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EDUCATION

1980 Ph.D., Cornell University. National Science Foundation Fellow.

1974 M.S.,B.S. Yale University. Graduated summa cum laude. In three years I obtained both the B.S. and M.S. degrees in mathematics.

EXPERIENCE

1/14 – 5/14 Visiting Professor, Computer Science Dept., Stanford University.

1/10 – 5/10 Visiting Professor, Computer Science Dept., Stanford University.

8/95 – present Professor, Computer Science Dept., University of Massachusetts.

9/03 – 8/04 Visiting Professor, Computer Science Dept., University of Wisconsin-Madison.

9/95 – 7/96 Visiting Professor, Computer Science Dept., Cornell University.

7/89 - 8/95 Associate Professor, Computer Science Dept., University of Massachusetts.

1986 - 6/89 Associate Professor, Computer Science Dept., Yale University.

1983-86 Assistant Professor and NSF Postdoctoral Fellow, Computer Science and Mathematics Depts, Yale University.

Fall, 1985 Visitor, Mathematical Sciences Research Institute, Berkeley, CA.

1980-1983 Assistant Professor of Computer Science, Mathematics Dept., Tufts University. Visiting Scientist, Laboratory for Computer Science, M.I.T.

9/74-8/75 Software Engineer, GTE Sylvania.

PUBLICATIONS (Journals and Highly Refereed Conferences)

Oded Padon, Neil Immerman, Aleksandr Karbyshev, Mooly Sagiv and Sharon Shoham, "Decidability of Inferring Inductive Invariants", *POPL* (2016), 217-231.

Cibele Freire, Wolfgang Gatterbauer, Neil Immerman, Alexandra Meliou, "The Complexity of Resilience and Responsibility for Self-Join-Free Conjunctive Queries", *PVLDB 9(3)* (2015); full version: "A Characterization of the Complexity of Resilience and Responsibility for Self-Join-Free Conjunctive Queries", arXiv 1507.006742 (2015).

Oded Padon, Neil Immerman, Aleksandr Karbyshev, Ori Lahav, Mooly Sagiv, Sharon Shoham, "Decentralizing SDN Policies", POPL 2015.

Shachar Itzhaky, Anindya Banerjee, Neil Immerman, Ori Lahav, Aleksandar Nanevski, Mooly Sagiv, "Modular Reasoning about Heap Paths via Effectively Propositional Formulas", *POPL 2014*, 385-396.

Shachar Itzhaky, Sumit Gulwani, Neil Immerman, Mooly Sagiv, "Solving Geometry Problems Using a Combination of Symbolic and Numerical Reasoning", *LPAR-19: Logic for Programming, Artificial Intelligence, and Reasoning*, Lecture Notes in Computer Science Volume 8312 (2013), 457-472.

Shachar Itzhaky, Anindya Banerjee, Neil Immerman, Aleks Nanevski, and Mooly Sagiv, "Effectively-Propositional Reasoning About Reachability in Linked Data Structures" *Symposium on Computer-Aided Verification* (2013), 756-772.

Siddharth Srivastava, Neil Immerman, and Shlomo Zilberstein, "Applicability Conditions for Plans with Loops: Computability Results and Algorithms," *Artificial Intelligence*, 191192 (2012), 119.

Wentian Lu, Gerome Miklau, and Neil Immerman, "Auditing a Database Under Retention Policies," *VLDB Journal* (July, 2012).

Christoph Reichenbach, Yannis Smaragdakis, and Neil Immerman, "PQL: A Purely-Declarative Java Extension for Parallel Programming", *European Conference on Object-Oriented Programming* (2012).

Siddharth Srivastava, Hector Geffner, Shlomo Zilberstein, Neil Immerman, "Qualitative Numeric Planning", Twenty-Fifth AAAI Conference on Artificial Intelligence (AAAI-11), August 7 - 11, 2011, in San Francisco, California, USA.

Siddharth Srivastava, Neil Immerman, Shlomo Zilberstein and Tianjiao Zhang, "Directed Search for Generalized Plans Using Classical Planners," in third ICAPS Workshop on Validation and Verification of Planning and Scheduling Systems (VVPS 2011), June 13th, 2011, Freiburg, Germany.

Siddharth Srivastava, Neil Immerman, and Shlomo Zilberstein, "A New Representation and Associated Algorithms for Generalized Planning," *Artificial Intelligence 175(2)* (Feb. 2011), 615-647.

Shachar Itzhaky, Sumit Gulwani, Neil Immerman, and Mooly Sagiv, "A Simple Inductive Synthesis Methodology and its Applications," OOPSLA/SPLASH 2010.

