012

26. Substitution-permutation networks, pseudorandom functions, and natural proofs
With Eric Miles
J. of the ACM, vol. 62, num. 6, 2015
Preliminary version in Int. Cryptology Conf. (CRYPTO), 2012

25. Tight bounds on computing error-correcting codes by bounded-depth circuits with arbitrary gates
With Anna Gál and Kristoffer Arnsfelt Hansen and Michal Koucký and Pavel Pudlák
IEEE Transactions on Information Theory, vol. 59, num. 10, pp. 6611-6627, 2013
Preliminary version in ACM Symp. on the Theory of Computing (STOC), 2012

24. Extractors for circuit sources
SIAM J. on Computing, vol. 43, num. 2, pp. 355-972, 2014
Preliminary version in IEEE Symp. on Foundations of Computer Science (FOCS), 2011
FOCS Special Issue

23. On beating the hybrid argument
With Bill Fefferman and Ronen Shaltiel and Christopher Umans
Theory of Computing, vol. 9, pp. 809-843, 2013
Preliminary version in ACM Innovations in Theoretical Computer Science conf. (ITCS), 2012

22. Randomness buys depth for approximate counting
Computational Complexity, vol. 23, num. 3, pp. 479-508, 2014
Preliminary version in IEEE Symp. on Foundations of Computer Science (FOCS), 2011

21. On the complexity of constructing pseudorandom functions (especially when they don't exist)
With Eric Miles
J. of Cryptology, pp. 1-24, 2013
Preliminary version in Theory of Cryptography Conf. (TCC), 2011

20. A Computational View of Market Efficiency
With Jasmina Hasanhodzic and Andrew W. Lo
Quantitative Finance, vol. 11, num. 7, 2011

19. Bounded-depth circuits cannot sample good codes
With Shachar Lovett
Computational Complexity, vol. 21, num. 2, pp. 245-266, 2012
Preliminary version in IEEE Conf. on Computational Complexity (CCC), 2011
CCC Special issue

18. The complexity of distributions
SIAM J. on Computing, vol. 41, num. 1, pp. 191-218, 2012
Preliminary version in 51th IEEE Symp. on Foundations of Computer Science (FOCS), 2010

17. Cell-probe lower bounds for succinct partial sums
With Mihai Pătraşcu
In 21th ACM-SIAM Symp. on Discrete Algorithms (SODA), 2010

16. Bounded Independence Fools Halfspaces
With Ilias Diakonikolas and Parikshit Gopalan and Ragesh Jaiswal and Rocco A. Servedio
SIAM J. on Computing, vol. 39, num. 8, pp. 3441-3462, 2010
Preliminary version in 50th IEEE Symp. on Foundations of Computer Science (FOCS), 2009

15. Bit-probe lower bounds for succinct data structures
SIAM J. on Computing, vol. 41, num. 6, pp. 1593–1604, 2012
Preliminary version in 41th ACM Symp. on the Theory of Computing (STOC), 2009
STOC Special Issue

14. Improved separations between nondeterministic and randomized multiparty communication
With Matei David and Toniann Pitassi
ACM Trans. Computation Theory, vol. 1, num. 2, pp. 1–20, 2009
Preliminary version in 12th Workshop on Randomization and Computation (RANDOM), 2008

13. The sum of d small-bias generators fools polynomials of degree d
Computational Complexity, vol. 18, num. 2, pp. 209-217, 2009
Preliminary version in IEEE Conf. on Computational Complexity (CCC), 2008
Best paper award

12. Hardness amplification proofs require majority
With Ronen Shaltiel
SIAM J. on Computing, vol. 39, num. 7, pp. 3122-3154, 2010
Preliminary version in 40th ACM Symp. on the Theory of Computing (STOC), 2008

11. One-way multiparty communication lower bound for pointer jumping with applications
With Avi Wigderson
Combinatorica, vol. 29, num. 6, pp. 719-743, 2009
Preliminary version in 48th IEEE Symp. on Foundations of Computer Science (FOCS), 2007
Invited to **FOCS Special Issue**

