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HEATHER MILLER

Citizenship

USA

Research Interests

Concurrent, distributed, eventually-consistent (edge computing), data-centric, and data-intensive (big data) programming, from the perspective of programming languages. I work on both theoretical ideas & implementations typically in and for the Scala programming language which seek to make it easier to build distributed systems.

Education

EPFL, *Lausanne, Switzerland* — *2009 – 2015*
Ph.D. in Computer Science
Advisor: Martin Odersky — *2011 – 2015*

University of Miami, *Coral Gables, FL* — *2006 – 2009*
BSEE in Electrical Engineering, Audio Engineering, *with honors, May 2009*

Cooper Union for the Advancement of Science and Art, *New York, NY* — *2004 – 2006*

Employment

Northeastern University, *Boston, MA, USA* — *9/2016 –*
Assistant Clinical Professor

Scala Center, EPFL, *Lausanne, Switzerland* — *10/2015 –*
Executive Director, Research Scientist (permanent)
Founded a new not-for-profit center dedicated to research, open source development, and education surrounding the Scala programming language.

Databricks, *Berkeley, CA, USA* — *8/2014 – 11/2014*
Research Intern
Supervisor: Matei Zaharia
Integrated Scala Pickling, our framework for fast, boilerplate-free, extensible serialization focused on distributed programming (OOPSLA'13,) into Spark.
Developed new function-passing programming model and framework, can be thought of as a generalization of Spark/MapReduce programming model (JFP'18).

Teaching Experience

Instructor, Designer, *Big Data Analysis with Scala and Spark* — *2017 –*
Popular Coursera MOOC on big data analysis using Spark. — *Coursera*

- General introduction to distributed systems for big data up through shuffling and optimizations like partitioning, as well as the basics of data analytics.
- Between March-November 2017, over 120,000 registered learners. Rated 4.6 out of 5 stars.

Instructor, Designer, *CS4240, Large-Scale Parallel Data Processing* *2017*
Northeastern University senior-level undergraduate course on big data processing, covering Spark, Hadoop, TensorFlow, amongst others. (~40 students) *Northeastern*

Instructor, Designer, *CS7680, Programming Models for Distributed Computation* *2016*
Northeastern University PhD-level course on programming models for distributed systems. (~20 students) *Northeastern*

Instructor, Co-Designer, *Reactive Programming & Parallelism* *2015 & 2016*
EPFL Undergraduate course on parallel, distributed, and asynchronous programming (90 – 150 students) *EPFL*

Lead, *Functional Programming Principles in Scala* *2012 – 2014*
Popular Coursera MOOC on functional programming in Scala, with >400,000 participants across iterations & largest completion rate for a course its size (~19%) *Coursera*

- Lead teaching staff organizing a team of graduate students, managing content production, designed course exercises with cloud-hosted grading, production of lecture videos, etc
- Created extensive course analysis with interactive visualizations; led to a publication at ICSE'14

(Lead) Teaching Assistant, *Programming Principles* *2011-2014*
Required EPFL undergraduate course on functional & logic programming (~160 students) *EPFL*

Book

Distributed Programming *MIT Press 2018/2019*
Heather Miller, Nat Dempkowski, James Larisch, Christopher Meiklejohn

A textbook about the building blocks we use to build distributed systems. These range from the small, RPC, futures, actors, to the large; systems built up of these components like MapReduce and Spark. We explore issues and concerns central to distributed systems like consistency, availability, and fault tolerance, from the lens of the programming models and frameworks that the programmer uses to build these systems.
Open Access (draft) Popular in the developer community, >2,200 stars on GitHub.

