MICHAEL DRUMHELLER

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EXPERIENCE

2012–present **Boeing Commercial Airplanes,** Seattle, WA
Associate Technical Fellow – Applied Mathematics & Computing

- Architect of a service-oriented system for bringing discoverability and scaling of computationally expensive engineering analysis, simulation, and optimization algorithms, which are currently unversioned binaries with data shared in non-secure ways (email, file shares, etc.), to the whole enterprise. This makes proprietary, specialist-written programs available to all engineers in a manner indistinguishable from native features in their favorite environment, saving time and preventing errors. Used skills in C++, Python, Go, and web services, on Windows and Unix.
- Company expert on mathematical modeling of surfaces for CAD/CAM on ultra-large-scale, ultra-fine-tolerance products (passenger airliners) and on automated NC programming of composites manufacturing processes.
- Created new, proprietary mathematical methods for surface modeling and data fitting that yield models as accurate as state-of-the-art methods but with an order of magnitude less data, enabling compact representations of airplane-scale parts for the first time. The data reduction and increased usability of these models speed up design, analysis, and manufacturing processes enough to save billions of dollars over ten years.
- Created new, proprietary mathematical methods for computer modeling of carbon-composite built-up surfaces on passenger airliners, filling a gap in composite design automation that has cost the industry hundreds of thousands of engineering hours per year for decades.
- Have been called in to apply data-modeling expertise on the fuselage, wing, and empennage of current and still-unannounced airplane models.
- Mentored specialists in other fields in developing computing and mathematics skills to amplify their impact.

2010–2012 **INRIX,** Kirkland, WA
Technical Program Manager

- Advised and consulted on machine learning algorithms for traffic-data and traffic-incident modeling and prediction.
- Oversaw a six-million-dollar contract with England's Highways Agency; created specifications, plans, and schedule; managed engineering to the schedule, and cultivated a strong relationship with the customer's technical staff.

- Handled technical end of customer relationships for all public-sector data deals.
- Program Managed a team of six developers and testers, delivering four releases of INRIX's traffic-data and incident-reporting platform, which aggregates, enhances, and redistributes billions of GPS points per hour.
- Developed new products and algorithms for "map-independent traffic data," enabling new multi-million–dollar deals with leading car companies.
- Oversaw several-fold expansion of INRIX's raw-traffic-data aggregation capacity.

2007–2009 **Tableau Software,** Seattle, WA
Senior Software Engineer

- Designed and implemented the Data Mining Interface, a visual environment for machine learning.
- Developed features in Tableau's million-line C++ codebase ranging from complex UI to OLEDB based protocols for MDX OLAP read-back.
- Part of a 2-person team that created Tableau for GIS (Tableau on maps), which enabled Tableau's early acquisition of market share in the insurance industry.
- Part of a 2-person team that developed Visual Totals for a third-party datacube product that lacked this core feature, enabling a lucrative deal with a customer for whom it was critical.
- Developed new statistical and data-mining features that are now standard in Tableau Desktop: Box-and-whisker plots; Interactively tunable regularized trend-splines; Graphical confidence bands for linear regression; Heat maps ("trend surfaces") for sparse irregular 2-D data.
- Onboarded new employees; was used as a resource by colleagues on multidimensional data analysis, data mining, statistics, MDX, Python, and C++.

1996–2007 **Boeing Research & Technology,** Seattle, WA
Associate Technical Fellow – The Math Group

- Invented mathematical methods for high-speed composites manufacturing. Contributions were recognized formally as integral to the success of the 787 airplane program.
- Architect and lead for a team of five that developed the math kernel of a proprietary composite fiber placement path-planning CAD software tool, in which the above mathematical methods were realized.
- Developed neural-net machine learning methods for flush air-data (speed, angle of attack, etc.) on a research combat drone, resulting in a lower maintenance, lower cost, and safer product. (A flush air-data system infers flight parameters from a matrix of buried pressure sensors using ML.)
- Project Manager and software developer for an internal generative design CAD system based on Constraint Logic Programming (constraint Prolog, aka clp(R)).

- Invented and developed a file-processing tool called Spots (see Publications) used for integrating engineering codes with design-of-experiments and optimization codes. This remains a standard part of Boeing's optimization of new airplane designs to this day.
- Contributed mathematical and software consulting to numerous other projects across the company, including:
  – Analysis and recommendations for onboarding third-party software tools for integrating disparate internal engineering codes.
  – Algorithms and software for automated design of bent-metal tubing, reducing the development costs of Boeing's then-newest airplane models. This tool is called the "Super Router" (see Publications and Patents, below).
  – A C++ "optimizer wrapper" and API, enabling easy, programmatic formulation and high-performance execution of complex optimization problems using "raw" C and Fortran nonlinear constrained optimization packages.

