DEFAUS 18

MACHINE LEARNING AND MAINTENANCE

PITCHER

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7 November 2018

ABSTRACT

In recent history, the Air Force has been operating at a sustained heightened operational tempo due to increased domestic and international engagements. Accordingly, the availability of serviceable assets to meet mission and training requirements is under great demand. This has fuelled the development of Fleet Management (FM)–from magnets on a whiteboard, to rudimentary spreadsheets, to current day software toolsets.

However, these toolsets are merely visualisation and reprocessing decision-support programs that rely on human interpretation for best possible outcomes. Workplace experience forms the primary bases for interpretation and often lacks any formal training or positional stability, repeatedly resulting in inefficient and costly outcomes. These toolsets should therefore be thought of in a '4th Generation Maintenance' context.

Proposal

Artificial Intelligence (AI), in the form of Machine Learning (ML), has the potential to propel FM into the 5th Generation. As such, we propose synergising ML and FM to develop a human-in-the-loop (HITL) active learning ML algorithm. HITL leverages both human and machine intelligence to create a smarter, more efficient and more confident ML model. Active learning is achieved through semi-supervised ML where the algorithm "votes" on an outcome based on past, present, and predictive (P3) data analysis.

PROPOSAL AND OUTCOMES

If in consensus–the decision forms the basis for an automated approach. If they disagree or lack confidence, the difficult fringe case is passed to the human fleet manager for a decision. These decisions are fed back into the system to continually train the ML algorithm. Evidence suggests that a variant of Pareto's famous 80:20 rule is consistent with the most accurate ML systems to date–that is 80% AI-driven, 19% human selection, and 1% of randomness. Hence, the configuration of our proposed model.

Developing an ML FM algorithm has the potential to drastically enhance the entire ADF FM continuum, and provide the following key benefits:

- Increased asset availability by using P3 data analysis to reduce servicing and unscheduled maintenance downtown;
- Reduced planning burden through AI's ability to learn and conduct a large portion of the FM workload;
- Reduced through-life asset costs by the algorithm's ability to grow its knowledge base as platforms age–reducing maintenance requirement determination support

While there are efforts to reduce the current ICT capability gap, they continue to reside in the 4th Generation space. Our proposed model aligns with the outcomes of the Air Force Strategy 2017-2027, Plan Jericho and the Air Force Maintenance Management Governance Review (AFMMGR 2015), and to launch ADF Fleet Management into the 5th Generation.