10. Pseudorandom bits for polynomials
With Andrej Bogdanov
SIAM J. on Computing, vol. 39, num. 6, pp. 2464-2486, 2010
Preliminary version in IEEE Symp. on Foundations of Computer Science (FOCS), 2007
FOCS Special Issue

9. Norms, XOR lemmas, and lower bounds for polynomials and protocols
With Avi Wigderson
Theory of Computing, vol. 4, pp. 137-168, 2008
Preliminary version in IEEE Conf. on Computational Complexity (CCC), 2007

8. On approximate majority and probabilistic time
Computational Complexity, vol. 18, num. 3, pp. 337-375, 2009
Preliminary version in IEEE Conf. on Computational Complexity (CCC), 2007

7. Pseudorandom Bits for Constant-Depth Circuits with Few Arbitrary Symmetric Gates
SIAM J. on Computing, vol. 36, num. 5, pp. 1387-1403, 2007
Preliminary version in 20th IEEE Conf. on Computational Complexity (CCC), 2005
SIAM Student Paper Prize

6. On Constructing Parallel Pseudorandom Generators from One-Way Functions
In 20th IEEE Conf. on Computational Complexity (CCC), 2005

5. Constant-Depth Circuits for Arithmetic in Finite Fields of Characteristic Two
With Alexander Healy
In 23rd Symp. on Theoretical Aspects of Computer Science (STACS), 2006

4. Fooling Parity Tests with Parity Gates
With Dan Gutfreund
In 8thWorkshop on Randomization and Computation (RANDOM), 2004

3. Using Nondeterminism to Amplify Hardness
With Alexander Healy and Salil P. Vadhan
SIAM J. on Computing, vol. 35, num. 4, pp. 903-931, 2006
Preliminary version in ACM Symp. on the Theory of Computing (STOC), 2004
STOC Special Issue

2. The Complexity of Constructing Pseudorandom Generators from Hard Functions
Computational Complexity, vol. 13, num. 3-4, pp. 147–188, 2004
Preliminary version in IEEE Conf. on Computational Complexity (CCC), 2003

1. E-unifiability via Narrowing
In 7th Italian Conference on Theoretical Computer Science (ICTCS), 2001

SURVEYS AND MY PH.D. THESIS

All of the surveys below are peer reviewed.

6. Non-abelian combinatorics and communication complexity
   SIGACT News, Complexity Theory Column, vol. 50, num. 3, 2019
   Invited survey

5. Challenges in computational lower bounds
   SIGACT News, Open Problems Column, vol. 48, num. 1, 2017

4. Selected Results in Additive Combinatorics: An Exposition
   Theory of Computing Library, Graduate Surveys series, vol. 3, pp. 1-15, 2011

3. On the power of small-depth computation
   Foundations and Trends in Theoretical Computer Science, vol. 5, num. 1, pp. 1–72, 2009
   Invited survey

2. Correlation bounds for polynomials over $\{0,1\}$
   SIGACT News, Complexity Theory Column, vol. 40, num. 1, 2009
   Invited survey

1. The Complexity of Hardness Amplification and Derandomization
   Ph.D. thesis, Harvard University, 2006

PREPRINTS AND NOTES

11. Mathematics of the impossible: The complexity of computation
    Manuscript, 2023

10. Resilient functions: Optimized, simplified, and generalized
    With Peter Ivanov
    Manuscript, 2024

9. Pseudorandomness, symmetry, smoothing: II
   With Harm Derksen and Peter Ivanov and Chin Ho Lee
   Manuscript, 2024

8. Correlation bounds against polynomials, a survey
   Manuscript, 2022

7. Special topics in complexity theory
   Manuscript, 2017
   Lecture notes of the class taught at Northeastern University

