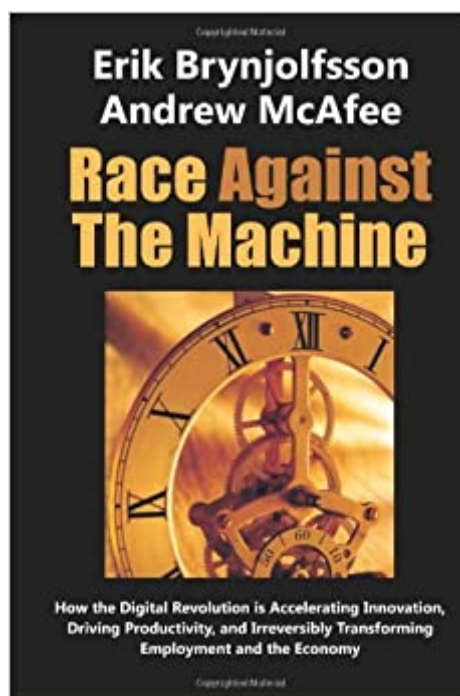




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# Race Against The Machine: How The Digital Revolution Is Accelerating Innovation, Driving Productivity, And Irreversibly Transforming Employment And The Economy



## Synopsis

Why has median income stopped rising in the US? Why is the share of population that is working falling so rapidly? Why are our economy and society becoming more unequal? A popular explanation right now is that the root cause underlying these symptoms is technological stagnation-- a slowdown in the kinds of ideas and inventions that bring progress and prosperity. In *Race Against the Machine*, MIT's Erik Brynjolfsson and Andrew McAfee present a very different explanation. Drawing on research by their team at the Center for Digital Business, they show that there's been no stagnation in technology -- in fact, the digital revolution is accelerating. Recent advances are the stuff of science fiction: computers now drive cars in traffic, translate between human languages effectively, and beat the best human Jeopardy! players. As these examples show, digital technologies are rapidly encroaching on skills that used to belong to humans alone. This phenomenon is both broad and deep, and has profound economic implications. Many of these implications are positive; digital innovation increases productivity, reduces prices (sometimes to zero), and grows the overall economic pie. But digital innovation has also changed how the economic pie is distributed, and here the news is not good for the median worker. As technology races ahead, it can leave many people behind. Workers whose skills have been mastered by computers have less to offer the job market, and see their wages and prospects shrink. Entrepreneurial business models, new organizational structures and different institutions are needed to ensure that the average worker is not left behind by cutting-edge machines. In *Race Against the Machine* Brynjolfsson and McAfee bring together a range of statistics, examples, and arguments to show that technological progress is accelerating, and that this trend has deep consequences for skills, wages, and jobs. The book makes the case that employment prospects are grim for many today not because there's been technology has stagnated, but instead because we humans and our organizations aren't keeping up.

## Book Information

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## Customer Reviews

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First self-published as an e-book in 2011, this is an excellent abstract of the authors' expanded full size nonfiction book, "The Second Machine Age", that the authors will publish three years later in 2014. Indeed, most of the foundation of "The Second Machine Age" is contained in this much shorter book. Within "The Second Machine Age" the authors will expand on a few concepts. They will bring in more historical context to their research by studying the Industrial Revolution that they describe as the first tipping point in human history (circa 1800). Indeed, any time series graph of worldwide economic growth, GDP per capita, population growth will typically show the exact same pattern. The curve will look nearly flat for a millennium and abruptly rise upward at an inflection point close to 1800. The authors indicate that this first inflection point in history was caused by the advent of James Watt steam engine introduced in 1775 at the onset of the Industrial Revolution. It led to innovative and technological improvements including mass production, railways, and mass transportation. Additionally, they will redefine the Present as the second tipping point. They will also refer to the first tipping point and its aftermath as the First Machine Age, and the second tipping point as the Second Machine Age. Additionally, within "The Second Machine Age" the authors will repackage their ideas so that all the benefits of technology will be encapsulated in a single word: "bounty." Meanwhile, all the associated concerns with technological unemployment and rising inequality will be captured in the word

spread. This will allow them to use effective shorthand description of their objectives. For instance, going forward how can we increase the bounty and reduce the spread? And, they will offer many recommendations on how to do so. Besides the mentioned expansion within "The Second Machine Age", "Race Against The Machine" very well captures the essence of their theory. The authors were among the first to recognize that the Great Recession recovery was different. Even though many economic metrics had recovered quickly including Real GDP, Real GDP per capita, corporate profits, business investments in equipment and software; other measures of economic health did not recover so well. All employment figures recovered a lot more slowly as job creation remained anemic for a long time. And, Real median household income remained flat. How can Real GDP per capita increase rapidly meanwhile Real median household income remained flat? The answer is simple. It is the difference between the Median and the Average. The Average is skewed upward by very large figures. Meanwhile, the Median is not. Thus, technological progress has contributed to a rapid rise in income for the technologically savvy, entrepreneurs in high-tech fields, stars able to resell their talent digitally worldwide. Thus, technology-benefitting elite has seen its income and wealth grow very rapidly. Their income/revenue growth contributes to GDP growth and it distorts upward average Real GDP per capita. Meanwhile, the majority that did not reap the benefits from technology has experienced stagnant income as some of their respective demand for their labor has been increasingly displaced by technology. The advent of computers, software, robots, artificial intelligence, and web based software platforms has affected just about every field (blue and white collar service industries included). And, this decoupling effect goes further back than the Great Recession. It can be observed since 1975 (near the onset of mass computerization). So, going back to the race between brains and technology, is there any hope for humans? The authors indicate the issue on an individual level is very interesting. They take the example of chess. IBM Deep Blue handily beat Kasparov in chess in 1997. Nowadays, even mid-tier software computer programs on cheap laptop computers can beat the best human chess player. So, what can human beings contribute to this most demanding cognitive challenge (playing chess)? Surprisingly, a whole lot! With the advent of freestyle chess, humans have regained a leading role in this discipline. Freestyle chess entails a tournament between completely different set of team players. A team can consist of a supercomputer (successor of IBM Deep Blue), or a supercomputer plus a human, or various combination of computers and human players cooperating on the same team. And, the outcome of such tournaments is counterintuitive. The winners are not the teams made up of grandmaster chess players and supercomputers. They are instead teams made of amateur chess

