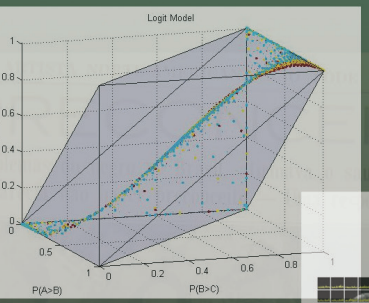
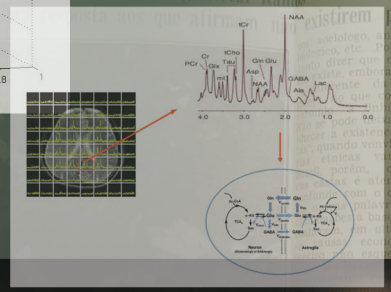
CAS

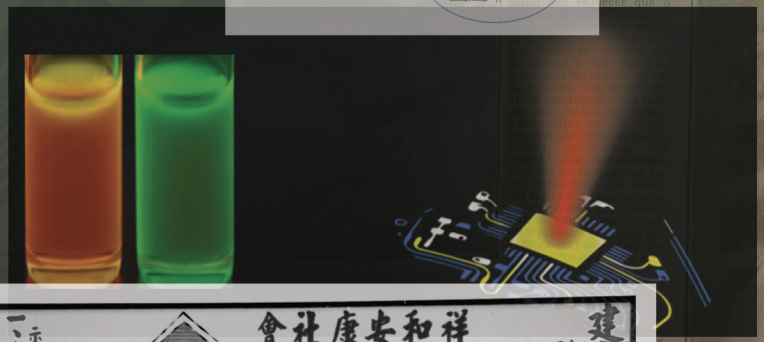
Center for Advanced Study

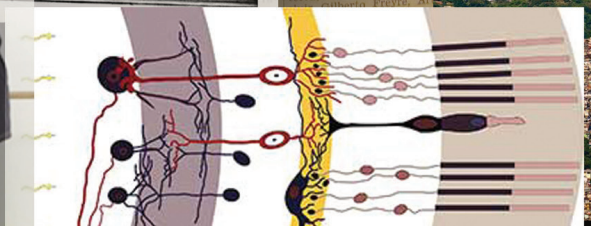
Research Appointments / Associates and Fellows 2016 - 17

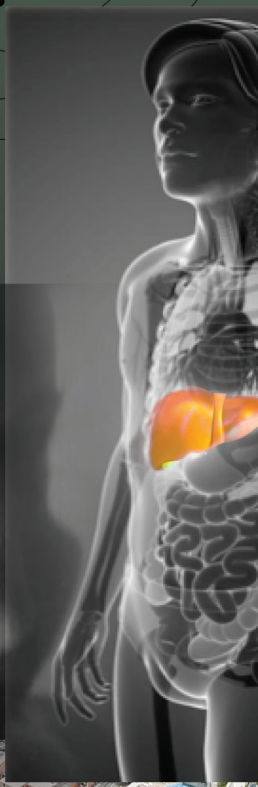
University of Illinois Urbana-Champaign











Sparse Discrete Structures • Uneasy Presents, Unrequited Pasts: South Africa and India in Contemporary Non-fiction • The Compliance Gap and Effects of International Agreements • Antiracism in Brazil • When the Patient is a Dog: Towards the Development of a Veterinary Medical Humanities • Energy Efficiency via Nano-mosaics • Autonomous Video Artist: Seeing the Machine in Human Vision • Inducing Unconventional Optical Behavior in Materials Using Confined Light • Deregulation of RNA splicing networks in fatty liver disease• Causal Inference—From Mere Observation to Intervention • Real Time Transposable Element Activity in Individual Live Cells • Pursuing Human Vision at the Quantum Level • Cinemas of Marginality: Experimental, Avant-Garde and Documentary Film in Ibero America • Geometric Group Theory • Label-Free Molecular Imaging Using Magnetic Resonance • Strong Democracy, Weak Police • Virago-Man Dem

CAS

Research Appointments 2016-17

Each year, the tenured and untenured University of Illinois faculty are invited to submit scholarly/creative proposals for consideration by the Center's permanent Professors. Faculty members with winning proposals are appointed Associates and Fellows and awarded one semester of release time to pursue their projects in the coming academic year.

In accordance with the Center's mission, these appointments provide an incentive to pursue the highest level of scholarly achievement. They also provide faculty members with an unusual opportunity to explore new ideas and demonstrate early results.

Along with the Professors, Associates and Fellows form the intellectual core of the Center for Advanced Study community.They participate in a yearly roundtable discussion of research interests, are invited to participate in CAS events, and have opportunities to present their work to the CAS community.Thus, each year brings together the established and the new in an ever-changing flux of ideas and disciplines.

In this brochure we are pleased to introduce the projects of the 2016-17 CAS Associates and Fellows.

CAS

CAS Review Committee

The review committee for the Associates and Fellows program consists of the Center for Advanced Study Professors. These senior scholars represent a wide range of disciplines. Their permanent appointment to the Center is among the highest forms of campus recognition.

