Artificial Intelligence's Role in Business Management Consulting.

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ITI1120 - Fall
11/19/2018

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Executive Summary

Business analytics has been around since approximately the 19th century when Frederick Winslow Taylor put these practices into place. The practice started really gaining traction around 1960s by the Ford Motor Company's president Henry Ford. Since the mid 1900s the practice has changed more from a single company monitoring itself to large global enterprises opening up to consult on thousands of companies. It is a multi billion dollar market that has made some of the largest companies in the world such as Deloitte and PwC. These companies work with thousands of clients all producing audits, consultant reports, and evaluations to their clients. Traditionally this has been achieved by having a contractor on site and in the client's books to determine the best places to change to a company's structure and habits.

Understanding how to implement modern techniques into old practices is the keystone of innovation. By being able to bring technology into business management consulting, innovation would be able to flourish and new breakthroughs would occur in efficiency and effectiveness. The most likely technology to bring into the industry of business management would be Artificial Intelligence. By automating the contractors job time could be spent in better places in the industry and lead to more accurate and promising results. Artificial intelligence has been developed and used in almost every major industry and is now bridging the gaps between being a helpful tool and being a required asset.

This paper attempts to take into consideration the problem of a consulting firm's growing clientbase and the technological challenges that these clients face. Provided are two solutions to this problem, one traditional and one technological. We will weigh the strengths and weaknesses of each method and determine the specific cases for which solution a client should pick.

Background

The term artificial intelligence was coined in the mid 1950's. Artificial Intelligence is generally defined as the use of computers to emulate a human brain in decision making and thought processing. Today it is more specifically defined as the "subfield of computer science concerned with the concepts and methods of symbolic inference by computer." The use of Artificial intelligence spans thousands of applications and has potential to be relevant in almost every major industry due to the high malleability of the concept of AI. Modern AI is more accessible than ever with most major tech companies having some form of framework or software that allows common users to interface to so that user can apply AI to modern problems.

The central goal of modelling artificial intelligence is to learn the joint probability of sequences of words in a language (Yoshua Bengio, Holger Schwenk, 2006). Technology is constantly evolving and improving, which can be shown through Moore's Law; An observation made in 1965 by Gordon Moore, co-founder of Intel, which states “Complexity of integrated circuits has approximately doubled every year since their introduction” (Moore, G. E, 1975). The modern implication of this law means every year, computers will double in speed and power; by extension the smartest Artificial Intelligence that is theoretically possible will double in mental capacity every year. For the sake of this argument we will assume that Moore’s law does not have a limit for how many transistors can fit on an integrated circuit since there has been no proof to state that this is the case.

The understanding of business analytics is a process that is well understood by humans; this provides an advantage when attempting to write an AI to perform this task. A perfect AI could perform tasks such as analyzing a business and providing feedback; however in order to confirm this we would have to have a program that can be called

“perfect”; and in order to do that we must define what this program would have to complete. A theoretical artificial intelligence for business analytics would have to take thousands of data points on a business as an input and output the most accurate and realistic recommendations for a business to take. This program would have to be able to perform the ability of selecting the most important data points and identifying how to maximize these, this is a problem that AI excels in; however understanding context of these data points would be the challenging part of an our AI program.

Business Management has seen advancements thanks to the field of Artificial Intelligence. Most notable of these would be the financial planning systems that incorporate AI into their calculations. Companies such as Wealthsimple, Robinhood, and Acorn all use AI to make financial calculations and predict market trends to maximise personal portfolios. The fixed amount of data points on the financial market allow this to be an easier problem than analyzing an entire business. To create an AI that can analyze a business we would need to find the correct data points to set as inputs to our AI and we would have to find a goal that we can quantify.

