SOCIAL NETWORK ANALYTICS

Course code: UE18CS346 (Elective-4)

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Introduction

- We are living in a world, where everything is connected, that is, people, groups, organizations, companies, information, events and places, with the advent of internet, www and online social media.

- We live in a world where vast number of (complex) networks are present.
  The study and analysis of such networks (i.e., analyzing network structure/data generated by those networks) is an important need to improve revenue, to enhance customer service and to improve the quality of public health, safety, and security.

- Social Network Analytics(SNA) can meet this need by discovering knowledge from these networks.

What is Social Network Analysis?

What is Social Network Analysis (SNA)?

- An analysis technique which studies
  - Relationships between people, groups and organizations.
  - How those relationships arise and
  - Consequences of those relationships

- SNA can be defined as a, "**distinctive set of methods used for mapping, measuring and analyzing the social relationships between people, groups and organizations**".

What is Social Network Analysis?

Some important Study/Analysis in SNA includes:

- Who is more influential/popular/important in the network?
- Who is the super-spreader of disease/Gossip in the network community?
- How is Link analysis is done in social networks?
- How do social networks evolve, emerge and change?
  - Random Networks, Small-world networks, Scale-Free networks and Power-law degree distributions.
- How Communities and overlapped communities are found in Social Networks?
- How do ideas, diseases, and technologies propagate through groups/community?
- What is SIR and SIS epidemic models? What are network processes?
- In Game theory, we study:
  - Game theory types, Dominant strategy equilibriums, Iterated deletion Procedures, Nash Equilibrium, Prisoner's Dilemma
  - Coordination games, Pareto Optimality and Mixed strategy equilibriums
- In the game theoretic models of network formation, we study:
  - Which networks are likely to form?
  - Are the networks that form stable or efficient?
  - Cost and benefit for each agent associated with each network.

SNA Applications

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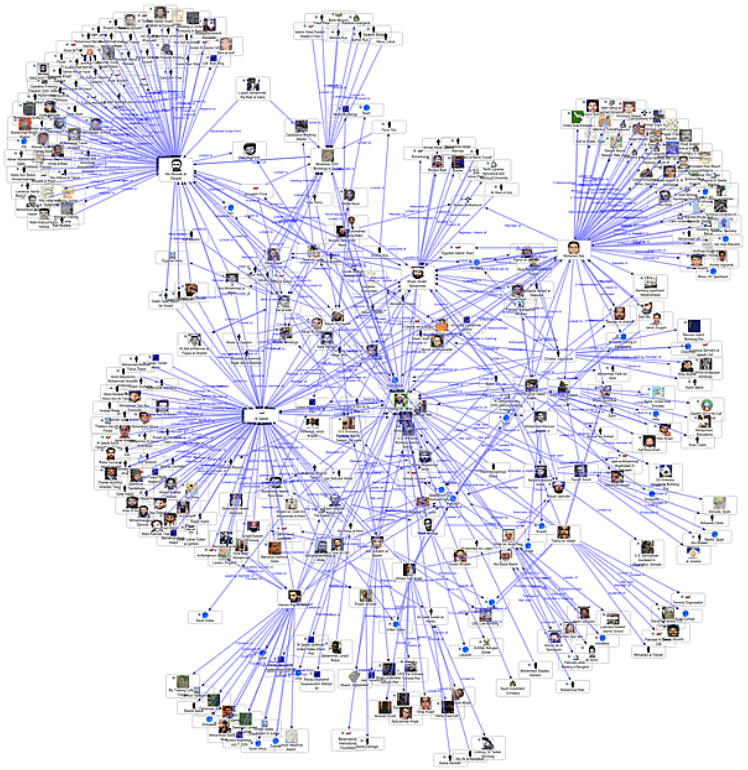
- **Business Applications**
  - Businesses use SNA to support activities such as
    - customer interaction and analysis,
    - marketing, and
    - business intelligence needs.
  - Used in recommender systems development.