Christoph Reichenbach, Neil Immerman, Yannis Smaragdakis, Edward Aftandilian, and Samuel Z. Guyer, "What Can the GC Compute Efficiently? A Language for Heap Assertions at GC Time," OOPSLA/SPLASH 2010.

Haopeng Zhang, Yanlei Diao, and Neil Immerman, "Recognizing Patterns in Streams with Imprecise Timestamps," VLDB 2010.

Siddharth Srivastava, Neil Immerman, and Shlomo Zilberstein, "Computing Applicability Conditions for Plans with Loops," *ICAPS* (2010), Best Paper Award.

Siddharth Srivastava, Neil Immerman, and Shlomo Zilberstein, "Merging Example Plans into Generalized Plans for Non-deterministic Environments," *AAMAS* (2010).

Philipp Weis and Neil Immerman, "Structure theorem and strict alternation hierarchy for FO^2 on words," *Logical Methods in Computer Science* 5(3), paper 4 (2009). A preliminary version appeared in *Computer Science Logic* (2007), 343-357.

T. Lev-Ami, N. Immerman, T. Reps, M. Sagiv, S. Srivastava, and G. Yorsh, "Simulating Reachability using First-Order Logic with Applications to Verification of Linked Data Structures," *Logical Methods in Computer Science* , 5(2), paper 12 (2009). A preliminary version appeared in CADE '05, 99 - 115.

E. Allender, M. Bauland, N. Immerman, H. Schnoor, and H. Vollmer, "The Complexity of Satisfiability Problems: Refining Schaefer's Theorem" *J. Comput. Sys. Sci.* 75 (2009), 245-254. Preliminary version appeared in *Mathematical Foundations of Comput. Sci.* '05, 71-82.

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Siddharth Srivastava, Neil Immerman, and Shlomo Zilberstein, "Learning Generalized Plans: From Classical Plans to Algorithms Through Imprecise Counting", AAAI (2008), 991-997.

Jagrati Agrawal, Daniel Gyllstrom, Yanlei Diao, and Neil Immerman, "Efficient Pattern Matching over Event Streams", *SIGMOD* (2008), 147-160.

Daniel Gyllstrom, Jagrati Agrawal, Yanlei Diao, and Neil Immerman, "On Supporting Kleene Closure over Event Streams" *ICDE* (2008), 1391-1393.

Siddharth Srivastava, Neil Immerman, and, Shlomo Zilberstein, "Using Abstraction for Generalized Planning," Workshop on Artificial Intelligence Planning and Learning , in conjunction with ICAPS-07 (2007).

Tal Lev-Ami, Mooly Sagiv, Neil Immerman, and Tom Reps, *Constructing Specialized Shape Analysis for Uniform Change*, VMCAI 2007, 215-233.

Tal Lev-Ami, Neil Immerman, Mooly Sagiv, "Abstraction for Shape Analysis with Fast and Precise Transformers", CAV 2006, 533 - 546.

D. Barrington, N. Immerman, C. Lautemann, N. Schweikardt, and D. Thérien, "First-Order Expressibility of Languages with Neutral Letters Or: The Crane Beach Conjecture," *J. Comput. Sys. Sci.* 70(2) (2005), 101-127. A preliminary version appeared in *IEEE Symp. Logic In Comput. Sci.* (2001), 187-196.

N. Immerman, A. Rabinovich, T. Reps, M. Sagiv, and G. Yorsh, "The Boundary Between Decidability and Undecidability for Transitive-Closure Logics", CSL '04, 160-174.

N. Immerman, A. Rabinovich, T. Reps, M. Sagiv, and G. Yorsh, "Verification via Structure Simulation", CAV '04, 281-294.

M. Adler and N. Immerman, "An n! Lower Bound On Formula Size," *ACM Transactions on Computational Logic,* 4(3) (2003), 296-314. Preliminary version appeared in *IEEE Symp. Logic In Comput. Sci.* (2001), 197-206.

M. Hertz, N. Immerman, and J.E. Moss, "Framework for Analyzing Garbage Collection," 2nd IFIP Theoretical Computer Science Congress (2002), 230-241.

W. Hesse and N. Immerman, "Complete problems for Dynamic Complexity Classes," *IEEE Symp. Logic In Comput. Sci.* (2002), 313-322.

S. Landau and N. Immerman, "Embedding Linkages on an Integer Lattice," *Algorithmica,* 32(3) (2002), 423–436.

D. Bernstein, R. Givan, N. Immerman, and, S. Zilberstein, "The Complexity of Decentralized Control of Markov Decision Processes," *Mathematics of Operations Research, 27(3)* (2002), 819 - 840. A preliminary version of this paper appeared in *Uncertainty in A.I.* (2000), 32-37.

