Prof. S. Lakshmivarahan completed his Ph.D. in Electrical Engineering from the Indian Institute of Science, Bangalore, India in 1973. After serving as an assistant professor at the Indian Institute Technology, Madras, India and as a visiting assistant professor at Brown University and Yale University, he has joined the University of Oklahoma in 1978, where he is currently the George Lynn Cross Research Professor at the School of Computer Science. His four major areas of teaching and research are learning algorithms, parallel and distributed processing, dynamic data assimilation, computational sciences and finance. He has directed over 42 Master's theses and over 30 Ph.D. dissertations and has been ranked an outstanding teacher each year for the past thirty five years in a row. The University of Oklahoma has acknowledged his superiority in teaching by awarding him the Regents Award for Superior Teaching in 1991. Within a short span of four years after he joined OU, he received the Regents award for Superior Accomplishments in Research and Creative Activity in 1982. He has authored/coauthored 6 books, published 80 archival journal papers and has presented research papers at 115 international/national conferences. He has offered over thirty short courses at major centers of higher learning in Canada, China, Brazil, India, England, Germany, Japan, Mexico, Taiwan and USA. For these accomplishments, he was elected a Fellow of the Institute of Electrical and Electronic Engineers (IEEE) in 1993 and a Fellow of the Association for Computing Machinery (ACM) in 1995. His recent book on Dynamic Data Assimilation published in 2006, has received the 2007 Outstanding Scientific Paper award by the National Office of Oceanic and Atmospheric Research, USA. Recognizing his overall contributions to teaching, research and service, the University of Oklahoma has bestowed on him its highest honor by naming S. Lakshmivarahan, a George Lynn Cross Research Professor in 1995.

Dr. Sarika Jalan completed her PhD in Physics with specialization in nonlinear dynamics and complex systems from Physical Research Laboratory, India in 2005. She has six years of post-doctoral experience at MPI-MiS, Leipzig, MPI-PKS and at NUS, Singapore. During this period, she was working on spectral properties of complex systems as well as applications to biological systems. Upon joining IIT Indore in December 2010, she established Complex Systems Lab, which focuses on inter-disciplinary research, utilizing techniques from Physics, Mathematics, Bio-informatics and Computer Sciences. Using network theory, nonlinear dynamics and computational techniques, the lab on one hand works on developing tools pertaining to complex systems research and on other hand applies these techniques to real world systems coming from Biology and Social science.

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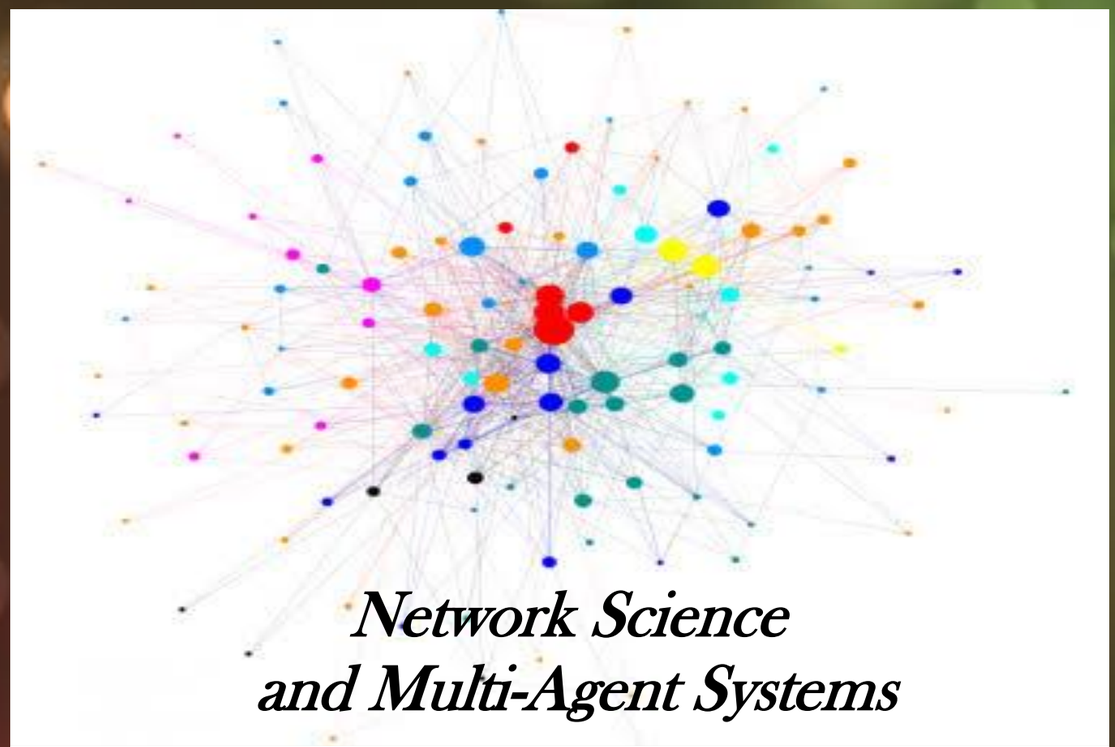

