



Biological Networks

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Extended Abstract

The theory of complex networks has a wide range of applications in a variety of disciplines such as communications and power system engineering, the internet and worldwide web (www), food webs, human social networks, molecular biology, population biology and biological networks. The focus of this talk is on biological applications of the theory of graphs and networks. Network analysis leads to a better understanding of the critical role of these networks in many key questions.

we present some of the popular biological networks which have been investigated by several authors.

Protein-Protein Interaction network (PPI-Network) is a graph $G = (V, E)$ where V is a set of proteins and two proteins are joined by an edge if they interact physically. The interaction between viral proteins and human proteins can be represented as a bipartite graph G . The vertex set of G is $V_1 \cup V_2$, where V_1 is the set of viral proteins and V_2 is the set of all human proteins. A viral protein $v \in V_1$ is joined to a human protein $w \in V_2$ if v interacts with w . This bipartite graph is called viral-human protein interaction network and this network has been investigated by Mukhopadhyay and Maulik [2].

Human protein and disease association network is a bipartite graph G whose vertex is $V_1 \cup V_2$, where V_1 is the set of human proteins and V_2 is the set of diseases and $v_1 \in V_1$ is joined by an edge to $v_2 \in V_2$, if the human protein v_1 is associated with the disease v_2 . This network has been investigated by Mukhopadhyay and Maulik [2].

Metabolome based reaction network is a directed graph $D = (V, A)$ where V is a set of metabolites and a vertex v is joined to a vertex w by an arc (v, w) if there is a reaction or interaction which transforms the metabolite v to the metabolite w . This network has been investigated by Veeky Baths et al. [4].

Gene regulation is a general term for cellular control of the synthesis of protein at the transcription step. Often one gene is regulated by another gene via the corresponding protein. Thus gene regulation leads to the concept of gene regulatory network, which has been investigated by Yue and Chunmei [5]. Gene regulatory network is a directed graph $D = (V, A)$ where V is the set of genes and two genes $g_1, g_2 \in V$ are joined by an arc if there is a regulatory relationship between g_1 and g_2 , or more precisely g_1 regulates g_2 .

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