Blake Elias

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Research Interests

Themes	Cognitive Architectures, Biologically-Inspired Models, Collective Intelligence
Methods	Neural-Symbolic Architectures, Logic Programming, Evolutionary Game Theory
Applications	Multi-Agent Systems, Sustainability, Computational Economics

Education

2016–2018 **Massachusetts Institute of Technology**, M.Eng., Electrical Engineering and Computer Science.

- Concentration: Artificial Intelligence
- Thesis: *High Throughput Pin-Tool Based Automated DNA Assembly*
- Supervisor: Ron Weiss

2012–2016 **Massachusetts Institute of Technology**, S.B., Electrical Engineering and Computer Science.

- Thesis: *Homer: Spaced Repetition Learning for MIT Classes*
- Supervisor: Sanjay E. Sarma

Research and Work Experience

2018 - 2019 **Microsoft Research**, AI Resident (Associate Researcher 1), Redmond, WA, USA.

- 1-year fellowship at Microsoft Research AI.
- Neural-Symbolic Program Synthesis.
  - Augmented neural network training with symbolic knowledge of program semantics.
- Human-guided domain adaptation: comparison of active learning vs. machine teaching.
- Combined inductive and transductive reasoning in computer vision.
  - Novel semantic segmentation algorithm combining neural networks, k-means clustering, and human-in-the-loop training.
- Mentors: Nebojsa Jojic, Alex Polozov.

2016 - 2018 **MIT Synthetic Biology Center**, Research Assistant, Cambridge, MA, USA.

- Low-cost, high-throughput automated DNA assembly.

Feb - Aug 2015 **IdeaFlow, Inc.**, Software Engineer, Cambridge, MA and Palo Alto, CA, USA.

- Helped raise $1.4mm in seed funding and on-board 3 customers.
- Human-AI hybrid platform for collective intelligence: `https://www.ideaflow.io/`
- Investors include Tim Armstrong (Former CEO, AOL), Marty Weiner (Former CTO, Reddit; Founding Engineer, Pinterest), Jim Pallotta (Former Vice Chairman, Tudor Investment Group; Co-Owner, Boston Celtics).

Jun - Sep 2014 **MIT Media Lab - Fluid Interfaces**, Research Assistant, Cambridge, MA, USA.

- Novel video stream format allowing simultaneous play-back and recording at distinct time-points.
- Augmented-reality applications for education.

Jun - Aug 2013 **Google, Inc.**, Technical Program Management Intern, Mountain View, CA, USA.

- Collaborated with project manager and technical lead to ship Google Places for Business: a mobile app for local business owners.

Jun - Aug 2012 **Datalot, Inc.**, Data Science Intern, New York, NY, USA.
- Developed and shipped real-time bidding logic for advertising auctions.

Jun - Aug 2011 **Morgan Stanley, Inc.**, Enterprise Infrastructure Intern, New York, NY, USA.
- Approximate maximum-weight perfect matchings in complete weighted graphs.
- Found high-weight matchings using genetic algorithms.
- Solved an employee-pairing problem faced by management.

Publications

Conference Publications

[1] C. Robinson, A. Ortiz, K. Malkin, **B. Elias**, A. Peng, D. Morris, B. Dilkina and N. Jojic. "Human-Machine Collaboration for Fast Land Cover Mapping". In *Thirty-Fourth AAAI Conference on Artificial Intelligence, 2020.*

Theses

[2] **B. Elias.** "High Throughput Pin-Tool Based Automated DNA Assembly." Massachusetts Institute of Technology, 2018. Master of Engineering Thesis.

[3] **B. Elias.** "Homer: Spaced Repetition Learning for MIT Classes." Massachusetts Institute of Technology, 2016. Bachelor of Science Thesis.

Presentations

Posters

[1] **Thinking Fast and Slow With Neural Networks and k-Means Clustering**, Microsoft Research, August 2019.

[2] **Human-Machine Collaboration for Fast Land Cover Mapping**, Microsoft Research, August 2019.

[3] **Neural-Symbolic Program Synthesis**, Microsoft Research, March 2019.

Talks

[4] **Tutorial: Advanced Symbolic Programming**.
- Microsoft Research. Redmond WA, July 2019

[5] **Human-Machine Collaboration for Fast Land Cover Mapping**.
- Microsoft AI for Good. Redmond WA, June 2019

[6] **High Throughput Pin-Tool Based Automated DNA Assembly**.
- Asimov Inc. Cambridge MA, May 2018
- MIT Weiss Lab for Synthetic Biology. Cambridge MA, February 2018

[7] **Homer: Spaced Repetition Learning for MIT Classes**.
- MIT 2.S992: Learner's Workshop. Cambridge MA, February 2015

Teaching

Spring 2018, Spring 2017 **Biological Circuit Engineering Laboratory**, MIT 6.129, Teaching Assistant.
- Ordinary differential equation modeling (analytical and numerical) of molecular interactions across populations of cells.
- Design, simulation and construction of synthetic organisms.

Fall 2016 **Design and Analysis of Algorithms**, MIT 6.046, Teaching Assistant.
- Linear programming, max-flow/min-cut; parallel, distributed, randomized and sub-linear algorithms. Cryptography, complexity theory, dynamic programming, ammortized analysis.
- Instructor for weekly recitations and office hours; prepared homework and exam problems.

Fall 2012 **"Big Data": Programming Collective Intelligence**, MIT Splash!, Volunteer Instructor.

- Collaborative filtering, Naïve Bayes, PageRank.
- Introductory weekend class for high school students.

Relevant Coursework

AI Computational Cognitive Science; Large-Scale Symbolic Systems; Human Intelligence Enterprise

ML Mathematics of Deep Learning; Machine Learning (classical); Deep Learning Specialization (Coursera); Reinforcement Learning (YouTube)

CS Quantum Computation; Theory of Computation; Design and Analysis of Algorithms

EE Signals and Systems; Biological Circuit Engineering Laboratory; Computation Structures (Computer Architecture)

Mathematics Linear Algebra; Probabilistic Systems Analysis; Multivariable Calculus

Professional Training

July 2019 **Mathematics of Machine Learning Summer Graduate School**, Mathematical Sciences Research Institute and University of Washington, Seattle, WA, USA.

- Statistical Learning Theory
- Convex Optimization
- Deep Learning Theory
- Bandits
- Reinforcement Learning

Skills

Mathematics Programming Language Theory, Mathematical Optimization, Linear Algebra, Probability

ML/AI Deep Learning, Generative Models, Symbolic Logic Systems

Programming Python, Javascript, Java, C, Bash, Scheme/Lisp

Libraries PyTorch, Tensorflow, NumPy, Scikit-Learn

Engineering Git, Unix, PyTest; Software library design, Machine learning training pipelines; Compilers