

Upcoming Technology with Transformative Potential for Life Sciences

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ABSTRACT

Digitization of data elements is allowing health professionals to utilize technology to assist in the management of activities. Most solutions today have the means to raise the standards of efficiency within the organization. This is done when workflow best practices and automation configurations are implemented in line with the deployment. The result of these is to transform the healthcare organization.

INTRODUCTION

This paper will delve into the new tools available to healthcare professionals to overcome the increasing demands that they face on resources and budgets in the management of routine activities. It will also reveal the percentages of efficiency gained by example implementations of automation, use of intelligent architecture and data mining tools such as bots, natural language processing (NLP), text mining semantics, and how they all can potentially be leveraged to elevate the organization from operating at an industry best level to a transformational one.

NEED FOR TRANSFORMATION

Many previously labor intensive functions in life sciences are now becoming commoditized with the aid of technology. Digitization of data elements is allowing health professionals to utilize technology to assist in the management of activities. Deploying a database is the first step to raise the level of efficiency that a healthcare organization experiences from baseline. Most solutions today have the means to raise the standards of efficiency within the organization. This is done when workflow-best-practices-and-automation-configurations are implemented in line with the deployment. The result of these implementations is the transformation of the organization beyond the realm of industry best practices. There are new tools available to healthcare professionals to overcome the increasing demands that resources and budgets place on them in the management of routine activities, such as automation implementations, use of intelligent bots, and data mining tools. These are just few of the more commonly deployed activities from the list of known technology. All can immediately be leveraged to elevate the organization from operating at an industry best level to a transformational one.

AUTOMATION DEFINED

Automation is this year's buzzword, but in-depth understanding of the components that make up automated processes is not known well. Automation is simply applying rule-based algorithms to tasks. If a task is repetitive and non-changing, then it is a good candidate for automation. Automation is an excellent modality for data mining activities. Big data presents the challenge of pertinent elements discovery. Recently, big data mining has been able to advance using automation. However, previously it has been a laborious task to search through the records using various algorithms at each pass through. Automation is sometimes used interchangeably with artificial intelligence (AI), and this is not accurate. As mentioned, automation is rule-based; whereas artificial intelligence is machine learning. AI enables the computer, database, or machine to process and deploy algorithms as it sees fit. The machine is "fed" data and "learns" from it. It then applies this learning to other similar tasks. If it experiences an outlier, a piece of anomalous data, it deploys a best fit for that, therefore an "intelligence". According to Forrester Research, investment in Artificial Intelligence (AI) is expected to triple this year. Tech giants such as Google, Microsoft and Amazon are already tapping the potential of machine learning with inventions like Home, Cortana and Alexa.

In order for AI to operate well, it needs to mine data at an exponential rate. Large data sets in the trillions of bytes have to pass through the AI machine for it to grasp and formulate its rules and algorithms. For healthcare and life sciences domains, the need for real-time data mining is crucial. It is not advantageous in these domains to shift through data elements as a backlog activity. Actionable insight is always on elements being generated in the present. However, this kind of activity has been constrained by technology and labor requirements. But, if technology could be upgraded along with the near elimination of labor resources, the health sciences would have an automated data mining system. Such a system is in its early stages at the FDA.

TECHNOLOGY USE AT GOVERNMENTAL AGENCIES

The FDA Data Mining Council (DMC) was formed in 2007. A collaborative group, the DMC explores methods and best practices recommended by experts from other federal agencies, industry, and academia, all of whom have analogous experience in knowledge discovery through various data mining approaches. The Council serves as a

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forum for FDA scientists to share their experiences and challenges in analyzing data contained in the vast databases that the FDA maintains, as well as a setting to discuss new methods for such analyses. The FDA currently receives approximately two million adverse events, use error, and product complaint reports each year from consumers, health care professionals, manufacturers, and others. Since the early 1990s, the FDA has advocated data mining to the industry in an effort to gain a better understanding of the signals within the safety data. Now, FDA data mining experts have expanded their attention to add more sophisticated data mining methods and apply data mining to other types of product safety-related FDA and non-FDA databases.

The Proportional Reporting Ratio (PRR) is the foundational concept for many disproportionality methods. However, because this method does not adjust for small, observed or expected numbers of product-event interest pair reports, other, more advanced statistical methods are employed. These methods include the Multi-Item Gamma Poisson Shrinker (MGPS), which produces Empirical Bayesian Geometric Mean (EBGM) scores. Several FDA Centers including CDER, CBER, and CFSAN, use the MGPS algorithm for their routine surveillance activities. Various commercially available software programs generate PRR and/or EBGM scores. CDER has applied Empirica Study™ to analyze drug clinical trial data in either New Drug Applications or supplemental applications. Empirica Study™ interfaces with data that conforms to the standardized Study Data Tabulation Model (SDTM) of the Clinical Data Interchange Standards Consortium (CDISC) data standards to create a wide set of automatically generated analytical outputs and tailor-made, reusable tables and graphs. These outputs have helped reviewers to provide more efficient analyses of potential safety issues in clinical trial data of drugs approved by the FDA. The FDA notes the benefits of data mining in the areas of standard processes (because data mining is automated, the outputs are statistically objective and devoid of manual analyses), simultaneous analysis (across an entire database at once), efficiency (analyses computed in minutes), and automated signal investigations (transparency with audit trails, drill-down capability, observation of signals over time, and study of a product in populations). These tools are in the early stages of the automation efforts at the FDA.

TECHNOLOGY FOR LIFE SCIENCES

However, the FDA operates in a regulated environment. Several pharmaceutical companies are now experimenting with automation and artificial intelligence tools, such as bots, which are outside the purview of current regulations. Chatbots, or bots as they are known, are assisting with routine tasks, such as getting weather updates, flight messages, and booking hotels. In addition, they are now, answering simple health inquiries from physicians.

Merck-Sharpe-Dome (MSD) Italy has launched the MSD Salute Bot in 2016. The first focus has been the Immuno-Oncology. Soon to come, there will be many more areas. The Bot is running on Facebook Messenger. From the MSD perspective, physicians are digital consumers looking for relevant information for their professional activity. Some key factors, like the increase of media availability, mobile devices penetration, and the decrease of time available, are resulting in a reduction of time spent navigating/searching on the web. Only available to registered physicians at this time, the Bot has interacted with hundreds during the 2016 winter holidays. Bots are the first layer of accessible and deployable AI that encompasses natural language processing (NLP) on the general lexicon. Anyone can deploy a Bot via online free tools and building kits. As of now, Bots, though available for the outreach activity, do not decipher complicated medical lexicons well.

HUMANS STILL NEEDED

Currently, the Bot, no matter how strong the AI or NLP element, cannot replace the human interaction for in-depth conversations on health, disease diagnosis, or exploratory conversations with a health professional. Its aim is different. That is, to relieve the health professional from answering the routine questions. Bots are best employed when used for social media outreach activities. They fare extremely well in instances requiring a customer service orientation. Yet, technology is advancing and these tools will as well. New processing power in chip technology, coupled with advances in algorithmic analysis will yield better tools for the healthcare and life sciences industries.

CONCLUSION

AI, NLP, Bots, Automation, Machine Learning, and Data Mining are not new. They have been used in other industries such as manufacturing, customer service, and finance. Now progress in these other industries and the elimination of the requirement for extensive resources has caught on with the health sciences. As new adopters of these technological advances share their experiences, the entire health and life sciences can benefit with access to a new set of transformative tools.

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