

ED WILSON, Ph.D., P.E.

Ed@intellization.com
Redwood Shores, CA
http://intellization.com/files/Edward_Wilson_CV.pdf

Expertise Summary

- Technical problem solver, especially those related to data-driven algorithmic development and analysis.
- Areas of expertise: advanced data analysis; algorithm development; statistical modeling; machine learning; neural networks; data mining; estimation; system identification; autonomy; computational advertising. All with research and solution development for real problems with real data in various domains. Technically active since beginning Ph.D. research in machine learning at Stanford in 1989.
- Have enjoyed working in a variety of roles, including: business owner, Chief Scientist, Director of Research, Lecturer, Professor, Principal Investigator, Expert Analyst/Witness, and Consultant.
- Extensive experience with MATLAB, used since 1989. Some Java and C.

Education

- Ph.D. [STANFORD UNIVERSITY](#) Mechanical Engineering / EE 1995
Advisors: Aero-Astro Prof's Stephen Rock and Robert Cannon, Stanford Aerospace Robotics Laboratory
Dissertation: "Experiments in Neural-Network Control of a Free-Flying Space Robot"
Ph.D. Minor in Electrical Engineering
- S.M. [M.I.T.](#) Mechanical Engineering 1987
Advisor: Prof. George Chryssolouris, MIT Laboratory for Manufacturing and Productivity
Thesis: "Design and Construction of a Laser Machine Tool for Processing Advanced Materials"
- S.B., S.B. [M.I.T.](#) [Physics](#), Mechanical Engineering 1987
Three degrees earned in 4 years at MIT. Concentration in Economics; Air Force ROTC; Soccer team.

Professional Experience

1995 - present [INTELLIZATION](#) Redwood Shores, CA
Selected clients for this technical consulting business:

[M.I.T. SPACE SYSTEMS LAB](#) / PAYLOAD SYSTEMS INC. Cambridge, MA

- Developed, implemented, and experimentally validated two patented spacecraft autonomy algorithms. Remotely conducted six space flight experiment test sessions using the MIT SPHERES experimental spacecraft on the International Space Station in 2006 and 2007.

[NASA AMES RESEARCH CENTER](#), Intelligent Systems Division Moffett Field, CA

Autonomous-system research and development, with application and deployment on several aerospace systems in the Information Sciences Directorate. Applied to:

- Spacecraft Fault Detection Identification and Recovery – collaboration with Johnson Space Center, developing advanced control technology to detect thruster failures for the X-38 and Mini AERCam spacecraft.
- Collaboration with the Automated Software Engineering group to develop Kalman Filter application test cases for AutoFilter, focusing on spacecraft and planetary rover state estimation.
- Rendezvous and docking – developing NN optimization technology to improve accuracy, safety, and fuel efficiency for spacecraft docking

- Automation and optimization of interferometric fringe tracking and motion prediction, implemented at the Infrared/Optical Telescope Array (IOTA) at Mt. Hopkins, Arizona
- Automated high precision balancing system and optimization algorithms for the Stratospheric Observatory For Infrared Astronomy (SOFIA) – this is a spherical-air-bearing-supported telescope that flies in a modified 747
- Automated image processing to track incoming aircraft at SFO
- Identification and counterbalancing controller optimization and fault tolerance for the Space-station centrifuge, with initial implementation on a laboratory hardware prototype.

SYSTEMS ALTERNATIVES INTERNATIONAL, LLC

Toledo, OH

Control system research and development for a leading supplier of process optimization systems to the metals and glass industries. Applied to:

- Neural-network electrode regulation for an electric arc furnace (EAF) used in steelmaking
- Total energy optimization for an EAF
- Charge mix optimization and material property identification for optimal charge design

BIVWAK DIGITAL MUSIC, INC.

San Mateo, CA

Developed analytical processing software and optimized estimation algorithms for a data mining system to automatically identify music listeners' tastes and recommend new songs (implemented as internet-based personalized radio service).