James D. Anderson
education policy, education desegregation, African-American public education

Renée L. Baillargeon
early conceptual development, infant cognition

Tamer Başar
distributed decision making, robust estimation and control, dynamic games, network economics

May R. Berenbaum
entomology, chemical ecology

Bruce C. Berndt
analytic number theory, Srinivasa Ramanujan

David M. Ceperley
quantum Monte Carlo methods, quantum many-body systems

Leon Dash
immersion journalism, domestic and international reporting

Matthew W. Finkin
labor and employment law, legal issues in higher education

Martha U. Gillette
cellular neuroscience, circadian rhythm

Nigel Goldenfeld
condensed matter physics, evolution, microbial ecology, statistical mechanics

Bruce Hajek
communications engineering, stochastic methods

Brigit P. Kelly
poetry

Anthony James Leggett
low-temperature physics, superconductivity

Stephen P. Long
environmental physiology, global atmospheric change, C4 photosynthesis

Michael S. Moore
law and philosophy, jurisprudence, criminal law, ethics and meta-ethical philosophy, philosophy of punishment and responsibility, philosophical psychology

Tere O'Connor
dance, choreography, consciousness

Gene E. Robinson
genomics, social behavior, social insects

Jay Rosenstein
journalism, film, documentaries

Klaus Schulten
condensed matter physics, biomolecular modeling, vision, photosynthesis, force generation, membrane channels, cellular organization

Jonathan Sweedler
bioanalytical chemistry, peptide hormones, neurotransmitters, neuromodulatory agents

Maria Todorova
history, Balkans, nationalism

Lou van den Dries
model theory, o-minimality

Dale J. Van Harlingen
experimental low-temperature physics, superconductivity, microfabrication of superconductor devices, scanning probe microscopy, mesoscopic systems

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Invitation to Apply
We invite the campus faculty to submit proposals for the 2017-18 academic year. For more information, please consult our website at www.cas.illinois.edu

Application deadline:
October 4, 2016

Contents

Sparse Discrete Structures

Jozsef Balog
Associate

Department of Mathematics

This project will focus on **extremal and probabilistic combinatorics** and on several related areas. Professor Balog and his coauthors have developed the so-called container method, and contributed to the theory of applications of flag algebras. These new methods are considered the most exciting recent breakthroughs of the field with many unexplored directions.
The project's central focus is further developing the container method which connects several interrelated problems on the borders of combinatorics and probability. The questions raised are connected to other areas, such as classical asymptotic enumeration, geometry, extremal problems for graphs and set systems, Ramsey theory, combinatorial geometry, random graphs, and probabilistic methods. One of the most important aims of the project is the effort to understand the "critical probabilities" at which various properties of interest appear in large discrete random systems.

This is a classical area that originated in the 1960s when theory random graphs and percolation was born. But it is also an area that has seen significant developments in recent years, and one that has close ties with several other disciplines, including statistical physics and theoretical computer science. Professor Balog will work on additional applications arising from theoretical computer science and combinatorial number theory.

During his CAS appointment, Professor Balog will travel to Cambridge University and ETH Zurich in order to collaborate with the leading experts of the field.

Uneasy Presents, Unrequited Pasts: South Africa and India in Contemporary Non-fiction

Manisha Basu
Fellow

Department of English

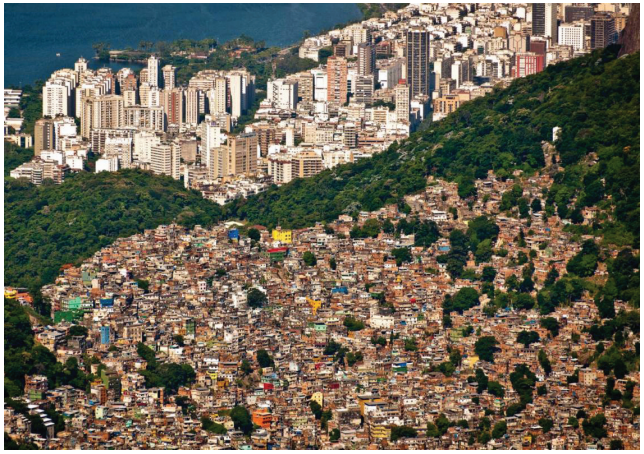
This project studies in a comparative framework, the recent burgeoning of Anglophone non-fictional works in the contemporary South African and Indian literary contexts. It argues that creative non-fiction writers from India and South Africa are beginning to express a similar idea, albeit in different ways. This is the idea that non-fiction, rather than imaginative fictional work, is increasingly the most viable platform from which the current configurations of these two societies may be explored. It is in relation to such a claim that this book project seeks to investigate, through the lens of their historical genesis, present-day resonances between the South African and Indian situations. Both India and South Africa are today powerful political, economic, and cultural presences in their respective regions. They are characterized by an escalation in deregulated markets, the accelerated spread of smart technologies, and an increasing privileging of urban-metropolitan life.

Despite such celebrated 'advances,' both South African and Indian societies continue to be characterized by gross inequities of income and state-led divisions based on racial, tribal, caste, and religious identities. What then is it about creative non-fiction that lends itself to a conversation with such enforced apartness and ongoing inequality, and in what way does this favoring of creative non-fiction speak to the long history of anti-colonial dissent that characterizes both the Indian and South African contexts? This book project seeks to situate and unravel these questions in the context on the one hand of what in the twenty-first century has come to be referred to as a 'new scramble for Africa' and on the other, of what is possibly the space for a radical dialogue between Southern nations that may in fact shape an emerging configuration of global powers.

