

# Hey Doc! Just ask Watson



IBM's Watson technology powers a popular game show in the U.S. But the analytical and natural language processing capabilities of the machine has useful applications in the field of medicine. The day is not far when Watson will help medicos take more accurate life-saving decisions

By Brian Pereira

**T**here is a popular game show in the U.S., called *Jeopardy!* If you've watched it on TV, or perhaps tried your hand at the game, you would have witnessed firsthand, the intellectual duel between a human and a machine. The technology behind this game is called 'Watson' and it was developed by a team of engineers at IBM. But nobody invests over USD 2 billion in a machine that powers a wordplay game. IBM believes Watson's first business application will be solving problems in the healthcare industry.

Named after IBM founder Thomas J. Watson, this is an analytical computing system that specializes in analyzing natural human language, and provides specific answers to complex questions at rapid speeds. Watson has the ability to analyze the meaning and context of human language, and rapidly process information to find more precise answers to questions posed in natural language. Watson, however, is far beyond a simple Q&A machine. It demonstrates advances in technology that will create a new class of systems that can learn and talk.

"We have been talking to clients

about its potential applications in industry and the one area that has emerged as the highest priority is healthcare," informs Dr Manish Gupta, Director, IBM Research - India. Dr Gupta is also Chief Technologist, IBM India/South Asia.

#### HEALTHCARE APPLICATIONS

Watson's analytical capabilities can be applied to areas like radiology, oncology, cardiology, primary care and biopharma.

- Radiology:** It provides the potential to create algorithms that automatically identify and flag

anomalies on MRIs and images much smaller than a radiologist can see with the human eye. It has the potential to interact with and guide the radiologist to do deeper analysis and additional imaging to identify a potential problem.

- Oncology:** The technology can be used to potentially guide physicians and patients to examine the value tradeoffs between benefits and harms across cancer treatment and screening options, allowing patients to make more informed decisions or prompt physicians with decision aids and coaching.
- Cardiology:** Watson-like capabilities could be used to guide cardiologists to avoid the most common mistakes in the field by ingesting and analyzing treatment data and test results, as well as automatically looking for causes for concern, such as the overuse of diuretics, the presence of pulmonary edema, or too much digitalis as noted in a blood test. Thus, it can direct cardiologists on balancing the most effective drug dosage or procedures.
- Primary care:** Due to its ability to combine diagnosis data and treatment recommendations with analytics and locate specialists in a patient's health plan, who live



"Healthcare has emerged as the highest priority area where IBM's Watson technology can be applied"

**Dr Manish Gupta**  
Director, IBM Research - India

within 15 miles of the patients' home and have the highest cure rate; it can provide patients better care under their primary care team. It can be used to attain more effective treatment and reduce the expenditure on the treatment of costly chronic illness.

- Biopharma:** With its capacity to track drug interactions, contraindications and model, combined with analyzing data from numerous clinical trials; Watson can help biopharma companies to pioneer new areas for maximizing profit and developing new therapies.

#### HOW IT ANALYZES

For healthcare, the way it does the diagnosis is similar to what a doctor does in his clinic. When you go to a doctor, you describe your symptoms and he prescribes certain treatment. The symptoms that you describe are

equivalent to asking a question in a *Jeopardy!* game.

The doctor relies on his medical knowledge and his years of experience to make a diagnosis. Often the doctor comes up with a hypothesis, considering two or three possibilities. Because of his experience he is able to make an accurate diagnosis. If in doubt, he probably asks you to do a couple of medical tests or refers you to a specialist.

Dr Gupta explains that this is analogous to what the Watson system does. "When you ask a question, it searches through its bank of millions of documents and comes up with many potential answers. As it combines all these results, it narrows this down to relatively few possibilities, say about three or four. It also estimates the confidence it has in the answer being correct."

With 15 TB of memory, Watson stores not just Electronic Medical Records (EMR) but all the information around a patient's case — symptoms, findings, physician notes, patient interviews and family history. Then it uses analytics technology to automatically consider all the texts, reference materials, prior cases, and all the latest knowledge in journals and medical literature to propose a differential diagnosis.

While widespread adoption of Watson technology in the healthcare sector is still some time away, IBM's research team is working in close collaboration with the medical fraternity in the West and is also in discussions with several hospitals. 

—With inputs from a technical paper on Watson, provided by IBM

► Brian Pereira [brian.pereira@ubm.com](mailto:brian.pereira@ubm.com)

### INTO THE HEART AND SOUL OF WATSON

What does it take to build a machine that requires high-performance computing capabilities in the teraflop domain? After all, scanning millions of digitized documents in three seconds is something that only "big iron" systems can do.

When IBM's research scientists set out to tackle the challenge of developing Watson, they asked IBM to provide the most advanced, commercially available system, which was developed for running many analytics processes at once.

The system comprises a cluster of Power 7 servers — in fact there are a total of 10 racks of Power 750-based servers. The computing power of Watson can be compared to over 2,880 computers with a single processor core, linked together in super high-speed network. The computational power is 80 teraflops.

To put all this in perspective, a computer with a single processor core takes more than two hours to perform the deep analytics needed to answer a single *Jeopardy!* clue. Watson does this in less than three seconds. And for that it needs 15 TB of memory, to accommodate a massive database.

Watson is designed according to Unstructured Information Management Architecture — UIMA for short. This software architecture is the standard for developing programs that analyze unstructured information such as text, audio and images.