Planet of the Machines

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Over two years after The Great Recession officially ended in June 2009, the unemployment rate in the United States was at 9.1%, only one percent lower than its peak value. The unemployment statistics are surprising considering that other measures of economic growth indicated the economy was recovering. GDP growth, the total of all goods and services produced in the United States, averaged 2.6%, a rate higher than the 1970's, 1980's, and 1990's. By 2010, investment in equipment and software rebounded to 95% of its historical peak. According to The New York Times, the companies in the Standard & Poor's 500-stock index are expected to report record profits this year, and corporate profit as a share of the economy is at a 50-year high (Lohr, 2011). With businesses growing, earning profits, and buying equipment, this observation begs the question of why American companies did not begin rehiring workers laid off during the recession as we had anticipated.

According to Jeremy Rifkin in his book, The End of Work, "we are entering a new phase in world history—one in which fewer and fewer workers will be needed to produce the goods and services for the global population" (1995, p. 16). The rapid advancement of computers and machines to do increasingly complex jobs makes his claim palpable. Today, digital technologies are the key drivers of productivity and growth; they are reinventing the world of business and have become one of the most influential forces in the economy. Since June 2009, corporate spending on equipment and software has increased by 26 percent, indicating that corporations have taken advantage of technological advances. However, payrolls have remained flat for many (Lohr, 2011). In addition, many sectors of society are being influenced by technological displacement because it makes the labor of millions of people irrelevant. While some skills have become more valuable than ever in our society, many more have become easily replaced. Reflected in today's unemployment statistics, people have little to offer employers that a computer cannot do. Digitization has the unique ability to provide ever-expanding possibilities to companies with increasingly rapid advancements. While cyclicality (natural economic fluctuations), out-sourcing, off-shoring, and taxes and regulation are certainly important facets of the economy, in this article I will explore the amazing technology that is displacing human labor (Brynjolfsson & McAfee, 2011).

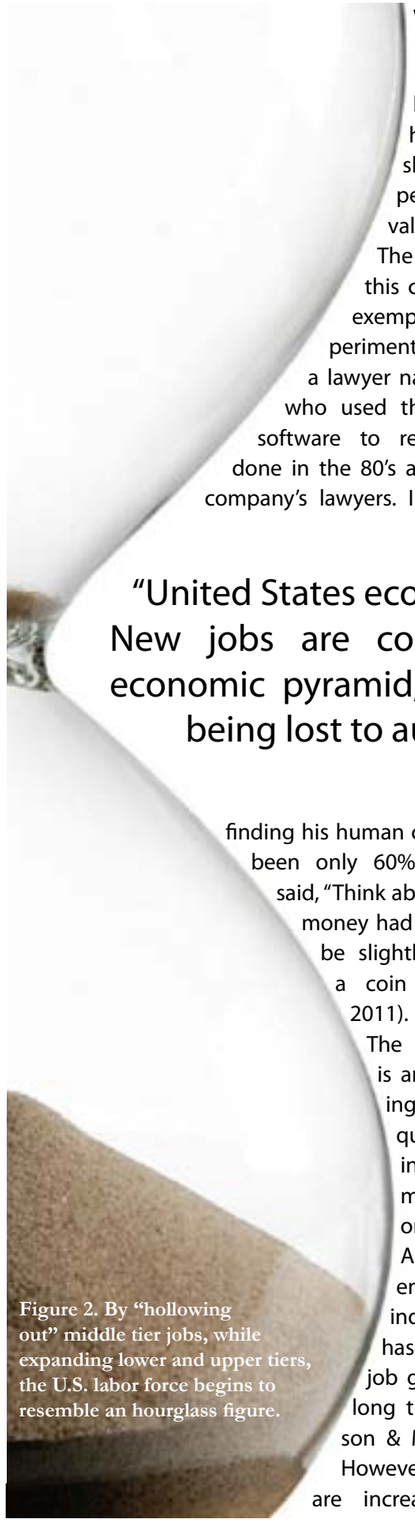
Even in fields such as language and writing that are not commonly associated with technological innovation in the same way that mathematics and the sciences are, profound technological advancements have made their appearance felt. The two most incredible examples of this are Geofluent and Livescience, computer software that use algorithms specializing in complex communication to automate the previously exclusive human capability of writing. A translation services company called Lionbridge started using GeoFluent in 2011 to replace their human language translators. GeoFluent's capabilities are powered by SMT (statistical machine translation) software developed at IBM that uses statistical models derived from Lionbridge's massive amounts of digital transcripts to generate natural sounding translations. This gives GeoFluent the ability to take online messages and instantly translate them to an unmatched variety of other languages in speech that seems authentically human. In large-high tech companies that are likely to have customers and parties in different countries, this software is replacing the need for human translators and customer service representatives (Brynjolfsson & McAfee, 2011).