J.Y. Halpern, R. Harper, N. Immerman, Ph.G. Kolaitis, M.Y. Vardi, and V. Vianu, "On the Unusual Effectiveness of Logic in Computer Science," *Bulletin of Symbolic Logic* 7(2) (2001), 213-236.

N. Immerman, J. Buss, and D.M. Barrington, "Number of Variables Is Equivalent To Space," *J. Symbolic Logic* 66(3) (2001), 1217 - 1230.

N. Alechina and N. Immerman, "Reachability Logic: An Efficient Fragment of Transitive Closure Logic," *Logic Journal of the IGPL* 8(3) (2000), 325-338. Preliminary versions were presented at Methods for Modalities, Amsterdam, May, 1999 and at Finite Model Theory and its Applications, Trento, July, 1999.

K. Etessami and N. Immerman, "Tree Canonization and Transitive Closure," *Information and Computation* 157(1,2) (2000), 2 - 24. A preliminary version appeared in *IEEE Symp. Logic In Comput. Sci.* (1995), 331-341.

N. Immerman and M. Vardi, "Model Checking and Transitive Closure Logic," *Symposium on Computer-Aided Verification* (1997), 291 - 302.

S. Patnaik and N. Immerman, "Dyn-FO: A Parallel, Dynamic Complexity Class," *J. Comput. Sys. Sci.* 55(2) (1997), 199-209. A preliminary version of this paper appeared in *ACM Symp. Principles Database Systems* (1994), 210-221.

E. Allender, J. Balcázar and N. Immerman, "A First-Order Isomorphism Theorem," *SIAM J. Comput.* 26(2) (1997), 557-567. A preliminary version appeared in *Tenth Symp. Theoretical Aspects Comp. Sci.* (1993), 163-174.

J.A. Medina and N. Immerman, "A Generalization of Fagin's Theorem," *IEEE Symp. Logic In Comput. Sci.* (1996), 2 – 12.

N. Immerman, S. Patnaik and D. Stemple, "The Expressiveness of a Family of Finite Set Languages," *Theoretical Computer Science* 155(1) (1996), 111-140. A preliminary version appeared in *Tenth ACM Symposium on Principles of Database Systems* (1991), 37-52.

N. Immerman and S. Landau, "The Complexity of Iterated Multiplication," *Information and Computation* , 116(1) (1995), 103-116. A preliminary version appeared in *Fourth Annual Structure in Complexity Theory Symp.* (1989), 104-111.

K. Etessami and N. Immerman, "Reachability and the Power of Local Ordering," *Theoret. Comp. Sci.* 148(2) (1995), 261-279. A preliminary version appeared in *Eleventh Symp. Theoretical Aspects Comp. Sci.* (1994), 123 - 135.

Y. Gurevich, N. Immerman and S. Shelah, "McColm's Conjecture," *IEEE Symp. Logic In Comput. Sci.* (1994), 10-19.

J.A. Medina and N. Immerman, "A Syntactic Characterization of NP-Completeness," *IEEE Symp. Logic In Comput. Sci.* (1994), 241-250.

S. Landau and N. Immerman, "The Similarities (and Differences) between Polynomials and Integers," *International Conference on Number Theoretic and Algebraic Methods in Computer Science* (1993), 57-59.

J. Cai, M. Fürer and N. Immerman, "An Optimal Lower Bound on the Number of Variables for Graph Identification," *Combinatorica* 12:4 (1992), 389-410. A preliminary version appeared in *30th IEEE FOCS Symp.* (1989), 612-617.

D. Barrington, N. Immerman and H. Straubing, "On Uniformity Within NC[1]," *JCSS* 41:3 (1990), 274 - 306. A preliminary version of this paper appeared in *Third Annual Structure in Complexity Theory Symp.* (1988), 47-59.

N. Immerman and D. Kozen, "Definability with Bounded Number of Bound Variables," *Information and Computation,* 83 (1989), 121-139. A preliminary version appeared in *IEEE Symp. Logic In Comput. Sci.* (1987), 236-244.

N. Immerman and S. Mahaney, "Relativizing Relativized Computations," *Theoretical Computer Science* 68 (1989), 267-276.

N. Immerman, "Expressibility and Parallel Complexity," *SIAM J. of Comput.* 18 (1989), 625-638.

N. Immerman, "Nondeterministic Space is Closed Under Complementation," *SIAM J. Comput.* **17**, No. 5 (1988), 935-938. Also appeared in *Third Structure in Complexity Theory Symp.* (1988), 112-115.

