DOWNLOAD PDF PROGRESS ACCELERATES EXPONENTIALLY RAY KURZWEIL

Chapter 1 : Alex BÃ¤cker's Wiki / The Singularity Is Near, by Ray Kurzweil

In it, Kurzweil, after Moravec, argued for extending Moore's Law to describe exponential growth of diverse forms of technological progress. Whenever a technology approaches some kind of a barrier, according to Kurzweil, a new technology will be invented to allow us to cross that barrier.

Superintelligence A superintelligence, hyperintelligence, or superhuman intelligence is a hypothetical agent that possesses intelligence far surpassing that of the brightest and most gifted human minds. John von Neumann, Vernor Vinge and Ray Kurzweil define the concept in terms of the technological creation of super intelligence. Some argue that advances in artificial intelligence AI will probably result in general reasoning systems that lack human cognitive limitations. Others believe that humans will evolve or directly modify their biology so as to achieve radically greater intelligence. A number of futures studies scenarios combine elements from both of these possibilities, suggesting that humans are likely to interface with computers , or upload their minds to computers , in a way that enables substantial intelligence amplification. Non-AI singularity[edit] Some writers use "the singularity" in a broader way to refer to any radical changes in our society brought about by new technologies such as molecular nanotechnology , [16] [17] [18] although Vinge and other writers specifically state that without superintelligence, such changes would not qualify as a true singularity. The means speculated to produce intelligence augmentation are numerous, and include bioengineering , genetic engineering , nootropic drugs, AI assistants, direct brainâ€"computer interfaces and mind uploading. The existence of multiple paths to an intelligence explosion makes a singularity more likely; for a singularity to not occur they would all have to fail. Despite the numerous speculated means for amplifying human intelligence, non-human artificial intelligence specifically seed AI is the most popular option for organizations[which? Contrariwise, as the intelligences become more advanced, further advances will become more and more complicated, possibly overcoming the advantage of increased intelligence. Each improvement must be able to beget at least one more improvement, on average, for the singularity to continue. Finally the laws of physics will eventually prevent any further improvements. There are two logically independent, but mutually reinforcing causes of intelligence improvements: On the other hand, most AI researchers[who? Hawkins [citation needed], responding to Good, argued that the upper limit is relatively low; Belief in this idea is based on a naive understanding of what intelligence is. As an analogy, imagine we had a computer that could design new computers chips, systems, and software faster than itself. Would such a computer lead to infinitely fast computers or even computers that were faster than anything humans could ever build? It might accelerate the rate of improvements for a while, but in the end there are limits to how big and fast computers can be. There would be no singularity. Whereas if it were a lot higher than current human levels of intelligence, the effects of the singularity would be great enough as to be indistinguishable to humans from a singularity with an upper limit. For example, if the speed of thought could be increased a million-fold, a subjective year would pass in 30 physical seconds. But Berglas notes that computer speech recognition is approaching human capabilities, and that this capability seems to require 0. This analogy suggests that modern computer hardware is within a few orders of magnitude of being as powerful as the human brain. He predicts that the exponential growth will continue, and that in a few decades the computing power of all computers will exceed that of "unenhanced" human brains, with superhuman artificial intelligence appearing around the same time. Computer scientist and futurist Hans Moravec proposed in a book [29] that the exponential growth curve could be extended back through earlier computing technologies prior to the integrated circuit. There will be no distinction, post-Singularity, between human and machine". Accelerating change According to Kurzweil, his logarithmic graph of 15 lists of paradigm shifts for key historic events shows an exponential trend Some singularity proponents argue its inevitability through extrapolation of past trends, especially those pertaining to shortening gaps between improvements to technology. In one of the first uses of the term "singularity" in the context of technological progress, Stanislaw Ulam tells of a conversation with John von Neumann about

