ASTRONAUT SCHOLARSHIP FOUNDATION

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2011 Astronaut Scholar Meeting
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2012 Astronaut Scholar Technical Conference Abstracts

May 5, 2012
Cocoa Beach, FL

Keynote Speaker

Walt Cunningham

Walt Cunningham, a member of the third group of astronauts selected by NASA, was the Lunar Module Pilot on the first manned Apollo mission, Apollo 7, an 11-day Earth-orbit flight in October 1968.

Cunningham was born in Creston, Iowa, on March 16, 1932. He received a Bachelor of Arts with honors in physics in 1960 and a Master of Arts in physics in 1961 from the University of California at Los Angeles. Before becoming an astronaut, he worked as a scientist with the RAND Corporation. He attended the Advanced Management Program, Harvard School of Business, in 1974.

Cunningham joined the Navy in 1951 and began flight training in 1952. In 1953, he joined a Marine squadron. He served in the Marine Corps until 1956 and in the Marine Corps Reserve program until 1975. He holds the rank of Colonel, USMC (retired).

NASA selected Cunningham as an astronaut in October 1963, and on October 11, 1968, he launched with Commander Walter Schirra and Command Module Pilot Donn Eisele aboard Apollo 7 - a spacecraft that had been almost completely redesigned after the first Apollo crew died in the Apollo 1 launch pad fire on January 27, 1967. The 260-hour, 4 1/2-million-mile flight was a complete success and provided NASA with confidence to send the next Apollo crew, Apollo 8, into orbit around the Moon.

Cunningham retired from NASA in 1975 and two years later, a book about his experiences as an astronaut, "The All American Boys," was published by Macmillan. He currently is president of Acorn Ventures, Inc., Houston and serves on the Board of Directors of the Astronaut Scholarship Foundation.

Walt Cunningham was inducted into the U.S. Astronaut Hall of Fame on October 4, 1997.

Ryan Badman

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2011-2012 Astronaut Scholar, Syracuse University
Syracuse University

Research Experiences That Have Motivated Me to Pursue Physics

This is a very exciting time to be a part of high energy physics research. The energy scale our colliders are capable of measuring is expected to allow, as a minimum, the discovery of the Higgs boson, which is the final particle needed to complete the Standard Model and to explain the masses of W and Z bosons, leptons, and quarks. Many physicists also predict that the energy scales attainable in experiments like the Large Hadron Collider and the International Linear collider may be enough to discover new dimensions, previously unobserved forces of nature, or even the elusive dark matter particle.

Ryan Badman is a physics and applied mathematics major at Syracuse University. He has been involved in a plethora of research experiences, including studying the formation of molecular hydrogen in the interstellar medium, a statistical physics project on fluid behavior, dark matter research for the Cryogenic Dark Matter Search, working for the CERN LHCb experiment, working at the Cornell University Synchrotron, currently doing a theory project for Lattice Quantum Chromodynamics, and will be doing research at CERN in Geneva Switzerland this summer. He is currently planning on completing his Ph.D. at the Institute of High Energy Physics in Beijing for the Daya Bay neutrino experiment.

Larry Bradley, Ph.D.

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1993-1994 Astronaut Scholar, University of Central Florida
Space Telescope Science Institute

The Search for the First Generations of Galaxies in the Early Universe

One of the most exciting frontiers in observational cosmology is the search for the first galaxies in the universe. Using the newly updated Hubble Space Telescope, we are now beginning to discover and study infant star-forming galaxies between 500 and 700 million years after the Big Bang, at a time when the universe was less than 5 percent of its current age of 13.7 billion years.

While this work poses an observational challenge that is pushing the capabilities of even the Hubble Space Telescope, nature has provided us some assistance in the form of "cosmic telescopes". Massive galaxy clusters can act as gravitational lenses whose large magnifications provide an opportunity to observe the distant universe in unprecedented detail. I will describe my recent work as part of a very large 524-orbit Hubble survey called Cluster Lensing and Supernova survey with Hubble (CLASH) and how I am using these observations to search for the most distant galaxies in the universe.

