

Search in networks

[Workshop abstract]

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Milgram's famous small world experiment revealed that not only were any two people in the world connected by a short chain of acquaintances, but that people are quite good at finding these chains. Navigating one's social network is a natural human skill, one that can come in handy when finding a job, for example. Still, it may seem surprising that a message can quickly traverse networks composed of millions of people even though individually the nodes in the chain have little knowledge of the topology beyond their circle of acquaintances. What's more, participants are typically given only a few bits of information about the target, such as the target's occupation and place of residence. Though the task may be challenging, most participants follow a simple greedy strategy that turns out to be surprisingly effective: pass the message to an acquaintance who is closer to the target geographically or professionally. Occasionally, participants find that they don't know anyone who is closer to the target according to some attribute. In this circumstance, they might pass the message onto someone who is well connected, who in turn is more likely to know someone closer to the target.

The key to the success of using local strategies for traversing a large network is the structure of the network itself. There must be an abundance of local links - these will help the chain close in on the target once the target is quite close. Still, there must also be a balance of long range links - these will allow the message to traverse great distances in the beginning of the chain, when the target is still quite far away. In this talk, we will discuss theoretical models of social structure that is able to support decentralized search. We will also cover empirical studies of email and blog networks displaying structure that is in agreement with the theoretical models. Finally, we will discuss the role that hubs can play in search when a network has a scale-free degree distribution and the application of these insights to peer-to-peer networks.