Decision Support for Prognostics of Complex Systems: A Practical Approach Using Bayesian Networks

Virtual - Researchers Catch-up

Research on prognostic health management tools for use in condition-based maintenance policies offers to increase the availability of assets while also decreasing maintenance costs and unplanned downtime events. However, these benefits have not been seen by the mining industry because these tools are not compatible with the common industry practice of condition-based maintenance. For such benefits to be realised in the mining industry, new tools are needed that can combine heterogeneous data and expert knowledge for prognostics of complex systems. Bayesian networks are a possible approach which can fill this gap, but they have not been used to model complex mining assets for prognostic health management. For this reason, my research will develop decision support systems based on Bayesian networks which will be constructed using datasets and expert elicited knowledge from three mining companies. From these companies three complex systems have been identified: overland conveyors, haul trucks, and heavy haulage locomotives. This research will use an object-oriented Bayesian network approach to diagnose and forecast the health condition of the asset from condition monitoring and system operation data. The structure of the network as well as the probability distributions for the nodes will be elicited from domain expert knowledge. An efficient validation methodology will be devised to build user confidence in the decision support system's predictions. The decision support system will then be partially deployed in industry to assess performance and usability. The deployment will allow for a more accurate prediction of future asset health condition which will increase the quality of maintenance planners' decision making. Developing a general methodology for the construction of decision support systems for prognostic health management will provide a clear approach for companies to follow in order to move towards an effective company-wide condition-based maintenance policy.

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Theme 2
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