6. Succinct and explicit circuits for sorting and connectivity
   With Hamid Jahanjou and Eric Miles
   Manuscript, 2014

5. On a special case of rigidity
   With Rocco A. Servedio
   Manuscript, 2012

4. From RAM to SAT
   With NEU
   Manuscript, 2012

3. Think like the pros
   Manuscript, 2011
   Lecture notes aimed towards students lacking mathematical maturity

2. Reducing 3XOR to listing triangles, an exposition
   Manuscript, 2011

1. Gems of Theoretical Computer Science
   Manuscript, 2009
   Lecture notes of the class taught at Northeastern University

OTHER WORK BY RESEARCH GROUP

12. Space Hardness of Solving Structured Linear Systems
    Xuangui Huang
    In Int. Symp. on Algorithms and Computation (ISAAC), 2020

11. Fourier Bounds and Pseudorandom Generators for Product Tests
    Chin Ho Lee
    In Conf. on Computational Complexity (CCC), 2019

10. Absolutely Sound Testing of Lifted Codes
    Elad Haramaty and Noga Ron-Zewi and Madhu Sudan
    Theory of Computing, vol. 11, pp. 299–338, 2015

9. Optimal Dynamic Distributed MIS
   Keren Censor-Hillel and Elad Haramaty and Zohar S. Karnin
   In Symp. on Principles of Distributed Computing (PODC), 2016

8. Robust Testing of Lifted Codes with Applications to Low-Degree Testing
   Alan Guo and Elad Haramaty and Madhu Sudan
   In IEEE Symp. on Foundations of Computer Science (FOCS), 2015

7. Amplifying Privacy in Privacy Amplification
   Divesh Aggarwal and Yevgeniy Dodis and Zahra Jafargholi and Eric Miles and Leonid Reyzin
   In Int. Cryptology Conf. (CRYPTO), 2014

6. Non-malleable Codes from Additive Combinatorics
   Divesh Aggarwal and Yevgeniy Dodis and Shachar Lovett
   In ACM Symp. on the Theory of Computing (STOC), 2014

5. Key Derivation Without Entropy Waste
Yevgeniy Dodis and Krzysztof Pietrzak and Daniel Wichs
In Int. Conf. on the Theory and Applications of Cryptographic Techniques (EUROCRYPT), 2014

4. Iterated group products and leakage resilience against NC^1
Eric Miles
In ACM Innovations in Theoretical Computer Science conf. (ITCS), 2014

3. Coalescing-Branching Random Walks on Graphs
Chinmoy Dutta and Gopal Pandurangan and Rajmohan Rajaraman and Scott Roche
In ACM Symp. on Parallelism in Algorithms and Architectures (SPAA), 2013

2. Split and Join: Strong Partitions and Universal Steiner Trees for Graphs
Costas Busch and Chinmoy Dutta and Jaikumar Radhakrishnan and Rajmohan Rajaraman and Srivathsan Srinivasagopalan
In IEEE Symp. on Foundations of Computer Science (FOCS), 2012

1. More on a Problem of Zarankiewicz
Chinmoy Dutta and Jaikumar Radhakrishnan
In Int. Symp. on Algorithms and Computation (ISAAC), 2012

TALKS

90. Amherst, MA — Spring 2025
On the Grand Challenge

89. IEEE Symp. on Foundations of Computer Science, Chicago, IL — FOCS; Fall 2024
Boosting uniformity in quasirandom groups: faster and simpler

88. Probability and Analysis Webinar — 2024 01 29
Correlation bounds and all that

87. Simons Institute, Berkeley, CA — Simons; 2023 02 16
Correlation bounds and all that

86. Complexity Meetings, University of Warwick, UK — 2022 09 08
Correlation bounds and all that

85. Innovations in Theoretical Computer Science, Simons Institute, Berkeley, CA — ITCS; 2022 02 03
Mixing in non-quasirandom groups

84. Northeastern Univ. Mathematics department, Boston, MA — NEU; 2021 11
Mixing in groups

83. Int. Coll. on Automata, Languages, and Programming, Glasgow, UK — ICALP; 2021 07
Fourier conjectures, correlation bounds, and Majority

