

Bilkent EEE Distinguished Seminar Series

Bilkent University - Department of Electrical and Electronics Engineering



Graph Constructions for Machine Learning Applications: New Insights and Algorithms

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Graphs have long been used in a wide variety of problems, such as in the analysis of social networks, machine learning, network protocol optimization or image processing. In the last few years, a growing body of work has been developed to extend and complement well-known concepts in spectral graph theory, leading to the emergence of Graph Signal Processing (GSP) as a broad research field.

In this talk, we focus on summarizing recent results that lead to a GSP perspective of machine learning problems. The key observation is that representations of sample data points (e.g., images in a training set) can be used to construct graphs, with nodes representing samples, label information resulting in graph signals, and edge weights capturing the relative positions of samples in feature space. We will first review how this perspective has been used in well-known techniques for label propagation and semi-supervised learning. Then, we will introduce the non-negative kernel regression (NNK) graph construction, describe its properties, and introduce example applications in machine learning areas such as i) model explainability, ii) local interpolative classification, and iii) self-supervised learning.

Bio: Antonio Ortega is a Professor of Electrical and Computer Engineering at the University of Southern California (USC). He received his undergraduate and doctoral degrees from the Universidad Politecnica de Madrid, Madrid, Spain and Columbia University, New York, NY, respectively. He is a Fellow of the IEEE and EURASIP, and a member of ACM and APSIPA. He was the Editor-in-Chief of the IEEE Transactions of Signal and Information Processing over Networks and recently served as a member of the Board of Governors of the IEEE Signal Processing Society. He has received several paper awards, including the 2016 Signal Processing Magazine award. His recent research work is focusing on graph signal processing, machine learning, multimedia compression and wireless sensor networks. He is the author of the book "Introduction to Graph Signal Processing", published by Cambridge University Press in 2022.

