DEARBORN | MATHEMATICS & STATISTICS
UNIVERSITY OF MICHIGAN-DEARBORN

Colloquium

MONDAY, SEPT 21 , 2026

3:30 PM - 4:30 PM | 2048 CB

AN AI ENHANCED APPROACH TO LOG CONCAVITY IN COMBINATORIAL SEQUENCES

Speaker: Eric Ramos

Bio

Professor Ramos is an educator in the mathematical sciences with over a decade experience teaching students at the undergraduate and graduate level. He has mentored dozens of students in mathematical research, leading to a number of published works. As a researcher, Professor Ramos has authored over 30 papers spanning many mathematical disciplines including algebra, combinatorics, probability, and computation. He has disseminated this work as an invited speaker at almost 100 conferences and seminars.

Abstract

Given a graph G, its independence sequence is the integral sequence a_1,a_2,...,a_n, where a_i is the number of independent sets of vertices of size i. We also define the leaf indexed subtree sequence b_1,...,b_n where b_i is the number of subtrees of G with exactly i leaves. In the late 80's Alavi, Erd\"os, Malde, Schwenk conjectured that the independence sequence is always unimodal whenever G is a tree. This conjecture was then naturally strengthened to claim that the independence sequence of trees should be log-concave, in the sense that a_i^2 is always above a_{i-1}a_{i+1}. More recent work of Jamison has also conjectured that the sequence b_i is log concave as well. These stronger conjectures stood for many years, until in 2023, Kadrawi, Levit, Yosef, and Mizrachi proved that there were exactly two trees on 26 vertices whose independence sequence was not log-concave. In this talk, we will discuss an application of the AI architecture PatternBoost, developed by Charton, Ellenberg, Wagner, and Williamson to train a machine to find tens of thousands of new counter-examples to the log-concavity conjecture for independence sequences of trees. We also provide the first examples of trees whose leaf indexed subtree sequences are not log concave. Through all of this we postulate that PatternBoost is somehow especially well suited for finding these log concavity breakages.

Refreshments will be provided!