Big Data in Radiology: Friend or Foe?

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VIENNA—Experts at ECR 2016 discuss whether big data analytics can help or hinder radiology.

Big data need not be just a buzzword in today’s radiology departments. At ECR 2016, Bruce J. Hillman, MD, proved that big data is already a successful, and threatening, part of medical imaging.

Some opportunities for big data to shine include: better understanding of patient preferences, efficient clinical pathways, quality assurance, and benchmark and compare work within the department, Hillman said.

Some smaller organizations are already helping organizations improve with big data analytics.

**Montage Health**
Montage Healthcare Solutions provides software for data mining and analytics specifically for radiology.

“Montage Health has developed a collaborative research network with clients of mostly hospitals and health systems,” Hillman said. “They have linked together 500 imaging providers for roughly 200 million radiology reports.”

The ability to reference this data allows Montage to conduct quality assurance, and identify population health and efficiency issues. Even more important, is that they can compare this data within an institution or across many institutions.

“Let’s say a negative quality indicator is the words ‘cannot exclude’ in a radiology report,” Hillman said. He cited an example of a report that showed every radiologist, within an organization or within a group of organizations, and how often one of their reports used the words “cannot exclude.”

“This is a very good example of using that network of 500 providers to help benchmark and also provide information as to who really needs improvement,” he said.

**Zebra Medical Vision**
Zebra Medical Vision wants to improve care with machine learning and computer vision tools.

It is globally linked to a number of institutions and provides researchers with open access to a large number of medical images linked to reports and some clinical data, Hillman explained.

“They are, in essence, a foundation for developing new algorithms to do big data analytics,” he said.

“The goal is to develop predictive models and personalized medicine that will help us do things like supplant gross screening, as we do now, with informed surveillance, and perhaps detect disease earlier for better treatment.”

While a business’s approach to big data can be seen as a way to improve health care, other approaches can feel threatening.

**IBM**
Montage and Zebra are big data small businesses, but IBM is big data big business, Hillman said.

IBM has taken on the grand challenge of wanting to reinvent health care. They want to take their Watson computer platform, the one that challenged and defeated both the longest-running champion, Ken Jennings, and greatest money winner, Brad Rutter, on *Jeopardy*!

For those that are skeptical that Watson can read and diagnose images, Hillman explained how Watson prepared for *Jeopardy*!

“In *Jeopardy!* they used natural language and taught Watson to link bits of data in rational ways,”
Hillman explained that when an answer appeared, Watson generated up to 100 possible questions and then used a scoring algorithm to rate those answers in order of likelihood. To discourage Watson from buzzing in with the wrong question and therefore having money subtracted, Watson was taught to determine its best answer in terms of likelihood and then to consider the status of both his situation in terms of cash won and that of the competitors, and to use that information to determine whether he should buzz in or not.

“You can see, [teaching Code Name: Avicenna to read images] is not such a difficult challenge when they’ve done something like they did for Jeopardy!” Hillman said. IBM adamantly claims that Code Name: Avicenna is about helping humans work with machines to better understand the massive amounts of information needed to make medical decisions, Hillman said.

“What Watson could do to help radiologists is assess the appropriateness of a referral in an instant, or select from 1500 images just the ones that are the most meaningful, act as a 2nd reader, a basic CAD, suggest a differential diagnosis, and suggest follow-up tests,” he said. “It sounds a lot like what radiologists do.”

Watson has a number of virtues that would say maybe we should let it work as radiologists, Hillman said. “It’s absolutely indefatigable, it doesn’t complain, it accepts uncertainty, whereas many humans have a lot of trouble with [uncertainty], it has virtually limitless memory, and it learns from its mistakes.”

On the radiologist’s side, however, might just be Watson’s cost, a criticism usually made against radiologists. “As expensive as radiologists are at this point in time, Watson may be more expensive,” Hillman said. “There may be a lot of problems with confidentiality, regulatory approval, reimbursement, and who do you sue if Watson makes a mistake? IBM?”

Regardless, IBM and a small army of smaller organizations are working on big data. Hillman has no doubt that machines will be doing at least part of the radiologist’s job in the next 5-10 years. He cited two possible pathways for the future: one in which technology completely disrupts the classical sense of radiology and changes the whole business, who does it, and who gets paid for it. The alternative is to use the systems to work jointly with humans to improve value overall.

“It’s up to us,” Hillman said. “We have given up a great deal of what our job used to represent in the favor of incentives to do more and get paid more, basically as shadow readers…we have to redefine ourselves as consultants once again.”

Radiologists need to become patient advocates, mediators of computer diagnoses and treatments,
he said.
“I have no doubt that medical imaging is going to survive, the question is will we be participants ten years down the line?”

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