Editorial

Healthc Inform Res. 2016 July;22(3):153-155.
http://dx.doi.org/10.4258/hir.2016.22.3.153
pISSN 2093-3681 • eISSN 2093-369X

HIR
Healthcare Informatics Research

Big Data and Healthcare: Building an Augmented World

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Starting from July of 2016, literally bumping into people on the streets trying to catch Pokémon has become a common sight. Pokémon, of course, are fictional creatures based on the popular Japanese video game franchise that has become the basis of animated series and films [1]. Unlike other fictional characters, however, Pokémon now exist in an augmented reality (AR) in the new mobile game, Pokémon Go, which transforms your physical location into a world that hosts characters superimposed on the reality that we see through our smart phones.

Having become an international sensation within days of its release, Pokémon Go integrates fiction-based excitement into our physical reality. What makes this location-based game possible is global positioning system (GPS) technology, a major staple of big data. GPS allows data to be collected (as in Google maps) while allowing this collection to be added upon by crowd-sourced data [2]. In our field, of course, the question naturally arises: Could this game phenomenon be a precursor to an integration of similar technologies into healthcare somewhere down the road?

Since the beginning of the so-called "4th industrial revolution" that started in the middle of the last century, we have seen digital advances in almost every field. This revolution has brought about increases in storage capacity, processing power, and access to knowledge, all of which are concepts associated with big data [3]. Gartner Inc. has predicted five technologies for big data in 2016—machine learning, artificial intelligence, the Internet of Things, automated composition engines, and robo-boss [4]—technologies not only made possible by big data but also used to create more big data. As healthcare is a field in which much interest has been directed toward big data and its utilization, business entities have been working diligently to break and develop new ground in this field. In Febuary of this year, for instance, IBM Watson Health, one of the most well-known examples of the integration of big data and machine learning into healthcare, announced that it would buy Truven Health Analytics, a cloud-based healthcare data and analytics company, a move that would make IBM's health cloud the largest and most diverse collection of health-related data in the world [5].

In the 2015 European Commission workshop on Big Data in Health Research: An EU Action Plan, "big data in health" was defined to "encompass high volume, high diversity biological, clinical, environmental, and lifestyle information collected from single individuals to large cohorts, in relation to their health and wellness status, at one or several time points" [6]. Interest in the application of big data in healthcare has been seen around the world, perhaps most noticeably in the 100,000 Genomes Project in the UK [7] and the NIH Big Data to Knowledge and Precision Medicine Intiatives in the United States [8,9]. China has also recently announced plans to develop a big data platform that will be able to cover the entire life cycle [10]. Such exemplary iniatives ambitiously envision collecting various forms of health data that include structured data (e.g., genotype, phenotype, and genomics data) as well as semi-structured and unstructured data (e.g., medical imaging, Electronic Health Records,

lifestyle, environmental, and health economics data) [6].

These advances in big data analytics have naturally transformed our question of "What has happened?" (descriptive) to "What could happen?" (predictive) and "What should we do then?" (prescriptive) [11]. The growth of these topics can be seen in the biomedical literature. As of July 2016, a PubMed search of articles with "big data" in the title retrieved approximately 900 results published since 2008. The articles cover a broad range, from introductory topics, such as opportunities and challenges of big data in certain areas to more technical topics such as proofs for modeling and simulation [12,13]. Predictive studies, however, have yet to receive adequate attention in the literature [14]. While Health Informatics Research (HIR) has published review papers and editorials regarding big data [15-18] in the past, this issue of HIR includes a review paper [19] that examines the potential of the medical Internet of Things and big data in producing "personalised preventative health coaches," digital health advisors that can analyze the implications that big data has for the health and well-being of individuals.

With big data now a buzzword in scholarly papers, reports, news articles, and blogs, we realize that implementing the promises of big data into the world of healthcare is easier said than done. The conversion of big data into applicable knowledge requires moves to be taken on various fronts [6]. To make data sharing possible from various sources and in various formats, standards for data generation and processing must be adopted to ensure the data's interoperability [6,20]. Ethical and legal processes must be established to prevent the abuse of personal information [6,21]. We must also focus on leveraging the productivity of big data projects by including interdisciplinary workforce training, as more bio/health informatians, biostatisticians, and computational scientists will join teams for research, clinical practice, and health admistration [6].

A seemless integration of big data into our healthcare system may seem to lie still in the distant future. In spite of the buzzword "big data" has become, the work of researchers from both academia and industry has thus far focused more on the collection rather than application of data, and we have seen few tangible integrations in the real world, let alone the healthcare industry. But the few integrations we have seen, as in fields such as gaming, integrations that seemed like science fiction only ten years ago, invite us to imagine the world of possibilities they can bring. The foundations of this world have been set, and it is our job to build upon them.

