

AGCO Seminar

Speaker: AGCO Seminar

Speaker: Felix Hommelsheim, Bremen U. Alemania.

Title: Improved Approximation Algorithms for Path and Forest Augmentation via a Novel Relaxation.

Abstract:

The Forest Augmentation Problem (FAP) asks for a minimum set of additional edges (links) that make a given forest 2-edge-connected while spanning all vertices. A key special case is the Path Augmentation Problem (PAP), where the input forest consists of vertex-disjoint paths. Grandoni, Jabal Ameli, and Traub [STOC'22] recently broke the long-standing 2-approximation barrier for FAP, achieving a 1.9973-approximation. A crucial component of this result was their 1.9913-approximation for PAP; the first better-than-2 approximation for PAP.

In this work, we improve these results and provide a 1.9412-approximation for PAP, which implies a 1.9955-approximation for FAP. One of our key innovations is a $(\frac{7}{4} + \epsilon)$ -approximation preserving reduction to so-called structured instances, which simplifies the problem and enables our improved approximation. Additionally, we introduce a new relaxation inspired by 2-edge covers and analyze it via a corresponding packing problem, where the relationship between the two problems is similar to the relationship between 2-edge covers and 2-matchings. Using a factor-revealing LP, we bound the cost of our solution to the packing problem w.r.t. the relaxation and derive a strong initial solution. We then transform this solution into a feasible PAP solution, combining techniques from FAP and related connectivity augmentation problems, along with new insights. A key aspect of our approach is leveraging the properties of structured PAP instances to achieve our final approximation guarantee. Our reduction framework and relaxation may be of independent interest in future work on connectivity augmentation problems.

When: August 13, 3:00 pm - 4:00 pm.

Where: Campus San Joaquín, UC, Room: TBA.