EXperimental Learning

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Big Data and Social Analytics certificate course

MODULE 4 UNIT 4

Graph signal processing and temporal dynamics of social networks

MIT BDA Module 4 Unit 4 Video Resource

Learning outcomes:

LO1: Identify the basic concepts of peer networks, the temporal dynamics of social networks, and network theory.

LO4: Articulate how data techniques can be used to reveal peer networks.

Title: Graph signal processing and temporal dynamics of social networks

In Video 7, Arek Stopczynski explores the temporal dynamics of social networks. He illustrates how networks are easy to identify and analyze on a micro timescale, but that these will likely develop into a complex hairball over time.

Video 7: Arek Stopczynski – Temporal dynamics of social networks.
(To download the video, click here.)

For a more in-depth understanding of the temporal dynamics of social networks, and how these insights can be used to accurately predict participation in social contexts, read this paper on the fundamental structures of dynamic social networks.

Note:

This reading goes beyond the scope of what is required for this course, and is therefore purely for enrichment purposes.

In video 8, Xiaowen Dong discusses the concepts of graph signal processing, graph signal representation, and frequency analysis.

Video 8: Xiaowen Dong – Graph signal processing.
(To download the video, click here.)

If you are interested in finding out more about graph signal processing, beyond the scope of this course, read the paper titled "The Emerging Field of Signal Processing on Graphs". For students who would like to take their understanding of the theory behind graph signal processing further, refer to this Python Graph Signal Processing Toolbox, as well as this Spectral Graph Wavelet Transform resource on Github, which will allow you to perform signal processing tasks on graphs.

Additionally, when discussing the concepts mentioned earlier, Xiaowen Dong introduces a real-world example using data obtained from Flickr, which acts as proof of the concept of graph signal processing. In particular, the example looks at the problem of inferring mobility patterns using the Flickr data generated by users in central London. Should you wish to discover more about this research carried out by Xiaowen Dong and his colleagues, read Sections 5.3-5.5 of Xiaowen's PhD thesis. It elaborates on the abovementioned research conducted in London, as well as similar research conducted using other data resources.

You are now ready to apply your knowledge

Now that you've engaged with Video 7 and 8 in this resource, you are ready to apply your newly gained knowledge by completing the corresponding activity in the Advanced unit. You can access this activity by navigating back to your module learning path, or click to access it directly from here:

4.14 Practical Assessment: Apply graph signal processing to real-world data

Reference list

Video 7

Sekara, Vedran, Arkadiusz Stopczynski, and Sune Lehmann. 2015. "The fundamental structures of dynamic social networks." arXiv eprint arXiv:1506.04704.

Stopczynski, Arkadiusz, Piotr Sapiezynski, Alex 'Sandy' Pentland, and Sune Lehmann. 2015."Temporal fidelity in dynamic social networks." The European Physical Journal B 88:1-6. Accessed June 20, 2016. doi:10.1140/epjb/e2015-60549-7.

Video 8

Dong, Xiaowen. 2014. "Multi-View Signal Processing and Learning on Graphs." PhD thesis. École Polytechnique Fédérale de Lausanne (EPFL).

Hammond, David K., Pierre Vandergheynst, and R´emi Gribonval. Wavelets on graphs via spectral graph theory. Applied and Computational Harmonic Analysis, Elsevier, 2011, 30 (2), pp.129– 150. <10.1016/j.acha.2010.04.005>.

Shuman, David I., Sunil K. Narang, Pascal Frossard, Antonio Ortega, and Pierre Vandergheynst. 2013. "The Emerging Field of Signal Processing on Graphs." IEEE Signal Processing Magazine 83-98. Accessed July 26, 2016. doi: 10.1109/MSP.2012.2235192.

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