Dr. Larry Bradley received the Astronaut Scholarship in 1993-1994 while completing Bachelors degrees in physics and mathematics at the University of Central Florida. He obtained a Ph.D. in astrophysics from The Johns Hopkins University, where he subsequently worked as a research scientist with the Hubble Space Telescope Advanced Camera for Surveys Science Team. He currently works at the Space Telescope Science Institute in Baltimore, Maryland, where his research focuses on the study of galaxies in the very early universe. He is a co-investigator on several Hubble projects, including the HUDF09, BoRG, CLASH, and ACS GTO science teams. Larry has served on the Astronaut Scholarship Foundation Board of Directors since 2003 and its Scholarship Committee since 2000.

Benjamin Braun

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2011-2012 Astronaut Scholar, University of Texas
University of Texas

Speeding Up Verification Protocols for Untrusted Computation

Cloud computing and peer-to-peer computing allow businesses and research groups to solve computation-intensive problems economically by using pay-per-use publicly available computing resources. However, computations done with these resources may contain errors. Our general-purpose protocol, named GINGER, allows a client to efficiently verify that a remote computer is performing a computation correctly. GINGER offers low cost verification for simple classes of computations, including matrix multiplication, polynomial evaluation, and the finding of univariate polynomial minima through bisection. Our current work is to broaden the class of computations which can be efficiently verified in the GINGER framework. Our longterm goal is to completely automate the process of applying GINGER to the verification of any computation specified in a high level language, so that the method becomes a truly general-purpose platform for performing reliable computations on any available resource.

Benjamin Braun will graduate from the University of Texas at Austin in May 2013 with degrees in Computer Science and Mathematics. He has performed research in computational biology as well as in theoretical computer science. Benjamin has had opportunities to speak on his research in designing DNA reactants for molecular circuits at the Design Automation Conference 2011 in San Diego, and again at the Harvard BIOMOD Convention 2011. He is currently researching new, cost-effective ways to verify that remote computing resources are performing computations correctly. He is a coauthor on the paper "Taking proof-based verified computation a few steps closer to actual practicality", which has been accepted to the USENIX Security Conference 2012. Benjamin has played the piano since a young age, and continues to expand his repertoire. He plans to attend grad school after his studies at the University are completed.

Sarah Cannon

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2011-2012 Astronaut Scholar, Tufts University
Tufts University

Tile Self-Assembly

The spontaneous self-assembly of DNA and other nanoparticles forms the basis for DNA computing and is also used in nanotechnology and nanobiology. Tile self-assembly is a mathematical model that abstracts this self-assembly process; each piece of DNA is represented by a square tile, while glues on each tile denote the locations to which certain other DNA pieces can attach. Sarah and other researchers are working to develop a complete theoretical framework for the DNA self-assembly process by considering this abstracted version consisting of tiles and glues. Current questions include which shapes or patterns can be made, how the number of tiles and glues needed to assemble a particular shape can be minimized, how small changes to the self-assembly process affect these results, and other related problems.

Sarah will graduate from Tufts University in May 2012 with a BA in Mathematics with a Computer Science minor. In addition to tile self-assembly, Sarah is also currently researching problems in computational geometry and graph theory. For her work on all of these problems, Sarah was selected as the female winner of Computing Research Association's Outstanding Undergraduate Researcher Award, among other honors. This summer she will continue her research at Tufts University, before beginning the University of Oxford's MSc in Mathematics and the Foundations of Computer Science course in Fall 2012 and Georgia Tech's Algorithms, Combinatorics, and Optimization Ph.D. program in Fall 2013.