Several companies have also developed journalism software that can write articles on sports, finance, and real estate, fields whose news stories tend to follow distinct patterns and revolve around statistics. When the numbers are input into the program, the clever software can produce highly readable stories within seconds. The most successful of these companies is Narrative Science, which is employed by Forbes to automatically generate online articles about corporate earnings statements. The

pieces sound genuinely human, but in lieu of an author it states, "Narrative Science, through its proprietary artificial intelligence platform, transforms data into stories and insights"(blogs.forbes.com/narrativescience). This software is now being used in political reporting, as well. Narrative Science announced a new service that generates articles about how the U.S. electoral race is reflected in social media, what issues and candidates are most and least discussed in a particular state or region, and other topics. It can even incorporate quotes from the most popular and interesting social networking posts into the final article. Narrative Science's software doesn't just list statistics, but attempts to understand what those numbers mean by analyzing countless sources of information and communicating their significance to the reader. The benefits of employing Narrative Science over a person are undeniable. For one, they are much cheaper; Narrative Science charges less than $10 per 500 word article, whereas human journalists cost about a dollar a word, sometimes much more. Narrative Science also claims to be more comprehensive and objective than any human reporter. A human journalist does not have the time to find, process, and analyze millions of tweets, but Narrative Science's computer software can compress this amount of work into a fraction of the time. In addition, it can produce articles instantaneously, an inhuman capability which is invaluable in a field as deadline oriented as news reporting (Morozov, 2012).

The rapidly advancing pattern recognition abilities computers possess are already being exploited by the legal industry, where digital labor may one day allow one lawyer do the work of 500. At the early stage of a lawsuit, called the discovery process, junior lawyers and paralegals work through huge volumes of documents. Millions of Americans have made this their career, but the cheaper and faster option of using newly developed e-discovery software to do this work could completely automate the popular job (Brynjolfsson & McAfee, 2011). These programs not only have the ability of finding documents with searchable terms at inhuman pace; as The New York Times correspondent John Markoff said, "Some programs go beyond just finding documents with relevant terms at computer speeds. They can extract relevant concepts—like documents relevant to social protest in the Middle East—even in the absence of specific terms, and deduce patterns of behavior that would have eluded lawyers examining millions of documents"(Markoff, 2011). E-discovery software can go far beyond our natural capabilities, making humans the slower, more expensive, and less valuable option. The severity of this conclusion was exemplified in an experiment conducted by a lawyer named Bill Herr, who used the e-discovery software to reanalyze work done in the 80's and 90's by his company's lawyers. In response to finding his human colleagues had been only 60% accurate, he said, "Think about how much money had been spent to be slightly better than a coin toss"(Markoff, 2011).

Figure 1. A shopper uses a self-checkout machine at a grocery store.



"United States economy is being "hollowed out": New jobs are coming at the bottom of the economic pyramid, while jobs in the middle are being lost to automation and outsourcing.."

Figure 2. By "hollowing out" middle tier jobs, while expanding lower and upper tiers, the U.S. labor force begins to resemble an hourglass figure.

The retail industry is another surprising field that is quickly becoming more automated. Nearly one in ten Americans are employed in this industry, which has been a reliable job generator for a long time (Brynjolfsson & McAfee, 2011). However, companies are increasingly trying to sell more products with fewer employees. Self-service machines and kiosks are eliminating the need for checkout clerks, virtual assistants like GeoFluent are taking the jobs of customer service representatives, and there are vending machines that provide everything, performing jobs that range from dispensing prescription drugs to selling iPods. While closing a sale usually requires complex human interaction skills, Americans have become so comfortable with online shopping that we are no longer fazed by the idea of buying a product without a salesman or clerk, utilizing technological equivalents like Amazon online reviews instead.