The Compliance Gap and Effects of International Agreements

Xinyuan Dai
Associate

Department of Political Science



With growing interdependence among countries, the number of international agreements among sovereign states has increased exponentially across diverse issue areas. If these international agreements are meant to regulate states' behavior, are they working? How do we know? Despite growing attention to the effects of international agreements, the current scholarship is confused as to what constitutes the appropriate criteria by which we should evaluate international agreements. This confusion results in a large part from the failure to appreciate systematically how the way in which agreements are negotiated shapes their effects. To understand what the observable compliance gap may tell us about the effects of international agreements, we need to first understand how and to what extent the compliance gap is structurally induced. This project will explain how the compliance gap is pre-determined by the problem structure that states face and the bargaining leverage of participating states. It will thus provide an analytical benchmark to infer the effects of international institutions, and further leads us to rethink the strategic nature of international agreements.

Antiracism in Brazil

Jerry Dávila
Associate

Department of History

a Época

Director-responsavel: F. RODRIGUES ALVES FILHO

ANO V — SÃO PAULO Quarta-feira, 26 de julho de 1950 — N. 989

Adhemar desagrava a «colored» Katherine Dunham

Expressivo gesto do governador paulista oferecendo nos Campos Elisecs um almoço em resposta ao "racismo" da arapuca Esplanada Hotel

Katherine Dunham, ao lado do governador Adhemar de Barros, ontem, no Palacio dos Campos Elisecs

Repercutiu admiravelmente o belo gesto do governador Adhemar de Barros, oferecendo ontem, nos Campos Elisecs, um almoço á consagrada bailarisa "colored" Katherine Dunham, que é tambem uma renomada antropologista. Como se sabe, os granfinos que arrendam o Hotel Esplanada tendo á frente a figura grotesca de Paulito Campos, conhecida nas rodas granfinas como "Paulito Bigode", impediu que o mundialmente famoso interprete da arte de Terpsicore obliteasse hospedagem naquela arapuca de luxo. Motivo alegado: Katherine é negra. O fato convulsionou todos os circulos intelectuais e parlamentares do país, tendo o illustre deputado Afonso Arinos de Melo Franco apresentado á mesa da Camara Federal um projeto que proibe a discriminação racial no Brasil. Há dois dias os encasacados do hotel granfino tiveram pelos jornais, em materia paga, dizendo que nada tem contra os negros, e que por diversas vezes já hospedaram pessoas de cor. Então porque não aceitaram a ara. Katherine Dunham? Positivamente desculpa de granfino, os descuidos das arvores genealogicas dos proprios donos do Esplanada.

Quem sabe se uma pesquisa não lhes traria muitas surpresas...

Sabedor da insolita atitude daqueles cavalheiros de quatrocentos anos, o sr. Adhemar de Barros prestou uma homenagem a inteligencia e á arte da mais famosa bailarina internacional, oferecendo-lhe um almoço. Estava desagravada a ofensa lançada a todos os homens de cor na pessoa da illustre visitante e artista, pelos modalhos bonitos da espelunca de luxo. O governador deu uma lição. Que sirva de exemplo, e que se adeuire ao gesto governamental o desejo de reafirmar que todos os homens são iguais, não importa a cor, a raça ou a religião.

Bravos governador!

In a world no longer divided by formal barriers of racial segregation like South African Apartheid and Jim Crow in the U.S. South, the problem of informal racial discrimination endures. In Brazil, the country with the largest population of African descent outside of Nigeria, informal discrimination has perpetuated stark inequalities in the 128 years since the abolition of slavery.

Antiracism in Brazil is a book in progress that studies race relations in Brazil to understand perceptions of discrimination and reactions against it. The study examines the decades between the passage of Brazil's largely ineffective law barring discrimination in 1951, and a revised 1989 law that was a more practical tool for challenging discrimination. The original 1951 law was almost unenforceable because it required plaintiffs to demonstrate that people whom they denounced had racist intent. Despite this almost impossible burden, black Brazilians still brought suit against incidents of discrimination. Professor Dávila has unearthed lawsuits, newspaper accounts and other sources in order to analyze challenges to discrimination in the courts and beyond.

This book examines the ways in which black and white Brazilians understood race relations, to map ways in which black Brazilians worked to define discrimination in forums such as the press and the courts, and to trace the patterns of challenges against discriminatory practices in settings such as workplaces, restaurants, social and athletic clubs, and other public facilities. By focusing on broad reactions to informal but pervasive practices of discrimination, this study rethinks the history of race relations in Brazil by documenting and analyzing much more common forms of resistance to discrimination than had been previously acknowledged by scholars. In doing so, it contributes globally to the understanding of ways in which black Brazilians faced discrimination.

UMA GRANDE ARTISTA NORTE-AMERICANA NÃO PODE ENTRAR NUM HOTEL DE SÃO PAULO

O PRECONCEITO EXISTE!

Ha varios problemas do negro no Brasil, afirmava o saudoso sociólogo Artur Ramos — No Copacabana Palace Hotel parecia não haver preconceito — Uma resposta aos que afirmam existirem preipitos

CORREIO PAULISTANO

Quilombo

When the Patient is a Dog: Towards the Development of a Veterinary Medical Humanities

Jane Desmond
Associate

Department of Anthropology

Despite the recent "animal turn" in the humanities, and the ensuing growth of cultural studies of human-animal relations, the humanities and humanistic social sciences such as cultural anthropology have largely overlooked veterinary medicine as a key arena through which cultural values and assumptions about human/non-human animal relations are articulated, enacted, policed, and contested.