References

1. Wikipedia. Pokémon Go [Internet]. [place unknown]: Wikipedia; c2016 [cited at 2016 Jul 20]. Available from: https://en.wikipedia.org/wiki/Pok%C3%A9mon_Go.
2. Joseph B. The secret sauce in Pokémon Go: big data [Internet]. Irvine (CA): Digital Medial and Learning Initiative; c2016 [cited at 2016 Jul 20]. Available from: http://dmlcentral.net/secret-sauce-pokemon-go.
3. Schwab K. The fourth industrial revolution: what it means, how to respond [Internet]. Geneva: World Economic Forum; c2016 [cited at 2016 Jul 22]. Available from: https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/.
4. Jeevan M. Gartner predicts five big data trends that will dominate 2016 [Internet]. Singapole: bigdata-madesimple.com; c2016 [cited at 2016 Jul 19]. Available from: http://bigdata-madesimple.com/gartner-predicts-five-big-data-trends-that-will-dominate-2016/.
5. IBM Watson Health announces plans to acquire Truven Health Analytics for $2.6B, extending its leadership in value-based care solutions [Internet]. Armonk (NY): IBM; 2016 [cited at 2016 Jul 22]. Available from: https://www-03.ibm.com/press/us/en/pressrelease/49132.wss.
6. Auffray C, Balling R, Barroso I, Bencze L, Benson M, Bergeron J, et al. Making sense of big data in health research: towards an EU action plan. Genome Med 2016; 8(1):71.
7. Genomics England [Internet]. London: Department of Health; c2016 [cited at 2016 Jul 22]. Available from: https://www.genomicsengland.co.uk/.
8. Big data to knowledge initiative [Internet]. Washington (DC): National Institute of Health; c2016 [cited at 2016 Jul 20]. Available from: https://datascience.nih.gov.
9. Precision medicine intiative cohort program [Internet]. Washington (DC): National Institute of Health; c2016 [cited at 2016 Jul 20]. Available from: https://www.nih.gov/precision-medicine-initiative-cohort-program.
10. Full transcript of the State Council policy briefing on June 17 [Internet]. Beijing: The State Council of the People's Republic of China; c2016 [cited at 2016 Jul 20]. Available from: http://english.gov.cn/news/policy_briefings/2016/06/17/content_281475374009852.htm.
11. IBM Software. Descriptive, predictive, prescriptive: transforming asset and facilities management with analytics [Internet]. Armonk (NY): IBM; 2013 [cited at 2016 Jul 22]. Available from: http://www-01.ibm.com/

 http://dx.doi.org/10.4258/hir.2016.22.3.153

common/ssi/cgi-bin/ssialias?htmlfid=TIW14162USEN.
12. Denny JC, Bastarache L, Ritchie MD, Carroll RJ, Zink R, Mosley JD, et al. Systematic comparison of phenome-wide association study of electronic medical record data and genome-wide association study data. Nat Biotechnol 2013;31(12):1102-10.
13. Haas M, Stephenson D, Romero K, Gordon M, Zach N, Geerts H; Brain Health Modeling Initiative. Big data to smart data in AD: real-world examples of advanced modeling and simulation. Alzheimers Dement 2016 Jun 18 [Epub]. http://dx.doi.org/10.1016/j.jalz.2016.05.005.
14. Cichosz SL, Johansen MD, Hejlesen O. toward big data analytics: review of predictive models in management of diabetes and its complications. J Diabetes Sci Technol 2015;10(1):27-34.
15. Jee K, Kim GH. Potentiality of big data in the medical sector: focus on how to reshape the healthcare system. Healthc Inform Res 2013;19(2):79-85.
16. Kim JH. Health avatar: an informatics platform for personal and private big data. Healthc Inform Res 2014;20(1):1-2.
17. Ryu S, Song TM. Big data analysis in healthcare. Healthc Inform Res 2014;20(4):247-8.
18. Song TM, Ryu S. Big data analysis framework for healthcare and social sectors in Korea. Healthc Inform Res 2015;21(1):3-9.
19. Dimitrov D. Medical internet of things and big data in healthcare. Healthc Inform Res 2016;22(3):156-63.
20. Sukumar SR, Natarajan R, Ferrell RK. Quality of big data in health care. Int J Health Care Qual Assur 2015;28(6):621-34.
21. Mittelstadt BD, Floridi L. The ethics of big data: current and foreseeable issues in biomedical contexts. Sci Eng Ethics 2016;22(2):303-41.