Complex Network Analysis, MS (Boston)

Complex network analysis is the quantitative study of interconnected systems that influence every aspect of our lives—from where we get our news and who we share ideas with, to how we travel and the people we interact with, to the products we purchase and the foods we eat. Networks are ubiquitous across natural and human-made systems, and their structure and dynamics can explain and help improve the greatest challenges of the next century such as pandemics, food scarcity, cultural polarization, and climate change. Expertise in the emerging field of complex network analysis, within the landscape of the rapid growth of artificial intelligence and machine learning, forms the foundation of the next generation of thought leaders. Northeastern University leads the way in this burgeoning field, offering a unique master's degree program in complex network analysis methodologies. The program is designed to equip students with the conceptual and analytical tools needed to find patterns of connections in networked systems and apply these techniques in real-world settings. The curriculum includes industry-aligned concentration areas of focus, enabling graduates to apply complex network analysis skills in impactful careers in the public and private sectors as well as in research. The concentrations for this program correspond directly to the following industry sectors:

1. Public health and life sciences fields such as epidemiological modeling, public policy, and behavioral research
2. Social or urban science and research fields such as urban planning, social network research, economics, education, criminal science, or public policy
3. Finance or technological fields such as financial analytics, market research, or network analysis for business
4. Biological systems modeling used across research and industry including network biology, drug discovery, or multi-omics mining

In this degree program, students are admitted to the college associated with their concentration, and their degree is awarded by that college. The concentrations are associated with the following colleges:

- Complex Biological Networks—College of Science
- Complex Social Systems—College of Social Sciences and Humanities
- Economic and Technological Networks—Khoury College of Computer Sciences
- Population Health Dynamics—Bouvé College of Health Sciences

Students will follow all policies associated with their home college.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Required Courses

Code	Title	Hours
CNET 5050	Fundamentals of Complex Networks	4
CNET 5051	Analyzing Complex Network Data	4
CNET 5052	Advanced Tools for Complex Network Analysis	4
CNET 5901	Visualizing Complex Networks	2
CNET 5902	Communicating Network Data	2

Concentrations

Complete one of the following concentrations:

- Complex Biological Networks (p. 2)—College of Science
- Complex Social Systems (p. 2)—College of Social Sciences and Humanities
- Economic and Technological Networks (p. 3)—Khoury College of Computer Sciences
- Population Health Dynamics (p. 3)—Bouvé College of Health Sciences

Experiential Courses

Code	Title	Hours
Complete a total of 4 semester hours from the following (course may be repeated):		4
CNET 6107	Complex Network Analysis Research Rotation	
CNET 6108	Complex Network Analysis Capstone	
CNET 6990	Thesis	

Optional Co-op

Code	Title	Hours
CNET 6000	Professional Development for Co-op	1
CNET 6964	Co-op Work Experience	0

Program Credit/GPA Requirements

Minimum 33 total semester hours required
Additional hours may be required based on student choice of courses or concentration.
One semester hour of additional coursework is required for participation in co-op.

Minimum 3.000 GPA required

CONCENTRATION IN COMPLEX BIOLOGICAL NETWORKS—COLLEGE OF SCIENCE

Code	Title	Hours
A minimum of 16 semester hours is required to complete this concentration.		
Required		
CNET 5515	Complex Network Analysis for Biological Systems	4
Complete 8 semester hours from the following:		8
BINF 6308	Bioinformatics Computational Methods 1	
BINF 6310	Introduction to Bioinformatics	
EEMB 5130	Population Dynamics	
ENVR 5450	Applied Social-Ecological Systems Modeling	
MATH 5131	Introduction to Mathematical Methods and Modeling	
MATH 7340	Statistics for Bioinformatics	
PHYS 5211	Introduction to Scientific Computing	
Complete 4 semester hours from the following (students may opt to take the required course in the College of Science or Bouvé College of Health Sciences concentrations for this section):		4
CNET 5126	Spreading on Networks: From Epidemics to Memes	
CNET 5314	Complexity in Social Systems	
CNET 5411	Financial and Economic Networks	
CNET 6061	Analyzing Higher-Order Networks	
CNET 6063	Probabilistic Mathematics of Networks	
CNET 6099	Special Topics in Complex Networks	

