Sections for the Encyclopedia on Social Network Analysis and Mining

The content of ESNAM will be divided into two main parts. The first part of ESNAM is intended to cover the basic background and foundations material on social networks. The minimum information on social networks that researchers and practitioners are expected to learn in order to be effective and successful will be included here. The second part aims towards a comprehensive coverage of social network analysis and mining terminology including, historical perspective, data gathering and preparation, model construction, online social networks and communities, network dynamics, security and privacy, applications and case studies, and future research directions. For each of these areas, a wide range of essays covering basic definitions, terminology, research achievements and practical experience are expected. In addition to the two main parts there is an optional part which may be included if the board feels the necessity to expand the coverage of ESNAM to research groups, ideal program content for both graduate and undergraduate degrees, venues for disseminating research outcomes and further source material for researchers and practitioner.

Basic Background and Foundation Material

1. Internet, Web 2.0, Web services and semantic Web
2. Graph theory for social networks (sociograms)
3. Statistics for social networks
4. Linear algebra for social networks
5. Applied computational geometry for social networks
6. Machine learning and mining techniques for social networks

Comprehensive Coverage of Social Network: from Research to Practice

1. History of social networks: past, present and future
2. Data collection, data extraction, and data preparation
3. Basics of social network model construction
4. Social network analysis
5. Online social networks, social networking sites and social media
6. Social communities
7. Static versus dynamic networks
8. Social network construction and analysis tools
9. Spatio-temporal aspects in social networks and social media
10. Technology for online social networking and human computer Interaction
11. Privacy and security issues in social networks
12. Data management for social networks and social media
13. Applications and case studies
14. Current and future research directions

Optional Material that may be Considered for Inclusion in the Encyclopedia

1. Main research groups
2. Major journals and conferences
3. Graduate, undergraduate and professional programs
Internet, Web 2.0, Web Services and Semantic Web

- Composite Web service, modeling, creation and enabling infrastructures
- Database technologies for the semantic Web
- Dynamic invocation mechanisms for Web services
- E-Commerce applications and online advertising using Web services
- Finding structure and semantics in Web information
- Internet of things
- Interactive information sharing, interoperability and collaboration
- Managing Web documents and transactions
- Quality of service for Web services
- Query languages for Web data and the semantic Web
- Resource and solution management for Web services
- Spatial and temporal data on the Web
- Semantic Web services and mashups
- Semantic Web base architecture
- Semantic technologies for enabling reasoning and inference in Web 2.0 applications
- Semantic content for collaborative applications
- Semantics-enhanced design of Web 2.0 applications
- Social Web services
- Structured and semistructured data management and integration on the Web
- User-oriented contribution models
- Web services modeling, architecture and applications
- Web services personalization using context and context-aware Web services discovery
- Web ontology and Web ontology languages: Learning taxonomies and ontologies from the Web
Graph Theory for Social Networks (Sociograms)

- All graph theory basics, including node, edge, directed graph, undirected graphs, multigraph, tree, cyclic, acyclic, clique, path, walk, diameter, minimum spanning tree, coloring, etc.
- Connectivity
- Equivalence relations
- Graph theory and game theory
- Geodetic distance
- Graph matching
- Graph partitioning, clustering, mining, etc.
- Graph analysis and complex networks
- Graph representation, like matrix, list, etc
- Large-scale graph algorithms
- Management and querying of large social graphs
- Managing and animating longitudinal network data
- Maximum flow and minimum-cut
- Measures and similarity
- Partite graphs (bipartite, tripartite, etc) and graph folding
- Random graph models
- Spatio-temporal graphs
- Special graphs
- Weighted graphs
Statistics for Social Networks

- All basics of statistics and probability, including basic probability theory and various distributions and models
- Clustering algorithms
- Distance and similarity measures
- Gibbs sampling
- Least squares
- Markov Monte Carlo model
- Probabilistic analysis
- Probabilistic graphical models
- Probabilistic logic models
- Probabilistic relational models
- Queuing theory
- Regression analysis
- Simulations
- Simulated datasets
- Spatial statistics
- Synthetic datasets
- Univariate descriptive statistics
Linear Algebra for Social Networks

- Basics of matrix algebra
- Correspondence analysis
- Eigenvalues
- Independent component analysis
- Iterative methods for eigenvalues/eigenvectors
- Matrix analysis of networks
- Matrix decomposition
- Principal component analysis
- Probability matrices
- Ranking methods for networks
- Spectral analysis
- Semidiscrete decomposition
- Singular value decomposition
- Site importance assessment via eigenvectors
Applied Computational Geometry for Social Networks