82. Dartmouth College, Hanover, NH — Dartmouth; 2021 05 14
Why do lower bounds stop "just before" proving major results?

81. Boston University, Boston, MA — BU; Fall 2019
Why do lower bounds stop "just before" proving major results?

80. Simons Institute, Berkeley, CA — Simons; Fall 2018
Sampling lower bounds

79. Simons Institute, Berkeley, CA — Simons; Fall 2018
Bounded independence plus noise, and the communication complexity of decoding

78. Session on Math. Perspectives in Quantum Information Theory, Boston, MA — AMS; Spring 2018
The complexity of distributions: boolean average-case lower bounds

77. Northeastern Univ. Applied and Interdisciplinary Math. Seminar, Boston, MA — NEU; Spring 2018
Interleaved group products

76. Harvard workshop on additive combinatorics, Cambridge, MA — Harvard; Fall 2017
Interleaved group products

75. IEEE Symp. on Foundations of Computer Science, New Brunswick, NJ — FOCS; Fall 2016
The multiparty communication complexity of interleaved group products

74. Simons Institute, Berkeley, CA — Simons; Fall 2015
3SUM, 3XOR, Triangles

73. Simons Institute, Berkeley, CA — Simons; Fall 2015
Local reductions

72. ACM Symp. on Theory of Computing, Portland, OR — STOC; Summer 2015
The communication complexity of interleaved group products

71. Conf. on Computational Complexity, Portland, OR — CCC; Summer 2015
On randomness extractors in AC0

70. University of Tuzla, Bosnia — Tuzla; Spring 2015
The communication complexity of interleaved group products

69. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2015
The communication complexity of interleaved group products

68. FOCS workshop on higher-order Fourier analysis, Philadelphia, PA — FOCS workshop; Fall 2014
Interleaved products in special linear groups

67. Harvard University, Cambridge, MA — Harvard; Fall 2014
Local reductions

66. Banff workshop on communication complexity, Banff, Canada — Banff; Summer 2014
The communication complexity of addition

65. Stanford University, Palo Alto, CA — Stanford; Summer 2013
Local reductions

64. ACM-SIAM Symp. on Discrete Algorithms, New Orleans, LA — SODA; Spring 2013
The communication complexity of addition

63. La Sapienza University, Rome, Italy — La Sapienza; Fall 2012
The communication complexity of addition

62. Oberwolfach meeting on complexity theory, Oberwolfach, Germany — Oberwolfach; Fall 2012
Block-symmetric polynomials correlate with parity better than symmetric

61. Int. Workshop on Randomization and Computation, Cambridge, MA — RANDOM; Summer 2012
Extractors for Turing-machine sources

60. ACM Symp. on Theory of Computing, New York, NY — STOC; Spring 2012
Tight bounds on computing error-correcting codes by bounded-depth circuits with arbitrary gates

59. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2012
The complexity of distributions

58. IEEE Symp. on Foundations of Computer Science, Palm Springs, CA — FOCS; Fall 2011
Extractors for circuits sources

57. IEEE Symp. on Foundations of Computer Science, Palm Springs, CA — FOCS; Fall 2011
Randomness buys depth for approximate counting

56. Northeastern University, Boston, MA — NEU; Fall 2011
The communication complexity of addition

55. Bertinoro workshop on Ramsey Theory, Bertinoro, Italy — Bertinoro; Summer 2011
The disproof of the inverse conjecture for Gowers' norm via Ramsey Theory

54. Dagstuhl workshop on the complexity of discrete problems, Germany — Dagstuhl; Spring 2011
Extractors for circuit sources

53. Massachusetts Institute of Technology, Cambridge, MA — MIT; Spring 2011
The complexity of distributions

52. Northeastern University, Boston, MA — NEU; 16 November 2010
Williams' breakthrough

51. IEEE Symp. on Foundations of Computer Science, Las Vegas, NV — FOCS; Fall 2010
The complexity of distributions

50. Banff workshop on complexity theory, Banff, Canada — Banff; Summer 2010
The complexity of distributions

49. La Sapienza University, Rome, Italy — La Sapienza; Summer 2010
The complexity of distributions

48. Laci Babai's 60th birthday, Columbus, OH — Babai is 60; Spring 2010
The complexity of distributions

47. Microsoft Research New England — Microsoft; Spring 2010
The complexity of distributions

46. Harvard University, Cambridge, MA — Harvard; Fall 2009
Lower bounds for succinct data structures

45. La Sapienza University, Rome, Italy — La Sapienza; Summer 2009
Lower bounds for succinct data structures

44. ACM Symp. on Theory of Computing, Bethesda, MD — STOC; Spring 2009
Bit-probe lower bounds for succinct data structures