accelerating change: One conversation centered on the ever accelerating progress of technology and changes in the mode of human life, which gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue. Whenever technology approaches a barrier, Kurzweil writes, new technologies will surmount it. He predicts paradigm shifts will become increasingly common, leading to "technological change so rapid and profound it represents a rupture in the fabric of human history". Oft-cited dangers include those commonly associated with molecular nanotechnology and genetic engineering. These improvements would make further improvements possible, which would make further improvements possible, and so on. The mechanism for a recursively self-improving set of algorithms differs from an increase in raw computation speed in two ways. First, it does not require external influence: While speed increases seem to be only a quantitative difference from human intelligence, actual algorithm improvements would be qualitatively different. Eliezer Yudkowsky compares it to the changes that human intelligence brought: Similarly, the evolution of life had been a massive departure and acceleration from the previous geological rates of change, and improved intelligence could cause change to be as different again. First, the goal structure of the AI may not be invariant under self-improvement, potentially causing the AI to optimise for something other than was intended. They suggest that in the case of a software-limited singularity, intelligence explosion would actually become more likely than with a hardware-limited singularity, because in the software-limited case, once human-level AI was developed, it could run serially on very fast hardware, and the abundance of cheap hardware would make AI research less constrained. There is not the slightest reason to believe in a coming singularity. The fact that you can visualize a future in your imagination is not evidence that it is likely or even possible. Look at domed cities, jet-pack commuting, underwater cities, mile-high buildings, and nuclear-powered automobilesâ€”all staples of futuristic fantasies when I was a child that have never arrived. Sheer processing power is not a pixie dust that magically solves all your problems. We design them to behave as if they had certain sorts of psychology , but there is no psychological reality to the corresponding processes or behavior. Automation, Accelerating Technology and the Economy of the Future [50] postulates a "technology paradox" in that before the singularity could occur most routine jobs in the economy would be automated, since this would require a level of technology inferior to that of the singularity. This would cause massive unemployment and plummeting consumer demand, which in turn would destroy the incentive to invest in the technologies that would be required to bring about the Singularity. Job displacement is increasingly no longer limited to work traditionally considered to be "routine". This is due to excessive heat build-up from the chip, which cannot be dissipated quickly enough to prevent the chip from melting when operating at higher speeds. Advancements in speed may be possible in the future by virtue of more power-efficient CPU designs and multi-cell processors. Andrey Korotayev and others argue that historical hyperbolic growth curves can be attributed to feedback loops that ceased to affect global trends in the s, and thus hyperbolic growth should not be expected in the future. A study of the number of patents shows that human creativity does not show accelerating returns, but in fact, as suggested by Joseph Tainter in his The Collapse of Complex Societies, [61] a law of diminishing returns. The number of patents per thousand peaked in the period from to , and has been declining since. Jaron Lanier refutes the idea that the Singularity is inevitable. Standard of Living Since the Civil War , points out that measured economic growth has slowed around and slowed even further since the financial crisis of , and argues that the economic data show no trace of a coming Singularity as imagined by mathematician I. One line of criticism is that a log-log chart of this nature is inherently biased toward a straight-line result. Others identify selection bias in the points that Kurzweil chooses to use. For example, biologist PZ Myers points out that many of the early evolutionary "events" were picked arbitrarily. The Economist mocked the concept with a graph extrapolating that the number of blades on a razor, which has increased over the years from one to as many as five, will increase ever-faster to infinity. Based on population growth, the economy doubled every , years from the Paleolithic era until the Neolithic Revolution. The new agricultural economy doubled every years, a remarkable increase. If the rise of superhuman intelligence causes a similar revolution, argues Robin

Hanson, one would expect the economy to double at least quarterly and possibly on a weekly basis. Existential risk from artificial general intelligence The term "technological singularity" reflects the idea that such change may happen suddenly, and that it is difficult to predict how the resulting new world would operate. Digital technology has infiltrated the fabric of human society to a degree of indisputable and often life-sustaining dependence. We spend most of our waking time communicating through digitally mediated channels With one in three marriages in America beginning online, digital algorithms are also taking a role in human pair bonding and reproduction". The article further argues that from the perspective of the evolution , several previous Major Transitions in Evolution have transformed life through innovations in information storage and replication RNA , DNA , multicellularity , and culture and language. The digital information created by humans has reached a similar magnitude to biological information in the biosphere. Since the s, "the quantity of digital information stored has doubled about every 2. In biological terms, there are 7. The digital realm stored times more information than this in see fgure. The total amount of DNA contained in all of the cells on Earth is estimated to be about 5. This would represent a doubling of the amount of information stored in the biosphere across a total time period of just years". Artificial intelligence in fiction In February , under the auspices of the Association for the Advancement of Artificial Intelligence AAAI , Eric Horvitz chaired a meeting of leading computer scientists, artificial intelligence researchers and roboticists at Asilomar in Pacific Grove, California. The goal was to discuss the potential impact of the hypothetical possibility that robots could become self-sufficient and able to make their own decisions. They discussed the extent to which computers and robots might be able to acquire autonomy , and to what degree they could use such abilities to pose threats or hazards. Also, some computer viruses can evade elimination and, according to scientists in attendance, could therefore be said to have reached a "cockroach" stage of machine intelligence. The conference attendees noted that self-awareness as depicted in science-fiction is probably unlikely, but that other potential hazards and pitfalls exist. Existential risk from artificial general intelligence Berglas claims that there is no direct evolutionary motivation for an AI to be friendly to humans. When we create the first superintelligent entity, we might make a mistake and give it goals that lead it to annihilate humankind, assuming its enormous intellectual advantage gives it the power to do so. For example, we could mistakenly elevate a subgoal to the status of a supergoal. We tell it to solve a mathematical problem, and it complies by turning all the matter in the solar system into a giant calculating device, in the process killing the person who asked the question. A significant problem is that unfriendly artificial intelligence is likely to be much easier to create than friendly AI. While both require large advances in recursive optimisation process design, friendly AI also requires the ability to make goal structures invariant under self-improvement or the AI could transform itself into something unfriendly and a goal structure that aligns with human values and does not automatically destroy the human race. An unfriendly AI, on the other hand, can optimize for an arbitrary goal structure, which does not need to be invariant under self-modification. He noted that the first real AI would have a head start on self-improvement and, if friendly, could prevent unfriendly AIs from developing, as well as providing enormous benefits to mankind. It also proposed a simple design that was vulnerable to corruption of the reward generator. One hypothetical approach towards attempting to control an artificial intelligence is an AI box , where the artificial intelligence is kept constrained inside a simulated world and not allowed to affect the external world. However, a sufficiently intelligent AI may simply be able to escape by outsmarting its less intelligent human captors. Unfortunately, it might also be the last, unless we learn how to avoid the risks. Probably not â€” but this is more or less what is happening with AI. If instead the AI is smart enough to modify its own architecture as well as human researchers can, its time required to complete a redesign halves with each generation, and it progresses all 30 feasible generations in six years right. For instance, Intel has "the collective brainpower of tens of thousands of humans and probably millions of CPU cores to.. Storrs Hall believes that "many of the more commonly seen scenarios for overnight hard takeoff are circular â€” they seem to assume hyperhuman capabilities at the starting point of the self-improvement process" in order for an AI to be able to make the dramatic, domain-general improvements required for takeoff. Hall suggests that

