Vytas SunSpiral

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Summary

I am an entrepreneurial researcher moving fluidly between leading startups and building research labs to explore cutting edge robotic and AI technologies. Over the last 20 years I have been the founder, CTO, and Advisor of multiple startups, a Fellow of the NASA Innovative Advanced Concepts (NIAC) program, founder and Principle Investigator of the Dynamic Tensegrity Robotics Lab (DTRL) at NASA Ames Research Center, and research coordinator for many academic labs throughout the nation. Leading with passion and vision, I love to motivate multi-disciplinary teams to push the boundaries of science, while communicating our successes to the world and attracting collaborators, funding, and customers.

PROFESSIONAL EXPERIENCE

Director of Advanced Technologies, Zymergen Inc. **May 2017 – Present**

Zymergen is a rapidly growing startup (almost 400 staff), and we use automation and AI to engineer and optimize the genome of microbes to produce industrially useful materials. I am establishing the advanced research arm that develops technologies that will impact the company over the next 2-4 years. I'm integrating cutting edge ideas and techniques from fields such as robotics, genomic engineering, machine learning, microfluidics, computational material science, and quantum chemistry.

Principal Investigator, Dynamic Tensegrity Robotics Lab, **June 2010 – May 2017**
Intelligent Robotics Group, Intelligent Systems Division
NASA Ames Research Center, Moffett Field, CA, USA
Employed by Stinger Ghaffarian Technologies

As a senior researcher in the group my responsibilities include developing new lines of research, fostering collaboration with academia and private industry, providing project leadership, and attracting new sources of funding for the group. My role has been described as a "Serial Research Entrepreneur." I am a contributing author of the Space Robotics Chapter of the 2013 Roadmap for US Robotics.

Over the last few years I founded and grew the Dynamic Tensegrity Robotics Lab – Inspired by the role of fascia (connective tissue) in biology, and the neuroscience of motion control, we are developing new robotic technologies based on tensegrity structures which are highly compliant and self- organizing, enabling robots with spines and new forms of planetary exploration, while also giving meaningful insight into human biology and intelligence. We use a number of machine learning and AI techniques to explore controls of these structurally compliant systems. We built and released an open sources physics based simulator for these novel robots (NASA Tensegrity Robotics Toolkit – NTRT), and I have assembled an international collaboration of researchers to pursue these ideas, and won funding from NASA's Innovative Advanced Concepts (NAIC) program, and other NASA sources for support of new innovative technologies. See more at: http://www.magicalrobot.org

Other projects I have initiated and led include:
- Dragonfly Situational Awareness Console: This is a current project to develop ground control tools for an on-orbit self assembling spacecraft in geosynchronous orbit.
- ATHLETE Footfall: Developing ground control systems, UI, Image Processing, and motion planning algorithms for a walking six legged, four meter tall robot (ATHLETE).
- SmartSPHERES: attaching a SmartPhone to a free floating robot (SPHERES) on the International Space Station and enabling Ground Control Teleoperation.

NASA Awards:

Sept	2016	Certificate of Achievement – Management of Tensegrity Robotics
Sept	2015	Certificate of Achievement – Leadership and Mentoring.
Jan	2015	Software Initial Award – for Development and Release of NTRT.
Nov	2014	Ames Contractor Council Certificate of Excellence -- Individual
May	2014	Space Flight Awareness Team Award, Ames Research Center International Space Station Team.
Dec	2013	Employee of the Quarter, ISRDS Contract, SGT Inc.
Dec	2013	Certificate of Achievement for Business Development
Aug.	2013	Group Achievement Award, Smart SPHERES Team
March	2013	Certificate of Achievement for Leading Innovation, and academic and NASA collaboration on Tensegrity Robots.
Aug.	2012	NASA Innovative Advanced Concepts (NIAC) Fellow
Nov.	2011	Ames Contractor Council Certificate of Excellence for ISRDS Human Exploration Tele-Robotics Spheres Team.

Venture Partner, Comet Labs **Jan 2016 – Sept 2018**
Comet Labs is a VC Fund focused on Robotics and AI. http://www.cometlabs.io/

Board of Advisors, Catalia Health **Sept 2014 – Sept 2018**
Catalia Health brings together artificial intelligence, Robotics, psychology, and medicine to deliver lasting behavior change.