Publications

A Programming Model and Foundation for Lineage-Based Distributed Computation *JFP 2018 (to appear)*
Heather Miller, Philipp Haller, Normen Müller
Journal of Functional Programming
Special Issue: Programming Languages for Big Data

Simplicitly: Foundations and Applications of Implicit Function Types *POPL 2018*
Martin Odersky, Olivier Blanvillain, Fengyun Liu, Aggelos Biboudis
Heather Miller, Sandro Stucki
ACM SIGPLAN Symposium on Principles of Programming Languages

Function Passing: A Model for Typed, Distributed Functional Programming *SPLASH 2016*
Heather Miller, Philipp Haller, Normen Müller, Joceyln Boullier
ACM SIGPLAN International Symposium on New Ideas, New Paradigms, and Reflections on Programming & Software

Distributed Programming via Safe Closure Passing *PLACES 2015*
Philipp Haller, Heather Miller
Programming Language Approaches to Communication and Concurrency Centric Systems

Spores: A Type-Based Foundation for Closures in the Age of Concurrency and Distribution *ECOOP 2014*
Heather Miller, Philipp Haller, Martin Odersky
European Conference on Object Oriented Programming

Functional Programming For All! Scaling a MOOC for Students And Professionals Alike *ICSE 2014*
Heather Miller, Philipp Haller, Lukas Rytz, Martin Odersky
ACM SIGSOFT International Conference on Software Engineering

Instant Pickles: Generating Object-Oriented Pickler Combinators for Fast and Extensible Serialization *OOPSLA 2013*
Heather Miller, Philipp Haller, Eugene Burmako, Martin Odersky
ACM SIGPLAN Conference on Object Oriented Programming, Systems, Languages and Applications

RAY: Integrating Rx and Async for Direct-Style Reactive Streams *REM 2013*
Philipp Haller, Heather Miller
ACM SPLASH Workshop on Reactivity, Events and Modularity

FlowPools: A Lock-Free Deterministic Concurrent Dataflow Abstraction *LCPC 2012*
Aleksandar Prokopec, Heather Miller, Tobias Schlatter, Philipp Haller, Martin Odersky
International Workshop on Languages and Compilers for Parallel Computing
Invited to Revised Selected Papers on the 25th International Workshop on Languages and Compilers for Parallel Computing, Lecture Notes in Computer Science, Vol. 7760, 2013

Tools and Frameworks for Big Learning in Scala: Leveraging the Language for High Productivity and Performance *BigLearn 2011*
Heather Miller, Philipp Haller, Martin Odersky
NIPS Workshop on Parallel and Large-Scale Machine Learning

Parallelizing Machine Learning – Functionally: A Framework and Abstractions for Parallel Graph Processing *Scala 2011*
Philipp Haller, Heather Miller
Scala Workshop

Submitted/In Preparation

Monotonicity Types
Kevin Clancy, Heather Miller, Christopher Meiklejohn

The Essence of Coordination-Free Distributed Computation
Christopher Meiklejohn, Kevin Clancy, Heather Miller

Selected Tech Reports

The Function Passing Model: Types, Proofs, and Semantics
Philipp Haller, Normen Müller, Heather Miller
May 2016

Specialising Parsers for Queries
Manohar Jonnalagedda, Jorge Vicente Cantero, Heather Miller, Martin Odersky
April 2016

Improving Human-Compiler Interaction Through Customizable Type Feedback
Hubert Plociniczak, Heather Miller, Martin Odersky
December 2014

Self-Assembly: Lightweight Language Extension and Datatype Generic Programming, All-in-One!
Heather Miller, Philipp Haller, Bruno C. d. S. Oliveira
August 2014

Spores, Formally
Heather Miller, Philipp Haller
December 2013

FlowPools: A Lock-Free Deterministic Concurrent Dataflow Abstraction – Proofs
Aleksandar Prokopec, Heather Miller, Philipp Haller
June 2012

External Service

General Chair and/or Program Chair:

Curry On (**Curry On**) *2015, 2016, 2017, 2018*
Trends in Functional Programming in Education (**TFPIE**) *2018*
Scala Symposium (**Scala**) *2013, 2014, 2017*
Programming Models & Languages for Distributed Computation (**PMLDC**) *2016, 2017*

Organizing Committee Member:

Object-Oriented Programming, Systems, Languages & Applications (**OOPSLA**) *2018*
European Conference on Object-Oriented Programming (**ECOOP**) *2015 – 2018*

Program Committee Member:

International Conference on Functional Programming (**ICFP**) *2018*
Object-Oriented Programming, Systems, Languages & Applications (**OOPSLA**) *2017*
Off the Beaten Track (**OBT**) *2018*
Scala Symposium (**Scala**) *2016*
Symposium on Trends in Functional Programming (**TFP**) *2016*
Symposium on Applied Computing (**SAC**) *2016*

Programming Language Evolution (**PLE**) *2015*
Domain-Specific Language Design and Implementation (**DSLDI**) *2015*

External Review Committee Member:

PLDI 2018, ECOOP 2016, ECOOP 2013, Scala 2013

Artifact Evaluation Committee:

POPL 2015

Diversity & Outreach

Girls Code It: Intensive Pre-College Computer Science Program *Summer 2018*
Northeastern
Conceived of and am organizing large pre-college program aimed at preparing high school-aged girls for a career in Computer Science.