The veterinary profession—its presumptions, practices, training methods, and history—is rarely analyzed by scholars, yet it has an impact on most of the population either through caring for pets or through maintaining public health through the food chain. Historically, writing on veterinary medicine has often been produced by veterinarians themselves who are trying to find out more about the roots of their profession. Recognizing and addressing this lacuna, Professor Desmond's largest long-term goal for this research is twofold. First, she will craft a fieldwork-based book about the contemporary practice of veterinary medicine in the U.S. that analyzes it from a social science/ethnographic and cultural studies approach. Topics will include: the dramatic recent feminization of the profession; the production of knowledge when the patient can't speak; the place of the animal in veterinary medicine (which varies across species); and how the profession articulates concepts of values and ethics while crafting relations between human and non-human animals. Second, Professor Desmond plans to bring that work both to the medical humanities scholarly community (currently focused solely on human medicine) and to veterinary colleges themselves, as a way of potentially enhancing and transforming veterinary medical education and enlarging the medical humanities to include multi-species medicine.

Energy Efficiency via Nano-mosaics

Rosa Espinosa-Marzal
Associate

Department of Civil & Environmental Engineering

Technologies to store electrical energy generated by renewable energy sources and to produce freshwater from wastewater and seawater rely on the behavior of liquids inside pores of around ten times the diameter of the molecules themselves. The behavior of liquids in such narrow spaces differs from that in the bulk. The confined molecules stick to the wall and arrange in layers. Similar to the magnets sticking on refrigerators, their strong attraction to the surface makes it difficult for them to slide. This commonly labeled **"solid-like" behavior of confined liquids** has been observed in "model" pores composed of atomically flat and chemically homogeneous surfaces.

The goal of this project is to achieve control over the behavior of the confined molecules by decorating the pore surface either with topographic or with chemical motifs, leading to valleys and peaks in the interaction landscape between the molecules and the confining surfaces. The focus will be on a particular class of liquids called ionic liquids that have been proposed as "designer" electrolyte for energy storage systems where they are confined in the electrode's nanopores. A high affinity between liquid molecules and pore surface is needed to achieve high values of stored energy, at the cost of serious limitation of molecular mobility and low efficiency.

Two tasks will be carried out: to design an experimental method to study the properties of the fluid nanoconfined between heterogeneous surfaces, and to evaluate new and old data in light of phenomenological models to elucidate the parameters that will increase flow rate but maintain the affinity to the decorated surface. By correctly tuning these heterogeneities' mosaics, it should be possible to manipulate the solid-like behavior and to achieve higher efficiencies. This work will also advance the fundamental understanding of the behavior of nanoconfined liquids in "real" (in contrast to "model") nanopores relevant to many applications.

Autonomous Video Artist: Seeing the Machine in Human Vision

Benjamin Grosser
Fellow

School of Art + Design

Humans see through the lens of culture. Rather than objectively observing our environment, we filter out much of what the eye collects based on prior experiences of the world. This act of gathering, filtering, and interpreting visual input constitutes the act of seeing. But because of this filtering, seeing is always accompanied by an act of not seeing. In other words, our ways of looking at the world are culturally developed, leading us to see what we have learned to see.

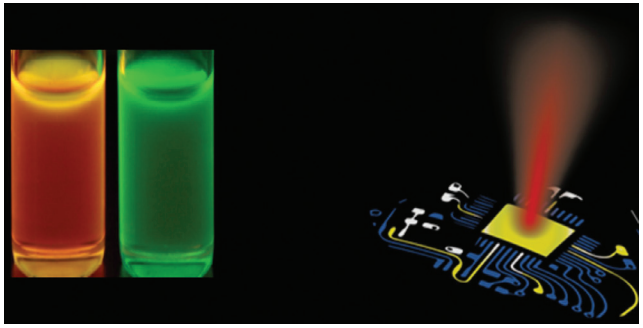
Posthumanist thought argues that a full understanding of human experience requires consideration of non-human experience that sees around our blind spots. Donna Haraway proposed a genderless "cyborg" that would see gender differently in order to disrupt limiting norms of gender and identity. With recent technological advancements, artificial intelligence makes possible the construction of a computational other, a posthumanist outside observer that employs machine vision to see and interpret the world without the influence of cultural history.

To investigate the effects of culture on human vision, Professor Grosser will create a new artwork called Autonomous Video Artist (AVA). AVA will be an artificially-intelligent, self-propelling, video-capture robot that seeks out, records, edits, and uploads its own video art to the web. AVA will be that outside observer that not only looks at our world, but attempts to decode it as an artist. But different than human artists, AVA hasn't spent years watching videos or learning how artists convey narrative using temporal media. Instead, AVA will start from the beginning, using an iterative process of making to develop its own ideas of what video art can be. Most importantly, AVA will see the world differently than we do. This difference will help uncover how culture directs what we see and don't see, showing us the machine in human vision.

Inducing Unconventional Optical Behavior in Materials Using Confined Light

Prashant Jain
Beckman Fellow

Department of Chemistry



This research focuses on a study of how photons behave when confined to the nanoscale and what unique optical phenomena we can elicit from such confinement. The proposed studies are designed to explore how one can use photon confinement to fundamentally alter the optical response of light absorbers and thereby control the flow of energy in these materials, such that these energy conversion processes have an enhanced utility in solar energy harvesting.

