Michael A. Bukatin

PUBLICATIONS

Papers in mathematics and computer science:

Michael Bukatin. Higher-order neuromorphic computations with linear streams (extended abstract). In: Online program of *CCC 2020: Continuity, Computability, Constructivity – From Logic to Algorithms*, September 2020. `ccc-2020:paper-6` ; `researchgate` ; `conference url`

***** Michael Bukatin and Jon Anthony. Dataflow Matrix Machines and V-values: a Bridge between Programs and Neural Nets. In Beáta Gyuris, Katalin Mády, and Gábor Recski, editors, *K + K = 120: Papers dedicated to László Kálmán and András Kornai on the occasion of their 60th birthdays*, Research Institute for Linguistics, Hungarian Academy of Sciences, 2017 (online), 2019 (paperback, pp.153-185). `arXiv:1712.07447`

***** Leonid Perlov and Michael Bukatin. Revisiting EPRL: All Finite-Dimensional Solutions by Naimark's Fundamental Theorem. *Annales Henri Poincaré* **18** (9) (2017) 3035-3048.

Michael Bukatin and Jon Anthony. Dataflow Matrix Machines as a Model of Computations with Linear Streams. In LearnAut 2017 ("Learning and Automata" Workshop at LICS 2017). `arXiv:1706.00648`

***** Michael Bukatin and Steve Matthews. Linear Models of Computation and Program Learning. In G.Gottlob, G.Sutcliffe and A.Voronkov, editors, GCAI 2015, *EasyChair Proceedings in Computing*, **36**, 66-78.

***** Michael Bukatin, Ralph Kopperman, and Steve Matthews. Some Corollaries of the Correspondence between Partial Metrics and Multivalued Equalities. *Fuzzy Sets and Systems* **256** (2014) 57-72.

Steve Matthews and Michael Bukatin. An Intelligent Theory of Cost for Partial Metric Spaces. In Joscha Bach et al, eds., Artificial General Intelligence: 5th International Conference, *Lecture Notes in Artificial Intelligence*, **7716**, 168-176, Springer, 2012.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. On the Nature of Correspondence between Partial Metrics and Fuzzy Equalities. In U.Höhle et al, editors, *33rd Linz Seminar on Fuzzy Set Theory: Enriched Category Theory and Related Topics (Abstracts),* Linz, Austria, February 14-18, 2012, Johannes Kepler Universität, Linz, pp. 9-12. `http://www.flll.jku.at/div/research/linz2012/LINZ2012Abstracts.pdf`

***** Michael Bukatin, Ralph Kopperman, Steve Matthews, and Homeira Pajoohesh. Partial Metric Spaces. *American Mathematical Monthly* **116** (2009) 708-718.

Michael Bukatin, Ralph Kopperman, Steve Matthews, and Homeira Pajoohesh. Partial Metrics and Quantale-valued Sets (Extended Abstract). In D.Cenzer et al, editors, *CCA 2006: Proceedings of the Third International Conference on Computability and Complexity in Analysis*, Informatik Berichte, **336** (09/2006), FernUniversitaet in Hagen, pp. 91-92.

***** Erik Rauch, Michael Bukatin, and Kenneth Baker. A Confidence-Based Framework for Disambiguating Geographic Terms. In A.Kornai and B.Sundheim, editors, *HLT-NAACL 2003 Workshop: Analysis of Geographic References*, 50-54, Asscociation for Computational Linguistics, 2003.

Michael A. Bukatin. Logic of Fixed Points and Scott Topology. *Topology Proceedings*, **26**, 2002, 433-468.

Michael A. Bukatin, Svetlana Yu. Shorina. On a Smyth Conjecture. *Topology Proceedings*, **24**, 1999, 57-70.

***** Michael A. Bukatin, Svetlana Yu. Shorina. Partial Metrics and Co-continuous Valuations. In M. Nivat, ed., Foundations of Software Science and Computation Structures, *Lecture Notes in Computer Science*, **1378**, 125-139, Springer, 1998.

***** Michael A. Bukatin, Joshua S. Scott. Towards Computing Distances between Programs via Scott Domains. In S. Adian, A. Nerode, eds., Logical Foundations of Computer Science, *Lecture Notes in Computer Science*, **1234**, 33-43, Springer, 1997.

Papers in computational chemistry:

Alexander A. Rashin, Michael A. Bukatin. A View of Thermodynamics of Hydration Emerging from Continuum Studies. *Biophysical Chemistry*, **51** (1994) 167-192.

