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## Education

**Georgia Institute of Technology**, M.S. Computer Science (Atlanta, GA) *2017 – 2019*

» Focus on high performance computing and machine learning theory. Advised by Dr. Jacob Abernethy.

**University of Michigan**, B.S. Honors Applied Mathematics (Ann Arbor, MI) *2013 – 2017*

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## Work Experience

**Machine Learning & Graphics Engineer**, EmbodyMe (Tokyo, Japan) *May 2020–Present*

- » Improved visual quality of our face reenactment app by training a new GAN inpainting architecture.
- » Introduced good software engineering & documentation practices to accommodate a growing team.
- » Refactored training and visualization code to improve modularity and leverage **Python**'s static typing features.
- » Led a biweekly deep learning & graphics reading group to distribute knowledge and follow new developments.

**Research Intern**, RIKEN AIP, advised by Dr. Emtiyaz Khan (Tokyo, Japan) *Summer 2019*

- » Studied training dynamics of variational autoencoders (VAEs) and the amortization gap.

**Research Assistant**, University of Michigan, advised by Dr. Peter McIsaac (Ann Arbor, MI) *2013 – 2015*

- » Built a **flask** app for humanities researchers to visualize topic models on 19th-century German periodicals.
- » Corrected noisy digital scans using a Hidden Markov Model over word fragments. Trained on a synthetic dataset of eroded digital scans with known text. Segmented words based on letter-successor-variety.
- » Implemented online variational inference for LDA/HDP from scratch in Python.
- » Trained a logistic regression classifier to detect toponyms using **word2vec** features on a Dutch dataset.

**Software Engineering Intern**, Microsoft (Seattle, WA) *Summer 2016*

- » Built a multiplatform mobile app (**C#** / Xamarin) to display Windows telemetry statistics to developers.

**Data Science Intern**, Are You a Human (*now Distil Networks*) (Detroit, MI) *Summer 2015*

- » Improved webcrawler detection accuracy with feature engineering and random forest models for device fingerprinting.

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## Projects & Open Source

**Noteworthy**, an open-source Markdown editor with bidirectional links and excellent math support *2020*

- » Markdown parsing, processing, and serialization via abstract syntax tree transformations.
- » My **prosemirror-math** package adds interactive WYSIWYG math editing support to ProseMirror.
- » My **remark-cite** package adds **pandoc**-style citation syntax to the **remark** markdown parser.
- » Built with Electron, **TypeScript**, ProseMirror, KaTeX, and SolidJS.

### Open Source Contributions

- » **pandoc** (Haskell) Added support for hyperlinked citation titles. Improved syntax for fenced blocks.
- » **byline** (Haskell) Added support for vivid ANSI terminal colors. Resolved unlawful semigroup instance.

**Incompressible Fluid Simulation** *2019*

- » Interactive **C++/CUDA** simulation of incompressible flow using parallel Jacobi solver with vorticity confinement.
- » Compared against CPU implementation with incomplete Cholesky preconditioned conjugate gradient.

**Borscht**, a command line tool for music library tagging, written in **Haskell** *2021*

- » Queries the Discogs API to assign metadata to local music files, storing the result in a SQLite database.
- » Implemented a custom Datalog inference engine (semi-naive evaluation with stratified negation) allowing playlist creation from first-order logical formulas (parsed with monadic parser combinators).
- » Built with Haskell, cabal, **req**, **aeson**, **persistent**, **mtl**, **stm**.

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## Technical Skills

	<i>Advanced</i>	<i>Proficient</i>	<i>Familiar</i>
<b>Languages</b>	TypeScript, Python	Haskell, C#, Java	Scala, C++, Coq
<b>ML</b>	numpy, gensim	pytorch, scikit-learn	tensorflow
<b>Graphics</b>		CUDA	OpenGL, OpenCV
<b>Tools</b>		L <sup>A</sup> T <sub>E</sub> X, Git, LLVM, flask	Node, Docker

## Teaching

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**Teaching Assistant**, CSE 7640, Computational Data Analysis (GT) *S20*  
**Teaching Assistant**, CS 4540, Advanced Algorithms for Machine Learning (GT) *F18, F19*  
**Teaching Assistant**, EECS 545/445, Machine Learning (UM) *S16, F17, S17*  
» Gave lectures on numerical methods, convex geometry, linear programming, statistical inference.  
» Authored lecture notes and designed projects. Taught a weekly discussion section of around twenty students.

