Jan-Willem van de Meent

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Research Overview

I work on probabilistic programming frameworks: libraries that provide building blocks for model development in data science, machine learning, and artificial intelligence. I am one of the creators of the Anglican, a probabilistic programming system that is closely integrated with Clojure. I am currently developing of Probabilistic Torch, a library for deep generative models that extends PyTorch.

Positions

Assistant Professor **2016 – present**
Northeastern University, College of Computer and Information Science,
Department of Electrical and Computer Engineering (*Affiliated Faculty*)

Research: Probabilistic programming, Bayesian machine learning, data science.

Postdoctoral Research Assistant **2013 – 2016**
University of Oxford, Engineering Science 2015 – 2016
Columbia University, Statistics 2013 – 2015

Advisor: Frank Wood
Research: Probabilistic programming, Monte Carlo methods, approximate inference.

Postdoctoral Research Fellow **2011 – 2013**
Columbia University, Applied Physics and Applied Mathematics & Chemistry

Advisors: Chris Wiggins and Ruben Gonzalez
Research: Machine learning for biophysics, approximate inference.
Funding: NWO Rubicon Fellowship (15%-20% funding rate, 83k EUR).

Education

PhD, Theoretical Physics **2010**
Leiden University and University of Cambridge
Advisors: Wim van Saarloos (*Leiden*) and Ray Goldstein (*Cambridge*)
Research: Theory and experiments on fluid mechanics of intracellular transport.

MSc, Physics (Cum Laude) **2006**
Leiden University
Advisors: Wim van Saarloos and Martin van Hecke
Research: Physics of granular materials. Computational fluid dynamics.

Service

Senior Program Committee
PROBPROG International Conference on Probabilistic Programming (*co-chair*) 2018 – 2019

Organizing Committee
POPL Workshop on Probabilistic Programming Semantics 2018
IJCAI Workshop on Declarative Learning based Programming 2017
NIPS Workshop on Black Box Learning and Inference 2015

Program Committee
Neural Information Processing Systems 2013 – 2018
Artificial Intelligence and Statistics 2014 – 2019
International Conference on Machine Learning 2015 – 2019
AAAI Conference on Artificial Intelligence 2017 – 2019
International Conference on Learning Representations 2018 – 2019
Machine Learning for Healthcare 2018 – 2019

Grant Reviewing
National Science Foundation (*2 panels, 1 ad-hoc review*) 2017 – 2018

Khoury College
MS Data Science Committee 2018 – 2019
Graduate Admissions Committee (*Organized Open House in Spring 2017*) 2016 – 2018

Awards

NIPS Top 10% Reviewer Award 2018
ICML Exceptional Reviewer Award 2015
NWO Rubicon Fellowship (15%-20% *funding rate*, 83k EUR) 2011
Publication in J. Fluid Mech. featured in accompanying viewpoint. 2010
Publication in Phys. Rev. Lett. featured in Research Highlights section of Nature 2008
Publication featured on cover of PNAS (a top-3 journal in the biological sciences) 2008

Advising

Northeastern University	**2016 – present**
PhD Advisees	
Jered McInerney (*joint with Byron Wallace*)	2018 – present
Iris Seaman	2018 – present
Eli Sennesh (*joint with Lisa Feldman Barrett*)	2018 – present
Heiko Zimmermann	2018 – present
Babak Esmaeli	2017 – present
Hao Wu	2017 – present
Undergraduate Advisees	
Matthew Mage	2018 – present
Maha Alkhairy	2016 – 2017
External Advisees	
Franklin Huang (*Viewpoint High School, Calabasas, CA*)	2017 – 2018
PhD Committee	
Alican Bozkurt (*advisors: Jennifer Dy and Dana Brooks*)	2019 – present
Yijia Gu (*advisor: Thomas Wahl*)	2017 – present
Oxford University (Informal)	**2013 – 2016**
Tom Rainforth (*DPhil*)	2014 – 2016
Yura Perov (*MScR*)	2014 – 2015
Dave Janz (*MEng*)	2014 – 2015
Columbia University (Informal)	**2011 – 2013**
Sakellarios Zairis (*PhD*)	2011 – 2013
Kevin Emmett (*PhD*)	2011 – 2013

Teaching

CS 7140 Advanced Machine Learning **Spring 2019**
Enrollment: ∼25.

