Improving the Quality of Technical Data for Developing Case Based Reasoning Diagnostic Software for Aircraft Maintenance

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Business motivation and objectives

Time spent by airline maintenance operators to solve engine failures and the related costs (flight delays or cancellations) are a major concern to SNECMA which manufacture engines for civilian aircrafts such as BOEING 737s and Airbus A340s. The use of an intelligent diagnostic software contributes to improving customer support and reduces the cost of ownership by improving troubleshooting accuracy and reducing airplane downtime.

However, classical rule-based or model based experts systems are costly to develop and maintain. Our goal has been to improve the development of troubleshooting systems through Case Based Reasoning (CBR) and Data Mining. These technologies reason from past cases, whose solution is known, rather than rules. New problems are solved by searching for similar problem solving experiences and by adapting the solutions that worked in the past.

Our second objective was to acquire the capacity to produce systems which match the quality standard in the aeronautic industry in the given time frame. We aim at both assuring the quality of the core data mining and CBR software as well as the quality of the technical information that is fed into the system (case Knowledge).

The experiment

We have improved the development of diagnostic software for Boeing 737 engines. The case quality is monitored through a steering committee of specialists and is ensured by collecting quality information at the source (airlines such as British Airways). The main results of the experiments are:

• setting up an organisation to collect failure cases and monitor their quality
• the implementation of a quality plan for the core CBR & datamining software
• a pilot application delivered at British Airways Engineering for joint testing,
• a measured impact on our capability to develop such software in the future

The impact and experience gained

The work achieved had helped us improve the process by which we develop quality decision support software by obtaining better case descriptions and setting up an organisation to monitor their quality. The experience gained in the aircraft industry contributes to raise the case quality culture for CBR & Datamining and will enable large scale deployment of these technologies in other industries as well. We now have fewer cases in the system (1500 examplary cases instead of 23,000 raw ones) which have a higher quality. This yield more accuracy on the average consultation (83% precision instead of a maximum of 20% prior to the experiment) and allowed us to reduce the cycle and cost of development by a factor of 2. For 6 systems on all our engines, this represents a saving of K$600 of cash flow (42% gain) on the development cost. It also moves forward by two and a half years the break even point for our global business plan for diagnostic software that are based on case data.

Acknowledgements

Funding for this work has been provided by the European Commission as part of the ESSI Software Best Practice initiative (Process Improvement Experiment project #21522)