2005 – 2007 **QUANTCAST CORP.**, Chief Scientist

San Francisco, CA

- Led analytical development for the world's only open internet ratings service.
- Developed algorithms to characterize websites and users by processing many terabytes of web traffic data.
- Developed statistical modeling solution to enable, for the first time, accurate website audience measurement while accounting for cookie deletion, blocking, etc. – a long-standing industry problem.
- Worked with Scientific Advisors, Stanford Statistics Prof's Hastie and Friedman.
- First non-founding employee after beginning as consultant (Intellization).

1996 - 1999 **STANFORD UNIVERSITY**, Lecturer

Stanford, CA

Taught *Engineering 104: Dynamic Behavior*, a senior / masters-level course in the autumn quarter ('96, '97, '98, '99). Course focus: development of physical models for mechanical, electrical, and electromechanical dynamic systems; derivation of equations of motion; analysis of natural and forced response; root locus; frequency response; Laplace transforms.

1995 - 1999 **NEURAL APPLICATIONS CORP. / SAI**, Director of Research

Redwood Shores, CA

Directed design, development, and implementation of industrial process optimization systems, with application of neural-network technology for projects in the metals industry. Principal Investigator on a DOE Small Business Innovation Research award for "Intelligent Adaptive Systems for Optimal Energy Input in Steelmaking." Received award from *Industry Week* magazine for developing one of the top "25 Technologies of the Year" in 1996.

1994 - 1995 **USS CONSTELLATION (CV-64)**, Professor

Western Pacific Ocean

Taught Introduction to Computer Science (CS101) on an aircraft carrier as part of the US Navy's Program for Afloat College Education. Onboard during a WESPAC, travel included a tail-hook landing and visits to Japan, Korea, Hong Kong, China, Singapore, Malaysia, and Bahrain.

1983 - 2004 **UNITED STATES AIR FORCE**, Reserve Officer

McClellan AFB, CA

During reserve service at McClellan AFB from 1990-1995, Technical consultant for the Advanced Electronics Technology Center, a complete IC-manufacturing facility, providing reverse-engineering, digital/analog design, fabrication, and testing. Responsible for development of digital-control-system algorithms and management of system integration for aircraft-vision-system servo controllers.

- 1990 - 1995 [STANFORD AEROSPACE ROBOTICS LAB](#), Research Assistant Stanford, CA
 Developed a new neural-network architecture and network training algorithms for application to the control of an air-bearing-supported laboratory prototype of a free-flying space robot. Developed and experimentally demonstrated a fully autonomous adaptive neural-network control system on this robot, with real-time reconfiguration (re-stabilization within four seconds) to destabilizing actuator failures. Involved rapid identification of thruster characteristics based on accelerometer data, autonomous excitation to improve identification, and accelerated on-line training of a neural-network control system to optimize thruster control based on the new configuration.
- 1987 - 1993 HUGHES AIRCRAFT COMPANY, Radar Systems Group El Segundo, CA
 Provided technical consulting support for the F-22 Raptor Radar Processor Division, advising on research and development of neural-network-based optical character recognition and automated electronics-assembly systems.
 Developed thermal system ID software to analyze electronic component temperatures during burn-in. Modified F-18 Radar air-flow test procedure based on theoretical and experimental analysis.
 Developed and implemented new laser calibration procedures for high-speed CNC machining centers used for F-14, F-15, F-18, and B-2 radar antenna manufacturing.
 Supported development of a high-precision Cartesian positioner used for B-2 antenna testing.
- 1989 - 1990 STANFORD UNIVERSITY, Teaching Assistant Stanford, CA
 Teaching assistant for graduate-level classes in Dynamic Behavior, Control Systems, Dynamics and Control of Spacecraft and Aircraft.
 Won AIAA award for the best Teaching Assistant in the department that year.
- 1986 - 1987 [MIT LAB FOR MANUFACTURING AND PRODUCTIVITY](#), Research Asst. Cambridge, MA
 For Master's thesis, designed and directed construction of a working prototype for a patented laser-machine-tool concept using two continuous-wave 800 Watt CO₂ laser beams that performs machining operations on ceramics and hardened steels. Managed team of six undergraduates during summers and independent activities period.