Mentor, Alchemist Accelerator **Sept 2014 – 2017**
http://www.alchemistaccelerator.com/

Board of Advisors, SkyFront **Nov 2015 – Dec 2016**
SkyFront is creating a hybrid-electric quadcopter drone, capable of flying for 4 hours, enabling many promising commercial applications for drones which are currently impossible with the standard 20 minute flight times of drones on the market today.

Mentor, Qualcomm Robotics Accelerator **Oct 2014 – Oct 2015**
http://www.QualcommAccelerator.com

Founder and Chief Technology Officer, DemocracyDirect.me June 2011 – May 2012
Democracy Direct aims to change the way we interact with our government, politicians, campaigns and bills. Using social tools we empower you to communicate directly with the politicians that represent you and the ones that think like you.

Board of Advisors, BodyTrack.org May 2011 – Dec 2012
The BodyTrack project seeks to help people working to track down suspected environment/health interactions (food sensitivities, asthma or migraine triggers, sleep problems, etc.) by building open-source and open-API tools that empower individuals to embark on the process of medical self-discovery.

Chief Technology Officer Nov 2008 – June 2010
Board of Advisors Dec 2007 - June 2010
Apisphere Inc., Berkeley, CA, USA
Apisphere sells a cloud-based platform for automated Mobile Internet Services for location aware mobile devices. As CTO I've been involved in almost every aspect of the company, providing the center of gravity between the divergent needs of engineering, sales, marketing, funding, customer support, and forward looking technical leadership. Heavily involved in the creation of funding and customer proposals and contracts, Apisphere has grown from zero to $3M in yearly revenues during my time as CTO. I wrote three, and filed two, patent applications for Apisphere technology.

Athlete Footfall Project Lead and Oct 2006 – Jan 2009
PI of Robotic Manipulation Research Lab (ArmLab) Sept 2005 – Jan 2009
NASA Ames Research Center, Moffett Field, CA, USA
Employed by Carnegie Mellon University
Athlete is a four meter diameter, six legged, 42-DOF robot which was built at JPL. I led the effort to automate the walking process, which was being manually teleoperated. This project entailed the development and integration of ground tools for telemetry processing, stereo image processing and integration from 9 stereo pairs, stability analysis, force/torque analysis, motion planning, terrain/obstacle avoidance, 3D visualizations for operator situational awareness, gait generation, leg sequencing, command sequencing, execution monitoring, and field testing at lunar analog sites. For more on the project and links to papers, see:
http://www.magicalrobot.org/BeingHuman/2011/01/walking-vision-and-self-awareness

The ArmLab was dedicated to researching dexterous and non-dexterous manipulation. Its assets included two Amtec 7-DOF arms, two Barrett Hands, integrated fingertip 6-axis force torque sensors, stereovision camera systems, and a 5 DOF planetary relevant manipulator. As PI of the ArmLab I managed between 2 to 11 students (undergrad, masters and PhD) as various forms of manipulation were explored, such as: soil manipulation and trenching, compliant grasping, grasping and retrieving deployed communication nodes, remote science instrument placement mechanisms, and DH parameter optimization techniques.

NASA Awards:
April 2009 Group Achievement Award, "Human Robotics Systems Moses Lake Field Test Team"

August 2008 Outstanding Service Award, NASA Ames
June 2007 Outstanding Service Award, NASA Ames

Robotics Researcher **June 2002 – Sept 2005**
NASA Ames Research Center, Moffett Field, CA, USA
Employed by QSS Group, Inc.
During this time I worked on multiple projects within the Model Based Diagnostics Group and the Embedded Decisions Systems Group. Significant research was done on applying particle filters to hybrid models for fault diagnostics. This work was applied both to planetary rovers and to autonomous drilling rigs. Also, a system to predict operator intention for the control of Robonaut (a humanoid robot) was created. This research involved using Bayesian inference techniques and other statistical models to segment and categorize six dimensional (pose and orientation) motion trajectories. The results could easily be extended to gesture recognition or other HRI applications. A number of papers were published based on these projects.

