Universidad Carlos III de Madrid

COURSE:	Graph analysis and data visualization applications		
MASTER UNIVERSITARIO EN MÉTODOS ANALÍTICOS PARA DATOS MASIVOS: BIG DATA Teacher: Esteban Moro / Young-Ho Eom		ECTS:3	TERM: 2

WEEKLY PLANNING

WEEK	SESSION	DESCRIPTION	GROUP		Special room for session	WEEKLY PROGRAMMING FOR STUDENT		
			1	2		DESCRIPCTION	CLASS HOURS	HOMEWORK HOURS
1	1	Graphs and general concepts • Mathematical definition and examples • Graph Theory, historical introduction • Weighted and directed graphs • Bipartite graphs	X			Theory	1.5h	2h
1	2	Graphs and general concepts • Adjacency matrix • Degree, average degree, degree distributions • Topological concepts in graphs (distance, shortest path, diameter) • Practical example	X			Theory	1.5h	2h
2	1	Graphs and general concepts • Centrality metrics • Cliques, Motifs, clustering and communities	X			Theory	1.5h	2h
2	2	Graphs and general concepts • Types of networks: random networks, small world, scale-free • Hubs and preferential attachment	X			Theory	1.5h	2h

3	1	Social Networks • Definition and context • Local and global properties of social networks • Difference between social networks and other networks	X			Theory	1.5h	2h
3	2	Social Networks • Social mechanisms • Applications of social networks: fraud detection, recommendation systems, product adoption, churn, etc.	X			Theory	1.5h	2h
4	1	Graph analysis / Social Network Analysis • Overview of software/libraries for SNA • Introduction to the igraph library • Introduction to the networkX library in Python	X		Computer Classroom	Practice	1.5h	2h
4	2	Graph analysis /Social Network Analysis • Practical example • Create a graph • Analyze a graph • Simulate a graph • Test a graph	X		Computer Classroom	Practice	1.5h	2h
5	1	Practical examples of graph analysis • Link prediction: application to friend recommendation • Epidemic models in networks	X		Computer Classroom	Practice	1.5h	2h
5	2	Practical examples of graph analysis • Build, analyze and visualize information networks: the case of Twitter and its API • Analysis and visualization of dynamic networks	X		Computer Classroom	Practice	1.5h	2h
6	1	Introduction to data visualization • Data types and sources • Main tools to visualize data. Introduction to Tableau, ggplot and D3 • Data reduction techniques	X			Theory	1.5h	2h

6	2	Introduction to data visualization • Static visualization of data • Visualization of one-dimensional data • Visualization of multi-dimensional data	X		Computer Classroom	Practice	1.5h	2h
7	1	Advanced data visualization • Geo-spatial data • Content (text) visualization • Time-series and predictive model visualization • Graph visualization • Dynamic data visualization	X			Theory	1.5h	2h
7	2	Advanced data visualization • Visualizaton of transport data (world-wide flights) • Visualization of large social networks from Twitter • Visualization of movie ratings	X		Computer Classroom	Practice	1.5h	2h
TOTAL							21 Hours	28 Hours