Honors / Other

- Sub-contractor (Intellization) on successful NASA Small Business Technology Transfer (STTR) award – “SPHERES Autonomy and Identification Testbed”, with MIT Space Systems Lab, 2005
- Principal Investigator on proposal finalist for the 2004 NASA H+RT BAA – “Information Technologies for Autonomous Rendezvous and Docking”, led by Intellization, with Stanford University Aerospace Robotics Lab (Prof. Rock), MIT Space Systems Lab (Prof. Miller), Lockheed-Martin Advanced Technology Center (Dr. Pedreiro), NASA MSFC (Mr. Lomas), NASA JSC (Mr. Hu), and NASA Ames (Dr. Mah) as collaborators. Placed in top 2.5% of all proposals, 2004
- Sub-contractor (Intellization) on successful 2004 NASA H+RT BAA award – “Automated Assembly and Reconfiguration of Future Large-Scale Space Systems”, led by Lockheed-Martin Advanced Technology Center (Dr. Pedreiro), 2004
- Principal Investigator on NASA Collaborative Decision Systems award, “Intelligent navigational fault tolerance with limited sensing,” 2004
- Principal Investigator on NASA Ames Director's Discretionary Fund award, “Autonomous repair of underactuated spacecraft through on-line neural-network adaptation,” 2004
- Principal Investigator on NASA CICT/Intelligent Systems Technology Infusion award, 2003
- Best Paper Award, Fault Detection Session, 2002 American Control Conference
- Co-PI on discretionary funding award from NASA Deputy Associate Administrator for Space Flight, “Neurocontrol technologies for spacecraft docking,” 2001
- Recognized in [Industry Week](#) (12/16/96) for developing one of the top 25 “Technologies of the Year” – for Electric Arc Furnace optimization technology, 1996
- Profiled in [Industry Week](#) (12/16/96) as one of 50 “R&D Stars to Watch,” 1996
- Principal Investigator on US Dept. of Energy Small Business Innovation Research award, “Intelligent Adaptive Systems for Optimal Energy Input in Steelmaking,” 1996
- Professional Engineer, Mechanical, licensed in California (license # 30011), 1996-present
- Outstanding Paper Award, Workshop on Neural Networks, 1993

Air Force Office of Scientific Research AASERT Fellowship at Stanford, 1992-1995
AIAA Teaching Award (voted best teaching assistant in Stanford Aero-Astro Department), 1990
Howard Hughes Doctoral Fellowship at Stanford, 1988-1989
Honor Society Memberships: Tau Beta Pi, Pi Tau Sigma, Sigma Xi, 1987
Professional society memberships (former): IEEE, AIAA, ASME, SPIE, IASTED, Iron & Steel Society
Graduate Resident Instructor at MIT, 1986-1987
US Air Force ROTC Full Scholarship at MIT, 1983-1987
Graduated first out of 672 from William Allen H.S., Allentown PA, 1983
William Allen H.S. Scholar Athlete Award; several other academic awards and multi-district-wide math and science contests, 1983
Allentown City Chess Club Overall Individual Champion, 1983
Penn-Jersey (High School) Chess League Overall Individual Champion, 1981
Californiaman Ironman Triathlon – 47th place overall, 2005
Heavenly Gunbarrel 25 mogul endurance race – 2nd place overall snowboard, 2010. 3rd in '09 and '11
Youth sports coach, referee, umpire in AYSO soccer, Little League baseball, and CYSA club soccer, 2008-present
Linked in profile: <http://www.linkedin.com/pub/edward-wilson/6/263/6aa>

Patents, Conference Session Chairing, and First Author Publication

Patents

[“Multiple concurrent recursive least squares identification with application to on-line spacecraft mass-property identification.”](#) *United States Patent 7110915.*

[“Model-based fault detection and isolation for intermittently active faults with application to motion-based thruster fault detection and isolation for spacecraft.”](#) *United States Patent 7451021.*

Sole inventor and patent author for both patents.

Conference Session Chairing

International Space Station Centrifuge Balance and Control session at the *AIAA Guidance, Navigation and Control Conference* in San Francisco, California, August 2005.

