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Will Computers Ever Overcome the Need for Actuaries?

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Through their Grammy award winning album of the year, *The Suburbs*, Arcade Fire expressed their interest in technology in the song *Deep Blue*: "You could have never predicted that it could see through you Kasparov, Deep Blue, 1996"[1]. In 1996, Gary Kasparov, the number one chess player in the world at the time, beat Deep Blue, a computer programmed by an IBM special team, at a game of chess. A year later, an improved version of Deep Blue won over Kasparov. This event triggered many discussions on where artificial intelligence stands, and begged the ultimate question: will computers ever be superior to human beings? Many machines have replaced jobs in the last century, both white and blue collar. How will this evolve in the future and where do actuaries fit in all of this, are questions this article will explore. I was asked in a casual conversation if computers would ever replace actuaries. My first reaction was: never! I started thinking a little more about it, and let's see if a closer look at the topic will change my mind…

Chess is an interesting "man machine" combat, given the need for strategy and visualization. The human against the computer chess battle was somewhat of a close match (1996: 4-2 Kasparov and 1997: 3.5-2.5 Deep Blue). Many similar chess competitions took place from that day to today, but this one was particularly interesting, because it was the first time a computer beat the best chess player in the world in an official match under standard rules. Deep Blue was able to process 200,000,000 positions per second. In contrast, experts estimated that Gary Kasparov was able to analyze three positions per second. It naturally follows that the computer can analyze 12,000,000,000 positions in a minute. Can we do the same simple linear interpolation for a person? I have my doubts about it: given the presence of emotions and feelings, the human brain doesn't work as steadily as a computer. The number of possible chess games is astronomical. Even sophisticated computers can't go through all possible combinations of positions through brute force (at least not yet…). A computer can calculate and analyze many positions quickly, but it looks like humans (well, at least Gary Kasparov) was able to find the right moves and positions without having to go through all possible scenarios. With experience, knowledge and good judgment, Kasparov was able to narrow down good future moves to a smaller subset and analyze those moves without going through all the possible combination of positions. It is hard to determine which set of "skills" is better. The battle was ferocious and even a bit , but most importantly, what can we really conclude from that?

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Let's try a different angle. What do a high school student, a rocket scientist and a painter have in common? They all use a traditional calculator to do their homework, analyses and taxes respectively. It's a tool virtually everyone uses to a certain degree. Between the traditional calculator and the human brain, which device would you place a bet on computing the following expression the fastest within 10 decimal places: 1,984 x 4 / [ln(12)]^0.5? My money would be on the calculator (at least if my brain was competing…) Does that mean that the machine is superior to man? In terms of performing this calculation, yes, I would say that the calculator is better. But human beings created the calculator. So which one is "smarter"? Does asking this question even make sense?

Again, let's have a look at another context: the invention of the car. When the automobile was invented, were people scared of the new invention, thinking: "Will the machine get better than mankind"? Obviously I was not around to posit this, but some people could have had the following reaction: the machine is getting stronger and faster than human beings, this is scary! Like chess, a contest could have been organized (and may have happened): the machine against the 100 meter world champion. In our era, I don't feel that people have an inferiority complex

toward cars or trucks which can go faster from one point to another and carry heavier loads of cargo than them.

In the construction and manufacturing world, machinery has evolved in the last few decades. The eternal question "Will robots ever replace the need for human labor?" has always aroused opinions. But if we look around, does every single individual have an adequate place to live? Is every single house of every neighborhood of every suburb and cities with children in perfectly renovated? Most would agree that the world would be a better place if every abandoned piece of land or building could be replaced by green grass or a place where kids could play baseball (or ice rinks for Canadian kids so they could play hockey…) But yet, the answer to the robot question is no. So there is still a very present need for human labor! With the improvement of technology, construction projects require less human intervention making the end product more accessible economically to more individuals and families, freeing up human resources, now needed given more households have access to it.

In the same way, as computing technology improves, actuaries find themselves manually computing less and analyzing more. It is clear that technology has changed the role of actuaries over the decades, just like it has for virtually every other profession in one way or another. Actuaries have been affected, particularly given the many calculations required to perform most studies. As technology improves, the human computation part of the job decreases to leave room for more sophisticated evaluations in a wider range of contexts. A few decades ago, actuaries needed to spend time calculating by hand or calculator what modern actuaries can get instantly. No matter where computing power leads us, insurance and retirement income is used by people. The hard part of the analysis performed by actuaries is naturally not the actual computing of the calculation, but more the understanding and explaining of the calculation, results, magnitude and direction. Once that's understood, one needs to make a judgment on how that fits into the surrounding social, demographic, economic and regulatory environment and understand choices available and consequences. The work performed ultimately affects other human beings such as the actuary himself, which leads me to believe that actuaries will always be needed.