Alex Carney

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2011-2012 Astronaut Scholar, University of Michigan
University of Michigan

Polynomial Dynamics Over the Rational Numbers

With how often they arise in nearly every scientific subject, one might well think we understand everything about polynomials. I will explain how this is far from true, and how questions from the Greeks all the way up through modern calculus present new and useful ways to study polynomials. My own research, in the intersection of number theory and dynamics, demonstrates how these simple objects can carry a profoundly beautiful structure stemming from their connection to elliptic and hyperelliptic curves. This work suggests a generalization of Mazur's theorem on the rational torsion of elliptic curves to include general algebraic varieties.

Alex Carney recently graduated from the University of Michigan with a B.S. in mathematics. In addition to having multiple publications in number theory, he performs regularly on violin as a soloist and in multiple ensembles. Alex races with the Michigan Running Club and recently competed at the 2012 Boston Marathon. He will attend the University of Cambridge next year as a Marshall Scholar, where he will study mathematics as well as the history and philosophy of science.

Matt Coudron

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2010-2011 Astronaut Scholar, University of Minnesota
Massachusetts Institute of Technology

Quantum Error Correction and Quantum Information

In the last two decades quantum computation and quantum information have become major fields of study, pursued by a rapidly growing community of physicists, mathematicians, and computer scientists. Theory has shown that the ability to create, store, and manipulate quantum states would lead directly to technological breakthroughs in computation, communication, and precision sensing. Any practical quantum technology must contain a scheme for protecting quantum states from decoherence due to a noisy environment. Such schemes are the objects of study in quantum error correction. In this talk I will outline the ideas underlying my research in quantum error correction.

Matt graduated from the University of Minnesota in 2011 with a BS in mathematics. As an undergraduate he had the opportunity to participate in a wide variety of mathematics summer research projects, as well as the 2011 ACM International Collegiate Programming Contest world finals. Matt is currently pursuing a Ph.D. in Computer Science at MIT. As an iQuiSE (Interdisciplinary Quantum Information Science and Engineering) fellow he works on the theoretical aspects of protecting and utilizing quantum information.

Ryan East

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2006-2008 Astronaut Scholar, University of Oklahoma
NASA Lyndon B. Johnson Space Center (JSC)

ISS Increment 30 - 32 Trajectory Operations

Ryan East is currently supporting International Space Station (ISS) operations as Trajectory Analyst for Increment 31 and Increment 32 later this year. He supports the Lead Trajectory Operations Officer (TOPO) to ensure an integrated trajectory with visiting vehicle traffic, in overseeing the altitude strategy and reboost planning, and in providing updated trajectory data to other Increment team members on a weekly basis.

Ryan is originally from Greenwood, Arkansas, and has dreamed of becoming a flight controller in JSC's Mission Control Center since he was ten years old. After participating in JSC's Cooperative Education Program while in college, he joined NASA full-time and is training to become a TOPO flight controller. He earned a B.S. in Aerospace Engineering from the University of Oklahoma in 2008 and a M.S. in Aerospace Engineering from the University of Texas at Austin in 2009.

Ashley Ewh

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2008-2010 Astronaut Scholar, University of Central Florida
University of Central Florida

Development of Metallic Nuclear Fuels

The Reduced Enrichment for Research and Test Reactors (RERTR) program was founded to convert test reactors to the use of low enriched uranium nuclear fuel alloys. U-Mo alloys were determined to be excellent due to their low enrichment and stability during irradiation. However, performance and service life of fuels can be drastically reduced due to volume expansion caused by a solid-state diffusional interaction between the U-Mo fuel alloy and the cladding material. It is suspected that including a barrier layer between the fuel and cladding may suppress this interaction. One of the potential candidates for the barrier material is Zr.

Some potential advantages of Zr are its low neutron absorption and manufacturability. This study presents results of diffusion experiments between Mo and Zr conducted in order to provide kinetic data for further development of these fuels.