rather than recursively self-improving its hardware, software, and infrastructure all on its own, a fledgling AI would be better off specializing in one area where it was most effective and then buying the remaining components on the marketplace, because the quality of products on the marketplace continually improves, and the AI would have a hard time keeping up with the cutting-edge technology used by the rest of the world. Goertzel is skeptical of a very hard, 5-minute takeoff but thinks a takeoff from human to superhuman level on the order of 5 years is reasonable. He calls this a "semihard takeoff". More also argues that a superintelligence would not transform the world overnight, because a superintelligence would need to engage with existing, slow human systems to accomplish physical impacts on the world. Kurzweil argues that the technological advances in medicine would allow us to continuously repair and replace defective components in our bodies, prolonging life to an undetermined age.

DOWNLOAD PDF PROGRESS ACCELERATES EXPONENTIALLY RAY KURZWEIL

Chapter 2 : Ray Kurzweil â€“ J.D. Moyer

An analysis of the history of technology shows that technological change is exponential, contrary to the common-sense intuitive linear view. So we won't experience years of progress in the 21st century -- it will be more like 20, years of progress (at today's rate).

Why are we so exponential, Ray Kurzweil? Why are we so Exponential, Ray Kurzweil? TED talks offer some of the most powerful and educational presentations from across the globe. TED contributors are part of a massive movement, holding a huge archive of video recorded subjects and events that many of us tune in to. This article covers one very special topic that was highlighted by Ray Kurzweil in with relevance to our time and technology today. But this is no longer the case. Exponential growth indicates that; Technological advances will come with a new wave of computational machine complexity and superiority. Do you need a website? At Cloudnames we offer all the right services you need to be your best online. We specialise in developing websites that meet progressive and changing demands of the digital world. I chatbot systems and much more. Much of our scientific and experimental research can track and measure the advances of information technology. As the rate of our technological advances continues to accelerate, the future also accelerates faster than we traditionally would expect. Problems that may seem unmanageable now, could become solvable in the near future -implying that it will become intuitive. And now we can confirm that it is. No doubt, these technological advances will be used to invest and plan for our future whether we appreciate the outcome or not. Similar to the Tripartite theory of Knowledge ; Seeing, living and believing are three different components but depend solely on one another for the reliable process of justification. Many have argued that much research and developments are transpiring behind closed doors and in some cases in secrecy. Which makes it harder to justify to those who are left in the dark. Typically due to Privatisation and Capitalism, it becomes difficult for the general public to take grasp of our changing world or take part in it, other than playing the consumer role. So, product based technology with inbuilt A. I features are the first impressions the general public will have regarding what direction we are heading some experts say. Yet, we are the ones responsible for integrating these forms of technology into our lives in order to survive and essentially keep-up. BUT, one thing is for certain -we are all driven by facts and evidence. He strongly believed that by the s, we will have reverse-engineered the human brain, and nanobots will be operating our consciousness. Although this TED talk was filmed 12 years ago, we can see the relevance and reality of his speech more clearly today. Ray Kurzweil, inventor, futurist, and director of engineering at Google. If Kurzweil had made these predictions based on exponential growth alone, then we could perhaps assume that; There is a clear correlation and connection of events that have and will take place in our immediate future defined by the expansion, scaling and higher capabilities of our science based technologies. This enables us to think seriously about what the next great possibilities for mankind will be, like immortality for instance which sounds totally bizarre, but achievable. Ray Kurzweil is an expert engineer and has radically advanced the fields of speech, text and audio technology. He offers deep and detailed academic writings and books on the advances of technology, the limits of biology and the future of human species. Therefore, we must pay attention because these are the quintessentials for our technological modernity. All of which would not be possible without I. T development of course. He made sound predictions over decade ago, some thought they were absurd or unfathomable, yet the here and now supports every inch of his claims. He invented the first optical character recognition OCR software for transforming written word into data, the first print-to-speech software for the blind, the first text-to-speech synthesizer, and the first music synthesizer capable of recreating the grand piano and other orchestral instruments, and the first commercially marketed large-vocabulary speech recognition. They use this powerful technology to serve good yet some would obviously argue otherwise. Take Maurice Conti, heavily influenced by Kurzweil he too explores new partnerships between technology, nature and humanity. Kurzweil, the Director of Engineering at Google leads a team that develops machine

