Kumar Gaurav

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Research Areas

- Network Science: Network generation models
  : Epidemiological modeling of diffusion phenomena over the network
- Social Networks: Viral Marketing on Social Networks
  : Role of social influence on Digital Piracy
- Wireless Sensor Networks: Coverage and Connectivity Issue in Deterministic WSN Topologies

Softwares**:** Networkx (Python), Gephi, MATLAB

Research Objectives

Please See Appendix- B

Academic Qualifications

Degree	Institute	Board/ University	Year
Ph.D.	IIT Kanpur	IIT Kanpur	2011- 2019
M.Tech.	IIT Kanpur	IIT Kanpur	2011- 2019
B. Tech (ECE)	College of Engineering Roorkee	UKTU	2011
Higher Secondary	Holy Mission High School Samastipur, Bihar	C.B.S.E.	2006
Secondary School	Sainik School Nagrota, Jammu and Kashmir	C.B.S.E.	2004

Teaching Experience

- Assistant Professor in HBTU Kanpur Since 2022
- Guest Faculty in HBTU Kanpur since July 2019
- Teaching Assistant in NPTEL MOOC on Digital Switching for the year 2018 and 2019
- Theory and Lab Tutor of Basic Electronics course at IIT Kanpur during Ph.D.

Courses Taught

UG Courses:

Class	Subject	Session	Semester
1st B.Tech	Electronics & Instrumentation Engineering	Since 2019-20	Every Semester
2nd B.Tech. IT	Digital Electronics	Since 2019-20	Every Odd Semester
2nd B.Tech. ET	Signals & System	Since 2020-21	Every Even Semester

PG Courses:

Class	Subject	Session	Semester
M.Tech. Electronics	Introduction to Signal Analysis	2021-22	Odd
All Ph.D. Scholars	Research Methodology(1st Unit)	2021-22	Even

PUBLICATIONS

Journals:

Published:

1. Kumar Gaurav, Saumik Bhattacharya, Yatindra Nath Singh, and Sayantari Ghosh, , "*To Purchase or to pirate: Investigating the role of social influence on digital piracy contagion",* Pramana Journal of Physics, 96(3), pp.1-12, 2022
2. Kumar Gaurav, Sayantari Ghosh, and Saumik Bhattacharya, Sayantari Ghosh, and Y.N. Singh, "*Ensuring the spread of referral marketing campaigns: a quantitative treatment",* Scientific Reports, Nature Research, pp. 1-15, 2020
3. Kumar Gaurav, S Bhattacharya, and S Ghosh, "*Viral Marketing on Social Networks: An Epidemiological Perspective*", Physica A: Statistical Mechanics and its Applications, Vol. 525, pp. 478-490, 2019
4. S Dhuli, Kumar Gaurav, and Y N Singh, "*Convergence analysis for regular wireless consensus networks*", IEEE Sensors Journal, no.8, pp. 4522-4531, 2015

Conferences (Peer-reviewed):

1. Ganapati Dash, Kumar Gaurav, S Ghosh, "*Effects of Vaccination Decisions and Peer influence on Epidemic Dynamics: A Network Perspective*", IEEE International Conference INDICON, IIT Guwahati, December 2021
2. R. N. Tripathi, Kumar Gaurav, Y. N. Singh, "*Configuration of the Communication Radius for Partial Coverage in Deterministic WSN Topologies*", International Conference on Advances in Signal Processing and Communication Engineering (ICASPACE), Hyderabad, July 2021
3. Avani Kesarwani, Ashutosh Singh**,** Kumar Gaurav, Ashok Kumar Shankhwar, "*Leader Similarity Based Community Detection Approach for Social Network",* IEEE International Conference for Innovation in Technology (INOCON), 2020
4. Kumar Gaurav, S Dhuli, and Y N Singh, "*Fraction of connections among friends of friends as a new metric for network analysis*", National Conference on Communications (NCC), 2018
5. Kumar Gaurav, S Ghosh, S Bhattacharya, and Y N Singh, "*Equilibria of Rumor Propagation: Deterministic and Network Approaches*", IEEE Region Ten Conference (TENCON), pp. 2029 – 2034, 2017