## Relevant Coursework (\*audited)

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Cs 6290, Advanced Computer Architecture (Prof. Tom Conte, GT) *S19*  
» Pipelining; instruction-level parallelism; superscalar processors; VLIW; Tomasulo/ROB/RAT  
» Memory hierarchies; multiprocessors; shared memory vs. message passing; cache coherency/consistency  
Cs 6241, Advanced Compiler Optimizations (Prof. Santosh Pande, GT) *S19*  
» For projects, wrote LLVM transform passes to perform optimizations discussed in class.  
» Reaching definitions; available expressions; partial redundancy elimination; infeasible paths  
» Data/loop/control dependencies; loop parallelism, reordering, unrolling, and vectorization  
CSE 6220, High-Performance Parallel Computing (Profs. Aluru & Catalyurek, GT) *S19*  
» Parallel runtime analysis; efficiency; interconnection networks & embeddings; MPI programming  
» Prefix sum; bitonic sort; sample sort; Cannon's algorithm; parallel FFT  
MATH 7244, Stochastic Calculus (Prof. Michael Damron, GT) *F18*  
» Brownian motion; mean-square calculus; continuous-time martingales; stochastic integration  
ISYE 7687, Discrete Optimization for Machine Learning (Prof. Sebastian Pokutta, GT) *S18*  
» Boosting and online learning; bandits and reinforcement learning; away-step conditional gradient  
» Completed a final report surveying algorithms for online submodular maximization.  
STATS 700, Bayesian Nonparametrics Seminar (Prof. Long Nguyen, UM) *F14, S16*  
» Existence and construction of Dirichlet processes; stick-breaking and Chinese restaurant processes  
» Indian Buffet Processes; Hierarchical Dirichlet Processes; online variational inference and natural gradients  
» Likelihood and sufficiency principles; Bayesian vs. frequentist statistics  
» Exponential families and conjugacy; Gibbs sampling; variational inference  
Cs 7545, Statistical Learning Theory (Prof. Jacob Abernethy, GT) *F17*  
» PAC-learning and VC-dimension; margin learning and kernel methods; boosting  
» Online convex optimization; convex-concave games; exponential weights; mirror descent  
Cs 6550, Design & Analysis of Algorithms (Prof. Jamie Morgenstern, GT) *S18*  
» Matroids and greedy algorithms; graph connectivity and shortest paths; matchings; linear programming  
» Gradient and mirror descent; ellipsoid method; Johnson-Lindenstrauss and random projections  
» Completed a final report on random matrix theory and algorithms for sampling random matrices.  
MATH 6455, Differential Geometry\* (Prof. Mohammad Ghomi, GT) *S18*  
» Smooth manifolds; vector fields; geodesics; Riemannian metrics; Levi-Civita connection  
» Submanifolds; differential forms; Lie groups; integral curves and flows  
MATH 571, Numerical Linear Algebra (UM) *F15*  
MATH 671, Fast Numerical Methods (UM) *S17*  
CSE 8803, Advanced Scientific Computing (Prof. Edmond Chow, GT) *S18*  
» Stationary iterative methods; conjugate gradient and Krylov subspaces; Chebyshev polynomials  
» Nonuniform FFT and butterfly algorithms; Ewald summation; multigrid; fast multipole methods  
» Finite element analysis; molecular simulation with hydrodynamic interactions  
MATH 597, Measure Theory & Real Analysis (UM) *S16*  
MATH 525, Probability Theory (UM) *F16*  
MATH 420, Advanced Linear Algebra (UM) *F15*

## Other Involvement

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**President**, Michigan Student Artificial Intelligence Lab *2015-2017*  
» Organized a weekly machine learning reading group for undergraduate & graduate students