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What is a complex network

NETWORK ANALYSISComplex Network Analysis studies how to recognise, describe, visualise and analyse complex networks. The most prominent way of analysing networks is using Python Library NetworkX which provides a prominent way for constructing and drawing complex Neural Networks.The prominent reason for the explosion of CNA research and applications is due to two factors - one is the availability of cheap and powerful computers that enables researchers and scientists with advanced training in mathematics, physics and social sciences to perform top notch researches and the other factor is the ever increasing complexity of social, behavioural, biological , financial and technological aspects of humanity.Network is a relational form of organisation and representation of discrete data. The two most important concepts concerning networks are entities and the relationships between them. Entities are referred to as nodes and relationships are known as edges. Network nodes and edges are high level abstractions and for most networks their true nature is not essential. When it is essential, we represent nodes and edges by adding properties also known as attributes. A relationship or edge typically involves two discrete entities or nodes although an entity can be in a relationship with itself, such a relationship is referred to as reflexive.**NODES AND EDGES****SHOWING DIRECTED AND UNDIRECTED RELATIONSHIPS**Before moving to what a complex network really looks like, let's talk about the basic simple network sometimes called a Classic Network. An example of a classic network is a linear network – timeline of our life, each life event (such as "birth", "first time walking", "school graduation", "marriage" and eventually "death") is an entity with at least one attribute which is time. "Happening after" is the relationship in this scenario as an edge connects two events together with one event happening immediately after the other. The reason why this network is considered simple is because it has a regular structure and not because it is small.**LINEAR TIMELINE OF LIFE**A complex Network has a non-trivial structure, it's neither a grid nor a tree. These complex networks happen in nature and the man-made world as a result of decentralised processes with no global control. Some of the representatives of this class of network include:Social networks: Families and Friends, Twitter and instagram followers etc..Cultural networks: Religion networks, Language families etc..Technological networks: transportation and communication systems etc...Financial networks: Financial networks, wall street market, international trade etc..Biological networks: gene/protein interactions, disease epidemics etc..**AN EXAMPLE OF A FINANCIAL NETWORK**Complex Network Analysis is the study of complex networks – their structure, properties and dynamics.The most common python tools for manipulating and processing networks are NetworkX, iGraph, graph-tool and networkit but my most preferred is NetworkX. Some of the reasons why I prefer NetworkX includes the ease of installation since it's written in pure python and can be imported as a library using :NetworkX also has excellent online documentation and active community of supporters on Stackoverflow and it's performance is acceptable up to 100,000 nodes.Complex Network Analysis is an iterative process , whereby the network grows, shrinks or undergoes certain transformations over time. Any network starts with one node and we can always add more nodes and edges to it as needed. The attributes of the nodes and the edges describe their properties and these come from any sort of data you might have such as Social network data, fraudulent users data, biological and disease epidemic data among others. A networkx network is a collection of edges and labeled nodes and to create a new network graph, you must choose an appropriate graph type and call the respective constructor; pass either no parameters (for an empty graph) or a list of edges as node pairs (lists or tuples).NetworkX supports four graph types namely:Undirected graphs: They consist of only undirected edges – these are edges that can be traversed in either direction so that an edge from node A to node B is the same as an edge from node B to node A. Undirected graphs also represent symmetric relationships, just to say if A is in a relationship with B, B is also in a relationship with A.2. Directed Graphs: They are also known as a digraphs, have at least one directed edge. "Being the mother of" is a symmetric relationship and would be represented by a directed edge. Twitter and Instagram also use this relationship as you can follow someone but not necessarily being followed back by the person on the social media platforms You can convert a digraph into an undirected graph. All directed edges become undirected, and all pairs of two reciprocal edges become single edges. However, remember that the original digraph and the derived undirected graph are different.3. Multigraphs: These are like undirected graphs, but they can have parallel edges – multiple edges between the same nodes. The Parallel edges may represent different types of relationships between the nodes. For example James may be a brother to John, but also maybe his classmate. Create an empty multigraph with the constructor:4. Directed Multigraphs: These are just directed graphs with parallel edges and you can create an empty directed multigraph with the constructor:So far so good, we have covered the basic concepts of network analysis such as simple networks and complex networks. Which library to use for complex network analysis such as NetworkX. Also the various graph types available, which scenario requires the use of each and how to create empty graphs with the constructor. Cristian Dina/Shutterstock Network security is the combination of policies and procedures implemented by a network administrator to avoid and keep track of unauthorized access, exploitation, modification or denial of the network and network resources. The primary purpose of network security is to prevent a network security attack which means any method, process, or means that can be used to attempt to compromise network security maliciously. Network security attacks can either be active or passive. Active attacks involve a network exploit in which an attacker attempts to change data transmitted to a specified target while a passive attack is unauthorized monitoring of a network system. How Does Network Security Work?A network security system combines multiple layers to address network security across an organization. The first layer enforces network security through a username/password mechanism allowing only authenticated users with customized privileges to access the network. When a user is granted access into the network system, the network policies are enforced by the network's configured firewall which restricts a user to particular services. The configuration software, however, cannot detect or prevent viruses and malware which is harmful to the network leading to loss of data. Antivirus software or an intrusion prevention system (IPS) is therefore integrated into the network security as the second layer to prevent viruses and other harmful malware from attacking the network.Access Control and Application Security Access control is a network security method that recognizes each user device enforced on security policy and helps keep out potential network attackers. It employs Network Access Control (NAC) to block noncompliant endpoint devices or limit their access. Application security is also important since any application may contain vulnerabilities that can be used by attackers to gain unauthorized access to the network. Application security includes the hardware, software and processes that are employed to limit these vulnerabilities. Behavioral analytics are tools used to monitor a network user's behavior to detect abnormal behavior. These tools automatically discern network activities that deviate from the norm. In turn they identify indicators of a potential network compromise and quickly remediate threats. Antivirus Software and FirewallsAntiviruses and firewalls are the most commonly known network security methods. Malicious software including viruses, worms, Trojans, ransomware and spyware are dangerous to network systems as they often lead to loss of data. Antivirus and antimalware software detect malware upon entry and also analyze files afterward to establish anomalies, remove malware and fix the damage. Firewalls can either be hardware, software or both and function as a barrier between a trusted internal network and an untrusted outside network such as the internet using a defined set of policies that can either allow or prevent traffic. Intrusion Prevention Systems and VPNs Intrusion Prevention Systems (IPS) are employed to block network attacks by actively scanning network traffic. These systems not only block malicious attacks but also continuously track suspicious files and malware that may have gained entry into the network to prevent the spread of outbreaks and reinfection. Virtual Private Networks (VPNs) allow communication between two systems. Data between these two points is encrypted, and users would need to authenticate themselves to enable communication between their devices and the network. Other network security types include Data loss prevention, email security, mobile device security, web security, security information, event management and wireless security.Benefits of Network SecurityWith almost every organization having an online presence, network security have to keep out malicious attacks that could compromise an organization's data. Only a few minutes of downtime is capable of causing widespread damage to an organization's operations. There are multiple methods, applications, tools and utilities companies and individuals can use to successfully secure their network systems, to prevent avoidable attacks and unnecessary downtime. Network security consists of several layers designed to implement policies and controls thus allowing only authorized users to gain access to network resources and at the same time block malicious attackers from gaining entry into the network. MORE FROM BLOGLINES

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