Proceedings of the Annual Conference of the South African Institute of Computer Scientists and Information Technologists, (SAICSIT), Port Elizabeth, South Africa, 26-28 September 2018

Dynamic Bayesian decision network to represent growers' adaptive pre-harvest burning decisions in a sugarcane supply chain

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Abstract

Sugarcane growers usually burn their cane to facilitate its harvesting and transportation. Cane quality tends to deteriorate after burning, so it must be delivered as soon as possible to the mill for processing. This situation is dynamic and many factors, including weather conditions, delivery quotas and previous decisions taken, affect when and how much cane to burn. A dynamic Bayesian decision network (DBDN) was developed, using an iterative knowledge engineering approach, to represent sugarcane growers' adaptive pre-harvest burning decisions. It was evaluated against five different scenarios which were crafted to represent the range of issues the grower faces when making these decisions. The DBDN was able to adapt reactively to delays in deliveries, although the model did not have enough states representing delayed delivery statuses. The model adapted proactively to rain forecasts, but only adapted reactively to high wind forecasts. The DBDN is a promising way of modelling such dynamic, adaptive operational decisions.