

The Rise of Intelligent Machines and What it Means to the Lab and Healthcare

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It is impossible to avoid interacting with machine intelligence in everyday life today. Every time you swipe your credit card a massive collection of machine learning algorithms are desperately trying to figure out if it's really you. Check out at a retail store and computers are running as fast as they can to tell manufacturers how to get more money from you. Healthcare will be equally affected, but it won't be the adoption of "Electronic Health Records". In fact these transcription programs are little more than replacements for the charts physicians have always used, not always to good effect [1]. What is more likely to change the nature of healthcare will be intelligent machines performing diagnosis and treatment delivery. These machines will use data from EHR systems along with real time body sensors, camera systems, voice recognition systems, along with direct access to the entire medical literature and real-time laboratory data to perform advanced calculations resulting in, hopefully, improved diagnosis.

It has been shown that intelligent machines teamed with experts are superior to experts working with their memory alone [2,3]. This will have a profound effect on the nature of healthcare delivery. Further, the advance of automation is already having a significant effect on labor markets, and there is no reason to believe healthcare will not be impacted [4].

Today, IBM is working with medical schools to bring their famous Watson system directly into the US healthcare system [5] and other groups are pursuing similar applications [6].

These shifts raise many questions that will affect all of us. To name a few: If human-machine teams are better than humans alone, who will judge malpractice? If automation systems replace human labor (as liquid handling systems and industrial robots have), what impact will this have on

the nature of the labor market in healthcare? These questions are being asked in all sectors of the economy and must also be faced in healthcare.

One trend stands out, automation affects routine operations first, before it changes less routine tasks [7]. That means that automation and machine intelligence will affect the laboratory space of the healthcare industry very early compared to highly variable tasks such as surgery [8].

In this plenary lecture examples of human-machine teams and the various successes and failures of such teams will be examined. Also, the overarching idea of the impact on society of the increased role of machine, in general, will be discussed. Comparisons and contrasts with the first machine age (the industrial revolution) to what is being called the second machine age (the rise of intelligent machines) will be used to draw out the consequences and likely benefits and difficulties we will have to face as a scientific community working in the healthcare field.

The bad news is that during the first years of the industrial revolution, there was systemic unemployment and widespread problems that took decades solve. The good news is that once solved, society saw massive improvements in quality of life and a historically unprecedented increase in global wealth. We are now entering the second machine age and we will see both seemingly intractable problems and a nearly unlimited potential for improvement in quality of life – in the case of healthcare that would mean the end of the most terrible diseases that ravage the rich and poor parts of our society alike.

[1] *Confessions of a Medical Scribe*,
<http://www.kevinmd.com/blog/2014/03/confessions-medical-scribe.html>.
Retrieved May 8, 2014

[2] Cowen, Tyler, *Average Is Over: Powering America Beyond the Age of the Great Stagnation*, Penguin Group US, 2013

[3] Steve Lohr, *Computer Algorithms Rely Increasingly on Human Helpers*, New York Times, March 10, 2013

[4] Brynjolfsson, Erik; McAfee, Andrew, *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W. W. Norton & Company. 2014

[5] IBM Watson Helps Fight Cancer With Evidence-based Diagnosis and Treatment Suggestions," Memorial Sloan-Kettering Cancer Center, January 2013, [http://www-935.ibm.com/services/multimedia/MSK Case Study IMC14794.pdf](http://www-935.ibm.com/services/multimedia/MSK_Case_Study_IMC14794.pdf)

[6] Rimm, David L., *C-Path: A Watson -Like Visit to the Pathology Lab*, Science Translational Medicine, 3 (108) 2011

[7] *Disruptive technologies: Advances that will transform life, business, and the global economy*, McKinsey Global Institute, May 2013

[8] Carl Benedikt Frey and Michael A. Osborne, *The Future of Employment: How Susceptible Are Jobs to Computerization*, Oxford University, Sept. 17, 2013.