Understanding the calculation is the important thing. For example, if one punches 3 + 4 on a calculator, the result 7 does not tell much if the user does not understand the concept that if he has 3 apples in a bag and 4 apples in another bag, and then combines the content of each bag into a single bag, he will end up with a total of seven apples. The same is true for actuaries: if a software program calculates a certain reserve under certain assumptions, no one can actually make good use of the figure if he doesn't understand the concept, purpose and manner in which it was calculated.

Virtually all actuaries perform modeling in one way or another in their work. Box once said: "All models are wrong, but some are useful"[(2)]. Models do not provide an exact prediction of the future. They provide a good sense of direction and magnitude, but a good modeler understands the limitations of the models he created. Further, black box analyses are usually useless, because they can't explain anything, so it's pointless to provide a review on something if a discussion on results is not possible. Opinions, discussions and visions are what actuaries really bring to the table. The interaction between the input and the output is the fundamental basis that will forge a meaningful opinion. Model sprawling can give a false sense of security. A good modeler needs to achieve the right balance between details and simplicity, which again requires judgment. So the machine itself is not the essence of the work; it's only a tool.

Pension and insurance liabilities are estimated based on future human actions, behaviors, the economic environment, randomness and countless other factors. Those liabilities have to be backed by assets that need to be invest-

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ed in a way that meets those liabilities. Those investments will always be estimates and depend on a number of factors. Complex situations will always require judgment which is something computers can't do.

The liabilities that insurance companies assume on behalf of their policyholders are complex and usually unknown. Equally complex are retiree pension liabilities that employers assume through a pension plan. These benefits (and corresponding liabilities) inure individuals who don't necessarily have the background to analyze whether or not the liabilities established are sufficient to keep the promises made to them. This is why regulators exist. Regulators consist of individuals with appropriate knowledge and expertise who act in the interest of insurance policyholders and employees. Here again, computers just can't come up with laws, limits and regulation in a dynamic and always changing world. They need to understand human behaviors on top of the knowledge and expertise of the domain.

Buying insurance policies and getting retirement benefits fulfill normal human needs. As long as individuals and families seek those needs, judgment will always be needed in order to make an opinion. But until everyone has optimal insurance coverage and a reasonable retirement plan, society will need actuaries to use their in-depth knowledge and skills to adapt to the current situation. Humans will always rely on other humans to build, understand and adapt their habitat, whether it is to build a house or insure it.

Hopefully, it is clear that both my first and second impressions led me to the same conclusion. As long as machines do not get a place to live, go to church, date, vote, buy goods, stocks and bonds, people will never be surpassed by machines and computers. Even IBM recognizes that their computer is not close to replacing any human any time soon: "Deep Blue is stunningly effective at solving chess problems, but it is less "intelligent" than even the stupidest human."[3].

Further, I think humankind should be proud of the positive machines they have built and developed to make the world a better place. If machines can perform tasks that humans used to perform, machines allow workers who formerly used to perform those tasks to be useful in society in a different way and allow more people to benefit from it in the long run. Knowledge, expertise, studies, experience and hard work by humans can never become obsolete and can only improve our environment assuming that the intentions are in the right place. Going back to the Deep Blue example, experts agreed that a reasonably good chess player who had access to the computer would beat any grand master easily. The combination of machines and human actions is what allows us to build and accomplish more in every context of life. Chess computer programs of today easily beat any chess grand master. Serious chess players usually view this as a positive thing as they now have an extra tool to practice, develop and shape their game. In fact, many experts believe that computers elevated the general caliber of the game of chess, since computer programs are readily available.

In parallel, computers allow actuaries to do more, otherwise they wouldn't be used in the workplace. Society will always need protection and face contingencies (through insurance, retirement income, investment, risk management and whatever the future brings). These protections can become quite complex. The actuaries' challenges will be to adapt to the current environment and gauge how to use their skills the best possible way, and I believe that computers will be a tool, not a threat. Humans will always need other humans to understand them, and the need for technical skills and mathematical reasoning combined with a good comprehensive view of the environment can always be put to good use.

Last time I checked, no political party wanted to grant Social Security numbers to computers, so we should be good for a while… ☆

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