A.A. Rashin, M.A. Bukatin, J. Andzelm, A.T. Hagler. Incorporation of Reaction Field Effects into Density Functional Calculations for Molecules of Arbitrary Shape in Solution. *Biophysical Chemistry*, **51** (1994) 375-392.

Alexander A. Rashin, Michael A. Bukatin. Magnitude of Hydration Entropies of Nonpolar and Polar Molecules. *The Journal of Physical Chemistry*, **98** (1994) 386-389.

Alexander A. Rashin, Michael A. Bukatin. Calculations of Hydration Entropies of Alkali and Halide Ions Based on the Continuum Approach. *The Journal of Physical Chemistry*, **97** (1993) 1974-1979.

Alexander A. Rashin, Michael A. Bukatin. Continuum-Based Calculations of Hydration Entropies and the Hydrophobic Effect. *The Journal of Physical Chemistry*, **95** (1991) 2942-2944.

Selected conference presentations: dataflow matrix machines and vector semantics

Michael Bukatin. *An overview of mathematical foundations of Transformer analysis.* A working presentation at the Hopf algebra reading seminar (Budapest, Hungary and online), November 2023. `github:anhinga/2023-notes/transformer-math`

***** Michael Bukatin. *Exploring synthesis of flexible neural machines with Zygote.jl.* A talk at JuliaCon 2023, Cambridge, MA, July 2023. `github:anhinga/DMM-synthesis-lab-journal/JuliaCon2023-talk`

***** Michael Bukatin. *Multiplying monochrome images as matrices: A*B and softmax.* A virtual poster presented at JuliaCon 2021, July 2021. `github:anhinga/JuliaCon2021-poster`

***** Michael Bukatin and Jon Anthony. *Dataflow Matrix Machines and V-values: a Bridge between Programs and Neural Nets.* IBM AI Systems Day 2018. Cambridge, MA, October 2018. `ibm-site:aisys18-bukatin.pdf`

Michael Bukatin and Jon Anthony. *Dataflow Matrix Machines as a Model of Computations with Linear Streams.* A poster at New England Machine Learning Day 2017. Cambridge, MA, May 2017.

Michael Bukatin and Jon Anthony. *Vector Space of Finite Prefix Trees for Dataflow Matrix Machines.* 51st Spring Topology and Dynamical Systems Conference. Jersey City, NJ, March 2017.

Michael Bukatin, Steve Matthews, and Andrey Radul. *Self-Referential Mechanism for Dataflow Matrix Machines and Generalized Recurrent Neural Networks.* New England Programming Languages and Systems Symposium, Northeastern University, Boston, Massachusetts, October 2016.

Michael Bukatin, Steve Matthews, and Andrey Radul. *Vector Semantics: from Partial Inconsistency and Bitopology to Recurrent Neural Networks and Self-referential Dataflow Matrix Machines.* 31st Summer Conference on Topology and Its Applications, Leicester, United Kingdom, August 2016.

Michael Bukatin and Steve Matthews. *Linear Models of Computation and Parametrization of Large Classes of Programs by Matrices.* New England Programming Languages and Systems Symposium, Tufts University, Medford, Massachusetts, November 2015.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Topics in Bicontinuity, Partial Inconsistency, and Vector Semantics.* Workshop on Categorical Aspects of Partial Metric Spaces, New York City, April 2015.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Progress Report on Partial Inconsistency, Bitopology, and Vector Semantics.* Conference on Computational Topology and Its Applications, Kent, Ohio, November 2014.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Partial Inconsistency and Vector Semantics: Sampling, Animation, and Program Learning.* 29th Summer Conference on Topology and Its Applications, Staten Island, New York, July 2014.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Partial Inconsistency and Bitopology.* 29th Summer Conference on Topology and Its Applications, Staten Island, New York, July 2014.

* Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Partial Inconsistency Landscape: an Overview.* 28th Summer Conference on Topology and Its Applications, North Bay, Ontario, July 2013.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Partial Inconsistency and Mathematics of Software.* CCNY Joint Math-CS Colloquium, New York City, April 2013.

Michael Bukatin. *Looking for Common Patterns.* Conference on Generalized Metrics for Limits, Computing, and More, New York City, April 2013.