N. Immerman, "Languages That Capture Complexity Classes," *SIAM J. of Computing* 16:4 (1987), 760-778. A preliminary version appeared in *15th ACM STOC Symp.* (1983), 347-354.

M.J. Fischer and N. Immerman, "Interpreting Logics of Knowledge in Propositional Dynamic Logic with Converse," *IPL* 25 (1987), 175-181.

M.J. Fischer and N. Immerman, "Foundations of Knowledge for Distributed Systems," *Theoretical Aspects of Reasoning About Knowledge,* Morgan Kaufmann (1986), 171-185.

N. Immerman, "Relational Queries Computable in Polynomial Time," *Information and Control* 68 (1986), 86-104. A preliminary version appeared in *14th ACM STOC Symp.* (1982), 147-152.

J. Hartmanis and N. Immerman, "On Complete Problems for NP Intersection CoNP," *12th International Conference on Automata, Languages and Programming,* Springer-Verlag Lecture Notes in Computer Science, No. 194 (1985), 250-259.

J. Hartmanis, N. Immerman and V. Sewelson, "Sparse Sets in NP-P: EXPTIME vs NEXPTIME,"*Information and Control* 65 (1985), 158-181. A preliminary version appeared in *15th ACM STOC Symp.* (1983), 382-391.

N. Immerman, "Upper and Lower Bounds for First Order Expressibility," *JCSS* 25 (1982), 76-98. A preliminary version appeared in *21st IEEE FOCS Symp.* (1980), 74-82.

N. Immerman, "Number of Quantifiers is Better Than Number of Tape Cells," *JCSS* 22 (1981), 384-406. A preliminary version appeared as, "Length of Predicate Calculus Formulas as a New Complexity Measure," *20th IEEE FOCS Symp.* (1979), 337-347.

J. Hartmanis, N. Immerman and S. Mahaney, "One-Way Log-tape Reductions," *19th IEEE FOCS Symp.* (1978), 65-72.

BOOKS

N. Immerman, *Descriptive Complexity*, 1999, Springer graduate texts in computer science. [This is a textbook on the study of the computational complexity of problems via the richness of logical languages needed to describe these problems. I am a prime developer of the area.]

N. Immerman and Ph. Kolaitis, editors, *Descriptive Complexity and Finite Models*, 1997, American Mathematical Society. [This is a collection of the revised versions of seven expository lectures that were given at the DIMACS workshop on Descriptive Complexity and Finite Models at Princeton in January, 1996. The topics reflect an effort to encourage connections with related fields of computer science, including other areas in the DIMACS special year in logic and algorithms.]

OTHER PUBLICATIONS

Marco Carmosino, Neil Immerman and Charles Jordan, "Experimental Descriptive Complexity", *Logic and Program Semantics: Essays Dedicated to Dexter Kozen on the Occasion of His 60th Birthday* 2012, R.L. Constable and A. Silva, eds., Springer LNCS 7230, 24-34.

Michael Crouch, Neil Immerman, and J. Eliot B. Moss, "Finding Reductions Automatically", in, *Fields of Logic and Computation:Essays Dedicated to Yuri Gurevich on the Occasion of His 70th Birthday*, A. Blass, N. Dershowitz, and W. Reisig, eds., (2010), Lecture Notes in Computer Science, volume 6300, Springer-Verlag, 117 - 136.

N. Immerman, "Progress in Descriptive Complexity," guest column, *Sigact News 36(4)* (2005), p. 24-35.

N. Immerman, "Computability and Complexity," in *Stanford Encyclopedia of Philosophy*, see http://plato.stanford.edu/entries/computability.

N. Immerman, "Computational Complexity Classes," *Supplement III Encyclopaedia of Mathematics*, 2001, ed. M. Hazewinkel, Kluwer Academic Publishers, 106-109.

N. Immerman, "Progress in Descriptive Complexity," guest column on Computational Complexity, EATCS Bulletin (Feb., 1999), 72-80. Also appeared in *Current Trends in theoretical Computer Science: Entering the 21st Century,* G. Paum, G. Rozenberg, and A. Salomaa, eds., 2001, World Scientific, 71-82.

N. Immerman, "Descriptive Complexity: A Logician's Approach to Computation," *Notices of the American Mathematical Society* 42(10) (1995), 1127 - 1133.