- Data structures for high dimensional data sets
- Euclidean minimum spanning trees
- High-dimensional data sets
- Geometric clustering in high dimensional data sets
- Social ties from geographic coincidences
Machine Learning and Mining Techniques for Social Networks

- Active, multi-task and transfer learning
- Association rules mining
- Business Intelligence
- Concept taxonomies and Web mining
- Crime data mining and network analysis
- Data and knowledge visualization
- Distance and similarity measures
- Document/text clustering, classification and indexing
- Frequent pattern mining and sequential pattern mining
- Graph and link mining
- Investigative, inductive and predictive data mining
- Learning based advertisement at online social media
- Learning based organization, indexing, search, navigation, retrieval and ranking of social media content
- Learning based prediction, understanding and recommending social media content
- Learning based social context analysis
- Learn based techniques to tackle privacy and security issues in social media (e.g. media watermarking)
- Machine learning algorithms
- Multimedia mining (audio/video)
- Online/offline learning and matchmaking
- Offline mining versus interactive and online mining
- Parallel and distributed data mining
- Preference learning or elicitation
- Privacy preserving data mining
- Real-time semantic mining and analysis of social data
- Social context based clustering and classification for large scale image, video and audio
- Social networks for intelligent systems
- Supervised/unsupervised learning: clustering, classification, ensemble methods and ranking
- Temporal and spatial data mining
- Unstructured, structured and semi-structured data mining
- Web content mining
- Web structure mining
- Web usage mining
- Web harvesting
- Web mining for blog analysis
- Web mining for online personalization and recommendation system
- Web mining and intelligence
Data Collection, Data Extraction, and Data Preparation

- Automated information extraction with machine learning
- Agent based model for data collection and extraction
- Benchmark data
- Capturing and representing context in social network and social media
- Data integration and knowledge representation
- Data normalization, discretization, and fuzzification
- Data preprocessing and noise elimination
- Data cleaning and quality
- Extracting social patterns from data
- Feature reduction and selection
- Generation and aggregation of social semantics
- Handling diversity in the data (e.g., text, structures, images of various kinds, links)
- Information acquisition, management and retrieval for social networks and social media
- Keyword search in unstructured, structured and semi-structured data
- Manual data collection by questionnaire and evidence gathering
- Multilingual information extraction and integration
- Natural language processing (audio, text, etc) for data collection
- Ontologies and data models for social data representation and analysis
- Semantic Processing and question answering for raw social data collection and analysis
- Social image search and social group recommendation
History of Social Networks: Past, Present and Future

- Activities that could be classified under social network research prior to 1930
- Foundations during the period 1930 -1970
- Prior to online social network and social media era
- During the online social network and social media era
- Spatio-temporal social networks and media
- What is next: where the trend is heading next?
Basics of Social Network Model Construction and Evolution

- Connection between biological similarities and social network formulation
- Covert networks
- Establishment of social relations
- Evolution of social networks
- Global and distributed versus local and centralized social networks
- Identifying actors and links
- Identifying same identity across social networks and media sites
- Implicit versus explicit social interactions
- Information Diffusion
- Merging and integration of social networks
- Modeling social preferences based on social interactions
- Multi-agent based social network modeling and analysis
- Power-law networks and scale-free networks
- One mode, two mode, ego-centered, social central and special dyadic networks
- Random networks
- Small world networks
- Social network folding
- Social network partitioning
- Weighted social networks
Social Network Analysis

- This section is intended to cover quantitative versus qualitative approaches; all the available metric and techniques for the analysis of social network and social media, including path-based and walk-based centrality (degree, closeness, betweenness, eigenvector, etc), density, cliques, Reciprocity, social influence, diffusion, social cognition, etc. Also, to cover validation and post-processing of the analysis results, like effect of the analysis results on success/failure, building relationships, identifying terrorists, improving homeland security, performance, database design, etc.
- Contextual social network analysis
- Critical mass, diffusion theory and geographical models
- Current metrics and alternative measures of social media effectiveness
- Importance assessment
- Performance measurement and analysis of online social networks systems.
- Predicting personality, ethnicity, education level, gender, age group, etc from postings and behavior
- Relational models
- Semantic technology for social network analysis
- Social capital
- Social intelligence and media intelligence
- Social Web search and analysis for social network and media
- Structural cohesion
- Structural models
- Structural holes
Online Social Networks, Social Networking Sites and Social Media

