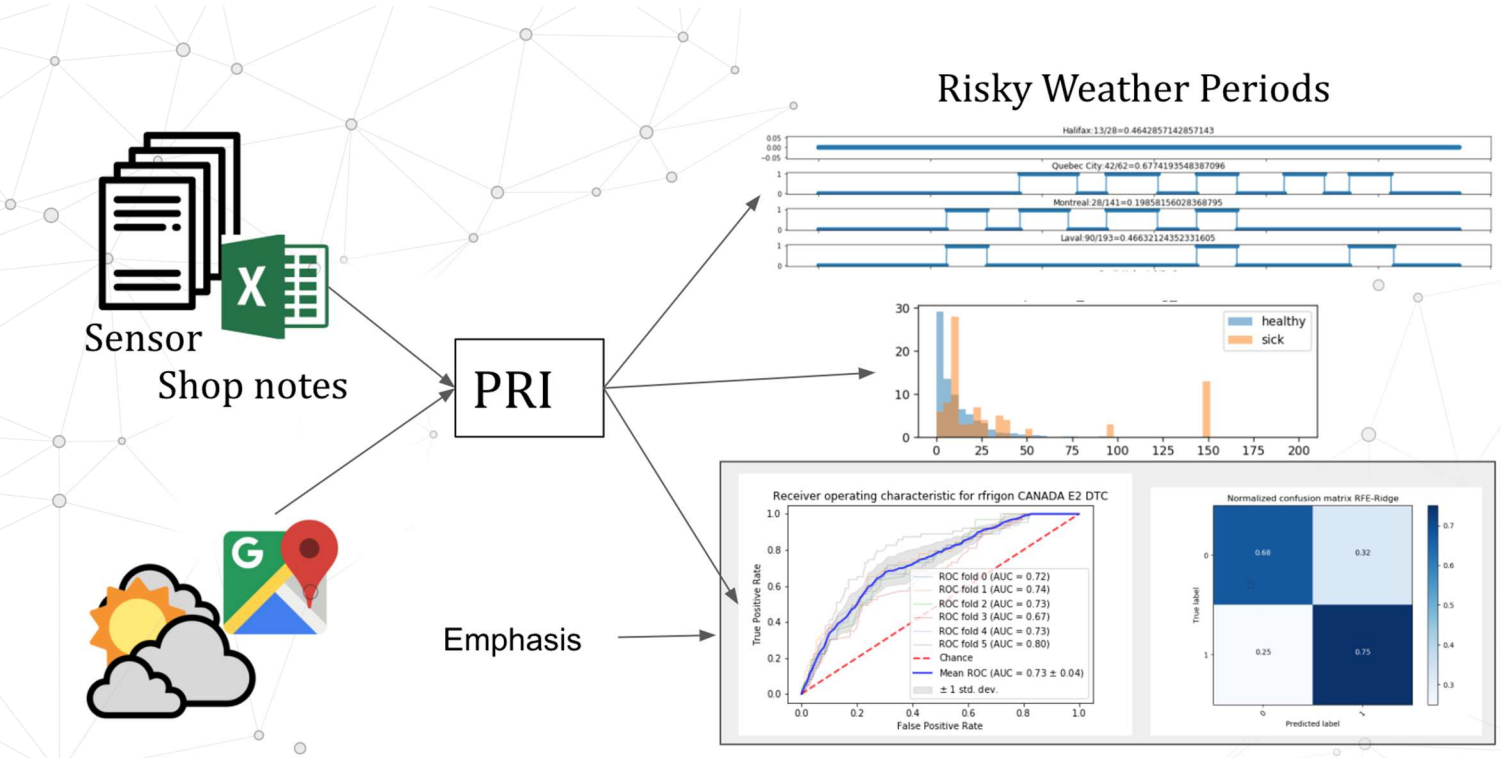
Predictive Repair Intelligence Solutions

Manufacturers worldwide traditionally rely on a concept called scheduled preventative maintenance to keep their products in good operating condition, whether they are vehicles on the road, commercial airliners in the sky, or wind mills in the remote outposts. A typical characteristic of such a mode of maintenance is that many perfectly good parts get tossed as a price for optimizing the uptime, since in all cases, an unexpected breakdown of the machinery is by far the most expensive mishap any company could face.

A far more ideal method for fleet management is what's known as predictive maintenance, whereby an intelligent algorithm takes in numerous measurements and predicts the pending component failure with a high degree of accuracy. From hereon, we refer to this algorithm as Predictive Repair Intelligence or PRI. In general, predictive models of this sort work either by classification for a breakdown within a prediction horizon, or by means of a Remaining Useful Life (RUL) assessment. While the application of supervised learning to such a problem can seem mundane, dealing with a real-life PRI case proves to be anything but straightforward. Here, in the rubber meets the road scenario, academic clarity counts much less than hard knuckled experience with real data, domain folklores, and the wild wild west of IoT sensors.



BigR.io's PRI project with a high-end auto manufacturer involved machine sensor data, proprietary dealer information system, warranty information, as well as public domain datasets such as Weather and GPS data.

BigR.io stands out as a thought leader in Predictive and Prescriptive analysis and solutions supported by our AI advancement with its Machine Learning practice, delivering custom solutions to its clients on the same robust and scalable engineering platform that backs its software and integration offerings.