Professor Jain will leverage optical resonances of metal nanoparticles to generate such confined photons. The optical excitation of resonances in metal nanostructures results in the generation of intense electric fields around the nanostructure. There is immense untapped potential for employing these intense fields for fundamentally altering light-matter interactions in materials and thereby achieving much more directed and efficient flow of energy. Professor Jain will focus on two examples:

a) Titania is a semiconducting material that absorbs ultraviolet light, but has little absorption of visible sunlight. Here, a scheme to induce non-natural visible light absorption in titania by placing this material within a strongly focused near-field of a carefully designed metal nanostructure will be pursued. In addition to being fundamentally interesting, visible-absorption induced in this manner can open up the technological potential of harvesting sunlight for generating hydrogen from water using a titania photocatalyst.

b) Typically, light-absorbers, following photoexcitation, lose their excitation energy to thermal dissipation or heat. This is because thermal dissipation—vibrational cooling—is much faster than the process of conversion of the excited state into an emissive photon or a voltage-generating exciton. By placing such absorbers in a strong near-field, the latter processes, which are much more productive for energy generation, can be made much faster. Thereby, thermal dissipation, which is an undesirable energy loss mechanism and a fact of nature, can be beaten at its game.

Deregulation of RNA Splicing Networks in Fatty Liver Disease

Auinash Kalsotra
Beckman Fellow

Department of Biochemistry

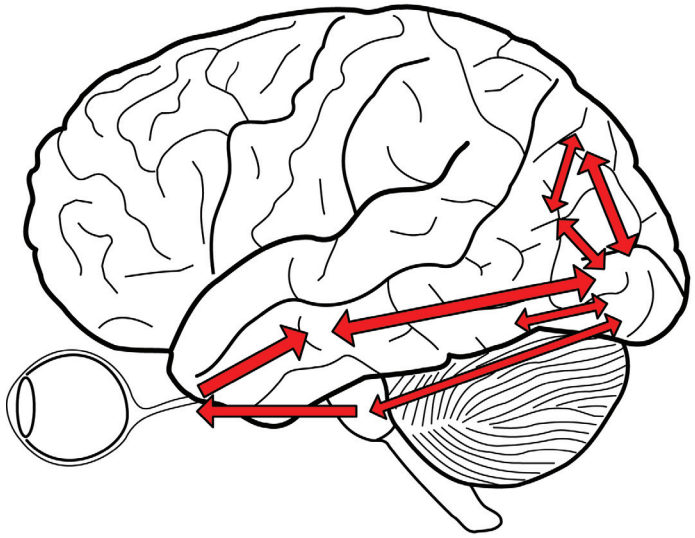
Up to 25% of Americans have excess accumulation of fat within their liver, and the numbers are on the rise. Although the initial buildup of fat is relatively harmless, it can progress into a condition called nonalcoholic steatohepatitis (NASH), which causes the liver cells to swell and become injured. NASH is often accompanied by inflammation and scarring (fibrosis) that can result in cirrhosis, liver failure and death. Why some individuals with extra fat in their livers develop NASH remains unknown. Current knowledge of this disease is limited because early stages (simple steatosis) are asymptomatic and difficult to detect. Furthermore, development of effective therapeutics against NASH has been slow due to lack of a feasible and robust model system. Professor Kalsotra and his research team have developed a mouse model that spontaneously develops all of the hallmarks of human NASH.

While studying the functional roles of alternative splicing—an evolutionarily conserved mechanism to generate proteome diversity—the team discovered that loss-of-function of a splicing regulatory protein in mice triggers severe and early onset of NASH. During his Center appointment, Professor Kalsotra will focus on determining how and why a loss in hepatic splicing activity results in this advanced form of liver disease. He and his team will first investigate the molecular and cellular abnormalities that stimulate disease pathogenesis in the absence of the splicing factor. They will next employ state-of-the-art genomics and computational methods to characterize the hepatic splicing regulatory networks of normal and fatty livers. Finally, they will determine which of the splicing substrates are critical for maintaining normal liver architecture and function. The CAS fellowship will render a crucial period of teaching release that will allow protected research and reflection time needed for these scholarly activities.

Causal Inference—From Mere Observation to Intervention

Negar Kiyavash
Associate

Industrial & Enterprise Systems Engineering



Despite the fact that human judgments about the likelihood of events and dependencies among variables are strongly influenced by the perception of cause-effect relationships, our understanding of complex systems for the most part has been achieved by means of simple correlative or structural statistics, such as degree distributions, alongside strong assumptions about their dynamics, such as linearity. Such assumptions do not hold true for many complex networks of interest and correlation-type measures of dependencies, rather than incorporating causal relationships, pose a severe limitation to our inference capability.

The objective of the proposed research is to understand causal influences in networks that allow succinct representation of their dependency structure. Such a representation aids not only in learning the functional map of the network but also in performing inference and control tasks. An information-theoretic framework will be used to develop a comprehensive theoretical and practical approach. Such a framework could significantly enhance the scientific community's ability to understand complex phenomena. More precisely, it would be possible to more quickly identify the causes of malfunctions in a post-failure network, detect anomalies before they turn into catastrophes, and even intervene at a timely fashion to prevent escalation. Moreover, comprehension of natural complex networks, such as biological networks, offers the opportunity to enhance man-made systems and use resources more effectively.

Real Time Transposable Element Activity in Individual Live Cells

Thomas Kuhlman
Fellow

Department of Physics

Professor Kuhlman's laboratory uses the tools and techniques of physics to explore the **molecular basis of mutation and evolution**, using specially constructed fluorescent reporters to watch genome instabilities occur in real time and in living cells. His research team quantifies the statistics by which mutations and other genome reorganization arise, the influence of the environment on these statistics, and the effects of genome dynamics on the growth rate of the organism. In service of this project, Professor Kuhlman's lab uses and develops state-of-the-art imaging, molecular and microbiological techniques, and microfluidics.

