Industrial & Systems Engineering

Seminar Announcement

Combining path planning from artificial intelligence with mixed-integer programming to optimize the geometry of wildlife corridors

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Abstract: Spatially-explicit mixed-integer programming models (MIPs) allow decision makers to explore a variety of complex scenarios and determine optimal sets of actions across a landscape. In reserve selection problems, the landscape is partitioned into units, and the decision maker must select which units to include in a wildlife reserve. As areas of habitat on the landscape are often scarce, connectivity of these regions through wildlife corridors is critical for species protection. Mixed integer programming models have been used in the past to create wildlife corridors, but they lack the capacity to control corridor geometry.

I propose the Optimal Corridor Construction Approach (OCCA), an approach that employs path planning techniques from artificial intelligence to account for and control corridor geometry, such as width and length. By combining path planning with network optimization, the OCCA allows the user to control and optimize the geometric characteristics of corridors. The OCCA may be used in other applications involving route construction (e.g., vehicle routing) or barrier construction (e.g., fire break design).

I demonstrate how the OCCA can be used in a real world case study. Reindeer husbandry and commercial forestry co-exist in the forests of Northern Sweden. As interwoven as the two industries are, conflicts have arisen. Forest practices have reduced reindeer habitat and compromised the animals' ability to move through the forest on their migration routes. In an attempt to reduce impacts on reindeer husbandry while maximizing harvest revenues, I use the OCCA in a spatially explicit harvest scheduling model to incorporate reindeer corridors within a harvest schedule. The results suggest that the inclusion of reindeer corridors in harvest scheduling can be done at minimal cost.

Bio: Rachel St John is a PhD candidate in Industrial and Systems Engineering at the University of Washington. She received her M.S. in Quantitative Ecology and Resource Management at the University of Washington in 2011 and a B.S. in Mathematics and Statistics at the University of Alaska Fairbanks in 2009.

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