Planning is the process of creating activities and organizing activities to achieve a result. Planning requires that managers be aware of environmental conditions facing their organization and forecast future conditions. It also requires that managers be good decision makers. When a management firm is contacted for an analysis of a company part of their jobs is to examine the result of a companies planning process and to assess where risks and opportunities may exist. As consulting firms experience growth and an influx of demand, the ability to accurately measure and provide feedback on the planning process can be difficult. Since companies would plan and execute these plans differently across different industries, a firm would have to take the context of a plan into account when performing and analysis. This takes time when a human has to re-learn

contexts from case to case however an artificial intelligence system would have no problem applying its knowledge across multiple cases.

Organizing is the function of management that involves developing an organizational structure and allocating human resources to ensure the accomplishment of objectives. The structure of the organization is the framework within which effort is coordinated. The structure is usually represented by an organization chart, which provides a graphic representation of the chain of command within an organization. Decisions made about the structure of an organization are generally referred to as organizational design decisions. Due to the structured nature of companies, organizing can be one of the most important steps in an consulted analysis. When a consulting firm receives a contract to a large company, it can often take time to traverse a companies structure. This is where an AI system could provide valuable speed. Algorithms exist in computer science to manipulate and search hierarchies for inconsistencies and inefficiencies which would save valuable time in a consultation.

Leading involves the social and informal sources of influence that you use to inspire action taken by others. If managers are effective leaders, their subordinates will be enthusiastic about exerting effort to attain organizational objectives. Since leading often has emotional requirements this can provide to be an issue to an AI system. In lieu of this an AI system would have to analyze the statistical data of a set of leaders and pick traits that it believes work well and shortfalls of leaders that perform ineffectively. In this aspect the pros and cons of humans instead of AI systems would have to be weighed.
Controlling involves ensuring that performance does not deviate from standards. Controlling consists of three steps, which include (1) establishing performance standards, (2) comparing actual performance against standards, and (3) taking corrective action when necessary. Performance standards are often stated in monetary terms such as revenue, costs, or profits but may also be stated in other terms, such as

units produced, number of defective products, or levels of quality or customer service. On an increase in contracts for a firm, the amount of data points that would have to be examined for establishing performance standards and comparing actual performance against standards would require a large amount of human resources to analyze. This could be deemed ineffective due to the inherent lack of a large amount of people to communicate effectively. When controlling a system, AI would have a great strength in being able to closely monitor performance of a companies finances and human resources in order to determine where statistical anomalies may lay. It is also assumed that an AI would be able to effectively relate any statistical anomalies to their sources and determine what course of action would best be taken to fix the problems.

Problem Definition

In the current era of technological innovation, companies are adopting more technologies and consulting firms are unable to keep up simply by using traditional analysis methods that have worked up until now. Consulting firms are required to analyze business decisions made and this has always required on site human interaction at all levels of management and employment. Financial analysis must also be conducted by performing an audit of the companies finances. These two results must then be examined and interpreted to provide recommendations to how a company can increase their profits and maximize their effectiveness. The amount of small to medium companies in Canada has grown 7.7% from 2015-2016 alone. The largest industry of growth in this period was the industry of scientific and technical services. Due to the amount of data created increasing every day and the amount of locations of that data in a company also increasing, firms are being required to look into too many locations to find solutions to problems. The amount of data per company is not the only issue that firms are facing, the amount of companies themselves requiring business consulting grow every year and as a result firms are unable to keep up with redefining their methods for every new contract they get. Current firms keep methods of analysis fairly secret due to the competitive nature of the industry however it can be assumed most companies use consultants that perform on site analysis of a company to generate reports and recommendations. This paper assumes that larger companies may be starting to use more computational methods of analysis such as AI softwares and data amalgamators however it also assumes that none have a full replacement of a human consultant. If nothing is changed large consulting firms will produce ineffective advice and inaccurate results which what this paper aims to prevent.

Alternatives to the Problem

Using an Artificial Intelligence system to replace human worker

By using a computer system that is built on an artificial intelligence framework and that integrates with a neural network, the growth of a firm's client base can be easily managed by automating the examination and audit process. By using artificial intelligence software, data points of a company can be easily manipulated and quickly calculated. The planning, organizing, and controlling aspects of management would all see great increases in efficiency while an artificial intelligence system would also provide valuable insight to a company's leadership, highlighting strengths within a company and opportunities for further growth. Due to the repeated learning that artificial intelligence excels in and the fact that firms work on a case by case basis, which often requires people to take valuable time to learn the intricacies of a case each time a new one is presented.

