When Will the Analytics of Things Grow Up?

By: Tom Davenport

A few years ago, while working with DJ Patil (now the Chief Data Scientist of the U.S. Office of Science and Technology Policy) on an article about data scientists, he related to me a general rule about big data that we had both observed in the field: "Big data equals small math." My explanation for this phenomenon is that companies often have to spend so much time and effort getting big data into shape for analysis that they have little energy left for sophisticated analytics. The result is that, for many organizations, the most complex analysis they do with big data is the bar chart.


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Unfortunately, the same situation is true for Internet of Things (IoT) analytics. This should not be surprising, since it's a form of big data. The challenge with IoT data is often not the volume, but the variety of data. If you want to know what's going on with a car, for example, there are a couple of hundred sensors creating data that require integration, much of it in manufacturers' proprietary formats.

As a result, most of the "analytics of things" thus far have been descriptive analytics – bar (and Heaven forbid, pie) charts, means and medians, and alerts for out-of-bounds data. These "measures of central tendency" are useful for reducing the amount of data and getting some idea of what's going on in it, but there are far more useful statistics that could be generated on IoT data.

So for the rest of this column, I'll describe the analytics of things – both current and potential – in terms of the typology of analytics that I and others have employed widely: descriptive, diagnostic, predictive, and prescriptive.

Descriptive Analytics for the IoT

As I mentioned above, these have been the most common form of IoT analytics thus far. But there is still progress to be made in the descriptive analytics domain. Integrated descriptive analytics about a large entity like a person's overall health, a car, a locomotive, or a city's traffic network are required to make sense of the performance of these entities. The city-state of Singapore, for example, has developed a dashboard of IoT traffic data to understand the overall state and patterns of traffic. It's not the be-all and end-all of IoT analytics, but it at least gets all the important descriptive analytics in one place.

Another useful form of descriptive IoT analytics is comparative analytics, which allow a user to compare an individual's or an organization's performance to that of others. Activity tracker manufacturers like Fitbit and fitness data managers like RunKeeper and MyFitnessPal allow comparison with friends' activities. The comparative descriptive analytics provide motivation and accountability for fitness activities. Similarly, the Nest thermostat offers energy reports on how users compare to their neighbors in energy usage.

Diagnostic Analytics for the IoT

I have not often used the diagnostic analytics classification favored by Gartner because the explanatory statistical models it involves are usually just a stepping stone to predictive or prescriptive analytics. But diagnostic analytics have some standalone value in the IoT context, particularly for qualifying alerts. One big problem for the IoT is going to be the massive number of alerts that it generates. Alerts are generally intended to get humans to pay attention, but "alert fatigue" is going to set in fast if there are too many of them – as there are already today in health care with medical devices. Diagnostic analytics can determine whether alerts really need attention and what is causing them. My friends at the analytics software company Via Science, where I am an adviser, tell me that Bayesian networks are really good at distinguishing important alerts, and I take their word for it. I would imagine that logistic regression models could do it sometimes as well.

Predictive Analytics for the IoT

While there aren't a lot of examples of predictive analytics with IoT data yet, there are some, and there need to be more. The most common example is probably predictive locational analysis, which happens every time I use my smartphone or car GPS to plan a route. Somewhat less but increasingly common is predictive maintenance on industrial machines, which tells companies like GE or Schindler Elevator that their equipment is about to break down, so it better be serviced.

Predictive health is another area with a lot of potential, but not much actual value. Applications could take your daily steps, weight, and calorie consumption (that's the toughest data point at the moment, since it relies on self-reporting), and predict things like your likelihood of getting Type 2 diabetes, or even your lifespan. More prosaic predictions could involve your likelihood of losing weight in time for your class reunion, or your beating your best time in an upcoming marathon.

Prescriptive Analytics for the IoT

Prescriptive analytics are those that provide specific recommendations based on predictions, experiments, or optimizations. It's not hard to see how these could be valuable with the IoT. An airline pilot could be told, "Shut down engine number four now, before it overheats." At GE, maintenance people are already told when to wash a jet engine with water, which apparently lowers the failure rate and lengthens the lifespan of the engines.

Prescriptive medical applications of the IoT could be very valuable as well. Medical device data could tell clinicians when to intervene with particular patients. Instead of annual medical checkups, which are both expensive and not terribly effective, patients could be advised by home health devices when to see a doctor. Philips already has a service offering called CareSage that uses wearable device data to alert clinicians that an elderly patient needs an intervention.

In some IoT environments, such as "smart cities," analytics will need to provide automated prescriptive action. It's useful to look at a dashboard and know which streets are congested in Singapore, for example, but the real value comes when a system can change traffic light durations and block off freeway entrances based on IoT data. Similar automated actions will need to be put in place for industrial environments with IoT sensors and data. In such settings, the amount of data and the need for rapid decision making will swamp human abilities to make decisions on it.

Given the young age and high complexity of the IoT data environment, it's not surprising that the "analytics of things" isn't very mature yet. But in order for us to get value from the IoT, we need to move beyond bar charts as quickly as possible.

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