DS 5230 Unsupervised Machine Learning and Data Mining **Fall 2018**
Enrollment: 27. *Overall instructor teaching effectiveness rating:* 4.1 / 5.0

CS 7140 Advanced Machine Learning **Spring 2018**
Enrollment: 22. *Overall instructor teaching effectiveness rating:* 4.5 / 5.0

CS 6220 Data Mining Techniques **Spring 2017**
Enrollment: 19. *Overall instructor teaching effectiveness rating:* 4.2 / 5.0

CS 6220 Data Mining Techniques **Fall 2016**
Enrollment: 5. *Overall instructor teaching effectiveness rating:* 4.0 / 5.0

Funding

NCS-FO: Leveraging Deep Probabilistic Models to Understand the Neural Bases of Subjective Experience **2018 – 2021**
Source: National Science Foundation (Award #1835309)
Role: Principal Investigator
Co-PIs: Ajay Satpute, Benjamin Hutchinson, Jennifer Dy, Sarah Ostaddabas
Amount: ∼$999k (Total), ∼$333k (van de Meent)

Design and Evaluation of Deep Probabilistic Programs **2018 – 2021**
Source: Intel Corporation (Gift)
Role: Principal Investigator
Amount: ∼$240k

Interpretable and Explainable Deep Learning for Health **2018 – 2021**
Source: 3M Corporation (Sponsored Research)
Role: Principal Investigator
Amount: ∼$172k

Leveraging Deep Learning to Model Inter-Subject Variation in fMRI Studies **2017 – 2018**
Source: Northeastern University (Tier 1)
Role: Principal Investigator
Co-PI: Ajay Satpute
Amount: ∼$50k

Cold Spray **2017 – 2018**
Source: Army Research Laboratory
Role: Subcontractor
Amount: ∼$80k

Pending Proposals

Probabilistic Label-Efficient Deep Generative Structures (PLEDGES)
Source: Defense Advanced Research Projects Agency
Role: Primary Investigator (*for Northeastern*)
Lead: Charles River Analytics
Co-PIs: Byron Wallace (*Khoury*), Deniz Erdogmus (*ECE*), Stratis Ioannidis (*ECE*), Xue Lin (*ECE*), Frank Wood (*UBC*), Leon Sigal (*UBC*), Regina Barzilay (*MIT*), Alexander Rush (*Harvard*), Sameer Singh (*UCI*).
Amount: ∼$3,149k (Northeastern Total), ∼$945k (van de Meent)

RI: Medium: Learning Disentangled Representations for Text to Aid Interpretability and Transfer
Source: National Science Foundation
Role: Co-Principal Investigator
Co-PI: Byron Wallace (*Contact PI*)
Amount: ∼$1,200k (Total), ∼$600k (van de Meent)

Compositional Methods for Amortized Inference in Neural Probabilistic Programs
Source: Oracle Corporation
Role: Principal Investigator
Amount: ∼$300k

SCH: INT: Collaborative Research: Targeted Neural Text Summarization of Electronic Medical Records to Improve Imaging Diagnosis
Source: National Science Foundation
Role: Co-Principal Investigator
Co-PIs: Byron Wallace (*Contact PI*), Geoffrey Young (*Brigham Women's Hospital*)
Amount: ∼$553k (Northeastern), ∼$100k (van de Meent)

Publications

Preprint

[1] **J.-W. van de Meent**, B. Paige, H. Yang, and F. Wood. "An Introduction to Probabilistic Programming". In: *arXiv:1809.10756 [cs, stat]* (2018).