Network Science and Multi-Agent Systems

May 30 – June 10, 2016

Indian Institute of Technology Indore
Discipline of Physics
Complex Systems Lab

Overview

Ever since the publication of the historic paper entitled "The Small World Problem" in the international journal "Psychology Today" (Vol. 2, pages 60-67) by S. Milgram in 1967 promoting the concept of six degrees of separation, there has been ever growing interest in the analysis of interconnected systems. Thanks to the advances in computer and communication technologies along with the evolution of Internet, World Wide Web and inexpensive wireless connectivity, the degree of separation has shrunk even further to its lowest level. This increased connectivity provides great opportunities for easy interaction. The aim of this course is to provide a broad based introduction to this new and exciting area where a collection of intelligent agents - be it human, a robot, an animal or a bird, interact only with his/her local neighbors but have the ability to make global decisions. This ability to arrive at global consensus based on agents, distributed throughout the network, making decisions based only on the local information, has been witnessed in many of the naturally occurring systems such as ant colonies, migrating birds, synchronized firing of the fire-flies in tropical jungles, synchronization of clocks, to name a few.

In this course we will introduce a variety of mathematical tools based on algebraic graph theory, linear algebra and dynamics that constitute a basis for the analysis of large scale complex interconnected systems.

The course will be divided into four modules that will be covered in a total of 40 periods spanning over ten working days in two weeks. The topics in Module A will expose the participants to the introduction and overview of graph theory concepts, algebraic graph theory, various graph topologies and quantification of their properties. In Module B, the dynamics on graphs will be emphasized. The topics in the module include the consensus formation in a distributed multi-agent system, agreement protocol, convergence analysis and its dependence of the spectral properties of the graph Laplacian. Module C will cover the random walks on graphs. The topics include diffusion of information in networks - Cheeger's constant and its relation to the spectra of the Laplacian, Expander graphs, Ramanujam graphs, random walks on a graphs and Markov chains - rate of spread of infectious diseases among humans, spread of computer virus and their relation to the spectral properties of the graph Laplacian and Google page rank algorithms and its variants for web search- the core of the search engines. In Module D, some research problems and applications will be discussed, for example, Epidemics, tourism, spread of fashion in social networks, electric power network, water supply network, transportation networks of all kinds - road, water, air, etc., Chip firing game and sand-piles, synchronization.

On each working day, there will be a total of four lecture periods, each of seventy five minutes duration with two in the morning and two in the afternoon. We will have formal lectures in the first three periods and the last period will be devoted to problem solving sessions to gain hands on training.

Who should attend

- If you are an undergraduate, Master or PhD level scholar who would like to be introduced to the new and growing interdisciplinary area of Network Science and Multi-Agent systems.
- If you are a young and budding member of the faculty at various Engineering and Computer Science departments wanting to learn the developments and further developing research programs in the respective departments.
- If you are a scholar in governmental, industrial or consulting agencies who wishes to expand understanding the state of the art in this area.

Fees

The participation fees for taking the course is as follows:

Participants from abroad: US $500

Industry/ Research Organizations: Rs 10,000

Academic Institutions: Rs 4,000

The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges and 24 hr free internet facility.

The participants will be provided with accommodation on payment basis.

Dates: May 30 – June 10, 2016

The last date for registration: April 15, 2016

To register or for any questions
Please send an email to sarika@iiti.ac.in