Just like any change in a process, using an artificial intelligence system to replace human workers has benefits and challenges that can be associated with it. The benefits mostly revolve around the efficiency and accuracy of replacing human workers with pieces of software. The computational speed of a computer greatly outweighs that of the human brain and as such results would be delivered much quicker when using an artificial intelligence system as opposed to a human. Computers are also more consistent in results, making fewer calculation errors when comparing large amounts of numbers and data sets. These two benefits tie together by the fact that a human would be a much more costly solution in the long run as an artificial intelligence system would only require development and a small amount of maintenance instead of an ongoing salary. However, this is not to say that the challenges and risks of using a computer system do not exist. An artificial intelligence would take a large amount of time to develop and perfect, costing a large up front cost which may not start paying off for a large amount of time. An artificial intelligence system would also require constant

maintenance in case of bugs or errors. Since an artificial intelligence system is not automatically able to make decisions it would have to be ‘trained.’ This would require more start up time and depending on the method of training, may require human supervision and a highly specialized team.

Examining both the benefits and challenges associated with replacing a human with an artificial intelligence system it can be observed that using an artificial intelligence system would be a good move for a larger firm that can provide the funding to create such a program and take losses for the first span of the software’s lifetime. It can also be observed that only a firm that receives a large amount of high data clients would immediately benefit off of using a system such as the one presented here. Using an AI system would also provide a higher quality of work in the long run and this would attract customers from more technical industries which is the largest growing industry in Canada today. A risk associated with using such a system is that due to the limited use in modern day business analytics it is hard to estimate how such a system would work or for how long it would provide loss of revenue before being profitable. Due to the requirement of training, assuming the system uses supervised training, an artificial intelligence system would require a large amount of work to form an initial model to use in analysis. This model would also be highly unpredictable and prone to inconsistencies and errors. While this would get better over time it may prove to be an issue for the first several sets of data.

Scaling ‘horizontally’ and hiring more workers

Instead of using an artificial intelligence system, using humans to perform consultations and analyze a company's performance provides a safe and trusted method as well as a more predictable cost model. Due to the ability of humans to interpret and show emotion, humans would be effective in all four sections of management (Planning, Organizing, Leading, and Controlling) and would have a high chance of communicating the results of a consultation more effectively. However since this paper aims to compare humans to an AI system we would need to look at the approximate trade off for human work hours to AI work hours.

Much like replacing human workers with AI, scaling by hiring only human workers has pros and cons which much be considered when selecting the best solution to the problem at hand. While the benefits of using an AI system all related to efficiency and accuracy, the benefits of human a system are all relative to the size of the firm that would utilize our solution. The initial cost of hiring new workers is significant less than that of creating an artificial intelligence system due to the lack of technical ability associated with the task of hiring. The act of hiring human workers is also very reliable, since ‘human workers’ are not a new and emerging technology it can be said with a high degree of accuracy how well this solution would work. However due to the requirement of paying workers on a regular basis, this solution will prove to be more expensive in the long run as opposed to a piece of software which does not require a large salary. Humans are also very prone to errors in their work which a piece of software, in our case an artificial intelligence system after proper training, would not make.

Examining the pros and cons of hiring human workers shows that while large companies may not benefit from this solution to our initial problem, smaller firms that do not take on as many clients would benefit by this system more than they would using an

artificial intelligence system. Using human workers is easily predictable and has been used for decades which has allowed businesses to easily predict how the hiring of more workers will affect a company's productivity. In regards to errors however, it is not easy to predict where mistakes will be made when using human workers and instead must be checked over and reviewed which consumes more valuable time. However even with smaller firms being able to adapt this method today, it may not be as successful in the near future with the expansion of the use of technology in even small businesses. Since an artificial intelligence system would be a lot easier to interface with technology, it would provide valuable insight into a businesses relationship with technology.

