Part 1: Reflection Essay

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Networks

The mathematical term for a network is a graph. A network is a system of elements connected by explicit relations (Weingart, 2010). In "Demystifying Networks", Scott B. Weingart says that all data can be studied via network analysis. The relationships between entities are interdependent, not independent.

In the 1960's, Paul Baron, developed the concept of packet switching and the concept of decentralized network architecture (Rand, 2011). In a decentralized network, packet switching can be achieved by using nodes, which are devices or computers connected to the network and responsible for data packet routing. This provides a flexible network, where nodes can be added to improve performance (Rand, 2011). We experimented in class, on week 14, with circuit boards. Chris Woodford's article, "Computers", explains in detail how circuit boards are networking cards and how they function (Woodford, 2023).

There are several areas that networks encompass. Briefly, I will discuss random, small-world, and scale-free networks. In random networks, the edges are random variables. The simplest random network model is the Erdos-Renyi random network, where all the edges are independent (Nykamp, 2022). Good examples of small-world networks are Facebook, X, and the internet. The elements have a high rate of clustering. Small-world networks combine both random and regular networks. The nodes are together so that the paths are short in length and there is much clustering (Radar, 2012). Scale-free networks have a small number of nodes that have a large number of connections (Wang, 2010). This creates a structure where a few hub nodes are the connectors for the rest of the network. A good example of scale-free connections is

the brain. MRIs are used to study brain anatomy, which helps in the field of neurology (Wang, 2010).

In network analysis, research can be organized into three categories degree distribution, clustering coefficients, and shortest path length. Degree distribution refers to the number of links of a node that determines its node degree (Hansen, 2020). The degree distribution is used to characterize the node. The next area is clustering coefficients. People who are connected in tight groups (i.e., network clusters) have a high clustering coefficient (Hansen, 2020). If your friends all know each other, you have that dynamic. In our week 6 readings on influencers and content going viral, we discussed in class, the impact of virality on artists (Williams, 2024). Lastly, the mean path length is the shortest in a network analysis (Nykamp, 2021). The short path between the points is referred to as geodesic. When you have a group of nodes, the average length for the overall pairs is referred to as the mean path length (Nykamp, 2021).

Visualization can help analysts identify patterns and trends in network data that might not be apparent in raw form. The last component of networks in my research is network visualization. Network designers use visualization to optimize the structure of networks (Becker, 1980). A force-directed layout is used in physics applications to create a more natural-looking layout that minimizes the force between connected nodes (Becker, 1980).

The study of networks has led to significant advances in our understanding of complex systems and how they function. The properties of networks have led to advancements in neurological insights. As research in networks continues to evolve, there will certainly be new applications in other fields.

References:

Bracker, W. E., & Konsynski, B. R. (1980, December 7). *An overview of a network design system*. Https://Mathinsight.org/Definition/Network_mean_path_length. Retrieved April 12, 2024, from https://dl.acm.org/doi/pdf/10.1145/1500518.1500525

Hansen, D. L. (2020, September 12). *Social network analysis: Measuring, mapping, and modeling collections of connections*. Https://www.Sciencedirect.com/Topics/Computer-Science/Clustering-Coefficient. Retrieved April 14, 2024, from https://www.sciencedirect.com

Math Insight (2021, June 5). *Random Networks*. Https://Mathinsight.org/Random_network. Retrieved April 14, 2024, from https://www.mathinsight.org

Nykamp, D. Q. (2021, July 28). *Mean Path Length Definition*. Https://Mathinsight.org/Definition/Network_mean_path_length. Retrieved April 13, 2024, from https://www.mathinsigt.org

Radar (2012, April 5). *Types of Networks: Random, Small-World, Scale-Free*. Https://Noduslabs.com/Radar/Types-Networks-Random-Small-World-Scale-Free/#:~:Text=In%20fact%2C%20Watts%20and%20Strogatz,-world%20(SW)%20. Retrieved April 14, 2024, from https://www.noduslabs,com

Rand (2011, March 28). *Paul Baran and the origins of the internet*. Https://www.Rand.org/About/History/Baran.Html. Retrieved April 15, 2024, from https://www.rand.org

Wang, J., Zuo, X., & He, Y. (2010). Graph-based network analysis of resting-state functional MRI. *Frontiers in Systems Neuroscience*, *4*, 1419. https://doi.org/10.3389/fnsys.2010.00016

Weingart, S. B. (2010, January 23). *Demystifying Networks*. Https://Journalofdigitalhumanities.org/1-1/Demystifying-Networks-By-Scott-Weingart/. Retrieved April 15, 2024, from https://journalofdigitalhumanities.org

Williams, A. (2024, February 23). *Going viral on TikTok: How going viral impacts artists*. Https://www.Magneticmag.com/2022/08/How-Going-Viral-Impacts-Artists/. Retrieved April 13, 2024, from https://www.magneticmag.com

Woodford, C. (2023, April 9). *Computers*. Https://Explainthatstuff.com/Howcomputerswork.Html. Retrieved April 12, 2024, from https://www.xplainthatstuff

Part 2: Learning Outcomes

1. DI SLO 1: How did your work on this module demonstrate you successfully located and critically evaluated information using the Internet, library databases, and other digital tools? To successfully write the paper, I researched the various aspects of networks. There are different types, uses, and different applications of networks.

2. DI SLO 2: How did your work on this module demonstrate you used digital tools to safely, ethically, and effectively produce and exchange information and ideas? I cited the sources of information in the paper and any images used in the PowerPoint presentation were common use from www.freepik.com.

3. DI SLO 3: How did your work on this module demonstrate you creatively adapted to emerging and evolving technology? I learned new information about networks and the different network types. Network designers typically need a degree in computer science or information technology, frequently a master's degree is preferred.