Ashley Ewh is a graduate student in Materials Science and Engineering at the University of Central Florida. For the past six years, she has been a research assistant in the Advanced Materials Processing and Analysis Center under Dr. Yongho Sohn. She will be joining the Materials Science and Engineering Ph.D. program at Northwestern University this fall and plans to pursue a career in academia as a professor.

Martin Fan

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2011-2012 Astronaut Scholar, Washington University in St. Louis
Washington University in St. Louis

Discovery of Sphingolipid Biomarkers in a Mouse Model of Niemann-Pick Type C1 (NPC1) Disease

Niemann-Pick Type C1 (NPC1) disease is a rare genetic disorder marked by severe neurodegeneration and early death. There are currently no FDA-approved treatments, due in large part to a lack of clinical measures with which to evaluate potential therapies. Since the disease is caused by a buildup of lipids in cell lysosomes, we hypothesized that changes in the lipid profile of NPC1 subjects could be used to track disease progression and response to treatment. Using a mass spectrometry-based approach we have quantified the tissue concentrations of 40 different sphingolipid species in an $Npc1^{-/-}$ mouse model and compared the results to those of wild type and heterozygous mice. Our work has revealed nearly two dozen lipid species we will track as we move on to drug intervention studies.

Martin Fan recently graduated from Washington University in St. Louis with a degree in chemistry. As a student he worked with Dr. Daniel Ory to develop tools to follow NPC1 disease progression, and he is currently continuing this line of work as a research technician. He will be attending Harvard University to study immunology in the fall.

Jayleen Guttromson-Johnson

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2003-2005 Astronaut Scholar, Purdue University
NASA Lyndon B. Johnson Space Center (JSC)

Fire Cartridge Rattling Investigation Overview

The Fire Cartridge is a packed bed air filter with two layers of media designed to provide respiratory protection from combustion products after a fire event on the International Space Station. During development of Fire Cartridge prototypes, the two media beds were noticed to have shifted inside the cartridge. The movement of media within the cartridge can cause mixing of the bed layers, air voids, and channeling, which could cause preferential air flow and allow contaminants to pass through without removal. The investigation determined orbital vibrations achieve an optimal pack density and the optimal vibration parameters must be re-evaluated for each batch of media due to variations in particle size distribution between batches.

Jayleen Guttromson-Johnson is a project manager at NASA Johnson Space Center on multiple government furnished equipment projects in various life cycle stages. She collaborates with peers to mature projects from the requirement development stage to hardware delivery and on-orbit implementation. Jayleen earned a Bachelor of Science in Aeronautical and Astronautical Engineering and was Purdue University's 2003-2005 Astronaut Scholar. She has completed a Master of Aeronautical Science from Embry-Riddle Aeronautical University and received NASA's Space Flight Awareness Silver Snoopy Award for professional excellence.

Joseph Han, Ph.D.

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1999-2000 Astronaut Scholar, Texas A&M University
QuantumScape

Addressing Limitations of Energy Storage

In today's mobile and technological society, storing energy is a key enabler for everyday activities. Traditional Lithium ion batteries have shown a slow progressive growth in energy densities over the past several decades; unfortunately, nothing like the exponential growth of VLSI processing as observed by Moore's Law. In this talk, alternative technologies will be described that could greatly improve gravimetric and volumetric densities for energy storage.

Joseph is a Principal Scientist leading the modeling activities at a startup using chemistry and physics to revolutionize global energy storage technology. Previously, he was part of the Office of the CTO at Penguin Computing where he was tasked with leading the company into new areas where it could apply its HPC expertise. Joseph has also worked at Intel Corporation in the TCAD Integrated Processing Applications Group. Joseph has held roles that dealt with simulations of kinetics, thermodynamics, and material property prediction and design using *ab initio* quantum mechanical electronic structure calculations, molecular dynamics and Monte Carlo simulations, and continuum methods. Joseph has a B.S. and M.S. from Texas A&M University and a M.S. and Ph.D. from Stanford University in Chemical Engineering. Joseph has served on the ASF Scholarship Committee since 2011.