6 week-long residential program for 100 students which awards college credit and puts alumni of the program on an accelerated CS track upon matriculating at Northeastern University.

ScalaBridge Organizer
Organizer of free full-day workshops on the weekends aimed at teaching women and underrepresented minorities in computing how to think computationally and how to program in Scala.

ScalaBridge Chapters: Basel (CH), Zürich (CH), Copenhagen (DK), Boston (US).

Open Source

Scala Programming Language, *member of the Scala team* *2011 –*

- **Scala Spores** (Scala Improvement Proposal SIP-21), ***project lead***
  novel type-based abstraction for using closures safely in concurrent and distributed environments
- **Scala Pickling**, ***project lead***
  novel framework for fast, boilerplate-free, extensible serialization. Adopted by sbt, the most widely-used build tool for Scala. Popular open-source project on GitHub with >820 stars & dozens of contributors
- **Scala Futures & Promises** (Scala Improvement Proposal SIP-14), ***team member***
  unified non-blocking concurrency substrate for Scala, Akka, Play, and others
- **Scala Documentation**, ***creator, writer, lead maintainer***
  a central website for community-driven documentation for the Scala programming language and core libraries
- **Scaladoc**, ***co-maintainer***
  documentation tool for Scala's official API documentation

Honors

US National Science Foundation Graduate Research Fellowship *2011 – 2014*
EPFL Outstanding Teaching Award *2012*
EPFL Computer Science Fellowship *2009 – 2010*
Most Outstanding Audio Engineering Student, University of Miami *2009*
Most Outstanding Eta Kappa Nu Student, University of Miami *2009*
Information Technology Scholarship, University of Miami *2006 – 2009*

John Farina Family Scholarship, University of Miami	*2006 – 2009*
Eta Kappa Nu	*2008*
Tau Beta Pi	*2008*
SMART US Department of Defense Scholarship Alternate	*2007*
Cooper Union Full Tuition Scholarship	*2004 – 2006*

Selected Talks

What Happened to Distributed Programming Languages? — *Strange Loop & PWLConf 2017* **(invited)**
St. Louis, MO, USA. September 29, 2017

The Dramatic Consequences of the Open Source Revolution: Unrecognized Challenges & Some Modest Attempts at Solutions in Scala — *Devoxx 2017* **(invited)**
Paris, France. April 7, 2017

The Dramatic Consequences of the Open Source Revolution & How the Scala Center Hopes to Help — *Scala Exchange 2016* **(keynote)**
London, UK. December 9, 2016

Function Passing: A Model for Typed, Distributed Functional Programming — *SPLASH 2016*
Amsterdam, The Netherlands. November 2, 2016

Introducing the Scala Center — *Scala Days 2016* **(keynote)**
New York, NY, US. May 10, 2016 & Berlin, Germany. June 16, 2016
(total ~1700 attendees)

Function Passing Style: Typed, Distributed Functional Programming — *Strange Loop 2014*
St. Louis, MO, USA. September 19, 2014

Spores: A Type-Based Foundation for Closures in the Age of Concurrency and Distribution — *ECOOP 2014*
Uppsala, Sweden. August 1, 2014

Functional Programming For All! Scaling a MOOC for Students and Professionals Alike — *ICSE 2014*
Hyderabad, India. June 4, 2014

Academese to English: Scala's Type System, Dependent Types and What It Means To You — *NEScala 2014*
New York, NY, USA. March 1, 2014

Instant Pickles: Generating Object-Oriented Pickler Combinators for Fast and Extensible Serialization — *OOPSLA 2013*
Indianapolis, IN, USA. October 30, 2013

