An Unprecedented Winter Quarter

While our community recovers from the aftermath of the Thomas Fire and the resulting mudslides, our campus is bearing through an unprecedented academic term. With only nine weeks available for instruction, and with a number of faculty, staff, and students still displaced, we have a number of obstacles to consider. Fortunately, this Winter Quarter will also have some highlights, including a number of visits from well-known scientists. These invited speakers include Dr. Negar Kiyavash from the University of Illinois, whose talk is titled “Causal Inference in the Presence of Latent Nodes,” and Dr. Stephane Mallat, from ENS France, who will apply Deep Neural Networks to applications in Physics. We are also expecting an extended visit by Dr. Chiara Ravazzi from the National Research Council of Italy, Dr. Ananthram Swami from ARL, and — a special treat! — a visit by Dr. Albert-Laszlo Barabasi.

Course highlights include the delivery of our program’s second Network Science course and a seminar focus on graph embedding.

Highlight: Dr. Albert-Laszlo Barabasi

a meet and greet with one of the top researchers in the field of Network Science

Dr. Albert-Laszlo Barabasi will visit UCSB in February as a participant in the SAGE Center for the Mind Lecture Series. The title of his talk is “Taming Complexity: From Network Science to Network Control.” Of course we made sure to arrange some time for our IGERT trainees to meet with him during his visit. The following comes from his biography:

Albert-László Barabási is both the Robert Gray Dodge Professor of Network Science and a Distinguished University Professor at Northeastern University, where he directs the Center for Complex Network Research, and holds appointments in the Departments of Physics and Computer Science, as well as in the Department of Medicine, Harvard Medical School and Brigham and Women Hospital, and is a member of the Center for Cancer Systems Biology at Dana Farber Cancer Institute. A Hungarian born native of Transylvania, Romania, he received his Masters in Theoretical Physics at the Eötvös University in Budapest, Hungary and was awarded a Ph.D. three years later at Boston University. Barabási's latest book is Network Science (Cambridge University Press, 2016). He has also authored Linked: The New Science of Networks (Perseus, 2002), currently available in fifteen languages, Bursts: The Hidden Pattern behind Everything We Do (Dutton, 2010) available in five languages, and is the co-editor of The Structure and Dynamics of Networks (Princeton, 2005). His work lead to the discovery of scale-free networks in 1999, and proposed the Barabási-Albert model to explain their widespread emergence in natural, technological and social systems, from the cellular telephone to the WWW or online communities.
Modules: Innovations in Network Science

Our trainees continue to explore Network Science through short, original research modules. Below are three of the projects underway this quarter:

**Artificial Intelligence for Autonomous Interstellar Spacecraft Novelty Detection**

Under the direction of IGERT faculty member Linda Petzold, first-year trainee James Bird describes his module as one “at the crossroads of Experimental Cosmology & Applied Computer Vision.” A high-level description involves imagining a series of probes that will venture deep into space. They will encounter new & interesting things in space, such as unseen planets, asteroids, suns, or moons. The project relies on computer vision in order to spot these astronomical objects and recognize that they are of a certain type. A never-before-seen planet should be recognized as a planet, despite never being trained specifically with images of that planet. Since all of this hinges on the probe discoveries being vastly new and unseen, this delves into a budding area of computer vision called 'Unseen Object Recognition'. (Image credit: dailymail.co.uk)

**Heterosexual network structure and experiences of sexual discrimination among men who have sex with men in Seattle, Washington State**

Sexual networks that describe relationships between HIV key populations and the general population remain relatively uninvestigated. In this module Geography trainee Vania Wang and Professor Susan Cassels explore if experiencing sexual discrimination and a hesitancy of being open with their sexual orientation are cognitive drivers of heterosexual relationships among men who have sex with men (MSM). The analysis proposed in this study assesses network dynamics using an egocentric sample collected from the Mobile Study Survey, a 2014 demographic study aimed at investigating HIV risk behavior and migration patterns of MSM in Seattle. Comparisons will be assessed between the MSM/women sexual network model and the MSM-only model for differences in discrimination experience and sexual network parameters (e.g. degree distribution, clustering coefficient, and homophily). Given that effective disease surveillance and prevention is dependent on elucidating current HIV transmission trends, the results of our analysis may offer a unique perspective on sexual networks that bridge multiple population groups. (Image credit: worldArtsMe.com)

**Modeling Alzheimer's Disease State Dynamics**

In Alzheimer's disease, in vivo imaging techniques such as PET and fMRI scans can detect abnormal protein accumulations and disruptions in functional connectivity years before clinical symptoms emerge. Past studies have investigated the temporal and spatial relationships between these two protein deposits, and there has also been work characterizing abnormal changes in resting-state brain connectivity over the course of the disease. There are still, however, many unknowns about how the relationships between tau, amyloid and functional connectivity contribute to Alzheimer's disease state dynamics. In this project, trainee Rachel Redberg and associate Leonidas Eleftheriou will model the effect of tau and amyloid protein accumulation on functional connectivity, using a dynamic network approach with data from the Alzheimer's Disease Neuroimaging Initiative (ADNI) collection. (Image credit: kisspng.com)