CONCENTRATION IN COMPLEX SOCIAL SYSTEMS—COLLEGE OF SOCIAL SCIENCES AND HUMANITIES

Code	Title	Hours
A minimum of 13 semester hours is required to complete this concentration.		
Required		
CNET 5314	Complexity in Social Systems	3
Complete a minimum of 6 semester hours from the following:		6
CNET 5311	Physical and Digital Human Traces	
CNET 5360	Research Design for Social Networks	
INSH 5301	Introduction to Computational Statistics	
INSH 6101	Agent-Based Modeling for Applied and Social Sciences	
INSH 6300	Research Methods in the Social Sciences	
INSH 6304	Modeling and Analyzing Social Networks	
INSH 6406	Analyzing Complex Digitized Data	
INSH 6500	Statistical Analysis	
PHYS 5211	Introduction to Scientific Computing	
PPUA 5262	Big Data for Cities	
PPUA 7237	Advanced Spatial Analysis of Urban Systems	
Complete a minimum of 4 semester hours from the following (students may opt to take the required course in the College of Science or Bouvé College of Health Sciences concentrations for this section):		4
CNET 5126	Spreading on Networks: From Epidemics to Memes	

CNET 5411	Financial and Economic Networks
CNET 5515	Complex Network Analysis for Biological Systems
CNET 6061	Analyzing Higher-Order Networks
CNET 6063	Probabilistic Mathematics of Networks
CNET 6099	Special Topics in Complex Networks

CONCENTRATION IN ECONOMIC AND TECHNOLOGICAL NETWORKS—KHOURY COLLEGE OF COMPUTER SCIENCES

Code	Title	Hours
A minimum of 14 semester hours is required to complete this concentration.		
Required		
CNET 5411	Financial and Economic Networks	3
Complete a minimum of 7 semester hours from the following:		7
CS 7150	Deep Learning	
CS 7200	Statistical Methods for Computer Science	
DS 5220	Supervised Machine Learning and Learning Theory	
DS 5230	Unsupervised Machine Learning and Data Mining	
MISM 6212	Data Mining and Machine Learning for Business	
PHYS 5211	Introduction to Scientific Computing	
Complete a minimum of 4 semester hours from the following (students may opt to take the required course in the College of Science or Bouvé College of Health Sciences concentrations for this section):		4
CNET 5126	Spreading on Networks: From Epidemics to Memes	
CNET 5314	Complexity in Social Systems	
CNET 5515	Complex Network Analysis for Biological Systems	
CNET 6061	Analyzing Higher-Order Networks	
CNET 6063	Probabilistic Mathematics of Networks	
CNET 6099	Special Topics in Complex Networks	

CONCENTRATION IN POPULATION HEALTH DYNAMICS—BOUVÉ COLLEGE OF HEALTH SCIENCES

Code	Title	Hours
A minimum of 14 semester hours is required to complete this concentration.		
Required		
CNET 5126	Spreading on Networks: From Epidemics to Memes	4
Complete a minimum of 6 semester hours from the following:		6
BINF 6308	Bioinformatics Computational Methods 1	
PHTH 5210	Biostatistics in Public Health	
PHTH 6210	Applied Regression Analysis	
PHTH 6224	Social Epidemiology	
PHTH 6440	Advanced Methods in Biostatistics	
PHTH 6800	Causal Inference in Public Health Research	
PHTH 6801	Causal Inference 1	
PHYS 5211	Introduction to Scientific Computing	
Complete a minimum of 4 semester hours from the following (students may opt to take the required course in the College of Science or Bouvé College of Health Sciences concentrations for this section):		4
CNET 5314	Complexity in Social Systems	
CNET 5411	Financial and Economic Networks	
CNET 5515	Complex Network Analysis for Biological Systems	
CNET 6061	Analyzing Higher-Order Networks	
CNET 6063	Probabilistic Mathematics of Networks	
CNET 6099	Special Topics in Complex Networks	