1984–1996 **Thinking Machines Corporation,** Cambridge, MA
Research Scientist and Senior Software Engineer

- Developed with a team of six a C & assembly message-passing system called *CMMD* (precursor of MPI) for the Connection Machine CM-5 parallel supercomputer; Project Manager, oversaw CMMD's software life cycle; Primary author of the *CMMD Reference Manual* and the *CMMD User's Guide.*
- Devised an assembly-level optimization of the company's custom network-interface that increased interprocessor communication speeds by 20% over the previous implementation, solidifying the Connection Machine's reputation as the world's fastest interconnect and helping to close sales deals.
- Lead developer on a team of three on a Unix kernel-development project to network the CM-5 parallel supercomputer to a cluster of Sun workstations. Designed and developed an API for the embedding of CMMD's core network-transfer routines into the Unix kernel. This enabled a multi-million dollar contract with the U.S. Naval Research Laboratory.
- Designed, developed, and gave public demonstrations of a stereo machine-vision system for terrain elevation mapping on the Connection Machine CM-2 massively parallel computer.
- Developed with a team of five a massively parallel visual object recognition system for the Connection Machine. Written in *Lisp ("star-Lisp", a data-parallel Lisp dialect developed by Thinking Machines for the CM).

1990–present **Various Opera Companies and Orchestras,** USA
Baritone vocal soloist

EDUCATION

MIT, M.S. Brain and Cognitive Sciences – Artificial Intelligence Laboratory.
Thesis: *Learning a Motion Detector from Examples.*

MIT, B.S. Mechanical Engineering.
Thesis: *Mobile Robot Localization Using Sonar.*

Boston University, M. Mus. Vocal Performance.
Operatic baritone. Proficient in Italian.

PUBLICATIONS

Spots: A Powerful File Manipulator for MDO and Other Engineering Software Automation Tasks, Proc. 41st AIAA Aerosp. Sci. Mtg. & Exhib., Reno, Jan 2003.

Constraint-Based Design of Optimal Transport Elements, ASME Journal of Comp. & Info. Sci. in Engr. (JCISE – *best papers of SM '02, see next*), Vol. 2, No. 4, Dec 2002.

Constraint-Based Design of Optimal Transport Elements, Proc. 7th ACM Symposium on Solid Modeling and Applications (SM '02), Saabrücken, Germany, Jun 2002.

The Vision Machine (with Tomaso Poggio, James Little, et al.), In *Artificial Intelligence at MIT*, Vol. II, Winston and Shellard (eds.), MIT Press, pp. 492–529, 1990.

Model-Based Objection Recognition Using the Connection Machine, Proceedings of SPIE – International Society for Optical Engineering, Vol. 848, 1987.

On Parallel Stereo (with Tomaso Poggio), Proceedings of the IEEE International Conference on Robotics & Automation, pp. 1439–48, Apr 1986.

Connection Machine Stereomatching, Proceedings of the 5th National Conference on Artificial Intelligence, AAAI-86, Philadelphia, PA, pp. 748–753, 1986.

Mobile Robot Localization Using Sonar, IEEE Transactions on Pattern Analysis and Machine Intelligence, PAMI V.9 No. 2, Mar 1987 (and MIT AI Memo 826). Work done in Symbolics Lisp; has 424 citations per Google Scholar; was called in *Intro. to AI Robotics* (MIT Press 2002) *"the first serious analysis [of mobile sonar]…a classic."*

PATENTS, U.S. AND FOREIGN

- Drumheller, M., 2020, *System and method for forming a part by automated fiber placement*, US 10,654,228.
- Drumheller, M., Jones, A., and Klein, F., 2011, *Tape course generation method and apparatus for programming a composite tape lamination machine*, US 7,869,982.
- Drumheller, M. and Erignac, C., 2010, *Adaptive distance field constraint for designing a route for a transport element*, US 7,668,700.
- Drumheller, M., 2010, *Improved constraint-based method of designing a route for a transport element*, US 7,647,211.
- Drumheller, M., 2008, *Constraint-based method of designing a route for a transport element* (the "Super Router," see above), US 7,444,269.
- Drumheller, M., 2006, *Constraints-based method for designing a path for transport elements and device for carrying out the method*, France 2835941.
- Drumheller, M., Jones, A., and Klein, F., 2010, *Tape course generation method and apparatus for programming a composite tape lamination machine*, US 7,643,970.
- Steele, Jr., G., Hillis, D., Blelloch, G., Drumheller, M., Kahle, B., Lasser, C., Ranade, A., Salem, J., Sims, K., 1989, *Virtual processor techniques in a SIMD multiprocessor array*, US 4,827,403.