intelligence and natural language comprehension. Maurice Conti and his team are responsible for exploring trends and technologies that will shape our future and build solutions that can help connect us to the world far beyond our natural senses. Social Media Marketing Guide The Internet, Social Media and Networking Sites have shaken the media sector entirely, challenging newspapers, magazines, radio and TV-stations as a source of distributing news and entertainment in line with competing for advertising budgets. Download your free SMM Guide now and learn essential methods that will make your business an online success! Father of Nanoscience, Richard Feynman Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules. The key for both Kurzweil and Conti lies with Nanoscience and nanotechnology. In his talk the father of nanoscience, Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules. Over a decade later, in his explorations of ultraprecision machining, Professor Norio Taniguchi coined the term nanotechnology. And so, the ability to see and to control individual atoms and molecules was born. Keep in mind that everything in our planet is made up of atoms, from the food we eat, the clothes we wear, the buildings and houses we live in, including our own bodies. So, by deliberately making materials at nanoscale- we can take advantage of their enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity than their larger-scale counterparts. This means in very simple terms , not only can we control and transform anything on an atomic level but we can also predict and understand the behaviour of it through quantum principles, which is one of the reasons why technology has advanced so dramatically. We can now define its function in terms of how our own Universe works and how it will inhabit these very creations based on dimensions. Now imagine a machine based system , that could do all of this for you. Technology can serve positive environmental changes with the power it has today, yet not many people are talking about it. You may have heard of his involvement with Tesla and SolarCity for example. But, we tend to hear more about his efforts on colonising Mars and cheap space travel, compared to Solar roofs which can generate clean energy. This article discusses the many advantages of technology and the ways in which it can serve a lot of good, especially in the medical sector. Human Exploration and Intervention Both Kurzweil and Conti bring to light the capabilities of exponentially advancing technologies and therefore the ability to explore solutions to bring human invention, A. I ability, chemistry, biology and technology together in ways that can benefit the world on a humanitarian and evolutionary level. When we bring these two great thinkers and their Ted Talks together, what do we understand? These are all logarithmic graphs, so as you go up the levels it represents, generally multiplying by factor of 10 or It took us half a century to adopt the telephone, the first virtual-reality technology. Cell phones were adopted in about eight years. If you put different communication technologies on this logarithmic graph, television, radio, telephone were adopted in decades. Recent technologies â€” like the PC, the web, cell phones â€” were under a decadeâ€¦ both biology and technology are evolutionary processes â€”accelerate. They work through interaction â€” they create a capability, and then it uses that capability to bring on the next stage. The Hunter-Gatherer Age lasted several million years. And then the Agricultural Age lasted several thousand years. The Industrial Age lasted a couple of centuries. And now the Information Age has lasted just a few decades. We cannot evolve more than being confined to the limits of our own natural bodies, so we create means to move beyond it. We are talking about a technological evolution. Information technologies double their capacity, price performance, bandwidth, every year. How to define exponential growth in simple terms? To understand exponential growth in a more simplified way, we must look to our traditional and inherent survival instincts. In terms of our survival, we have only ever needed to think of growth as being linear. When it comes to understanding how our technology will advance, we inherently think linearly. So, when it comes to understanding how our technology will advance, we inherently think linearly. We think that hypothetically if a computer held 1GB of memory in the year , then in it will hold about 30GB. By the year , with memory capacity having doubled exponentially, a computer would hold over a billion GB â€” 1,,,GB Or 1 xabyte. We need to think about how much things have changed in the last 10 years; wireless internet, smartphones, social media, A. Just in the last few years of getting three-dimensional