[2] I. R. Seaman, **J.-W. van de Meent**, and D. Wingate. "Modeling Theory of Mind for Autonomous Agents with Probabilistic Programs". In: *arXiv:1812.01569 [cs]* (2018).

[3] T. Rainforth, Y. Zhou, X. Lu, Y. W. Teh, F. Wood, H. Yang, and **J.-W. van de Meent**. "Inference Trees: Adaptive Inference with Exploration". In: *arXiv:1806.09550 [stat]* (2018).

Conference

[1] B. Esmaeili, H. Huang, B. C. Wallace, and **J.-W. van de Meent**. "Structured Neural Topic Models for Reviews". In: *Artificial Intelligence and Statistics* (2019).

[2] B. Esmaeili, H. Wu, S. Jain, A. Bozkurt, N. Siddharth, B. Paige, D. H. Brooks, J. Dy, and **J.-W. van de Meent**. "Structured Disentangled Representations". In: *Artificial Intelligence and Statistics* (2019).

[3] S. Jain, E. Banner, **J.-W. van de Meent**, I. J. Marshall, and B. C. Wallace. "Learning Disentangled Representations of Texts with Application to Biomedical Abstracts". In: *Proceedings of the 2018 Conference on Empirical Methods in Natural Language Processing*. 2018.

[4] N. Siddharth*, B. Paige*, **J.-W. van de Meent***, A. Desmaison, N. D. Goodman, P. Kohli, F. Wood, and P. Torr. "Learning Disentangled Representations with Semi-Supervised Deep Generative Models". In: *Advances in Neural Information Processing Systems 30*. Ed. by I. Guyon, U. V. Luxburg, S. Bengio, H. Wallach, R. Fergus, S. Vishwanathan, and R. Garnett. 2017, pp. 5927–5937.

[5] D. Tolpin, **J.-W. van de Meent**, H. Yang, and F. Wood. "Design and Implementation of Probabilistic Programming Language Anglican". In: *Proceedings of the 28th Symposium on the Implementation and Application of Functional Programming Languages*. IFL 2016. Leuven, Belgium: ACM, 2016, 6:1–6:12.

[6] T. Rainforth, T. A. Le, **J.-W. van de Meent**, M. A. Osborne, and F. Wood. "Bayesian Optimization for Probabilistic Programs". In: *Advances in Neural Information Processing Systems*. 2016, pp. 280–288.

[7] T. Rainforth, C. A. Naesseth, F. Lindsten, B. Paige, **J.-W. van de Meent**, A. Doucet, and F. Wood. "Interacting Particle Markov Chain Monte Carlo". In: *Proceedings of The 33rd International Conference on Machine Learning*, 2016, pp. 2616–2625.

[8] **J.-W. van de Meent**, B. Paige, D. Tolpin, and F. Wood. "Black-Box Policy Search with Probabilistic Programs". In: *Proceedings of the 19th International Conference on Artificial Intelligence and Statistics* (2016), pp. 1195–1204.

[9] D. Tolpin, **J.-W. van de Meent**, B. Paige, and F. Wood. "Output-Sensitive Adaptive Metropolis-Hastings for Probabilistic Programs". English. In: *Machine Learning and Knowledge Discovery in Databases*. Ed. by A. Appice, P. P. Rodrigues, V. Santos Costa, J. Gama, A. Jorge, and C. Soares. Vol. 9285. Lecture Notes in Computer Science. Springer International Publishing, 2015, pp. 311–326.

[10] **J.-W. van de Meent**, H. Yang, V. Mansinghka, and F. Wood. "Particle Gibbs with Ancestor Sampling for Probabilistic Programs". In: *Artificial Intelligence and Statistics*. 2015.

[11] F. Wood, **J.-W. van de Meent**, and V. Mansinghka. "A new approach to probabilistic programming inference". In: *Artificial Intelligence and Statistics*. 2014, pp. 1024–1032.

[12] **J.-W. van de Meent**, J. E. Bronson, F. Wood, R. L. Gonzalez, and C. H. Wiggins. "Hierarchically-coupled hidden Markov models for learning kinetic rates from single-molecule data". In: *Proceedings of the 30th International Conference on Machine Learning* 28.2 (2013), pp. 361–369.