Workshops Attended

1. International summer school on big data in biological networks, Organized by Heidelberg University, Germany at Allahabad University Campus, April 01- April 05, 2019
2. Summer workshop on complex networks, Organized by IIIT Jabalpur, May 19 - May 24, 2014
3. Introduction to network science, Organized by IISC Bangalore, August 29 – September 02, 2011

APPENDIX- A

Ph.D. Research Synopsis

In the last two decades network science has emerged as an interdisciplinary research area which spans the domains of mathematics, physics, biology, medicine, economics, sociology, and many others. Current research in this area can be classified into three major subdivisions: identification and understanding the structure of the underlying network, knowing the network genesis, and studying the dynamics of any process occurring over these networks.

My Ph.D. work deals with the third subdivision where I have tried to model the diffusion of information over the network. Although the diffusion phenomenon is modeled in various ways in different branches of science, we have taken the route of compartmental epidemiological models due to its similarity with our applications.

Traditionally, the epidemic spread was analyzed using a differential equation based compartmental models. Though these models helped to understand diffusion dynamics in a social population, they are dependent on some simple basic assumptions. One of the fundamental assumptions of these models is homogenous mixing of the population, which is not appropriate in many cases. With advancement in network science, social interactions can now be represented in the form of a heterogeneous network. Though several attempts have been made to analyze epidemics using both these approaches independently, similarities and dissimilarities between them are not well-explored. Upon first inspection, both these approaches seem quite different. However, researchers have begun to realize that these frameworks are much closer than initially thought. In the thesis, I have studied and compared the results of information diffusion via both the approaches.

The thesis discusses three spreading phenomena: rumor in the society, viral marketing campaign, and the habit of online piracy. To make the models more realistic, extensive surveys have been carried out, where ever required. Survey results helped us to understand the behavioral transition between different classes based on the individual's psychology. We have also analyzed the similarities, dissimilarities, and appropriateness of homogeneous and heterogeneous approaches.

APPENDIX- B

Research Objectives

Although, network science is a fast-growing interdisciplinary area of research, along with fundamentals of network science it also requires a substantial foundation in at least one more discipline where these perspectives can be applied. Although the width of the discipline has increased rapidly, depth in terms of mathematical foundations of network science is still in its infancy. I am interested in pursuing research work in both these directions.

To model the diffusion phenomenon, I have used epidemic models in my work. Epidemiology itself is an interesting and necessary discipline to investigate. I am interested to work on the project related to the study of the epidemic spread in context of our county.

One of the basic questions which keeps coming into my mind is regarding the phenomenon of "rich get richer" which is one of the most accepted algorithm for generation of scale free networks (proposed by Albert- Barabasi) common in many real world scenario. Although, the model captures many interesting property of real world, I am not able to comprehend that nature can show such biases towards already rich nodes, rather there must be some co-operative phenomenon going on in the network resulting into scale free networks. I am interested to pursue this fundamental question to understand the network genesis more clearly.

I will continue my interest in applications related to viral marketing. With the rapid change in the campaigning process over digital and social media, we still need to understand all the factors involved in the process and how the structure of the network impacts this diffusion and how it can be used for fast and sustainable growth of the campaign.

In my Ph.D. work, I have investigated how the habit of online piracy is propagated from one person to another via their friends and family members. I am interested to extend this work to understand the propagation of more dangerous habits in the society like smoking, drinking, drugs and how understanding the network structure can help in controlling them.

Apart from these entire network science related domain, I have also worked on the problems related to wireless sensor networks like partial coverage in WSNs and the study of convergence in the regular WSN. I will also like to continue my work in this domain.