- Analytical frameworks for user interactions and behavior
- Applications for explicit social interactions
- Build optimal models for social networks
- Brand-related conversations and influence in social media
- Collaboration in virtual environments and/or online social networks.
- Consumer–brand relationship building in social media
- Consumer control and empowerment in social media
- Content creation and sharing in social media
- Crawlers and other mechanisms for observing social network structure.
- Criteria for evaluating research on virtual worlds and/or online social networks.
- Current approaches to and practices of using social media for promotional purposes
- Customer relationship management in social media
- Customer segmentation and customer profiling
- Dynamic Recommendation networks
- Effect of online identity: declaring/hiding identity in social networks
- Exploring the cultural, social and technical aspects of virtual worlds and/or online social networks.
- Impact of social networks and social media on recommendations systems
- Impact of online networks and social media on organizational environment
- Impact of online networks and social media on political changes
- Online social networks as effective learning sources
- Psychological or ethnographic studies of social networks and social media
- Personalized social content and personalization for search and for social interaction
- Proliferation of virtual worlds, social bookmarking, social media, online social networks and tagging systems
- Relationship between social media and mainstream media
- Semantic services, semantic Web and semantic aspects in social networks
- Simulations as research methods: problems, recommendations, evaluation.
- Social network structure in social media
- Social media and viral marketing and viral advertising
- Social media development and practice in different countries
- Social media mining and knowledge discovery
- Studying virtual worlds and/or online social networks
- Topology of online social networks
- The future of the social Web
- Unified identity across social networks
- User behavior in open forums and in commercial platforms
- Virtual environments and online social networks
- Voting, sentiment and opinion systems: inferring users' preferences based on social interactions
Social Communities

- Blogs-based communities
- Brand communities and influence in social media
- Communities discovery and analysis in large scale online/offline social networks
- Connecting communities
- Community formation, structure and evolution
- Communities for agents and agents for communities
- Competition within and between communities within and across social networks
- Detection of communities by document analysis
- Dyads and triads
- Evolution of patterns and communities on the Web
- Extracting individual and group behavior from mobility data
- Extracting and Inferring communities from link topology
- Geography and Web communities
- Group representation and profiling
- Hidden groups within communities
- Influence of time zone on evolution and coverage of Web communities
- Influence of age, gender, ethnicity, education level on evolution of communities
- Information diffusion
- Measurement and analysis of online communities and social media
- Online dating
- Physical versus virtual distance in community formation
- Social colonization
- Volatility and properties of online communities
- Web communities versus physical communities
**Static Versus Dynamic Networks**

- Anomaly detection in social network evolution
- Comparing past and current networks
- Context capture and awareness in mobile social networks
- Effectiveness of social network modeling and analysis in the study of power, preference aggregation, behavior, and information flow
- Event detection and tracking in social media
- Evolution of ad-hoc communities into stable and influential communities: the case of political uprisings in the Middle East
- Evolution of communities in organizations
- Evolution and change of opinion within and across social networks
- Location, time and context based reasoning
- Methods for integrating multiple networks
- Migration between communities
- Multi-modal accesses
- One individual versus multiple virtual personalities
- Prediction of link changes (addition/removal) in social networks
- Reasoning in dynamic contexts and analysis of dynamic opinions
- Semantic social networks
- System support for social analytics and network dynamics
- Temporal analysis on static and dynamic social networks topologies
- The friend of a friend (FOAF) project
- Trends discovery and preferential linkages
- Trends and dynamics in social semantic Web
- Triads in dynamic networks: cooperative versus competitive
Social Network Construction and Analysis Tools

- Coverage of the basic tools, including commercial, educational and prototypes, e.g., Pajek, ORA, UCINET, StOCNET, NetDriller, NetMiner, Idiro SNA Plus, etc.
- Connectivity and application development
- Free and open source tools
- Interoperability between various tools
- Languages, technologies and application programming interfaces for social networks.
- Migration to free software and open source environment
- New technologies
- Novel and challenging applications
- Open source and open information society
- Performance tuning and optimization
- Scalability
- Tools for designing and deploying social networks.
Spatio-Temporal Aspects in Social Networks and Social Media