Recommendations

This paper intends to make two different recommendations depending on the style of work being done by firm in question. If the firm intends to grow and accept more clients and those clients are ‘large’ in nature or have high technical needs such as an IT company or a company that has multiple virtual assets, it is recommended that the firm in question uses the artificial intelligence based approach. This is due to the reasons stated about speed and efficiency when faced with a large amount of clients. However if the firm is smaller, not currently taking on more clients, and those clients are of a less technical nature it is recommended that the firm in question simply hires more people to fill the gap in missing productivity.

For our paper we will focus on the first of these two recommendations, using an artificial intelligence system to replace human workers. This recommendation comes with more benefits to the average firm which is why we will be examining it as opposed to the second recommendation which is the more traditional method. Using an artificial intelligence system would be ‘future proof’ which means that the solution is unlikely to become obsolete. This would be due to the ‘learning’ stage of artificial intelligence where it becomes more efficient and accurate the more the artificial intelligence is used.

By adopting the recommended solution it is expected that competitors would attempt to follow suite. Until competitors are able to copy the solution, the initial firm to adopt it would have the strongest and fastest system. This would provide a valuable asset to any company and would show vast growth in the market until the system gets adopted by other firms. This secondary benefit to the recommendation would be a great way to drive innovation in the industry and would hopefully create more demand for artificial intelligence systems in business analytics which would drive the cost of a system down.

Due to the malleability of our system it could be adopted to other industries. Let's say our consulting firm works primarily with the Oil industry due to their workers being highly trained and specializing in the business habits of Oil. Due to the nature of ‘Model Retraining’ our artificial intelligence system would be able to transfer the learning it had in the oil sector and retrain the original model to adapt with any other industry. With this retraining, that exact same firm would be able to branch into other sectors of the market and would allow for extreme growth.

Implementation

To implement our system there are many frameworks already developed to help assist in the creation of our software. Essentially every major technology company has poured research into developing their own artificial intelligence systems such as Google, Intel, IBM, Amazon, and Microsoft. In the past few years these companies have been making moves in opening up their frameworks for public use, from Google's TensorFlow to Amazon's Caffe Engine. These frameworks would drastically cut the costs of development for our system and make it significantly more reliable.

In order to train our system we would need previous case studies from existing companies. The way 'Supervised learning' works is by feeding in data and stating how the output should look (i.e. the findings of the input case study) and allowing the internal values of the artificial intelligence to adjust. From thereon in we could set heuristics to maximize a the value of our goal. We would have to pick our goal very carefully but it would most likely be a combination of growth, profit, and public image. After we have properly built a model and heuristic the artificial intelligence can switch to unsupervised learning. Which is simply set as running our existing model and trying to optimize for the values we have selected. Since unsupervised learning does not require pre-existing inputs and outputs it is a lot more inexpensive and easier to operate with. Unsupervised learning is also where majority of innovation happens.

Development of such a large scale system would take time. Development happens in 5 stages: requirements, design, implementation, testing, and maintenance. Requirements would take anywhere between 1 to 2 weeks for our sized scale of software. Design will also take between 1 to 2 weeks. Implementation is the core of the software development and due to the scale of our software we can assume it will take a team of developers anywhere between 3 to 4 weeks. Testing takes simply 1 week each and is technically the simplest part of the development lifecycle. Maintenance is always

ongoing and takes a significantly smaller team as opposed to the previous 4 parts of the development cycle.

An artificial intelligence system would be significantly less expensive for long term use as the only costs associated with it would be the server space and the team that would maintain it. Estimating that our system could run on a server with 4 vCPUs and 16GB of ram, it would cost only 1,457.664 US$ a year to run our system per client. The approximate salary of contractor is approximately 100,000 US$ which means we can run just over 50,000 systems and replace one contractor. With the money saved we could hire a team of developers to maintain the code.

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