- **Security applications**
  - SNA is used in intelligence, counter-intelligence and law enforcement activities.
  - The **Security Agencies** can perform Social Network Analysis on Call Detail Records (CDRs) of terrorists, mafia and Criminal gang Networks.
  - The NSA used SNA in realizing 9/11attack (Al-Qaeda Network).

SOCIAL NETWORK ANALYTICS

SNA Applications

- **Internet and social media applications**
  - Facebook, LinkedIn, Twitter, CouchSurfing, etc. are using SNA to understand their users and improve their functionality.
  - SNA has also been applied to understand online behavior by individuals, organizations, and between websites.
  - Hyperlink analysis can be used to analyze the connections between websites/webpages to examine how information flows as individuals navigate the web.
- **Political Parties can use SNA to build a grass roots political campaign.**
- **SNA can be used in Recipe recommendation using ingredient networks.**



Social Network Visualization and Analysis Tools

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➢ Gephi

- **It is an open-source software for visualizing and analysing large networks graphs.**
- Gephi uses a 3D render engine to display graphs in real-time and speed up the exploration.
- You can use it to explore, analyse, spatialise, filter, cluterize, manipulate and export all types of graphs.

➢ E-NET

- It is a free software package for egocentric network analysis and visualization created by the developers of UCI-NET.

➢ Netlogo

- **It is a multi-agent programmable modeling environment.**
- **It is used by tens of thousands of students, teachers and researchers worldwide.**
- It also powers HubNet participatory simulations. It is authored by Uri Wilensky and developed at the CCL.

Social Network Visualization and Analysis Tools

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➢ NodeXL

- **NodeXL Basic is a free and open-source network analysis and visualization software package for Microsoft Excel 2007/2010/2013/2016.**
- **NodeXL Pro** is a fee based fully featured version of NodeXL that includes access to social media network data importers, advanced network metrics, and automation.

➢ Social Network Visualizer (SocNetV)

- **It is a social network analysis and visualization application**. You can draw a social network (graph/digraph) or load an existing one (GraphML, UCINET, Pajek, etc), compute statistics, centralities, and apply various layout algorithms based on centrality or prestige indices (i.e. Betweenness) or on dynamic models (i.e. spring-embedder)

➢ Ucinet

- **It is a comprehensive package for the analysis of social networks.** It contains dozens of network analytical tools, such as centrality measures, dyadic cohesion measures.

Social Network Visualization and Analysis Tools

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➢NetworkX

- **NetworkX is a Python package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.**
- NetworkX provides:
  - tools for the study of the structure and dynamics of social, biological, and infrastructure networks;
  - a standard programming interface and graph implementation that is suitable for many applications;
  - a rapid development environment for collaborative, multidisciplinary projects;
  - an interface to existing numerical algorithms and code written in C, C++, and FORTRAN; and
  - the ability to painlessly work with large nonstandard data sets.

- With NetworkX you can load and store networks in standard and nonstandard data formats, generate many types of random and classic networks, analyze network structure, build network models, design new network algorithms, draw networks, and much more.

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Evaluation Policy

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ISA:

Test #	Marks	% weight
T1	40	15%
T2	40	15%
Mini-Project (Individual)	20	10%

ESA:

Exam	Marks	% weight
Theory Exam	100	60%

Textbooks and References

Textbook:

1. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", D Easley and J Kleinberg, Cambridge University Press, 2010.

Reference Book(s):

1. "Social and Economic Networks", Mathew O Jackson, Princeton University Press, 2010.
2. "Networks – An introduction", MEJ Neumann, Oxford University Press 2010.
3. "Analyzing the social web", Jennifer Golbeck, Morgan Kaufmann, 2013.
4. "Social Media Mining-An Introduction", Reza Zafarani Mohammad Ali Abbasi Huan Liu, Cambridge University Press, 2014.

THANK YOU

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