A terrifying aspect of this issue is that the skills of machines are predicted to only improve with time. In a book written in 2004 by two leading economists, Frank Levy and Richard J. Murnane, titled The New Division of Labor, the authors analyze the capabilities of computers and human workers. Truck driving was cited as a career that would not be threatened by the rise of automation, because computers were considered to be incapable of recognizing and reacting to objects in real time (Levy & Murnane, 2004). However, in October 2010, only six years later, Google announced they had transfigured a group of Toyota Priuses into fully autonomous cars which had already logged over 140,000 thousands miles on American roads with only minor input from human back-seat drivers. The only car accident that occurred was when a human driver rear-ended one of the cars at a traffic light (Brynjolfsson & McAfee, 2011).

Levy and Murnane were logical in thinking automatic driving on populated roads would be impossible to automate. However, in under a decade Google technologists entered the realm of science fiction by building a computer that can substitute for human perception and pattern matching on the open road. They used the unfathomable amount of data they had collected for Google Maps and Google Street View to program the cars' computers with a boundless amount of information and a complete memory about the roads they would travel. The amazing vehicles were also constantly collecting real-time data using video, radar, and LIDAR (light detection and ranging) equipment

that was attached to the car. This high-tech gear fed data into software that understands the rules of the road, as well as the changes in driving conditions and the presence, trajectory, and identity of all objects in the vicinity (Brynjolfsson & McAfee, 2011). This software is what controls the car, providing better attentiveness, carefulness, and a faster reaction time than any human driver ever could.

What type of future do we have in store in this kind of technologically controlled world? To understand this, we can look at the past. At the turn of the 20th century, about 38% of all American workers were working on farms. Today, the figure is 2%. Machines took over most of the farm work, but new industries and new jobs that required less working hours and better working conditions were created. So far, technology has improved our quality of life, giving us better health care and rising incomes over the past 100 years. However, in the past 10 years, we have experienced, for the first time, stagnation in the rise of income for middle-classes, partly because of technology being increasingly capable of replacing their jobs (Lohr, 2011).

Figure 3. One of eight self-driving cars, this Toyota Prius is one being tested by Google's autonomous car team.

ware is now able to perform higher-skill and better-paying jobs. For example, bank tellers, airline check-in agents, accountants, and actuaries of insurance companies are now irrelevant because machines are capable of doing the work cheaper, faster, and without the possibility of human error. Unfortunately, these parts of the service sector provide the most jobs in the economy. In contrast, computers are incapable of replacing very low-skill positions like cleaning bathrooms or other janitorial work, so they remain populated by people. In addition, high-skill and high-paid jobs like being a manager, a courtroom litigator, or a doctor or a nurse, are also still in demand, since technology has not advanced enough to perform key tasks in these positions. Because these high-skill, high-pay jobs and low-skill, low-pay positions are currently out of the range of replacement by technology, while the jobs in the middle are quickly being filled in by machines, Professor Autor, an economics professor at Massachutesses Institute of Technology, argues that the United States economy is being "hollowed out":

New jobs are coming at the bottom of the economic pyramid, while jobs in the middle are being lost to automation and outsourcing. […] There is no reason to think that technology creates unemployment. Over the long run we find things for people to do. The harder question is, does changing technology always lead to better jobs? The answer is no. (Markoff, 2011)

Computers, along with their hardware, software, and networks, are going to become increasingly more powerful as we venture into the future, exponentially impacting jobs, skills, and the economy. However, we should keep in mind that while computers outperform humans in some tasks, they are narrow-minded and very literal. Computers are only able to do assigned tasks, and are still unhelpful in situations requiring creativity, spontaneity, and intuition, traits so far believed to be exclusive to humans. In the coming years, the way our society adapts to the automation of jobs will determine if the rapidly advancing capabilities of technology will save or destroy us. There could be strategies implemented in the event that there are not enough high- or low-level jobs for the displaced middle-level workers, such as having short weekends and long vacations so there are more jobs to go around, or government subsidized job creation. Maybe the whole idea of a "job" will change over the next couple of decades and their automation will lead to a whole new lifestyle we have never imagined, where people have more free time to spend with loved ones and doing activities they enjoy. In Race against the Machine, authors Erik Brynjolfsson and Andrew McAfee insist a partnership between humans and machines are going to be the key to maintaining a stable economy as technology advances. "In medicine, law, finance, retailing, manufacturing and even scientific discovery," they write, "the key to winning the race is not to compete against machines but to compete with machines."

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