43. Northeastern University, Boston, MA — NEU; Spring 2009
Bit-probe lower bounds for succinct data structures

42. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2009
Bounded independence fools halfspaces

41. Northeastern University, Boston, MA — NEU; Fall 2008
What is a proof? What is knowledge? What is randomness?

40. Boston University, Boston, MA — BU; Fall 2008
Polynomials over $\{0, 1\}$

39. Banff workshop on analytic tools in computational complexity, Banff, Canada — Banff; Summer 2008
Hardness amplification proofs require majority

38. IEEE Conf. on Computational Complexity, College Park, MD — CCC; Summer 2008
The sum of d small-bias generators fools polynomials of degree d

37. ACM Symp. on Theory of Computing, Victoria, Canada — STOC; Spring 2008
Hardness amplification proofs require majority

36. Columbia University, New York, NY — Columbia; Spring 2008
Hardness amplification proofs require majority

35. Northeastern University, Boston, MA — NEU; Spring 2008
Pseudorandomness

34. University of Illinois at Chicago, Chicago, IL — UIC; Spring 2008
Polynomials

33. The University of Chicago, Chicago, IL — UChicago; Spring 2008
Lower bounds

32. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2008
Hardness amplification proofs require majority

31. Cornell workshop on discrete harmonic analysis, Ithaca, NY — Cornell; Spring 2008
Polynomials

30. Theory Day, New York, NY — Theory Day; Fall 2007
    Polynomials

29. IEEE Symp. on Foundations of Computer Science, Providence, RI — FOCS; Fall 2007
    One-way multi-party communication lower bound for pointer jumping with applications

28. IEEE Symp. on Foundations of Computer Science, Providence, RI — FOCS; Fall 2007
    Pseudorandom bits for polynomials

27. Columbia University, New York, NY — Columbia; Fall 2007
    Selected results in additive combinatorics

26. IEEE Conf. on Computational Complexity, San Diego, CA — CCC; Summer 2007
    Norms, XOR lemmas, and lower bounds for GF(2) polynomials and multiparty protocols

25. IEEE Conf. on Computational Complexity, San Diego, CA — CCC; Summer 2007
    On approximate majority and probabilistic time

24. Oberwolfach meeting on complexity theory, Oberwolfach, Germany — Oberwolfach; Summer 2007
    One-way multi-party communication lower bound for pointer jumping

23. Dagstuhl workshop on the complexity of discrete problems, Germany — Dagstuhl; Spring 2007
    On approximate majority and probabilistic time

22. New York University, New York, NY — NYU; Spring 2007
    Pseudorandomness: New results and applications

21. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2007
    One-way multi-party communication lower bound for pointer jumping with applications

20. IBM Watson Research Center, Hawthorne, NY — IBM; Spring 2007
    Pseudorandomness: New results and applications

19. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2007
    On approximate majority and probabilistic time

18. Center for Discrete Math. and Theor. C. S., Rutgers, NJ — DIMACS; Spring 2007
    Norms, XOR lemmas, and lower bounds for GF(2) polynomials and multiparty protocols

17. Institute for Advanced Study, Princeton, NJ — IAS; Spring 2007
    Norms, XOR lemmas, and lower bounds for GF(2) polynomials and multiparty protocols

16. Toyota Technical Institute at Chicago, Chicago, IL — TTI; Spring 2006
    Derandomization: New results and applications