self-organizing molecular circuits to work. Supercomputers â€" same thing. Processor performance on Intel chips, the average price of a transistor â€" , you could buy one transistor for a dollar. You could buy 10 million in Every time we ask Siri or get a recommendation on Android, we use what is offered to enhance our human capabilities, there are A. Apple Products Siri Yet, all of this technology has always been passive, like all tools that were ever invented by humans, they served without active response or resistance , not until now. But that is no longer the case. If you have one of these [smartphone], in a few seconds, you can know the answer. But this is just a primitive beginning. They do exactly what we tell them and nothing more. Our very first tool only cut where we struck it. The chisel only carves where the artist points it. And even our most advanced tools do nothing without our explicit direction. All it needs are our directives and understanding of constraints. Maurice Conti gave a brilliant example to illustrate generative A. Then what the computer does is it explores the entire solution space: It takes big computers to do this. Like a human, A. Technology, science and A.

DOWNLOAD PDF PROGRESS ACCELERATES EXPONENTIALLY RAY KURZWEIL

Chapter 3 : Ray Kurzweil - Wikiquote

This is the second in a four-part series looking at the big ideas in Ray Kurzweil's book The Singularity Is Near. Be sure to read the other articles: Will the End of Moore's Law Halt Computing's Exponential Rise? How to Think Exponentially and Better Predict the Future Ray Kurzweil.

The Antisingularity I suspect most readers, like me, grew up learning to think of history as progress. But at UR we care not for tradition. We accept no givens, we serve no idols. Au contraireâ€”we crap on them. Expect a new crop of bitter, perverse screeds against democracy, coming soon. Or were we just told to think so, like good little school-bots? The idea of decline, a la Spengler , is unfashionable these days. But of course it has featured prominently in many cultures and civilizations, such as classical China, the Roman Republic, various Catholic traditions, etc. And as Deogolwulf points out, universal faith in progress is evidence for, not against, decline. Still, we have HDTVs and gig hard disks. Did Marcus Porcius Cato have either of these fine conveniences? Did Oswald Spengler, for that matter? So perhaps we can sneer at them after all. Spengler was a Nazi, Cato walked around flanked by fasces-wielding lictors. The past is darkness and superstition. The future is fiber optics and universal enlightenment. In the singularity, computers grow so smart they design themselves, making them even smarter than Kurzweil, and so ad infinitum. Kurzweil expects this as soon as I am no Kurzweil, but I know a thing or two about computers. Certainly technical progress accelerates itself exponentially. I think is a little soon, but I have no strong feelings on the issue. But historical progressâ€”whatever that may beâ€”is something else. History is littered with the ruins of failed civilizations. History is not an experiment. We do, however, have imaginations. And we can imagine them separately. In the last years we see enormous technical progressâ€”the Industrial Revolution. Clearly the leading edge of the Singularity. Small exponents, but exponents. But in Edward Gibbon wrote: He would certainly keep the knowledge, probably the wealth, maybe even the happiness. Twenty years after Gibbon wrote, the Jacobins were making leather out of human skins. There is no presentiment at all of the incredible barbarisms that would erupt, not in Papua New Guinea, but in France, Germany, Russia and North America. Now imagine the history of the last two centuries with these brutal wars of totalitarian democracy , but without the Industrial Revolution. Umâ€¦ Or even forget the wars. But without any gig hard disks or HDTVs. What it means is that technical progress has overcome the declining trends in Western society. Perhaps in the absence of the Industrial Revolution, the experience of late Antiquity would have been revisited, and Uzbek horsemen would be cantering across the ruins of Paris. Exponential technical acceleration has broken the savage cycle of history. Evolution designed humans to compete in a variety of brutally selective environments. When robotsâ€”or Helots â€”do all the work, why bother? We can just sit on the couch, play XBox , smoke green bud and masturbate frantically. If technical progress actually causes social and political decay, Mike Judge is an optimist. When the curve of technology is almost vertical, but not yet infinite? We are just in an unprecedentedly steep upcycle. The Uzbeks may yet water their horses in the Seineâ€”if there are any Uzbeks left. Or horses, for that matter.

Chapter 4 : THE SINGULARITY | blog.quintoapp.com

When Exponential Progress Becomes Reality Ray Kurzweil, The Singularity Is Near (New York: Penguin Books,), p. 70 (recent data extrapolated) "I used to say that this is the most important.