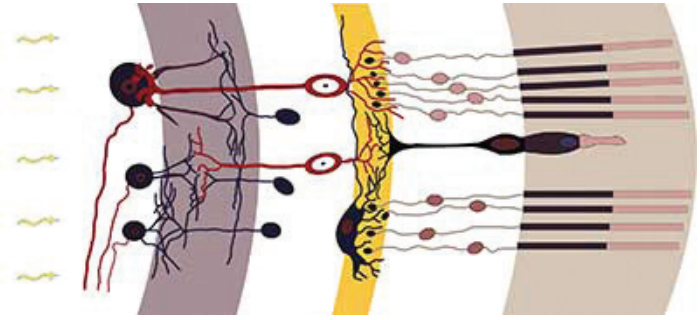
The genomes of all organisms contain transposable elements (TEs): parasitic genetic elements capable of self-catalyzed copying, proliferation, and integration into the host genome. As a result of this activity, the host genome can be significantly altered and disrupted: approximately 50% of the human genome is made up of TEs and their remnants as "junk DNA," and their activity is the direct causative agent of many diseases.

However, despite their importance and ubiquity, relatively little is known about the statistics and rates of transposition, and the distribution of effects on the host. To resolve this fundamental gap in the understanding of a basic building block of all genomes, Professor Kuhlman's lab has developed a synthetic TE whose activity results in the expression of fluorescent reporter proteins. As a consequence, the dynamics of TE propagation within living cells can be studied in spatially-resolved detail and in real time, to quantitatively characterize their contribution to and effects upon the health of the organism, and to investigate their interplay with other processes contributing to genome plasticity and their propagation throughout populations. The method is extensible to all types of TEs and cell types, and this real-time approach will potentially revolutionize our understanding of the dynamics of transposable elements, the evolution of genomes and "junk DNA," and our understanding of human disease caused by transposable elements.

Pursuing Human Vision at the Quantum Level

Paul Kwiat
Associate

Department of Physics



Courtesy of Wikimedia commons

Despite the fact that more than 70 years have passed since the first low-light vision experiments, it remains an open question whether humans can see single particles of light – "photons." Professor Kwiat's lab has developed unique hardware and methodology to definitively answer this question, by reliably preparing pulses of light containing exactly one, two, or any small number of photons. The photon is directed at random to one of two sets of rods in the observer's retina; by forcing the observer to choose where they believe they saw the photon (including cases where it was lost before hitting the retina), single-photon sensitivity can be determined more accurately than random guessing would allow simply by looking for correct answers.

In addition to coordinating a new multidisciplinary NSF-INSPIRE grant to investigate this topic, the CAS appointment will enable Professor Kwiat to develop the requisite technical capabilities to incorporate "adaptive optics" into the experiment.

By using deformable mirrors, eye-tracking hardware, and holographic techniques, it should be possible to direct photons onto individual rods. The overall detection efficiency should increase, as photons can no longer hit the dead space between rods. Moreover, one can test the phenomenon of visual adaption (reduced sensitivity to a repeated stimulus) at the single-photon level, and if present, intentionally use different rods for subsequent trials. Finally, one can study the visual response to different spatial patterns of light, thereby directly measuring the rod cells' neuronal linkages. This latter would eventually enable the capability to "prime" the neuronal circuit, so that the visual system can have an improved efficiency at detecting the next photon directed to the rod of choice. Achieving the required precision will be nontrivial, but the payoff would be an extremely powerful measurement system, enabling entirely new types of experiments on the human visual system at the single-quantum level.

Cinemas of Marginality: Experimental, Avant-Garde and Documentary Film in Ibero America

Eduardo Ledesma
Associate

Department of Spanish & Portuguese

Frame from *pneurosis* (2001), an experimental film by Daniela Cugliandolo, a hispano-argentine filmmaker who works with analog Super 8 technology and digital postproduction to question media and national boundaries.

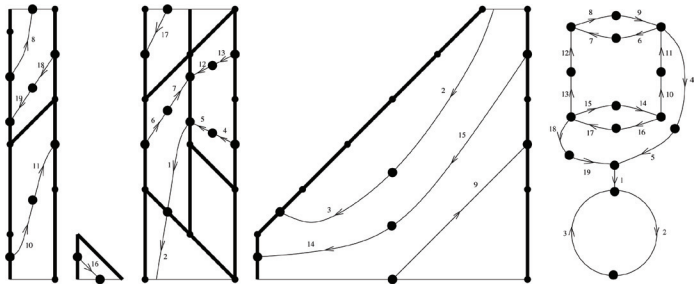
Nontheatrical film. Documentary film. Experimental film. Orphan cinema. Amateur film. Home movies. Expanded cinema. Small-gauge cinema. Paracinema. Super-8. Online videos. These are all varieties of noncommercial cinema that shun Hollywood spectacle-driven aesthetics, seeking instead to engage more critically with the formal and structural parameters of the film medium. Yet, far from restricting themselves to form, these cinemas often also delve into social, political and ideological concerns, especially when they originate from the margins or peripheries of so-called First World nations. This book project, situated within Latin American and Iberian Film Studies, examines debates about contestatory form and politics in avant-garde, experimental and documentary film in Latin America and Spain. It does not seek to provide a comprehensive overview of alternative film practices, but rather to focus on a set of films and filmmakers that have transgressed both geographical and aesthetic boundaries, sharing strategies and styles across the Atlantic in their efforts to create counter-cinemas.