players and mathematicians with expertise at analyzing freestyle chess games and guiding several laptop computers with Machine Learning and other algorithms. In freestyle chess, the grandmasters are at a marked disadvantage. This is because they are overconfident in their expertise just like any expert typically is (as captured within Phillip Tetlock's work on the subject) and they typically do not trust the machines and have little ability in using them. Supercomputers on a stand-alone basis have little chance in such tournaments. They can't match the creativity of human-computer teams. In the near future of freestyle chess, we can anticipate that grandmaster chess players and stand-alone supercomputers will quit this league. Humans who understand machines and machines make for the winning combination. And, this may be the case regardless of the field. As with chess, it is anticipated that IBM Watson specializing in healthcare will be much more effective when combined with the judgment of doctors than without (or probably the judgment of specialists able to better interpret IBM Watson diagnostics rather than expert doctors who are overconfident in their expertise). However, what is true for an elite few freestyle chess quants may have little relevance for the masses. Today's information technologies do contribute to inequality and technological unemployment because: 1) They favor more skilled and educated workers over lesser skilled and educated ones; 2) They increase the return to capital owners over labor; 3) They increase the advantages of stars over everybody else. Nevertheless, the authors still describe themselves as technology-optimists. And, they come up with a series of 19 specific recommendations so that society at large better adapts and learns how to race with the machine instead of against the machine. Their recommendations are associated with improving K-12 education, improving national infrastructure, reducing regulations affecting start-ups, rationalizing immigration policy so we can attract smart emigrants to fill crucial vacant jobs in engineering and science, reform the patent system to stimulate innovation instead of stifling it, reform the tax code to eliminate market distorting subsidies (in housing in particular), increase Government funding in basic research, and many other sensible recommendations. Although the authors' recommendations make good sense, many of them are likely to run into a political wall of polarization. And, even if politically feasible you still have to wonder on a nationwide basis how effective these recommendations would be in materially bending the curve so that more individuals can metamorphose themselves from victim of technology (holding jobs that race against the machine) into beneficiary of technology (quantitative jobs that race with the machine). This issue may be a formidable worldwide challenge in the present and coming decades. And, Keynes had exactly figured that out back in 1930: "We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in

the years to come-namely, technological unemployment. This means unemployment due to our discovery of means of economizing the use of labour outrunning the pace at which we can find new uses for labour. To their credit, the authors do give full credit to this astonishingly prescient prediction of Keynes in both their books.

A great introduction to the wild frontiers of technology for people not familiar with the field. Brynjolfsson and McAfee break the book down into five parts: (1) A brief summary of recent developments in the field (2) Moore's Law, Technology's Exponential Growth, and the Future (3) A Point in Time Analysis addressing today's relevant topics like: what happened to job growth, why is median income growth flat, and the job prospects of skilled vs. unskilled labor and how it has contributed to inequality (4) What should organizations, politicians, and policy makers do to prepare themselves for the future (5) Concluding Remarks. Despite some of the gloomy developments over the last decade, the authors remain optimistic about the potential of future technological innovation. They do tread lightly however, realizing that we are entering a new age of exponentially increasing technological innovation. They compare this phenomena to the ancient tale of the origins of the Chessboard. Long ago, the inventor of the chessboard was so overjoyed by his new creation that he decided to show it to his king. The king deemed it the single greatest game ever created and decided to give the man anything he pleased. The inventor asked for one grain of rice to be put on the first checkered box, subsequently doubling the amount of rice on each following box until all the boxes were filled. The first half of the board seemed to follow a linear pattern and everything was okay. It wasn't until the second half of the chessboard, that the king noticed that in order to meet this man's request, he would have to exhaust his entire country's grain storage. Stuck between two rocks, he decided to behead the man. Brynjolfsson and McAfee believe that we are coming to the end of the first half of the chessboard. Some jobs have been lost, however the cycle of innovation during the digital revolution seems to have followed the same sort of patterns -read linear- as the previous cycles caused by the invention's of electricity and steam powered engines. The author believes that the next half of the chess board will bring radically different changes. That is because for the first time in history man cannot keep up with the machine. The authors point quickly to an antiquated educational system that is partially to blame, however they realize that within the realm of objective logic based thinking, machine is simply better than man. And just like the first half of the chessboard brought sweeping change, and ultimately unemployment to blue collar professionals, the second half of the chess board could do the same with the white collar working force. The ending of this story however, is rosier than that of the chess inventor. Humans have a

unique skill that machines do not. We have the capability to be rationally irrational. Our emotions give us creative capabilities that cannot be replicated by machines and jobs will reemerge in these sorts of sectors. The authors specifically identified three: entrepreneurship, leadership, and creative tasks. I personally also think that the entertainment and spiritual/psychological guidance sectors will grow as well. After all, people will have to find new things to do with all the extra time that they will have. So to conclude, don't hesitate, go buy the book now! By it's end, you'll be full of imaginative speculations of what the future may have in store for us!

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