PL Abstractions for Distributed Programming: Pickle Your Spores! — *Indiana University* **(invited)**
Bloomington, IN, USA. October 25, 2013

Spores: Distributable Functions in Scala — *Strange Loop 2013*
St. Louis, MO, USA. September 19, 2013

Open Issues in Dataflow Programming — *LaME 2013* **(invited)**
Montpellier, France. July 1, 2013

Scala as a Research Tool — *ECOOP 2013 Tutorial*
Montpellier, France. July 1, 2013

On Pickles & Spores: Improving Scala's Support for Distributed Programming — *ScalaDays 2013*
New York, NY, USA. June 12, 2013

Futures & Promises in Scala 2.10 — *PhillyETE 2013* **(invited)**
Philadelphia, PA, USA. April 2, 2013

I am also a frequent speaker in industry, at industrial conferences, developer "meet-ups", and everything in between. Some such events include:

Scala World (9/2017, Lake District, UK), **Lambda Days** (5/2017, Lisbon, Portugal), **LxScala** (5/2017, Lisbon, Portugal), **Code Mesh** (11/2015, London, UK), **Scalar** (4/2015, Warsaw, Poland), **f(by)** (11/2014, Minsk, Belarus), **SF Scala** (11/2014, SF, USA), **Scalapeño** (9/2014, Tel Aviv, Israel), **SoundCloud TechTalks** (7/2014, Berlin, Germany), **Scala Days** (6/2014, Berlin, Germany), **NEScala** (3/2014, NYC, USA), amongst others.

External Activities

Scalawags Monthly Podcast, co-host — *2014 – 2016*

Students Supervised[1]

Kevin Clancy, *Eventual Consistency via Types*, PhD thesis — *2016 – Northeastern*

Joceyln Boullier, *Evaluating the Efficiacy of the Function Passing Model* M.Sc. thesis — *2/2016 – 8/2016 EPFL*

Jorge Vicente Cantero, *Implementing the Function Passing Model* B.Sc. thesis — *2/2016 – 6/2016 EPFL*

Louis Bliss, *Incremental Picklers for Scala Pickling* M.Sc. level, co-supervision with Philipp Haller — *9/2013 – 1/2014 EPFL*

Thaddée Yann Tyl, *Learning Scala Style* M.Sc. thesis — *2/2013 – 6/2013 EPFL*

Tobias Schlatter, *FlowSeqs: Barrier-Free ParSeqs* M.Sc. level, co-supervision w/ Philipp Haller & Aleksandar Prokopec — *9/2012 – 1/2013 EPFL*

Tobias Schlatter, *Multi-Lane FlowPools* M.Sc. level, co-supervision w/ Philipp Haller & Aleksandar Prokopec — *2/2012 – 6/2012 EPFL*

[1] At EPFL, research groups offer substantial projects for B.Sc./M.Sc. students to complete for credit. EPFL PhD students design and supervise these projects, as well as M.Sc. thesis projects.

Pierre Grydbeck, *Parallel Machine Learning: An Expectation Maximization Algorithm for Gaussian Mixture Models* — *2/2012 – 6/2012*
M.Sc. level, co-supervision with Philipp Haller — *EPFL*

Bruno Studer, *Parallel Machine Learning: Collaborative Filtering via Alternating Least Squares* — *2/2012 – 6/2012*
B.Sc. level, co-supervision with Philipp Haller — *EPFL*

Stanislav Peshterliev, *Parallel Natural Language Processing Algorithms in Scala* — *9/2011 – 1/2012*
M.Sc. level, co-supervision with Philipp Haller — *EPFL*

Olivier Blanvillain & Louis Bliss, *Parallelization of a Collaborative Filtering Algorithm with Menthor* — *9/2011 – 1/2012*
B.Sc. level, co-supervision with Philipp Haller — *EPFL*

Florian Gysin, *Improving Parallel Graph Processing Through the Introduction of Parallel Collections* — *9/2011 – 1/2012*
M.Sc. level, co-supervision with Philipp Haller — *EPFL*

Georges Discry, *Extending the Menthor Framework for Parallel Graph Processing to Distributed Computing* — *2/2011 – 6/2011*
M.Sc. level, co-supervision with Philipp Haller — *EPFL*

References

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