March 10, 2006

General Geographical Threshold Graphs

Milan Bradonjić
Joint work with Prof. Vwani Roychowdhury and Nima Sarshar
University of California Los Angeles

In this work, we analyze the geographical threshold graph (GTG) model of the network. It is assumed that the vertices $v_i \in V$ are uniformly and independently distributed in the d-dimensional space $\mathbb{R}^d$, which is provided with the Euclidian metric. Usually, real networks are embedded into a topological space, with the wiring costs (or social costs) being represented as metric distances.

In GTG model, each vertex v_i is assigned to random weight w_i, drawn from a density distribution $f(w)$. Edges are created according to a threshold function $\mathcal{T}$, which depends on the distances between vertices and the density distribution of weights $f(w)$ in the graph. The main contribution of this work is that for a given degree distribution $p_d(k)$ we derive a set of sufficient conditions on $\mathcal{T}$ which enables us to explicitly, analytically calculate the density function of weights $f(w)$.

Recently there has been an extensive research towards establishing mathematical models which emulates the real networks: Internet, WWW, social networks, biological and independent systems. Since our model is very general, the analysis which we derived can be applied in many different areas – the wireless communication systems, the financial markets, etc.