Modelling, Identification, and Simulation I and II sessions at the *IASTED International Conference on Intelligent Systems and Control* in Honolulu, Hawaii, August 2004.

Applications of Adaptive Systems I and II sessions in the *Neural Networks and Control Systems* track at the *45th IEEE International Midwest Symposium on Circuits and Systems* in Tulsa, OK, 2002.

Intelligent Systems session at the *Iron and Steel Society Symposium on Evolving Computer Application Trends in the Steel Industry* in Myrtle Beach, South Carolina, May 2000.

Intelligent Systems session at the *1998 Electric Furnace Conference* in New Orleans, LA, Nov. 1998.

Intelligent Systems session at the *Symposium on Computers and Controls in the Metals Industry* in St. Petersburg Beach, Florida, December, 1997.

Selected first-author Publications

Many of these papers, along with the associated presentations and videos, are available at <http://intellization.com/files/>. Individual hyperlinks are embedded below. Much recent work (e.g., at Quantcast and more recently) is proprietary and has not been published.

[“Motion-Based Thruster Fault Detection and Isolation,”](#) in *Proceedings of the AIAA Infotech@Aerospace Conference*, Arlington, Virginia, September 2005, with David W. Sutter and Robert W. Mah. [presentation](#)

[“Motion-Based Mass- and Thruster-Property Identification for Thruster-Controlled Spacecraft,”](#) in *Proceedings of the AIAA Infotech@Aerospace Conference*, Arlington, Virginia, September 2005, with David W. Sutter and Robert W. Mah. [presentation](#)

- [“Automatic balancing and intelligent fault-tolerance for a space-based centrifuge,”](#) in *Proceedings of the AIAA Guidance, Navigation and Control Conference*, San Francisco, California, August 2005, with Robert W. Mah. [presentation](#)
- [“Adaptive DFT-based interferometer fringe tracking,”](#) in *EURASIP Journal on Applied Signal Processing – special issue on Applications of Signal Processing in Astrophysics and Cosmology*, 2005:15 (2005) 2559-2572, with Ettore Pedretti et al.
- [“Multiple concurrent recursive least squares identification,”](#) in *Proceedings of the IASTED International Conference on Intelligent Systems and Control*, Honolulu, Hawaii, August 2004, with David W. Sutter and Robert W. Mah. [presentation](#)
- [“MCRLS for on-line spacecraft mass- and thruster-property identification,”](#) in *Proceedings of the IASTED International Conference on Intelligent Systems and Control*, Honolulu, Hawaii, August 2004, with David W. Sutter and Robert W. Mah. [presentation](#)
- [“Adaptive DFT-based fringe tracking and prediction at IOTA,”](#) in *Proceedings of the SPIE Astronomical Telescopes and Instrumentation Symposium: New Frontiers in Stellar Interferometry*, Glasgow, Scotland, June 2004, with Ettore Pedretti et al (SPIE vol. 5491-173). [presentation](#)
- [“Motion-based system identification and fault detection and isolation technologies for thruster controlled spacecraft,”](#) in *Proceedings of the JANNAF 3rd Modeling and Simulation Joint Subcommittee Meeting*, Colorado Springs, Colorado, December 2003, with David W. Sutter et al. [presentation](#)
- [“Gradient-based parameter optimization for systems containing discrete-valued functions,”](#) *International Journal of Robust and Nonlinear Control*, Volume 12, No. 11, pp. 1009-1028, September 2002, with Stephen Rock. Journal special issue: *Applications of Neural Networks in Control and Instrumentation*.
- [“On-line, gyro-based, mass-property identification for thruster-controlled spacecraft using recursive least squares,”](#) in *Proceedings of the 45th IEEE International Midwest Symposium on Circuits and Systems*, Tulsa, Oklahoma, vol. 2, pp. 334-337, August 2002, with Chris Lages and Robert W. Mah. [presentation](#)
- [“Gyro-based maximum-likelihood thruster fault detection and identification,”](#) in *Proceedings of the 2002 American Control Conference*, Anchorage, Alaska, pp. 4525-4530, May 2002, with Chris Lages and Robert W. Mah. [presentation](#)
- [“An Overview of Intelligent Systems Technologies for Process Optimization,”](#) *Symposium on Evolving Computer Application Trends in the Steel Industry*, Iron and Steel Society, Myrtle Beach, South Carolina, May, 2000.
- [“On-line fringe tracking and prediction at IOTA,”](#) in *Proceedings of the 18th Congress of the International Commission for Optics*, San Francisco, California, August 1999 (SPIE Vol. 3749).
- “Neurocontrol Technologies for Space Shuttle Docking,” presented at the *Space Shuttle Development Conference* at NASA Ames Research Center, July 30, 1999, with Robert W. Mah and John Schreiner.
- [“Neural network control in the metals industry,”](#) in *Proceedings of the 1999 American Control Conference*, San Diego, California, pp. 1657-1658, June 1999. Invited paper. [presentation](#)
- [“Intelligent Technologies for Electric Arc Furnace Optimization,”](#) in *1998 Electric Furnace Conference - Process Technology Conference Proceedings*, pp. 697-702, New Orleans, Louisiana, November 1998, with Michael Kan and Anjan Mirle. [presentation](#)
- [“Imbalance Identification and Compensation for an Airborne Telescope,”](#) in *Proceedings of the 1998 American Control Conference*, Volume 2, pp. 856-860, Philadelphia, Pennsylvania, June 1998, with Robert W. Mah, et al. [presentation](#)
- [“Virtual Sensor Technology for Process Optimization,”](#) *Symposium on Computers and Controls in the Metals Industry*, Iron and Steel Society, St. Petersburg Beach, Florida, December, 1997.