Cole Kazemba

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2009-2010 Astronaut Scholar, University of Minnesota
Georgia Institute of Technology

Dynamic Excitation Analysis and Trajectory Reconstruction of Blunt Body Entry Vehicles Through the Use of a Time-Lagged Aftbody Pitching Moment

Performing in-situ science at celestial bodies with sensible atmospheres requires that a scientific payload be delivered to the surface by a planetary entry vehicle. As a blunt vehicle enters a planetary atmosphere, the aerodynamic moments acting upon it often result in unstable pitching motions and divergence of oscillation amplitude. Characterizing the dynamic stability performance of an entry configuration is an area of research that has been plagued with experimental difficulties, contradictory observations, and large uncertainties. Accompanying the uncertainties in the expected dynamic response is a general lack of understanding regarding the flow physics that govern this complex phenomenon. Throughout the experimental history of dynamic stability investigations, it has been observed that the pitching moment often tends to exhibit a dependence on the direction of the pitching motion.

In order to further investigate the possible implications of a hysteresis effect on the aftbody contribution to the pitching moment and subsequent oscillation behavior, this study first attempts to develop a governing model of the pitch dynamics through the implementation of a time-lagged description of the aftbody pitching moment. After identifying a model, a parametric sweep was conducted to determine which combinations of these parameters result in favorable damping and which cause oscillation divergence. The model then is used to reconstruct simulated ballistic range data through the use of parameter estimation techniques, thereby demonstrating that certain combinations of the parameters governing the time-lagged pitching moment behavior can reproduce observed pitching behaviors without the use of a pitch damping coefficient. By developing a model which is independent of the pitch damping coefficient and instead relies on quantities which are both easier to measure or calculate computationally and carry insightful physical significance, the potential benefits of the model identified in this study are far-reaching for entry vehicle dynamics. This work attempts to be a first step towards an improved understanding of the governing quantities of dynamic instabilities and a more cost effective and intuitive means of characterizing the dynamic behavior for entry vehicles.

Cole Kazemba is a 2011-2012 NASA Space Technology Research Fellow who just completed (yesterday!) his Master's degree in Aerospace Engineering at the Space Systems Design Laboratory (SSDL) of Georgia Tech. At Georiga Tech his research focused on the architectural and stability analysis of key technologies related to entry, descent, and landing (EDL) for future atmospheric entry applications. Cole has performed research with 3M, NASA Ames Research Center, and the NASA Jet Propulsion Laboratory. He will be starting a career at NASA Ames Research Center this summer working as an Aerospace Engineer in both the Systems Analysis and Entry Systems and Vehicle Development branches. He was a 2009 Astronaut Scholar from the University of Minnesota where he received his B.S. in Aerospace Engineering and Mechanics in 2010.

Hannah Meredith

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2011-2012 Astronaut Scholar, University of Virginia
University of Virginia

Using Motility of *Entamoeba histolytica* as a Clinical Marker of Infection

Entamoeba histolytica is the second most deadly parasite in the world and is prevalent in developing countries where sanitation is low. Only one in five *E. histolytica* infections are virulent, but it is currently not possible to diagnose which infections will cause disease. Currently, clinics in developing nations use microscopy to diagnose the infection; however, only 60% of diagnoses are accurate. This results in over prescription of drugs and unsolved medical problems. Here, I propose a novel diagnostic tool that quantifies amoeba motility patterns to improve the accuracy of diagnosis.

