# Michael W. Dusenberry

**Research Engineer** Google DeepMind Mountain View, CA

Education

**B.S.** Computer Science (Minor, Chemistry) Appalachian State University, Boone, NC

Summa cum laude (4.0 major, 3.98 cumulative) Outstanding Senior in Computer Science Award

M.D. Candidate

Aug 2012 - (May 2014)The Brody School of Medicine at East Carolina University, Greenville, NC

Completed the first two years of the M.D. degree before leaving.

# Experience

| Senior Research Engineer  | May 2023–                      |
|---|--------------------------------|
| Research Engineer   | June 2021 – May 2023           |
| Google DeepMind (formerly Google Brain), Mountain View, CA                |                                |
| Senior research engineer focused on reliable A(G)I at scale (neural nets, | probability, decisions, uncer- |
| tainty, scalability to multiple hosts w/ multiple devices).               |                                |

### **Research Engineer**

### Google Cloud AI Research, Sunnyvale, CA

Research software engineer focused on Bayesian deep learning research and engineering, with applications to healthcare (including COVID case predictions) and other high-stakes industries.

**AI Resident** Google Brain & Google Health Research, Mountain View, CA

AI Resident focused on research in Bayesian deep learning and medicine.

### Committer & PMC Member, Apache SystemML The Apache Software Foundation

Committer & PMC member for the open-source project, Apache SystemML.

| Machine Learning Advisory Software Engineer                       | July 2017 – June 2018 |
|---|-----------------------|
| Machine Learning Software Engineer                                | May 2015 – July 2017  |
| IBM Center for Open-source Data & AI Technologies, San Francisco, | CA                    |

Machine learning engineer focused on deep learning research in medicine, and research in distributed systems for machine learning with Python, Scala, TensorFlow, Apache SystemML, and Apache Spark. Joined as part of the initial founding team and helped build the center from the ground up. In July 2017, my responsibilities expanded to include an advisory role for other machine learning projects within the center, as well as the leadership of small teams.

**Researcher**, Department of Emergency Medicine May 2013 – Feb 2017 The Brody School of Medicine at East Carolina University, Greenville, NC

dusenberrymw@google.com https://github.com/dusenberrymw https://linkedin.com/in/mikedusenberry

Aug 2008 – May 2012

July 2020 - June 2021

June 2018 - July 2020

Nov 2015-

Student researcher building and evaluating the use of custom neural networks (Python, Octave/MATLAB) as a machine learning approach to predicting outcomes in complex clinical cases in the emergency department, under the guidance of Dr. Kori Brewer, Ph.D. and Dr. Charles Brown, M.D. Project started during the M1 summer session as part of the Brody School of Medicine "Summer Scholars Student Research Program". Presented posters at the Brody School of Medicine Medical Student Research Day (2013), and the North Carolina Medical Society Scientific Poster Conference (2013). Primary author on a paper published in the American Journal of Emergency Medicine (2017).

#### Researcher, Department of Computer Science Appalachian State University, Boone, NC

Aug 2011 – Aug 2012

# Recruited from within the CS department, along with two graduate stude

Recruited from within the CS department, along with two graduate students, to form a research team for building and evaluating the use of online, automatically-grading software systems for use in CS classes.