15. La Sapienza University, Rome, Italy — La Sapienza; Spring 2006
    Derandomization: New results and applications

14. Harvard University, Cambridge, MA — Harvard; Spring 2006
    On approximate majority and probabilistic time

13. American Math. Society meeting on randomness in computation, Lincoln, NE — AMS; Fall 2005
    Pseudorandom bits for low complexity classes: new results and applications

12. Center for Math. and Comp. Science, Amsterdam, the Netherlands — CWI; Summer 2005
    Pseudorandom bits for constant-depth circuits with few arbitrary symmetric gates

11. IEEE Conf. on Computational Complexity, San Jose, CA — CCC; Summer 2005
    On constructing parallel pseudorandom generators from one-way functions

10. IEEE Conf. on Computational Complexity, San Jose, CA — CCC; Summer 2005
    Pseudorandom bits for constant-depth circuits with few arbitrary symmetric gates

9. Berkeley University, Berkeley, CA, — Berkeley; Spring 2005
   Pseudorandom bits for constant-depth circuits with few arbitrary symmetric gates

8. Microsoft Research, Mountain View, CA — Microsoft; Spring 2005
   Pseudorandom bits for constant-depth circuits with few arbitrary symmetric gates

7. Harvard University, Cambridge, MA — Harvard; Spring 2004
   Pseudorandom bits for constant-depth circuits with few arbitrary symmetric gates

6. Institute for Advanced Study, Princeton, NJ — IAS; Fall 2004
   Using nondeterminism to amplify hardness

5. ACM Symp. on Theory of Computing, Chicago, IL — STOC; Summer 2004
   Using nondeterminism to amplify hardness

4. Radcliffe Inst. for Adv. Study, Cambridge, MA — Radcliffe; Fall 2003
   Using nondeterminism to amplify hardness

3. IEEE Conf. on Computational Complexity, Aarhus, Denmark — CCC; Summer 2003
   The complexity of constructing pseudorandom generators from hard functions

2. Harvard University, Cambridge, MA — Harvard; Spring 2003
   The complexity of constructing pseudorandom generators from hard functions

1. Harvard University, Cambridge, MA — Harvard; Fall 2001
   E-unifiability via narrowing

VIDEO GAMES

ARORA, web game to study the perception of randomness — 2009 – present
Black Viper, distributed by Neo Software Produktions GmbH, Vienna, Austria — 1994 – 1996
Nathan Never, distributed by Softel Ltd., Rome, Italy — 1992

EXTERNAL GRANTS

NSF CCF-2430026, PI, *AF: Small: Randomness in complexity theory: Fooling, sampling, and mixing* 01/01/2025-12/31/2027
$600,000

NSF CCF-2114116, PI, *AF: Small: New Approaches to Complexity Theory Lower Bounds* 6/15/2021-5/31/2024
$499,997

NSF CCF-1813930, PI, *AF: Small: Research in Complexity Theory* 6/1/2018-12/31/2021
$499,896

REU supplements 2019
$8,000

NSF CCF-1319206, PI, *Research in complexity theory and related areas* 9/1/2013-8/31/2017
$493,824

MIT, PI, *Experiment on the perception of randomness* 1/2013–1/2014
$31,100

NSF CAREER Award, 0845003, PI, *Pseudorandom generators* 2/2009–1/2014
$452,009

REU supplements 2010, 2011
$16,000

INTERNAL GRANTS

TIER 1 grant July 1, 2022 - September 30, 2023
With Harm Derksen
$50,000

Co-op funding award 7/1/2020-12/31/2020
$6,000

TEACHING: COURSES

Note: This section is not up to date.
Sp=Spring, Fa=Fall, Su=Summer

Online Undergraduate Theory of Computation, **newly developed course** Su'23

PhD Complexity Theory, **newly developed course** Sp'23
Online MS Algorithms, **newly developed course** Su'23,Su'20, Su'19, Sp'19
Special topics in complexity theory, **newly developed course** Fa '17
PhD Gems of Theoretical Computer Science, **newly developed course** Sp '09
Undergraduate Theory of Computation Fa'16, Sp'14, Fa'12, Sp'12, Fa'11, Fa'10
MS Algorithms Fa '20, Su '20, Su '19, Sp '19 x 2, Sp '17 x 2, Sp 2016, Su 2015, Fa '12
PhD (core) Theory of Computation Sp '14, Sp '13, Sp '12, Sp '11, Sp '10