Hannah Meredith is graduating from the University of Virginia this spring with a BS in biomedical engineering. In the spirit of undergraduate research, Hannah has explored multiple research opportunities. She has spent some time researching molecular gastronomy, a non-traditional cooking style that enhances the eating experience by altering the appearance, texture and flavor combinations of food. She also explored the relationship between engineering and the government one summer through U.Va.'s Policy Internship Program. During her third year, Hannah joined a lab in the biomedical engineering department and started developing a clinical diagnostic test that could be used to detect an infectious strain of amoeba. Hannah also interned at the Oak Ridge National Laboratory, where she designed synthetic gene circuits to control basic cell functions. This experience sparked her interest in synthetic biology, which Hannah is excited to be continuing after graduation as she pursues her Ph.D. at Duke University. In addition to research, Hannah helped found *The Spectra*, U.Va.'s undergraduate engineering and science research journal, enjoys backpacking, cooking, and listening to jazz.

Bradley Pirtle

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2011-2012 Astronaut Scholar, University of Oklahoma
University of Oklahoma

Improving Tornado Prediction Using Artificial Intelligence

Responsible for over four-hundred deaths in the United States in 2011, tornadoes are a significant source of preventable deaths and property damage. One critical reason for the high number of fatalities caused by tornadoes each year is the high False-Alarm Ratio (FAR). FAR is a forecasting metric which describes the probability a meteorologist will issue a tornado warning, given a tornado does not actually exist. Ideally, the FAR would be approximately 0%, indicating a perfect forecaster. Far from 0%, however, the actual FAR consistently remains between 70-80%. This would indicate as many as 80% of all tornado-warnings are false-alarms. Consequently, the general public has gradually become desensitized to such forecasts. When a tornado-warning is issued, many do not seek appropriate shelter, which often costs lives.

While the reasons for the high FAR are complex and manifold, the most significant cause is simply the scarcity of real-world data. Fortunately, tornadoes are a relatively unusual meteorological phenomenon. However, tornado infrequency coupled with fundamental limitations of radar limit the amount of real-world data which has been collected. Because of the extraordinary complexity of tornado formation and the limited amount of real-world data, tornadoes have resisted complete understanding for millennia.

However, for the first time in history, scientific knowledge and computation efficacy have reached sufficient maturity to peer into the heart of a tornado and unshroud its mysteries. By using cutting-edge numerical models on the world's fastest supercomputers, datasets of simulated tornadoes can be generated with arbitrary resolution and scale. By adjusting countless parameters within the numerical models and working closely with domain scientists at the National Weather Center, the models are capable of generating simulated tornadoes which have an extraordinarily high fidelity to real-world storms.

By analyzing these simulated datasets, salient patterns and conditions which precede the formation of tornadoes may be discovered. By continuing to discover and understand these conditions, meteorologists can better distinguish storms which will produce tornadoes from those which will not. This is a critical first step in improving the FAR, which will ultimately aid in preventing unnecessary injuries and deaths.

Currently a senior at the University of Oklahoma, Bradley Pirtle is enrolled in an Accelerated Master's program in Computer Engineering and Computer Science. After completing the program, Bradley's dream is to pursue a Ph.D. in Computer Science at MIT. After countless years of schooling, Bradley will apply to join the Peace Corps upon graduation. After returning to the United States, he hopes to secure employment as a researcher in the government sector.

Hannah R. Reese

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2011-2012 Astronaut Scholar, North Carolina State University
North Carolina State University

Hydrophilically Modified Charcoal as a Pretreatment of Transgenic Plant Extract

The use of transgenic plants to produce immunoglobulin G is hampered by the difficulty in separating the product from the plant culture. A novel pretreatment by a hydrophilically modified charcoal is compared against activated charcoal as a potential candidate to remove phenolic compounds from plant extract but leave the valuable antibody product in solution for separation using affinity chromatography. Affinity separation by hexamer peptide ligand HWRGWV was tested in conjunction with this pretreatment. Different concentrations and incubation times of both modified and activated charcoals were used to determine their effects on phenolic and IgG removal. The modified charcoal at a concentration of 10mg/mL with a 10 minute incubation time was optimal for phenol removal and IgG yield. Hydrophilically modified charcoal as a pretreatment for plant extract has the potential to make separation easier but leave the precious IgG product intact. HWRGWV was shown to be able to separate IgG product from the plant cell culture with similar yield and purity to that of standard Protein A. The dynamic binding capacity of the column with the pretreated plant extract was 12mg/mL. The combination of these two innovations could improve the competitiveness of IgG produced from transgenic plants.