## Publications

### Preprints

- 1. Gemini Team. Gemini: A Family of Highly Capable Multimodal Models. arXiv:2312.11805, 2023. http://arxiv.org/abs/2312.11805.
- Benoit Dherin, Huiyi Hu, Jie Ren, Michael W. Dusenberry, and Balaji Lakshminarayanan. Morse Neural Networks for Uncertainty Quantification. *ICML Workshop on Structured Probabilistic Inference* & Generative Modeling, 2023. http://arxiv.org/abs/2307.00667.
- 3. Dustin Tran, Jeremiah Liu, **Michael W. Dusenberry**, Du Phan, Mark Collier, Jie Ren, Kehang Han, Zi Wang, Zelda Mariet, Huiyi Hu, Neil Band, Tim G. J. Rudner, Karan Singhal, Zachary Nado, Joost van Amersfoort, Andreas Kirsch, Rodolphe Jenatton, Nithum Thain, Honglin Yuan, Kelly Buchanan, Kevin Murphy, D. Sculley, Yarin Gal, Zoubin Ghahramani, Jasper Snoek, and Balaji Lakshminarayanan. Plex: Towards Reliability using Pretrained Large Model Extensions. *ICML Workshop on Pre-Training, ICML Workshop on PODs*, 2022. http://arxiv.org/abs/2207.07411.
- 4. E. Kelly Buchanan, Michael W Dusenberry, Jie Ren, Kevin Patrick Murphy, Balaji Lakshminarayanan, and Dustin Tran. Reliability benchmarks for image segmentation. *NeurIPS Workshop on Distribution Shifts*, 2022. https://openreview.net/forum?id=T6QZmBPlfv6.
- 5. Zachary Nado, Neil Band, Mark Collier, Josip Djolonga, Michael W. Dusenberry, Sebastian Farquhar, Angelos Filos, Marton Havasi, Rodolphe Jenatton, Ghassen Jerfel, Jeremiah Liu, Zelda Mariet, Jeremy Nixon, Shreyas Padhy, Jie Ren, Tim G. J. Rudner, Yeming Wen, Florian Wenzel, Kevin Murphy, D. Sculley, Balaji Lakshminarayanan, Jasper Snoek, Yarin Gal, and Dustin Tran. Uncertainty Baselines: Benchmarks for Uncertainty & Robustness in Deep Learning. arXiv:2106.04015, 2021. http://arxiv.org/abs/2106.04015.
- Jeremy Nixon, Michael W. Dusenberry, Linchuan Zhang, Ghassen Jerfel, and Dustin Tran. Measuring calibration in deep learning. arXiv:1904.01685, 2019. https://arxiv.org/abs/1904.01685.
- Niketan Pansare, Michael W. Dusenberry, Nakul Jindal, Matthias Boehm, Berthold Reinwald, and Prithviraj Sen. Deep learning with Apache SystemML. SysML, 2018. https://arxiv.org/abs/1802. 04647.
- 8. Michael W. Dusenberry and Fei Hu. Deep learning for breast cancer mitosis detection. 2018.