- Anonymity in socio-mobility data
- Influence and relevance of geography for spatio-temporal social networks
- Learning and Inference in spatio-temporal social networks
- Location based social networks
- Modeling and analysis of spatio-temporal social networks
- Modeling and statistical analysis of spatio-temporal data
- Spatio-temporal community context modeling
- Spatio-temporal constraints on social networks
- Spatio-temporal data analysis
- Spatio-temporal databases
- Spatio-temporal dynamic models of communities
- Spatio-temporal footprints in social networks
- Spatio-temporal event model for social network discovery
- Spatio-temporal event detection
- Spatio-temporal information for the Web
- Spatio-temporal mining, clustering and classification
- Spatio-temporal outlier and anomaly detection
- Spatio-temporal personalized search and recommendation
- Spatio-temporal proximity and social distance
- Spatio-temporal reasoning and decision support tools
- Spatio-temporal tracking of and variations in community structure
- Spatio-temporal transmission patterns in social networks
Technology for Online Social Networking and Human Computer Interaction

- Network-enabled mobile devices
- RFID and sensors
- Sensor networks
- Smart devices: boards, tables, PDA, smart phones, iPhone, iPod, etc
- Social semantics on mobile devices
- Touch screens
- Ubiquitous social networks
- Visual representation of dynamic social networks
Privacy and Security Issues in Social Networks

- Abuse/fraud/misbehavior detection and malware analysis in social networks
- Access control and identity management
- Actors as system and policy administrators
- Awareness of privacy and security issues
- Consequences of the use of real personal information in social networks
- Data protection inside and across communities
- Delegation and secure collaboration
- Global and border-crossing privacy and security management regulations
- Identity versus privacy, security, ethics, culture, civil liberty and anonymity issues
- Legal and regulatory issues related to social networks and social media
- Management of trust and privacy: reputation, rating and reviews
- Modeling trust and reputation in social networks
- Privacy and security challenges and mechanisms
- Privacy and security issues in spatio-temporal social networks
- Risk assessment and management
- Secure social-network application development and methodologies
- Secure tagging, bookmarking and annotations
- Trust and reputation management and encouragement
- Usability driven security mechanisms
Data Management for Social Networks and Social Media

- Data model mapping and data integration
- Data models and data structures for social networks and social media
- Fuzzy data management and fuzzy query models
- Graph query engines and query optimization for social data
- Integrating social network modeling and analysis into database management systems
- Natural language query interfaces
- Provenance and quality for querying social data
- Querying volatile, moving and dynamic networks and data sources
- Query languages for social networks and social media
- Query processing and optimization
- Real-time querying frameworks and languages for social data
- Scalability, approximate reasoning and querying in social applications
- Semantic modeling and query processing
- Stream querying and reasoning on social data
Applications and Case studies

- Analysis of the dark Web and developing crawler for dark Web forums
- Analysis of digital archives and museums
- Analysis of terrorist groups and homeland security
- Business modeling, economics and crisis management
- Business to business marketing
- Computer network analysis
- Crime data mining and network analysis
- Customer relationship management and consumer behavior
- Cyber anthropology
- Database design and performance tuning
- Electronic commerce
- Email spam detection
- Environmental management and wildlife monitoring systems.
- Global cultural and socio-political issues
- Healthcare, biomedicine and bioinformatics
- Multi-user games
- Online communities for education, e-learning and e-science
- Open source intelligence
- Promotions and advertisement
- Public sector
- Political institutions and political impact of social network discovery
- Social gaming
- Software industry and project management
- Terrorist and criminal networks
- Transportation and traffic control,
- User reviews ranking and profile modeling
Current and Future Research Directions

- Adoption of new services on social networks
- Agent based social simulation
- Agent-based computational models
- Benchmarking, modeling, and workload characterization.
- Bio-inspired information and communication networks
- Developing complex adaptive systems
- Effectiveness and usefulness of social-based routing
- Fuzzy technologies and applications
- Impact of social networks and social media on other disciplines
- Integration of virtual and physical worlds
- Interoperability between social applications and social media
- Mobile, peer-to-peer social networks and wireless ad hoc networks
- Performance issues in social networks software
- Scalability and robustness of social networks
- Socially-inspired and collaborative computing
- Social network application in multi-agent systems
- Spatio-temporal social computing
- Systems thinking and customer satisfaction
Optional Material that may be Considered for Inclusion in the Encyclopedia

Main Research Groups

- Listing of major research groups in the academia and industry with links to the labs/sites

Major Journals and Conferences

- Listing of the main journals and conferences in the field with links to each venue

Graduate, Undergraduate and Professional Programs

- Possible curriculum for undergraduate program in social network analysis and mining
- Possible curriculum for graduate program in social network analysis and mining
- General outline for major courses in social network analysis and mining curriculum