Early observations[edit] In during the town planning conference of London Daniel Burnham noted that "But it is not merely in the number of facts or sorts of knowledge that progress lies: One conversation centered on the ever accelerating progress of technology and changes in the mode of human life, which gives the appearance of approaching some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue. Moravec extends this to include technologies from long before the integrated circuit to future forms of technology. Moravec outlines a timeline and a scenario [6] [7] in which robots will evolve into a new series of artificial species, starting around â€" Extrapolating these trends, he speculates about a coming "mind fire" of rapidly expanding superintelligence similar to the explosion of intelligence predicted by Vinge. Burke contends that one cannot consider the development of any particular piece of the modern world in isolation. Rather, the entire gestalt of the modern world is the result of a web of interconnected events, each one consisting of a person or group acting for reasons of their own motivations e. The interplay of the results of these isolated events is what drives history and innovation, and is also the main focus of the series and its sequels. Burke also explores three corollaries to his initial thesis. The first is that, if history is driven by individuals who act only on what they know at the time, and not because of any idea as to where their actions will eventually lead, then predicting the future course of technological progress is merely conjecture. The second and third corollaries are explored most in the introductory and concluding episodes, and they represent the downside of an interconnected history. If history progresses because of the synergistic interaction of past events and innovations, then as history does progress, the number of these events and innovations increases. This increase in possible connections causes the process of innovation to not only continue, but to accelerate. Burke poses the question of what happens when this rate of innovation, or more importantly change itself, becomes too much for the average person to handle, and what this means for individual power, liberty, and privacy. He identified five distinct mindsteps in human history, and the technology that accompanied these "new world views": The date of the next mindstep 5; the series begins at 0 is given as , with two further, successively closer mindsteps in and , until the limit of the series in His speculations ventured beyond the technological: None of the mindsteps can be said to have been truly anticipated, and most were resisted at the early stages. In looking to the future we may equally be caught unawares. We may have to grapple with the presently inconceivable, with mind-stretching discoveries and concepts. Mass use of inventions: His subsequent Hugo award -winning novel A Fire Upon the Deep starts with an imaginative description of the evolution of a superintelligence passing through exponentially accelerating developmental stages ending in a transcendent , almost omnipotent power unfathomable by mere humans. His already mentioned influential paper on the technological singularity compactly summarizes the basic ideas. Whenever a technology approaches some kind of a barrier, according to Kurzweil, a new technology will be invented to allow us to cross that barrier. He cites numerous past examples of this to substantiate his assertions. He predicts that such paradigm shifts have and will continue to become increasingly common, leading to "technological change so rapid and profound it represents a rupture in the fabric of human history. Within a few decades, machine intelligence will surpass human intelligence, leading to the Singularityâ€"technological change so rapid and profound it represents a rupture in the fabric of human history. The implications include the merger of biological and nonbiological intelligence, immortal software-based humans, and ultra-high levels of intelligence that expand outward in the universe at the speed of light. According to Kurzweil, since the beginning of evolution , more complex life forms have been evolving exponentially faster, with shorter and shorter intervals between the emergence of radically new life forms, such as human beings, who have the capacity to engineer i. By extension, the rate of technical progress

amongst humans has also been exponentially increasing, as we discover more effective ways to do things, we also discover more effective ways to learn, i. Already within the past sixty years, life in the industrialized world has changed almost beyond recognition except for living memories from the first half of the 20th century. This pattern will culminate in unimaginable technological progress in the 21st century, leading to a singularity. Limits of accelerating change[edit] Accelerating change may not be restricted to the Anthropocene Epoch, [11] but a general and predictable developmental feature of the universe. Such advanced life forms would be interested in inner space, rather than outer space and interstellar expansion. The foundation organizing the Methuselah Mouse Prize believes aging research could be the subject of such a massive project if substantial progress is made in slowing or reversing cellular aging in mice. In our case this nonlinear second order positive feedback looks as follows: On the other hand, this research has shown that since the s the World System does not develop hyperbolically any more, its development diverges more and more from the blow-up regime, and at present it is moving "from singularity", rather than "toward singularity". Computer power grows exponentially.

Chapter 5 : The Antisingularity | Unqualified Reservations by Mencius Moldbug

Inventor, entrepreneur and visionary Ray Kurzweil explains in abundant, grounded detail why, by the s, we will have reverse-engineered the human brain and nanobots will be operating your consciousness.