#### Journals & Conferences

- James Urquhart Allingham, Jie Ren, Michael W. Dusenberry, Jeremiah Zhe Liu, Xiuye Gu, Yin Cui, Dustin Tran, and Balaji Lakshminarayanan. A Simple Zero-shot Prompt Weighting Technique to Improve Prompt Ensembling in Text-Image Models. In Proc. of International Conference on Machine Learning (ICML), 2023. http://arxiv.org/abs/2302.06235.
- Ruoxi Sun, Chun-Liang Li, Sercan O. Arik, Michael W. Dusenberry, Chen-Yu Lee, and Tomas Pfister. Neural Spline Search for Quantile Probabilistic Modeling. In Proc. of AAAI Conference on Artificial Intelligence (AAAI), 2023. http://arxiv.org/abs/2301.04857.
- Neil Band, Tim G. J. Rudner, Qixuan Feng, Angelos Filos, Zachary Nado, Michael W. Dusenberry, Ghassen Jerfel, Dustin Tran, and Yarin Gal. Benchmarking Bayesian Deep Learning on Diabetic Retinopathy Detection Tasks. In Proc. of Neural Information Processing Systems (NeurIPS), 2021. http://arxiv.org/abs/2211.12717.
- 12. Sercan Ö. Arık, Joel Shor, Rajarishi Sinha, Jinsung Yoon, Joseph R. Ledsam, Long T. Le, Michael W. Dusenberry, Nathanael C. Yoder, Kris Popendorf, Arkady Epshteyn, Johan Euphrosine, Elli Kanal, Isaac Jones, Chun-Liang Li, Beth Luan, Joe Mckenna, Vikas Menon, Shashank Singh, Mimi Sun, Ashwin Sura Ravi, Leyou Zhang, Dario Sava, Kane Cunningham, Hiroki Kayama, Thomas Tsai, Daisuke Yoneoka, Shuhei Nomura, Hiroaki Miyata, and Tomas Pfister. A prospective evaluation of AI-augmented epidemiology to forecast COVID-19 in the USA and Japan. *npj Digital Medicine*, 2021. https://doi.org/10.1038/s41746-021-00511-7.
- Yeming Wen, Ghassen Jerfel, Rafael Muller, Michael W. Dusenberry, Jasper Snoek, Balaji Lakshminarayanan, and Dustin Tran. Combining Ensembles and Data Augmentation can Harm your Calibration. In Proc. of International Conference on Learning Representations (ICLR), 2021. https: //arxiv.org/abs/2010.09875.
- Michael W. Dusenberry, Ghassen Jerfel, Yeming Wen, Yi-an Ma, Jasper Snoek, Katherine Heller, Balaji Lakshminarayanan, and Dustin Tran. Efficient and scalable bayesian neural nets with rank-1 factors. In Proc. of International Conference on Machine Learning (ICML), 2020. http://arxiv. org/abs/2005.07186.
- Michael W. Dusenberry, Dustin Tran, Edward Choi, Jonas Kemp, Jeremy Nixon, Ghassen Jerfel, Katherine Heller, and Andrew M. Dai. Analyzing the role of model uncertainty for electronic health records. In Proc. of ACM Conference on Health, Inference, and Learning (ACM CHIL), 2020. https: //arxiv.org/abs/1906.03842.
- Edward Choi, Zhen Xu, Yujia Li, Michael W. Dusenberry, Gerardo Flores, Yuan Xue, and Andrew M. Dai. Graph convolutional transformer: Learning the graphical structure of electronic health records. In Proc. of Association for the Advancement of Artificial Intelligence (AAAI), 2020. https://arxiv.org/abs/1906.04716.
- Dustin Tran, Michael W. Dusenberry, Mark van der Wilk, and Danijar Hafner. Bayesian Layers: A module for neural network uncertainty. In Proc. of Neural Information Processing Systems (NeurIPS), 2019. https://arxiv.org/abs/1812.03973.
- Michael W. Dusenberry, Charles K Brown, and Kori L Brewer. Artificial neural networks: Predicting head CT findings in elderly patients presenting with minor head injury after a fall. *The American Journal of Emergency Medicine*, 2017. https://doi.org/10.1016/j.ajem.2016.10.065.
- Matthias Boehm, Michael W. Dusenberry, Deron Eriksson, Alexandre V Evfimievski, Faraz Makari Manshadi, Niketan Pansare, Berthold Reinwald, Frederick R Reiss, Prithviraj Sen, Arvind C Surve, and Shirish Tatikonda. SystemML: Declarative machine learning on Spark. In *Proc. of the VLDB Endowment*, 2016. https://doi.org/10.14778/3007263.3007279.

### Software

| 1. | Uncertainty Baselines: Benchmarks for Uncertainty & Robustness in Deep Learning                | 2021   |
|----|--|--------|
|    | Zachary Nado, Neil Band, Mark Collier, Josip Djolonga, Michael W. Dusenberry, Sebastian        | Far-   |
|    | quhar, Angelos Filos, Marton Havasi, Rodolphe Jenatton, Ghassen Jerfel, Jeremiah Liu, Zelda Ma | ariet, |
|    | Jeremy Nixon, Shreyas Padhy, Jie Ren, Tim G. J. Rudner, Yeming Wen, Florian Wenzel, Kevin      | Mur-   |
|    | phy, D. Sculley, Balaji Lakshminarayanan, Jasper Snoek, Yarin Gal, Dustin Tran                 |        |
|    |  |        |

| 2 | 2. Bayesian Layers: A module for neural network uncertainty            | 2018 |
|---|--|------|
|   | Dustin Tran, Michael W. Dusenberry, Mark van der Wilk, Danijar Hafner. |      |

- 3. SystemML-NN: A deep learning library for Apache SystemML 2016 Michael W. Dusenberry
- 4. SystemML: Declarative machine learning on Spark 2015 Matthias Boehm, **Michael W. Dusenberry**, Deron Eriksson, Alexandre V Evfimievski, Faraz Makari Manshadi, Niketan Pansare, Berthold Reinwald, Frederick R Reiss, Prithviraj Sen, Arvind C Surve, and Shirish Tatikonda.