Workshop

[1] E. Sennesh, A. Ścibior, H. Wu, and **J.-W. van de Meent**. "Model and Inference Combinators for Deep Probabilistic Programming". In: *POPL Workshop on Languages for Inference (LAFI)*. 2019.

[2] A. Bozkurt, B. Esmaeli, D. H. Brooks, J. Dy, and **J.-W. van de Meent**. "Can VAEs Generate Novel Examples?" In: *NeurIPS Workshop on Critiquing and Correcting Trends in Machine Learning*. 2018.

[3] E. Sennesh, A. Ścibior, H. Wu, and **J.-W. van de Meent**. "Composing Modeling and Inference Operations with Probabilistic Program Combinators". In: *NeurIPS BNP Workshop*. 2018.

[4] E. Sennesh, H. Wu, and **J.-W. van de Meent**. "Combinators for Modeling and Inference". In: *International Conference on Probabilistic Programming (PROBPROG)*. 2018.

[5] D. Janz, B. Paige, T. Rainforth, **J.-W. van de Meent**, and F. Wood. "Probabilistic structure discovery in time series data". In: *NIPS 2016 workshop on Artificial Intelligence for Data Science* (2016).

[6] **J.-W. van de Meent**, B. Paige, D. Tolpin, and F. Wood. "An Interface for Black Box Learning in Probabilistic Programs". In: *POPL Workshop on Probabilistic Programming Semantics*. 2016.

[7] T. Rainforth, **J.-W. van de Meent**, and F. Wood. "Bayesian Optimization for Probabilistic Programs (2015), NIPS workshop on Black Box Learning and Inference". In: *NIPS Workshop on Black Box Learning and Inference*. 2015.

[8] D. Tolpin, B. Paige, **J.-W. van de Meent**, and F. Wood. "Path Finding under Uncertainty through Probabilistic Inference". In: *Proceedings of the 25th International Conference on Automated Planning and Scheduling, Workshop on Planning and Learning (ICAPS WPAL)*. 2015, p. 1502.07314.

[9] **J.-W. van de Meent**, H. Yang, and F. Wood. "Particle Gibbs with Ancestor Resampling for Probabilistic Programs". In: *3rd NIPS Workshop on Probabilistic Programming*. 2014.

Journal

[1] K. J. Emmett, J. K. Rosenstein, **J.-W. van de Meent**, K. L. Shepard, and C. H. Wiggins. "Statistical Inference for Nanopore Sequencing with a Biased Random Walk Model". In: *Biophysical Journal* 108 (April 2015), pp. 1852–1855.

[2] S. Johnson, **J.-W. van de Meent**, R. Phillips, C. H. Wiggins, and M. Linden. "Multiple LacI-mediated loops revealed by Bayesian statistics and tethered particle motion". In: *Nucleic Acids Research* (2014).

[3] A. R. Gansell, **J. W. van de Meent**, S. Zairis, and C. H. Wiggins. "Stylistic clusters and the Syrian/South Syrian tradition of first-millennium BCE Levantine ivory carving: A machine learning approach". In: *Journal of Archaeological Science* 44 (2014), pp. 194–205.

[4] **J.-W. van de Meent**, J. E. Bronson, C. H. Wiggins, and R. L. Gonzalez. "Empirical Bayes methods enable advanced population-level analyses of single-molecule FRET experiments." In: *Biophysical journal* 106.6 (2014), pp. 1327–37.

[5] **J.-W. van de Meent**, A. J. Sederman, L. F. Gladden, and R. E. Goldstein. "Measurement of cytoplasmic streaming in single plant cells by magnetic resonance velocimetry". In: *Journal of Fluid Mechanics* 642 (2010), pp. 5–14.