PhD (core) Advanced Algorithms Fa '09, Fa '08

Nominated for Excellence in Teaching Award 2013

RESEARCH TEAM (INCLUDING STUDENTS)

Visitor Elena Grigorescu (Spring 2020)
Yevgeniy Dodis (Spring and Summer 2013)

Postdoc Jad Silbak (Fall 2023 -)
Elad Haramaty (Fall 2014 - Summer 2016) → Postdoc at Harvard
Chinmoy Dutta (partial mentoring) → Twitter

Ph. D. Dustin Lin (Fall 2023 -)
Peter Ivanov (Summer 2019 - present)
Xuangui Huang (Fall 2017 - Spring 2023)
Chin Ho Lee (Fall 2013-Summer 2019) → Postdoc at Columbia → Postdoc at Harvard → Professor at North Carolina State University
Tanay Mehta (partial advising)
Hamid Jahanjou (partial advising)
Zahra Jafargholi (partial advising) → Postdoc at Aarhus University.
Eric Miles (Fall 2008-Spring 2014) → Postdoc at UCLA → Google.

M. S. Dolphy Fernandes (Summer 2009)

B. S. Liam Pavlovic (Summer 2020 – Fall 2020) → Ph.D. student at Northeastern University.
Daniel Kreymer (2009-2012) Block-symmetric polynomials project. → Amazon.
Sky O'Mara (Summer 2009) Block-symmetric polynomials project

SERVICE TO THE INSTITUTION

Note: This section is not up to date.

Elected senator 2023 – 2025
Faculty search committee, joint Computer Science and Game Design position 2010 – 2011
Faculty search committee, joint Computer Science and Mathematics position 2009 – 2010
Seminar organizer, Northeastern University theory seminar 2008 – 2015
Merit committee 2012 – 2013
Sabbatical committee 2012 – 2013
Ph.D. admission committee 2008 – 2009, 2016 – 2017, 2018–2019, 2019–2020
M.S. committee 2010 (?) – 2013
M.S. curriculum committee 2019 – 2020

SERVICE TO THE DISCIPLINE

Associate editor

SIAM Journal on Computing	SICOMP 2019 – present
ACM Transactions on Computation Theory	TOCT 2015 – 2023

Program committee

ICALP 2025	
RANDOM 2024	
IEEE Symp. on Foundations of Computer Science	FOCS 2022
Int. Coll. on Automata, Languages, and Programming	ICALP 2022
Conference on Computational Complexity	CCC 2021
58th Annual IEEE Symposium on Foundations of Computer Science	FOCS 2017
ACM-SIAM Symposium on Discrete Algorithms	SODA 2014
28th IEEE Conference on Computational Complexity	CCC 2013
16th Int. Workshop on Randomization and Computation	RANDOM 2012
25th IEEE Conference on Computational Complexity	CCC 2010
13th Int. Workshop on Randomization and Computation	RANDOM 2009
49th IEEE Symp. on Foundations of Computer Science	FOCS 2008
11th Int. Workshop on Randomization and Computation	RANDOM 2007

Grant reviewing

National Science Foundation (NSF) panelist	2008, 2009, 2011, 2014, 2015, 2016, 2019, 2020, 2024
Israel Science Foundation	2009, 2010
American University of Beirut	2012

Ph.D. committees, Laura Poplawski (Northeastern), Joshua Brody (Dartmouth) 2008 – 2009

Local co-organizer, 25th IEEE Conference on Computational Complexity CCC 2010

Scientific board, Electronic Colloquium on Computational Complexity 2009 – present

Contribution to popular-science book, *The Evolution of Technical Analysis*, Wiley 2010

Paper refereeing, (J. of ACM, SIAM J. on Computing, STOC, FOCS, . . .)