Already have an account? Page history last edited by Alex Backer, Ph. To a certain extent, the basic premise of the book is self-evident: There are multiple reasons for this, including that more people are alive today than at any time in the past, and that previous inventions facilitate the next one. Kurzweil argues against a bottleneck in human processing speed becoming limiting, arguing that computers will get us out of it, but a the bottleneck could be reached before we develop Ultraintelligent Machines, and b if Ultraintelligent machines are built for people, then some of their effects will be subject to human timescales. An improvement similar to that for example, finding a way to fit twice as many chips in the same space leads to exponential growth by definition. The more things change, the more they stay the same. One could also conclude that the linear increase in scientific throughput reflects a deficiency of the scientific publishing system. Not only is the cause of exponential growth in, say, computing power, a linear process, but its consequences are linear, too. Our life becomes only marginally better by a 2 kb increase in memory or a 2 kHz today, but changes of the same linear magnitude made a more significant effect when they constituted a doubling. Our senses detect logarithms of values, not the values themselves, and so it takes exponential change to effect linear perception. The importance of the opposable thumb is often overstated, and Kurzweil is no exception. Monkeys are able to manipulate their environment see video , and seem more dexterous by many measures with any limb than we are with our hands. Data may be doubling every year as he claims, but useful knowledge is not. Indeed, Kurzweil cites two legitimate definitions in his book p. One, by Anissimov; the other, by the legendary John von Neumann. Now the interesting thing about this is that both definitions describe two completely different phenomena. One is the empirical observation of the acceleration of technological development, which suggests that technological progress must either continue to accelerate to the point where society is being transformed at a whirlwind pace or slow its acceleration. The other is the theoretical prediction that when machines become able to improve themselves on their own, the pace of progress will accelerate tremendously. While I would rather agree with Anissimov that a discontinuity is likely when the first transhuman intelligence is created that launches itself into recursive self-improvement, this is not necessarily the same as the creation of a super-human intelligence. And while the two may happen in close temporal proximity, it would be useful to clarify what the actual requirements for a Singularity are. It seems to me that the former is directly conducive to a Singularity, and is likely to happen before the latter. Unfortunately, his plots all end 50 years ago. Now extend that to the present. Assuming merely that the exponential acceleration that Kurzweil describes in the past has continued for the last 50 years. If he is correct, we should be able to see a large number of paradigm shifts as impactful as the advent of writing in the last fifty years. Indeed, we should be currently seeing a paradigm shift as impactful as that approximately every year. If someone can tell me where they are, I would like to invest in them. Will the stock market go up with the tremendous rate of value creation sure to come from these ever-more-frequent paradigm shifts? Personally, I have no doubt that the Internet is one such paradigm shift of the last 50 years. The sequencing of the genome, or the ability to inexpensively and rapidly sequence genomes, is probably another. But I am not yet seeing one a year --not of the relevance of the invention of writing or the wheel. In his discussion on complexity p. Kurzweil seems to have missed the biggest thing that allows the genome to contain much less information and complexity than a human: But, while this is very efficient for information transfer, something that got selected for in bacteria where time to replicate the genome is a constraint in propagation speed for a lineage, it is very inefficient at transferring information across generations. I write this on a train in Austria, as I speed away from the streets of Salzburg, where centuries-old inscriptions in centuries-old buildings remain unbothered by the passage of time, even in what is arguably the most uniformly technologically up-to-date continent on Earth. I hope I get to hang around

long enough to find out. The big question that stands out to me from it is, why are so many disparate trends so closely following an exponential growth curve over many years the goodness of fit for many of these curves is striking? Why does technology growth in any one measurement such as computational power of computers as a function of time obey an exponential curve? The answer is given above: Humans work hard enough to improve things by a perceptible amount, and perception is logarithmic:

DOWNLOAD PDF PROGRESS ACCELERATES EXPONENTIALLY RAY KURZWEIL

Chapter 6 : Accelerating change - Wikipedia

His argument is simple â€" as tech accelerates at an exponential rate, progress could eventually become instantaneous, a singularity. He predicts as computers advance, they could merge with other tech like genomics, nanotechnology and robotics.