Salient themes explored in the book include: formal strategies deployed by militant filmmaking under dictatorial regimes; experimental filmmaking and intermedial practices; relations between experimental and mainstream cinema; and changing conditions of reception as films are screened in non-traditional venues such as art galleries, museums and building surfaces, and are archived online in sites such as Vimeo and YouTube. In addition, related to topics of mobility, migration, immigration, and borders, the book also studies the complex circulation of films and filmmakers within Latin America and across the Atlantic to/from the Iberian Peninsula. Already underway, this book will become Professor Ledesma's primary research focus for the next two years, with a planned completion date of September 2017. *Cinemas of Marginality* addresses important transatlantic and transnational connections in noncommercial cinema from Argentina, Chile, Peru, Colombia, Brazil, Mexico, and Spain, focusing on the last fifty years of filmmaking, from the 1960s until today.

Geometric Group Theory

Christopher Leininger
Associate

Department of Mathematics



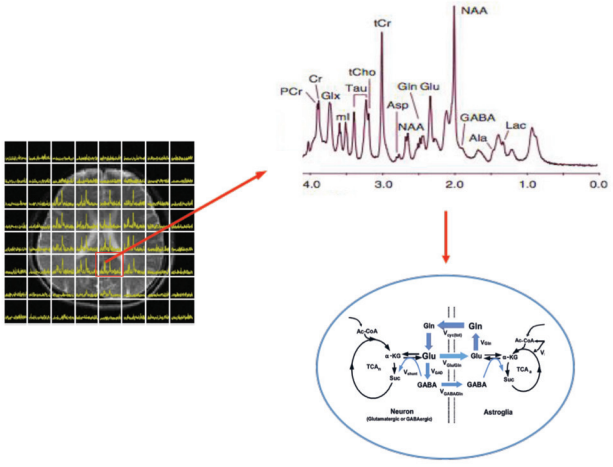
Professor Leininger's research is in geometric group theory, a branch of pure mathematics that studies symmetries of spaces, interpreted very broadly, through the use of geometry. In his work, the symmetries involved arise from geometric considerations, especially through surfaces, like the surface of a doughnut, and from graphs. Thus geometry enters as both the source of the symmetries, as well as a tool for studying the group of symmetries. In Fall semester 2016, the Mathematical Sciences Research Institute will host a semester program on geometric group theory, and Professor Leininger will participate in a substantial portion of the activities.

The "mapping class group of a surface" and the "outer automorphism group of a free group" are the symmetry groups where most of Professor Leininger's research takes place. Specific projects include the following: (1) continuing the study of the notion of "convex cocompactness" in the mapping class group. With Bestvina, Brombert, and Kent, Professor Leininger will look for simpler ways of describing this concept with the hopes that it will shed light on a long standing open problem of Gromov. (2) With Margalit, he will continue to study how long-term behavior of iteration of symmetries of surfaces is reflected in associated 3-dimensional spaces. (3) He will continue his work with Dowdall and Kapovich on "free-by-cyclic groups," building analogies between the theory developed for surfaces and the more mysterious theory for graphs.

Label-Free Molecular Imaging Using Magnetic Resonance

Zhi-Pei Liang
Associate

Department of Electrical & Computer Engineering



Molecular imaging has been a dream of biomedical imaging scientists for decades, and governments and industries have invested billions in this area. However, most existing molecular imaging techniques have to inject molecular probes and molecular reporters into a subject in order to obtain molecule-specific information from it, thereby limiting their practical utility. Magnetic resonance spectroscopic imaging (MRSI) has long been recognized as a potential powerful tool for non-invasive, label-free molecular imaging. However, clinical and research applications of MRSI have been developing very slowly due to several long-standing technical barriers, including long data acquisition time, poor spatial resolution, low signal-to-noise (SNR), and overwhelming nuisance signals (especially for 1H-MRSI). In order for MRSI to become a routine diagnostic and research tool for molecular imaging, accurate, spatially-resolved spectral information must be obtained reproducibly in a time acceptable to patients. Current MRSI methods, after more than three decades of research efforts and progress, still fall far short of providing this desired technical capability.

The primary objective of the proposed project is to devote a concentrated effort to bring a new MRSI technology into being by leveraging recent breakthroughs in this area. This technology, resulting from many years of research efforts, is based on a new approach to MRSI, which contains several key innovative features, including ultra-short TE acquisitions, sparse sampling of (k, t)-space, constrained image reconstruction, and statistical spectral quantification using spectral basis from quantum simulation. Preliminary results have shown an exciting potential of this technology to achieve an unprecedented combination of resolution, speed and SNR for MRSI. This technology, when fully developed, can transform noninvasive, label-free molecular imaging.

Strong Democracy, Weak Police

Jeffrey Martin
Fellow

Departments of Anthropology and East Asian Languages & Cultures

Billboard, Hualien City, Taiwan. Photographed by Jeffrey Martin, 2002.

This is a project about the relationship between democratic sovereignty and police power. It examines how the dynamic and unsettled trajectory of sovereign power in Taiwan has shaped the ground-level practice of policing there. It uses ethnographic and historical methods to advance new insight into the nature of modern police, into the surprisingly loose and historically dynamic linkage between sovereignty and police power, and into the meanings that democracy imposes on the scope and potential of police action.

