BE209 Aug. 1:0

Digital Epidemiology

Instructor

Vijay Chandru
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Teaching Assistant

None allocated yet
Email: Not applicable

Department: BioSystems Science and Engineering

Course Time: TBD

Lecture venue: BSSE Meeting Room

Detailed Course Page: http://www.healthheatmapindia.in/digital-epidemiology/

Announcements

This course will be offered over half a semester from 2018 onwards. Please watch the BSSE course page (http://www.be.iisc.ac.in) for details.

Brief description of the course

Epidemiology is the study of health and disease in populations. Googles Flu Trends, Flowminder, Healthmap, Biodiaspora are several examples of digital epidemiology already in play.

Engineered systems that are built from and depend upon, the seamless integration of computational algorithms and physical components is how National Science Foundation defines the field of cyber physical systems (CPS). Digital Epidemiology can be viewed as a health care application of CPS. The foundations of CPS includes a focus on the modeling of dynamic systems with attention to integrating computing, communication and control in uncertain and heterogeneous environments.

Modeling paradigms include linear and non-linear, stochastic, discrete-event and hybrid models that are analyzed by methods of optimization, probability theory and dynamic programming. The purpose of this

course is to introduce this emerging discipline of digital epidemiology to students at IISc. This offering of the course will be limited to a class size of 20 students.

Prerequisites

The only prerequisite for this course is a reasonable preparation in computational mathematics.

Syllabus

Introduction to epidemiology; statistical models and epidemiology with a lab component on outbreak analysis; Applications of models and physical components: a CPS perspective; Case Studies with a lab component; Data science and epidemiology, including precision medicine; lab component; Compartmental models in epidemiology; Spatial models â€“ patch based, cellular automata; Network models for communicable diseases; Graphical dynamical systems models in epidemiology; A case study of dengue: models and measures of control; guest lectures on current research topics.

Course outcomes

After taking this course, the student would become familiar with the concepts and methods of epidemiology in the context of the digital era of today. Statistical analysis methods, Cyber Physical Systems (CPS) approach to outbreak analysis and network models for communicable diseases will become familiar. Some exposure to precision medicine will also be provided.

Grading policy

Homework assignments, mid-term, a project, and final examination will be used to decide the grade in this course.

Assignments

http://www.healthheatmapindia.in/digital-epidemiology/de-assignments-and-references/

Resources

Epidemiology, A Very Short Introduction, Rodolfo Saracci, Oxford University Press
Statistical models in Epidemiology, D. Clayton and M. Hills, Oxford University Press
Statistical Methods in Epidemiology, the Environment and Clinical Trials, Halloran, M. Elizabeth, Berry, Donald
Marcel SalathÃ© et al., Digital epidemiology, PLoS Computational Biology, 8(7), 2012.
M. Newman. The structure and function of complex networks. SIAM Review, 45, 2003.
F. Brauer, P. van den Driessche, and J. Wu, editors. Mathematical Epidemiology. Springer Verlag, Lecture

Notes in Mathematics 1945.
R.M. Anderson and R.M. May. Infectious Diseases of Humans. Oxford University Press, Oxford, 1991
N. T. J. Bailey. The Mathematical Theory of Infectious Diseases and Its Applications. Hafner Press, New York, 1975.
M. Gersovitz and J. S. Hammer. Infectious diseases, public policy, and the marriage of economics and epidemiology. The World Bank Research Observer, 18(2):129â€“157, 2003.