REPUBLIC OF MACEDONIA
Ss. Cyril and Methodius University in Skopje
Faculty of Computer Science and Engineering

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Final project proposal

Type	Master
Title	*Inferring the dynamics of the processes that take place on networks*
Supervisor	Ljupco Kocarev
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Topic(s)	
network science	
Project can start from	Any period between 01.04.2014 – 01.03.2015
Project duration	4 months
Short description	
Objective: To develop algorithm for learning dynamical processes on networks Work description: First, different machine leaning techniques shall be developed for state and parameter estimation, or equation discovery of processes (virus and/or rumors spreading) taking place on networks. Both deterministic and stochastic equation will be considered. It is assumed that by the underlying network on which diffusion takes place is modeled by a finite, undirected graph G. The graph G is assumed to be known, at least approximately, as is often verified in practice, e.g., rumors spreading in a social network, or electrical perturbations propagating on the electrical grid. Next, we model the source as a random variable whose prior distribution is uniform over the set of all nodes, i.e., any node in the network is equally likely to be the source a priori. A maximum probability of localization criterion, which corresponds to designing an estimator such that the localization probability is maximized will be suggested. Since the source is uniformly random over G, the optimal estimator is the maximum likelihood (ML) estimator. The estimator performs averages over two different sources of randomness: (a) the uncertainty in the paths that the information takes to reach the observers, and (b) the uncertainty in the time that the information takes to cross the edges of G. Its complexity, however, increases exponentially with the number of nodes in G, and is therefore intractable. Strategies which are optimal for general trees, and suboptimal for general graphs shall be developed.	
Results and assessment	
Journal/conference paper	
Other (additional) information	
http://www.cs.manu.edu.mk/people/faculty/ljupco-kocarev	