Taiwan's modern police system was created by a sequence of colonial, imperial, and autocratic regimes. Its contemporary state, the Republic of China, underwent democratization in the 1990s, a shift that been remarkably successful when measured by conventional indicators of good governance and the quality of life. Using ethnographic methods to drill down into the everyday practices of policing, however, reveals three remarkable attributes of this contemporary system: (1) State police are weak: they do not presume to control a monopoly of legitimate violence, nor do they dictate the outcome of the events they are called to manage. (2) The broader field of policing (integrating state and non-state actors) is not organized by law. (3) Nonetheless, the overall quality of life in contemporary Taiwan remains democratic, peaceful, and secure. In sum: Taiwan reveals that it is evidently possible to secure democracy on a basis other than violence or law.

Professor Martin's contribution is to reveal this other basis: a historically specific cultural formation that generates social trust through an intimate idiom of particularistic relationships, rather than by reference to the abstract ideal of a general social contract. Beginning from the conundrum of a policing system that effectively secures a democracy without presuming a state monopoly on legitimate violence, Professor Martin will reveal how this achievement is enabled by a cultural tradition that imagines a peace founded in the quality of human subjects rather than on the coercive power of violence or the formal autonomy of law.

Virago-Man Dem

Cynthia Oliver
Associate

Department of Dance

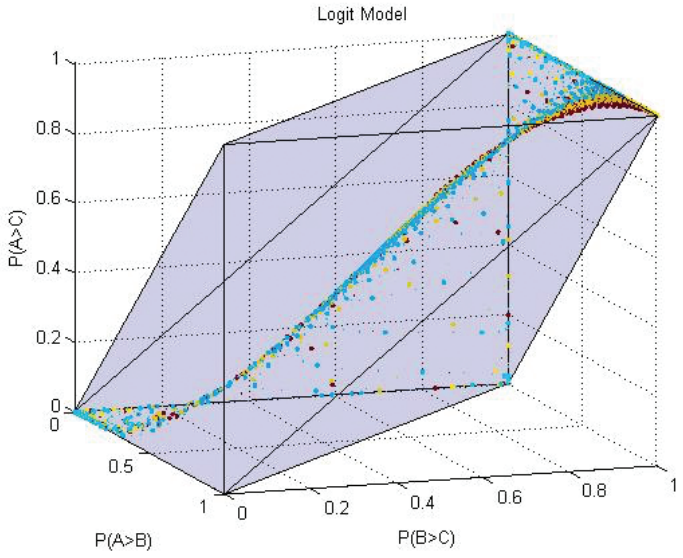
During her Center appointment, Professor Oliver will develop sections of the evening-length, dance-theatre work *Virago-Man Dem* premiering in 2017. *Virago-Man Dem* examines complexities of black masculinity. The title of the work is relevant to the project in three distinct ways. In the Caribbean, an area central to all of Professor Oliver's creative research, *Virago* is a term alluding to that "je ne sais quoi" power that works behind the veil of the world we know. The Latin root of *Virago, vir,* refers to the virile, and the term's "official" dictionary meaning, refers to cultural and gender transgression, often used in derogatory relation to a woman who possesses tendencies, like bravery or aggression, that are most associated with men. Professor Oliver is interested in these components and especially the transgressive ambiguity of the term, which takes on a very particular life in the Caribbean. Despite the region's rampant homophobia, masculinities in the Caribbean are wildly flexible in the ways they are expressed through personal style, posture, and men's interactions with others. *Virago-Man Dem* will attempt to capture this, along with and a broader spectrum of black masculinities through movement, visual mediums, sound environments/music, and the spoken word.

To arrive at this material, Professor Oliver plans to create environments locally to facilitate conversations among black men about their masculinity. She will invite them into the rehearsal process, and ultimately create a work that speaks with and to communities of black men. *Virago-Man Dem* will thus allow Professor Oliver to explore the spoken and unspoken attitudes and expressions in multiple black masculinities as they are performed by communities of men, staged on male bodies, but designed and interpreted by a woman—Professor Oliver herself. The work will be a performance of masculinity emerging from subtle, intra-gendered movement communications uniquely expressed through choreography.

Bridging the Theory-Behavior Gap in Decision Research

Michel Regenwetter
Associate

Department of Psychology



Geometric representation of probabilistic choice models

Decision making is difficult. Just as we teach our children to read and write, we should teach them decision literacy. Much of the recent financial crisis resulted from organized financial predators exploiting unsuspecting consumers. Since 2011 a dedicated government agency, the Consumer Financial Protection Bureau, aims to protect us from getting tricked into ruinous decisions. Behavioral decision research investigates how cognitive limitations and other factors impact decision making. However, decision behavior is not yet well understood.

The scientific study of decision making is hampered by tremendous heterogeneity in behavior. Over the past decade, Professor Regenwetter has developed a general theory of *uncertain choice behavior* that lets scholars model variability between and within decision makers very precisely. This framework overcomes logical reasoning fallacies engrained in current theories and methods; enhances scholars' ability to model and measure heterogeneity; and dramatically accelerates scholars' data analyses.

This project will result in a major journal article for submission to the flagship *Psychological Review*. This article will formulate the most comprehensive theory of *uncertain choice behavior* to date, supported with empirical illustrations and backed up with supercomputer-based data analyses. Although the theory uses sophisticated mathematics and statistics to diagnose different potential cognitive processes that drive uncertainty in decision making, Professor Regenwetter aims to make this theory accessible to a maximally broad research community.

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