Hannah grew up in the Blue Ridge Mountains of North Carolina before attending North Carolina State University for Chemical Engineering. She became interested in biotechnology during high school and pursued research opportunities in biopharmaceutical production during college. She will graduate in May of 2012 and will attend the University of California, Berkeley, beginning in the fall of 2012, to pursue her Ph.D. in Chemical Engineering.

Darcey Riley

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2011-2012 Astronaut Scholar, University of Rochester
University of Rochester

Semi-Supervised Learning for Statistical Parsing

Parsing is the process of determining the syntactic structure of a sentence. It is an integral component of many computer programs which process natural language, such as question-answering technologies and dialogue systems. Since parsing is often a first step in these tasks, it is important that parsers be made as accurate as possible, as errors in parsing can propagate through the entire system. For instance, parsing errors could lead a question-answering system to address the wrong question. Research in parsing has focused on statistical methods where grammar rules are learned by observing patterns in data. Usually, this data consists of a corpus of already-parsed sentences. One drawback of this approach is that the construction of these corpora involves manually parsing each sentence, a costly and time-intensive process. On the other hand, unparsed sentences are available in abundance, but it is much more difficult to learn a grammar from them. Thus, in my research, I try to get the best of both worlds by learning grammars from data containing both parsed and unparsed sentences; this is called semi-supervised learning.

Darcey Riley is completing her senior year at the University of Rochester, where she is majoring in Computer Science and Mathematics, in addition to receiving a master's degree in Computer Science. After graduation, she intends to pursue a Ph.D. in Computer Science at The Johns Hopkins University, specializing in Natural Language Processing.

Lisa A. Schott

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1987-1990 Astronaut Scholar, Georgia Institute of Technology
Quietly Making Noise, LLC

Acoustical Considerations for Health Care Facilities

Health care facilities including hospitals, medical office buildings, assisted living, and rehabilitation centers encounter many acoustical concerns. It is very important to address these concerns when designing buildings to ensure a positive healing environment. Relatively new regulations now apply to the design of health care facilities, and Lisa has become involved in acoustical design and testing to comply with these objectives and requirements. This presentation will outline the applicable regulatory requirements and why they are important. In addition, Lisa will present an overview of the types of technologies used for noise and vibration mitigation. Special concerns such as MRI's, other sensitive medical equipment, and patient alarms will be discussed.

Lisa Schott is President and Principal Acoustical Consultant of Quietly Making Noise, LLC, a company that she founded in 2002. She has worked for more than 26 years in the energy and building construction industries and provides a wide range of acoustical consulting services to clients with residential, commercial, and industrial projects. She graduated with highest honors from Georgia Tech with a bachelor's degree in Mechanical Engineering. She was an Astronaut Scholar from 1987 to 1990, serves on the Board of Directors and Strategic Planning Committee of the Astronaut Scholarship Foundation, and served on the Scholarship Committee from 1991 to 2007. She was named the Engineer of the Year for Technical Excellence in both 2009 and 2010 by the Florida Section of the American Society of Mechanical Engineers and was appointed to the Council of Outstanding Young Engineering Alumni of Georgia Tech in 2005. Lisa is on the Advisory Board for the George W. Woodruff School of Mechanical Engineering at Georgia Tech. She has written many technical papers on acoustics, provides training sessions on the topics of acoustics and noise control, and holds U.S. Patent 7,562,743 for an Acoustical Window and Door Covering which is marketed as Shut-Eye™ Acoustical Shutters. Lisa has served as an Adjunct Professor at the University of Central Florida, teaching a series of three lectures on Acoustics and Noise Control in the School of Architecture.