Project Lead for Tele-presence Robot **Oct 2001 - Nov 2001**
Contract with Mobot Inc., Pittsburgh, PA, USA
I was brought in as an independent contractor to manage this project through a critical stage of development and ensure it was completed on time. The RAVEN project is an interactive tele-presence robot built for the National Aviary in Pittsburgh that allows remote students to take guided tours of the Aviary. This project involved building the complete robot from the ground up (as opposed to buying a pre-built mobile base). You can read more about the results of this project at: http://upclose.lrdc.pitt.edu/people/louw_assets/RAVEN.PDF

Founder, Robot Personality Engineer, and Technical Manager Oct 1998 – Nov 2000
Mobot Inc., Pittsburgh, PA, USA
Mobot built and sold unsupervised fully autonomous socially interactive robots. These robots were mainly tour guides in public museums, but we also branched out into other roles for them. As the first employee hired by this small start-up, I had my hand in every aspect of the company. On the technical side, I designed, built, debugged, installed, and personalized robots. Creating practical robots requires a holistic understanding of: electrical and mechanical engineering; AI, vision, and machine learning; human cognition and social interaction; entertainment, education and issues of operating in a public space. As technical manager, I was responsible for overseeing development of new products and technologies. I also worked closely with customers, wrote contracts, worked on PR and marketing, applied for and received government grants, and helped develop a business plan. The robots we built achieved unprecedented records of long term autonomous deployment as they operated autonomously on a daily basis in public spaces for multiple years with no direct human supervision. Pictures of some the robots we built are available at: http://www.mobotinc.com/

EDUCATION

M.S. Computer Science **June 1998**
Stanford University, CA, USA
Masters Advisor: Dr. Oussama Khatib. A self-designed course of study on various aspects of autonomous robotics was completed, along with research into TR trees for Dr. Nils Nilsson (for a report on this work see: http://ai.stanford.edu/users/nilsson/trweb/learningcontrol.pdf).

B.A. With Honors, Symbolic Systems **June 1997**
Stanford University, CA, USA
Symbolic Systems is an interdisciplinary major that includes courses from the departments of Philosophy, Psychology, Linguistics, and Computer Science. A self-designed concentration on robotics and artificial intelligence was completed. Independent research on autonomous robotics, map building in dynamic settings, and hypothesis generation was conducted with Dr. Illah Nourbakhsh and Clay Kunz (see publications).

PATENTS

(Note: Prior to marriage in 2005, published as Thomas Willeke)

Vytas SunSpiral, Craig Harper, Vincent Sheffer, "System for and Method of Location-Based Process Execution," Provisional Patent, filed 2010.

Vytas SunSpiral, Craig Harper, "A System for Improved Passive Sensor Network Tracking of Cellular Mobile Devices Through Control of Communication Cycle Frequency," Provisional Patent, filed 2010.

Thomas Willeke (with Illah Nourbakhsh, Clayton Gregory Kunz, Carolyn O'Brien Green, and Vinton Coffman III). "Socially Interactive Autonomous Robot." US Patent Number 6760647, granted 7/6/2004, and also US Patent Number 6539284, granted March 25, 2003.

PUBLICATIONS

With over 50 publications, including National Reports, Journal Articles, Conference Papers, and Industry White Papers, my current publication record (and download links) is maintained at:
http://www.magicalrobot.org/BeingHuman/vytas-sunspirals-publications

PRESENTATIONS

For a full **list of many Invited Presentations** and links to recorded talks:
http://www.magicalrobot.org/BeingHuman/presenting

ACADEMIC ACTIVITIES

Session Chair

Chair of Modeling Session, Symposia: "To Boldly Go Where No Human-Robot Team Has Gone Before," *AAAI 2006 Spring Symposia*, Stanford, CA, March 2006

Panels

Frank Cepollina, Domenick Tenerelli, James Newman, **Vytas SunSpiral,** "Manned and Robotic Space Hardware Rescue: Silicon Valley Space Business Roundtable", Mountain View, CA, April 2012.

Michael Liebhold, **Vytas SunSpiral,** Andrew Newman, Geoff Zawolkow, Steve Adelman, Nacho Solis, Elizabeth Churchill, Doug Solomon "*IDEO Expert Salon on the Future of Machine-to-Machine Interaction*," Palo Alto, CA. Feb 2011

Thomas Willeke, William Hefley, Joseph Ballay, Anatole V. Gershman, *Human Computer Interaction in Industry: Experiences from the Field,* Carnegie Mellon University, Sept 1999.