BigR.io is a US based technology and consulting company with its headquarters in Boston. We empower our clients to drive innovation and advanced analytics through the use of data science. Our expertise in software engineering, product development, database technologies, cloud engineering, web and mobile applications development has helped us to create some highly specialized services and solutions using AI, ML and NLP proprietary tools.

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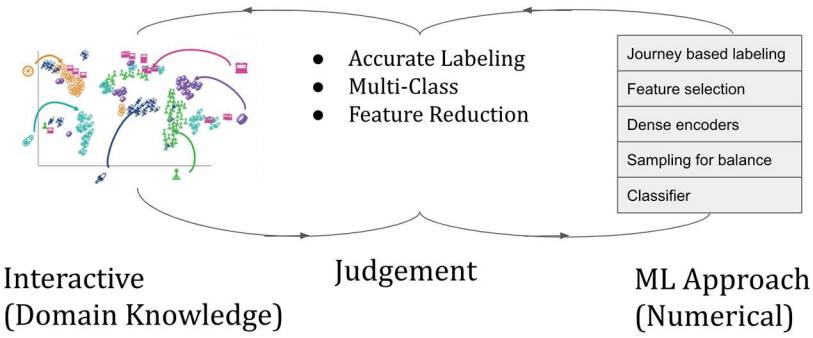
In a typical Data Science engagement, our team of experts walks into a hardware centric environment, where the client staff are of a deterministic logic mindset, with little prior exposure to statistical ways of problem solving. Design experts debug component failures by diving deeply into individual cases, uggling up to 4 or 5 failure instances maximum in his head. While information exchange is both interesting and informative, domain guidance alone rarely directly yields a workable set of relevant input signals and reliable labeled samples.

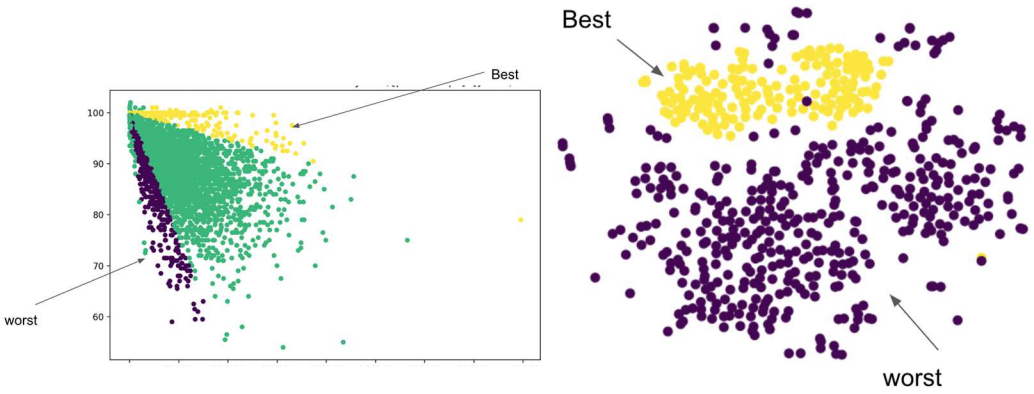
The key challenge starts with dimension reduction from over 200 signals down to a manageable set of 50 or fewer. Furthermore, the accuracy of failure labels is often untrustworthy, as labor cost for detailed diagnosis is far greater than making sacrificial part replacements. “Throwing parts at the problem” is considered the most practical way to eventually drive out the true cause of a warning light. Given these adverse initial conditions, Bigr.io has developed a general framework for attacking this class of problems, which we call the Virtuous cycle, whereby we iteratively apply visualization to gain intuition, and test out hypotheses using numerical / statistical techniques.



Iterative application of visual examination and numerical evaluation yields the necessary intuition for reducing a seemingly unmanageable problem to one that is based on reliable features selection and labeled samples.

Visualization techniques are especially useful when dealing with a noisy feature set compounded with high data volume. Our study into battery aging, for example, leveraged an advanced clustering technique which illustrates how battery charging data can be used to distinguish between the fastest and slowest aging units.

Visualization technique is used to investigate the effectiveness of battery charging cycle data for classifying battery aging behaviors.



Predictive maintenance, and IoT data science in general, deals with high dimensional noisy data, where any one sensor measurement means little in driving an outcome, but many of them collectively can produce accurate classifications, given the proper application of data preprocessing and algorithmic fine tuning. In our parlance, we use the machine learning model to serve as a Virtual Sensor, in cases where the ideal hardware, dedicated sensor does not exist. A real-life example is that whereas a humidity sensor can often pinpoint system leakage, no such sensor can be manufactured economically to withstand the rough and tumble conditions of a driving car. A software algorithm which incorporates various sensor signals that are sensitive to humidity, on the other hand, can serve as a virtual substitute in gauging humidity effects. We believe many example applications of this powerful concept exist in the manufacturing world, and application of advanced Data Science in complex mechatronics hold the key to uncover these opportunities for improving the quality of fleet health.

Our experience shows that collaboration is the key to success. We collaborate closely on the niche projects and with key decision makers in the company to understand the details of the engagement. We stay ahead of the curve working towards your success. Thus, if you are looking for a Predictive Repair Intelligence solution you can write to us at innovation@bigr.io