- ["Adaptive profile optimization for the electric arc furnace,"](#) *Steel Technology International*, pp. 140-145. Brunel House, London, 1997.
- ["Neural-Network Control of a Free-Flying Space Robot,"](#) *Simulation*, Volume 65, No. 2, pp. 103-115, August 1995, with Stephen Rock. [video](#). [video description](#).
- ["Reconfigurable Control of a Free-Flying Space Robot Using Neural Networks,"](#) in *Proceedings of the 1995 American Control Conference*, Volume 2, pp. 1355-1359, Seattle, Washington, June 1995, with Stephen Rock. [video](#). [video description](#).
- ["Experiments in Neural-Network Control of a Free-Flying Space Robot,"](#) Ph.D. Dissertation, Department of Mechanical Engineering, Stanford University, Stanford, CA 94305, March 1995. Also published as Stanford University Department of Aeronautics and Astronautics Report #666. [video](#). [video description](#).
- "Reconfigurable Thruster-Based Control Using Neural Networks," *NASA Symposium on Neural Networks for Aero Control*, NASA Ames Research Center, California, August 1994, with Stephen Rock and Robert Cannon.
- ["Backpropagation Learning for Systems with Discrete-Valued Functions,"](#) in *Proceedings of the INNS World Congress on Neural Networks*, Volume 3, pp. 332-339, San Diego, California, June 1994.
- ["Neural Network Control of a Free-Flying Space Robot,"](#) in *Proceedings of the INNS World Congress on Neural Networks*, Volume 2, pp. 15-22, San Diego, California, June 1994, with Stephen Rock.
- ["Experiments in Neural Network Control of a Free-Flying Space Robot,"](#) in *Proceedings of the Fifth Workshop on Neural Networks: Academic/Industrial/NASA/Defense*, pp. 204-209, San Francisco, California, November 1993 (SPIE Vol. 2204).
- ["Experiments in Control of a Free-Flying Space Robot Using Fully-Connected Neural Networks,"](#) in *Proceedings of the INNS World Congress on Neural Networks*, Volume 3, pp. 157-162, Portland, Oregon, July 1993, with Stephen Rock.
- ["Design and Construction of a Laser Machine Tool for Processing Advanced Materials,"](#) [Master's Thesis](#), MIT Laboratory for Manufacturing and Productivity, Dept. of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts, June 1987.