D.M. Barrington and N. Immerman, "Time, Hardware, and Uniformity," in *Complexity Theory Retrospective II,* L. Hemaspaandra and A. Selman, editors, 1997 Springer, 1-22. A preliminary version of this paper appeared in *IEEE Structure in Complexity Theory Symp.* (1994), 176- 185

N. Immerman, "DSPACE$[n^k]$ = VAR$[k+1]$," *Sixth IEEE Structure in Complexity Theory Symp.* (1991), 334-340, (invited paper).

N. Immerman and E. Lander, "Describing Graphs: A First-Order Approach to Graph Canonization," in *Complexity Theory Retrospective,* Alan Selman, ed., Springer-Verlag (1990), 59-81.

N. Immerman, "Complexity Classes," in *Annual Review of Computer Science,* Vol. 4 (1989-90), ed. Joseph Traub.

N. Immerman, "Descriptive and Computational Complexity," in *Computational Complexity Theory,* ed. J. Hartmanis, Lecture Notes for AMS Short Course on Computational Complexity Theory, *Proc. Symp. in Applied Math.* 38, American Mathematical Society (1989), 75-91.

N. Immerman, "Expressibility and Computational Complexity: Results and Directions," *Second IEEE Structure in Complexity Theory Symp.* (1987), 194-202, (invited paper).

N. Immerman, "First Order Expressibility as a New Complexity Measure," Ph.D. thesis, Cornell University Computer Science Department TR 80-432, 1980.

HONORS

I will be a Sackler Lecturer at The Mortimer and Raymond Sackler Institute of Advanced Studies, Tel-Aviv University, for the academic year 2016/2017.

Best paper award, ICAPS 2010.
Guggenheim Fellow, 2003 - 2004.
Fellow of the Association of Computing Machinery.
1995 Gödel prize, awarded by the European Association for Theoretical Computer Science and the ACM Special Interest Group in Automata and Computation Theory, shared with Robert Szelepcsényi.

GRANTS

P.I., NSF Research Grant in Theoretical Computer Science, 9/2011 – 8/2015
co-P.I., NSF Research Grant in Artificial Intelligence, 9/2009 – 8/2012
P.I., NSF Research Grant in Theoretical Computer Science, 8/2008 – 7/2010
P.I., NSF Research Grant in Program Analysis Science, 10/2005 – 9/2009
P.I., NSF Research Grant in Theoretical Computer Science, 6/2005 – 5/2008
P.I., NSF Research Grant in Theoretical Computer Science, 6/2002 – 5/2005
P.I., NSF Research Grant in Theoretical Computer Science, 8/99 – 12/2002
P.I., NSF Research Grant in Theoretical Computer Science, 7/95 – 12/99
P.I., NSF Research Grant in Theoretical Computer Science, 7/92 – 12/95
P.I., NSF Research Grant in Theoretical Computer Science, 8/90 – 12/92
P.I., NSF Research Grant in Theoretical Computer Science, 5/88 – 10/90
P.I., NSF Research Grant in Theoretical Computer Science, 7/86 – 7/88
NSF Postdoctoral Fellow, 6/83 – 5/86
P.I., NSF Research Grant in Theoretical Computer Science, 5/81 – 5/83

SERVICE to DISCIPLINE

program committees: Association for Symbolic Logic Annual Meeting, (2007)
Computer Science Logic, (1999, 2006, 2014)
LCC (co-chair, 2006)
IEEE Symp. on Logic in Computer Science, (1998, 2005, 2009, 2012, 2014, 2016, 2017)
Finite Model Theory Workshop, Bedlewo, Poland, (chair, 2003)
GandALF, (2011)
Int'l. Conf. Logic Programming, AI, and Reasoning, (2001,2010)
Principles of Database Systems, (1995, 2001)
Symposium on Theory of Computation, (1986, 1996)
Structure in Complexity Theory Conference, (1994, chair, 1991, 1989, 1987)
WoLLIC, (2012).

member: LCC Steering Committee, (2007 - 2010)
member: NSF Theory Panel, (2003, 2006, 2012), NSF NYI Panel, (1992), NSF RIA Panel, (1990), NSF Career Panel, (1995)
member: Advisory Board, Institute for Research in Cognitive Science, University of Pennsylvania, (1996 - 2000)

editor: Logical Methods in Computer Science, (2004 - present)

SIAM Journal on Computing, (2003 - 2015)

Chicago Journal of Theoretical Computer Science, (1994 - present)

Information and Computation, (1987 - 2004)

Journal of Symbolic Logic, (1996 - 1999)

Special Issue of JCSS for the Sixth Structures Symposium, (1991)

co-organizer: Workshop on Symmetry, Logic and Computation, Simons Institute, (Nov., 2016)

Workshop on Finite Models and Descriptive Complexity, DIMACS, (Jan., 1996)