Sam Schreiner

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2010-2011 Astronaut Scholar, University of Minnesota
University of Minnesota

Using an Ellipsoid Model to Track and Predict the Evolution and Propagation of Coronal Mass Ejections

Coronal mass ejections (CMEs) are powerful, large-scale magnetic plasma structures in the solar wind that can be extremely hazardous to technology within and beyond Earth's magnetosphere. Though coronal mass ejections have been studied for decades, the physics responsible for their structure, evolution, and propagation is not entirely understood. This work presents a new method for tracking and predicting the propagation and evolution of coronal mass ejections using an expanding, outward-propagating 3D ellipsoidal model. The model is constructed using data from multiple satellite imagers and can track the expansion and propagation of a CME in both the radial and transverse directions. The ellipsoidal model, despite is relative simplicity, was tested and found to be an effective tool for predicting the arrival of density enhancements associated with CMEs with an average accuracy of 2.9 hours. Though this work was not a statistical study, the results showed some promise that the forward structure of a CME could be effectively modeled as an ellipsoid.
Published in Solar Physics, DOI: 10.1007_s11207-012-9936-5.

The exploration and colonization of outer space has always been Sam's foremost academic interest. In Sam's first two years of college at the University of Minnesota, he studied Physics and conducted research concerning space plasma physics in both the heliosphere and geosphere. Through his physics research, he contributed to several publications and was the principle investigator and primary author on his own publication (see abstract). At the end of his second year of college, he decided to pursue his passion for outer space exploration by switching his major to Aerospace Engineering. In the fall of 2011 he began conducting a design-build-test research project on a high-lift, low-drag airfoil which is currently in progress. In addition to Aerospace Engineering, he is also learning Mandarin Chinese and pursuing a management minor at the University of Minnesota. He plans to graduate in the Spring of 2013.

Cam Upchurch

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2011-2012 Astronaut Scholar, University of Arizona
University of Arizona

Molecular Mechanisms of Lysosome Biogenesis

Lysosomes, affectionately referred to as the "garbage disposals" of our cells, are now recognized as central organelles with many functions, including regulation of cell death and wound repair. In spite of the central importance of lysosomes, very little is known about how lysosomes are formed—the process of lysosome biogenesis. Previously, my lab identified CUP-5 (for **c**oelomocyte **up**take deficiency) in *Caenorhabditis elegans* as the first protein to be shown to be required for lysosome biogenesis. CUP-5 is homologous to TRPML1 (transient receptor potential channel, mucolipin subfamily, member 1), that when lost in patients results in a lysosomal storage disease known as Mucolipidosis Type IV. I found evidence that two other proteins, CUP-8 and CUP-9, are also required for lysosome biogenesis. CUP-8 and CUP-9 are homologous to Amnionless and Cubilin, respectively, in humans. Loss of either human Amnionless or Cubilin results in Imerslund-Gräsbeck Syndrome.

We have since identified six other novel proteins involved in the endocytic pathway (CUP-12 to CUP-17). I showed that three of those, CUP-15, CUP-16, and CUP-17, are required for lysosome biogenesis. My current work involves two facets: 1) cloning, mapping, and sequencing these genes to determine their homologs in humans, and 2) working in mammalian cells to identify proteins that interact with the TRPML family. The overall goal of my work is to provide the first molecular model of lysosome biogenesis.

Cam is currently a senior in the Department of Molecular and Cellular Biology at the University of Arizona. In addition to his classes, Cam works as an independent undergraduate researcher in the lab of Dr. Hanna (Johnny) Fares, and a teaching assistant in the MCB Department. Cam will be graduating this May, and will attend (he will decide within the next two weeks) medical school in the fall to begin gaining the clinical skills necessary to work towards his goal of becoming a physician-scientist that directly adapts research into clinical applications. Cam will continue to pursue his research interests while in school and beyond, to achieve such, and looks forward to continue being a lifelong learner and mentor.