Selected conference presentations: domains for denotational semantics and related topics

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Enrichment in Quantaloids: a Typed Enrichment for Categorical Description of Heterogeneous Spaces.* American Mathematical Society Fall Central Sectional Meeting, Special Session on a Survey of Lattice-Valued Mathematics and its Applications, Akron, Ohio, October 2012.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *Revisiting Partial Metrics and Measures on Domains.* Fall 2012 Fuzzy Symposium, Kent, Ohio, October 2012.

Michael Bukatin, Ralph Kopperman, and Steve Matthews. *On Duality between Metric and Logical Viewpoints.* 26th Summer Conference on Topology and Its Applications, New York City, July 2011.

Michael Bukatin, Ralph Kopperman, Steve Matthews, and Homeira Pajoohesh. *Partial Metrics and Fuzzy Equalities.* BLAST 2009 (Boolean Algebras, Lattice Theory, Algebra, Set Theory and Topology), Las Cruces, New Mexico, August 2009.

Michael Bukatin, Ralph Kopperman, Steve Matthews, and Homeira Pajoohesh. *Partial Metrics and Fuzzy Equalities.* 24th Summer Conference on Topology and Its Applications, Brno, Czech Republic, July 2009.

* Michael A. Bukatin, Svetlana Yu. Shorina. *Relaxed Metrics, Maximal Points, and Negative Information.* Mathematical Foundations of Programming Semantics XIV, London, May 1998.

Selected preprints and research notes:

Michael Bukatin. *Pondering Invariant Properties of Self-Modifying Systems.* February 2024.
`github:anhinga/2024-notes/research-notes`

* Michael Bukatin. *Towards practical use of dataflow matrix machines.* March 2021 - July 2023.
`anhinga.github.io/brandeis-mirror/towards-practical-dmms.pdf`

* Michael Bukatin. *Exploring non-anthropocentric aspects of AI existential safety.* April 2023.
`LessWrong:WJuASYDnhZ8hs5CnD`

* András Kornai, Michael Bukatin, and Zsolt Zombori. *Safety without alignment.* February 2023.
`arXiv:2303.00752`

Michael Bukatin. *Dataflow matrix machines: a collaborative research agenda.* September 2022.
`anhinga.github.io/brandeis-mirror/dmm-collaborative-research-agenda.pdf`

Michael Bukatin. *Synergy between AI-generating algorithms and dataflow matrix machines.* March 2020.
`github:anhinga/2020-notes/research-notes`

Michael Bukatin. *Using streams of probabilistic samples in neural machines.* January 2020. `same url`

Michael Bukatin. *DMMs for VR and worldmaking; a modest proposal on effects and qualia.* December 2019.
`github:anhinga/2019-design-notes/research-notes`

Michael Bukatin. *Dataflow matrix machines: duality between* **W** *and its input; shader-style non-linear component.* June 2019. `same url`

Michael Bukatin. *Regularization in intrinsically sparse networks: an experimental study.* Feb-March 2019. `github:anhinga/synapses/regularization.md`

DMM technical report 11-2018. *Dataflow matrix machines: recent experiments and notes for next steps.* November 2018. `github:jsa-aerial/DMM/technical-report-2018`

***** Michael Bukatin, Steve Matthews, and Andrey Radul. *Notes on Pure Dataflow Matrix Machines: Programming with Self-referential Matrix Transformations.* October 2016. `arXiv:1610.00831`

***** Michael Bukatin, Steve Matthews, and Andrey Radul. *Programming Patterns in Dataflow Matrix Machines and Generalized Recurrent Neural Nets.* June 2016. `arXiv:1606.09470`

***** Michael Bukatin, Steve Matthews, and Andrey Radul. *Dataflow matrix machines as programmable, dynamically expandable, self-referential generalized recurrent neural networks.* May 2016. `arXiv:1605.05296`

White papers:

Michael Bukatin. *Dataflow matrix machines: a white paper.* September 2022. `bukatin:dmm-white-paper-2022`

Dissertation in computer science:

***** Michael Bukatin. *Mathematics of Domains.* PhD thesis, Brandeis University, 2002. `arXiv:1512.03868`

Conference organizing:

Co-organizer of the special session on Topology + Asymmetric Structures, 32nd Summer Conference on Topology and its Applications, Dayton, Ohio, June 2017.

Co-organizer of the special session on Asymmetry and its Applications, 29th Summer Conference on Topology and its Applications, Staten Island, New York, July 2014.

Co-organizer of the special session on Asymmetric Topology, 28th Summer Conference on Topology and its Applications, North Bay, Ontario, July 2013.