### Talks

| 1.  | Cohere For AI: Technical Talks, Virtual (YouTube)<br>Plex: Towards Reliability using Pretrained Large Model Extensions                      | Aug 31, 2022           |
|-----|---|------------------------|
| 2.  | ACM Conference on Health, Inference, and Learning (ACM CHIL), Virtual Analyzing the Role of Model Uncertainty for Electronic Health Records | July 24, 2020          |
| 3.  | International Conference on Machine Learning (ICML), Virtual<br>Efficient and Scalable Bayesian Neural Nets with Rank-1 Factors             | July 15, 2020          |
| 4.  | ICML workshop on Uncertainty & Robustness in DL, Long Beach, CA<br>Analyzing the Role of Model Uncertainty for Electronic Health Records    | June 14, 2019          |
| 5.  | Practical Big Data Workshop, Ann Arbor, MI<br>Bayesian Deep Learning for Medicine   | June 7, 2019           |
| 6.  | SF Big Analytics Meetup - Yelp HQ, San Francisco, CA<br>Deep Learning for Breast Cancer Mitosis Detection                                   | April 18, 2018         |
| 7.  | OpenTech AI conference at IBM Finland, Helsinki, Finland $AI + Healthcare$  | March 14, 2018         |
| 8.  | OpenTech AI conference at IBM Finland, Helsinki, Finland<br>Deep Learning for Breast Cancer Mitosis Detection                               | March 13, 2018         |
| 9.  | SF Big Analytics Meetup - GoPro HQ, San Mateo, CA<br>Deep Learning for Mitosis Detection  | Oct 18, 2017           |
| 10. | Strata Hadoop World, San Jose, CA<br>Deep Learning For Predicting Breast Cancer Proliferation Scores with Apache Syst                       | March 15, 2017 $temML$ |
| 11. | UC Berkeley Data Dialogs Conference, Berkeley, CA<br>Predicting Breast Cancer Proliferation Scores with Apache SystemML                     | Sept. 7, 2016          |
| 12. | UC Berkeley Data Science Web Talks, Berkeley, CA<br>Deep Learning with Apache SystemML  | Aug. 24, 2016          |

13. Datapalooza, Denver, CO Apache SystemML

### Mentoring

| Fei Hu (IBM ML Engineering Intern)         | June 2017 - Dec 2017 |
|--|----------------------|
| Anooj Patel (IBM ML Engineering Intern)    | Summer 2017          |
| Madison J. Myers (IBM Data Science Intern) | June 2016 - Feb 2017 |

## Teaching

| Teaching Assistant, CS3548: General Purpose | e GPU Programming | July 2011 – Aug 2011 |
|---|-------------------|----------------------|
| Appalachian State University, Boone, NC     |                   |                      |

# Academic Services

| Reviewer, Neural Information Processing Systems (NeurIPS)                    | 2020 -      |
|--|-------------|
| Reviewer, International Conference on Machine Learning (ICML)                | 2020 -      |
| Reviewer, International Conference on Learning Representations (ICLR)        | 2021 -      |
| Reviewer, ACM Conference on Health, Inference, and Learning (ACM CHIL)       | 2020 -      |
| Reviewer, Machine Learning for Healthcare (ML4H) workshop at NeurIPS         | 2019 -      |
| - Best Reviewer Award (1 of 3), 2020   |             |
| Reviewer, Uncertainty and Robustness in Deep Learning (UDL) workshop at ICML | 2020 - 2021 |

## **Blog Posts**

Mixture Density Networks: mikedusenberry.com/mixture-density-networks

### Skills

 $\label{eq:Languages: Python (current), {C, Scala, Java, Octave/MATLAB, Prolog} (previous) \\ \mbox{Libraries: JAX, NumPy, TensorFlow, PyTorch, Apache SystemML, Apache Spark Tools: Git, tmux, Vim, LATEX} \\$