[6] E. Sultan, **J.-W. van de Meent**, E. Somfai, A. N. Morozov, and W. van Saarloos. "Polymer rheology simulations at the meso- and macroscopic scale". In: *Europhysics Letters* 90.6 (2010), p. 64002.

[7] **J.-W. van de Meent**, I. Tuval, and R. Goldstein. "Nature's Microfluidic Transporter: Rotational Cytoplasmic Streaming at High Péclet Numbers". In: *Physical Review Letters* 101.17 (2008), p. 178102.

[8] R. E. Goldstein, I. Tuval, and **J.-W. van de Meent**. "Microfluidics of cytoplasmic streaming and its implications for intracellular transport." In: *Proceedings of the National Academy of Sciences of the United States of America* 105.10 (2008), pp. 3663–7.

[9] **J.-W. van de Meent**, A. Morozov, E. Somfai, E. Sultan, and W. van Saarloos. "Coherent structures in dissipative particle dynamics simulations of the transition to turbulence in compressible shear flows". In: *Physical Review E* 78.1 (2008), p. 015701.

[10] D. Fenistein, **J.-W. van de Meent**, and M. van Hecke. "Core Precession and Global Modes in Granular Bulk Flow". In: *Physical Review Letters* 96.11 (2006), p. 118001.

[11] D. Fenistein, **J.-W. van de Meent**, and M. van Hecke. "Universal and Wide Shear Zones in Granular Bulk Flow". In: *Physical Review Letters* 92.9 (2004), p. 094301.

Tech Report

[1] **J.-W. van de Meent**, B. Paige, and F. Wood. "Tempering by Subsampling". In: *ArXiv e-prints* (2014).

Patent

[1] F. Wood, T. B. Paige, V. K. Mansinghka, **J.-W. van de Meent**, and L. Perov. *Methods and devices for executing program code of a probabilistic programming language.* US Patent App. 15/126,916. 2017.

Talks

Design and Evaluation of Deep Probabilistic Programs
Intel, Uber AI Labs, 2018

Integrating Deep Learning and Probabilistic Programming
3M Corporation, Northeastern Robotics Reading Group, 2018

Structured Disentangled Representations
Northeastern SPIRAL Seminar (invited talk), 2018
https://www.ccs.neu.edu/home/jwvdm/slides/hfvae-neu.pdf

Probabilistic Programming for Planning as Inference Problems
AAAI workshop on Planning and Inference (invited talk), 2018
https://www.ccs.neu.edu/home/jwvdm/slides/bbps-aaai.pdf

Semi-Supervised Learning of Disentangled Representations
Oracle, UMass Amherst, Amazon, MIT, 2017

Inference and Learning for Probabilistic Programs
Columbia, Toronto, Amherst, Northeastern, Tufts, Cambridge, MIT, 2016
http://www.ccs.neu.edu/home/jwvdm/slides/inference-learning-prob-prog/

Black Box Policy Search with Probabilistic Programs
NIPS workshop on Black Box Learning and Inference 2015.

Particle Gibbs with Ancestor Sampling for Probabilistic Programs
Oxford, Berkeley, Stanford, Google DeepMind, 2015
NIPS Probabilistic Programming Workshop 2014
http://www.ccs.neu.edu/home/jwvdm/slides/pgas-nips-pp-workshop-2014/
https://www.youtube.com/watch?v=TsarkYeDLW0

Anglican: A Probabilistic Programming Language for Forward Inference
Oxford, Microsoft Research Cambridge, 2014

Anglican: A Church-of-England Venture
Analog Devices, Cambridge, 2013

Learning Kinetic Models from Single-Molecule Experiments
International Conference on Machine Learning, 2013
American Physical Society March Meeting, 2013
http://bit.ly/1TntySJ

Using coupled hidden Markov models to learn about biomolecular mechanics
Yahoo Research, San Jose, 2013
Nijmegen, 2013

Learning Kinetic Rates from Ensembles of Single-Molecule Time Series
McGill, Berkeley, 2012

Hierarchical Inference on Single-Molecule Time Series
NIPS Computational Biology Workshop, 2011