Standards Committees

2014 ISO Study Group on "*Safety Data for Human-Machine Interactions*" ISO TC199 / ISO TC184 SC2

Proposal/Grant/Conference Review Panels

Subject Matter Expert on government team defining the Advanced Robotics for Manufacturing Institute (ARM), part of the network of National Manufacturing Innovation Institutes, 2016.
NASA SBIR/STTR Reviewer, yearly from 2006 – Present
Reviewer for NASA Space Technology Research Fellowship (NSTRF), 2014 -Present
Reviewer for Journal of Field Robotics, 2015.
Review Panel for NASA's Early Career Fellowship "Technologies for Soft Machines", 2014
Reviewer for Journal of the British Interplanetary Society, 2014
Program Committee member for the Twelfth International Joint Conference on Autonomous Agents and Multiagent Systems (AAMAS 2013)
Reviewer for National Robotics Initiative (NRI), AI Panel, March 2012.
Reviewer for Human Robotic Interaction Conference, HRI, 2012
Idaho NASA EPSCoR Technical Advisory Committee**,** Oct 2010 - 2013
NASA EPSCoR Reviewer 2007, 2008
NSF CAREER Reviewer, 2008
Review panel for NASA's Planetary Instrument Definition and Development Program (PIDDP), Feb. 2007.
Reviewer IEEE Aerospace 2006

Student Mentoring

Beyond mentoring 50+ undergraduate and graduate summer interns over the years, I have had the privilege to mentor a number of Thesis efforts conducted with significant collaboration with my lab. All thesis documents can be found at: http://www.magicalrobot.org/BeingHuman/students

PhD:

- Jonathan Bruce, *"Design, Building, Testing, And Control Of SUPERball: A Tensegrity Robot To Enable New Forms Of Planetary Exploration"*, PhD Thesis, University Of California Santa Cruz, Dec 2016.
- Brian Tietz, "*Sensory Integration and Decision Making Based on an Insect Brain Model*" Case Western Reserve, PhD 2015
- Ken Caluwaerts, *"Design and Computational Aspects of Compliant Tensegrity Robots"*. Ghent University, PhD 2014
- Atil Iscen, "*Multiagent Learning for Locomotion and Coordination in Tensegrity Robotics*", PhD Thesis, Oregon State University, PhD 2014

- Daniel Chavez-Clemente, "*Gait Optimization For Multi-Legged Walking Robots, With Application To A Lunar Hexapod*", Stanford University, PhD 2011

- Jeff Friessen UC San Diego, PhD in Progress
- Steven Lessard, UC Santa Cruz, PhD in Progress
- Andrew Sabelhaus, UC Berkeley, PhD in Progress

Masters

- Marc André Leroy, "*Manufacturing, Control and Testing of a Tensegrity Robot for Planetary Landing and Exploration,"* Masters Thesis, School of Engineering, École Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, August 2017.
- Dawn Hustig-Schultz, "*Morphological Design and Control Of A Bio-Inspired, Structurally Compliant Quadruped,"* Master of Science in Computer Engineering, University of California, Santa Cruz, June 2017.
- Andrew P. Sabelhaus, "*Mechanism and Sensor Design for SUPERball, a Cable-Driven Tensegrity Robot,"* Master of Science in Mechanical Engineering, University of California, Berkeley, 2014.
- Steve Burt, "*Kinematics Algorithms For Tensegrity Structures*", UCSC, Masters, 2013
- Jérémie Despraz, "*Superballbot - Structures For Planetary Landing And Exploration*" Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland, Masters 2013
- George Korbel, *"Central Pattern Generator Gait Evolution Of A Robotic Modular Tetrahedral Tensegrity"*, Master Thesis, University of Idaho, Moscow Idaho, 2013
- Stefan Leutenegger, "*End Effector Design and Control of Planetary Rover Robot Arm for Communication Relay Retrieval*", ETH Zurich, Masters, 2008
- Camilla Ljungstrom, "*K9 Arm Mounting and Integration, and Network Node Collection Master's Thesis Proposal"* KTH, Sweden, Masters, 2007

ARTISTIC COLLABORATIONS AND AWARDS

Synaptic Motion, Capacitor. Sept 2014, YBCA, SF, Ca.
A Dance Performance exploring the Neuroscience of Creativity.
http://www.magicalrobot.org/BeingHuman/2014/11/synaptic-motion-highlights
Nominated for Outstanding Achievement in Visual Design, The Isadora Duncan Dance Awards, March 2016, YBCA.
Nominated to the STARTS Prize 2016, honoring innovation in Technology, Industry and Society stimulated by the Arts.

Resume Updated Aug 30th, 2018