In science-fiction writer Vernor Vinge authored a paper introducing and describing the idea of The Singularity, a near-future Rubicon for humanity; we create machines with superhuman intelligence, thus changing everything forever. In the post-Singularity world, all the old rules are thrown out, progress accelerates exponentially, and the real action shifts away from humanity and towards our cybernetic spawn. Human beings are relegated to the sidelines as intelligent machines take over the world or, in darker variations of the scenario, humans are enslaved or exterminated. Vernor Vinge -- this joker makes up wacky ideas for a living. This specificity gives the paper the feel of prophecy, at least to the unsophisticated reader. He is also a co-founder of the Singularity University. Exponential technological progress is going to change everything. By all accounts the people who run it are idealistic not hucksters , and the people who take the courses can generally afford it. But what is it, really? The mouse is nice, as is the trackpad. The portable computing device laptop or smart phone comes in really handy. And we can easily imagine an implant that allows us to access the internet via thought alone, or a contact lens micro-screen that projects data over our visual field. Has it changed us that much? Instead of arguing about who was in what movie, we just look it up. Where are the Canary Islands, exactly? Just look it up. Just look it up! Well, what about access to computing power? Computers can run enormously powerful simulations, and do enormously complex computations in the blink of an eye. Once again, look at how we currently use the enormous amount of computing power available to us, and project forward. What do we do with it now? We watch TV on our computers. We play computer games that accurately represent real-world physics. Maybe our screen-saver analyzes astronomical data, in search of signals from ET, or folds proteins with the spare cycles, but in neither case do we pay much attention. Daniel Dennett has an interesting counter-argument for people who like to speculate about superhuman intelligence by comparing human intelligence to animal intelligence, and then extrapolating to superhuman intelligence. Some kind of super-advanced alien or future A. We have the ability to think abstractly. We have the ability to run simulations in our minds and imagine various futures and outcomes we can run scenarios. We can think symbolically and manipulate symbols words, numbers, musical notation, languages of all sorts in infinite numbers of configurations why infinite? In short, human beings can perform abstract mental operations. Cats have a different relationship with symbols. This is not to say that cats will never evolve symbolic cognition, or that the human brain has stopped evolving. But once we possess the imaginative faculty, once we evolve the ability to perform abstract mental operations, once the cat is out of the bag so to speak then there can exist no idea that by its very nature is off limits to us. Sure, some areas are difficult to contemplate. Quantum mechanics falls into this category. Quantum mechanics is entirely outside of our range of sensory experience as human beings. Of course we can. Now that would change things up. Even the polarphant must obey the rules of Darwinian evolution. My point is that we should question the idea that superhuman intelligence can even exist. Certainly superhuman something-or-other can exist, but intelligence and consciousness are the wrong vector to examine. The cognitive space is like the chemistry space; there is not an entirely different set of elements somewhere else in the universe or in the future or in the past. A very large truck The other problem with Premise 2 is the idea that making something bigger or faster changes its nature or function. If you increase the speed of a computer, then it can do what it already does much more quickly. With the right programming, for example, a computer can explore a logical decision tree and look for a certain outcome; thus computers can be programmed to be extremely good at chess. A very large network is just that â€" a big network â€" it can facilitate communications among billions of people and quasi-intelligent agents bots, computer viruses, and so forth. New functionality does not emerge unless new structures emerge. In nature,

new structures can emerge via the process of evolution. In the realm of technology, new structures and functions are designed, or they evolve out of systems that are designed. You could of course argue that is already is, but if so, the evolving agents are funny cat videos and naked lady pictures. Only the strongest lolcat will survive. The emergence of superhuman intellect will result in a radical transformation of the world. Smart people, rather myopically, tend to take this idea for granted. Of course super-intelligence will be super important! Historically, extreme intelligence only amounts to something when it is paired with other human qualities, like ruthless ambition, innovative inventiveness, disciplined practice, or preternatural persistence Thomas Edison , for example, had all of those qualities. Or an unemployed, weed-dealing neighbor with a PhD in Semiotics? When extreme intelligence is paired with motivating factors, the world does get changed. The ambitious work of Thomas Edison and Nikola Tesla gave us cheap, universally available electricity, long-burning light bulbs, and dozens of other important inventions. Look at the A. The latter is going straight up; the former goes up and down in fits and starts. The most promising approaches to A.

Chapter 7 : Ray Kurzweil Debunks 'Exponential Returns' Doubters at SXSW

In The Singularity Is Near, Ray Kurzweil describes that the rapid growth of technology accelerates progress across all domains exponentially, leading to unexpected degrees of technological and social change occurring in increasingly smaller degrees of time.

Why is technology accelerating? Did you know that exponential growth has been going on for a much longer period? Or that such growth is occurring in other fields outside of computing, such as communication and genomics? In , Gordon Moore a founder of Intel published a paper observing that between and , the number of transistors on an integrated circuit have been doubling roughly every 18 to 24 months. He projected this would continue for some time. In , a scientist at Texas Instruments developed the first-ever integrated circuit. This scientist would go on to win the Nobel Prize. The first integrated circuit in Now, fast forward 13 years. The had 2, transistors with a gate length of 10, nanometers, and computer power of about KHz. The cost of a transistor: As Ray Kurzweil described in his most excellent book, The Singularity Is Near, exponential growth in computation has existed for over a century, and has gone through five different paradigms of exponential growth: Electromechanical computers 3rd Paradigm: Vacuum-tube based computers 4th Paradigm: Transistor-based computers 5th Paradigm: Why is Technology Accelerating? It is important to understand the underlying drivers for the Law of Accelerating Returns. Evolution biological or technological results in a better next-generation product. That product is thereby a more effective and capable method, and is used in developing the next stage of evolutionary progress. Put differently, we are using faster tools to design and build faster tools. In biological evolution, the more advanced life form think cellular is able to gather energy and reproduce more effectively, and therefore outperforms and out-evolves other life forms. As a particular evolutionary process e. This results in a second level of exponential growth i. To paraphrase Kurzweilâ€¦ The Law of Accelerating Returns also explains exponential advancement of life biology on this planet. Looking at biological evolution on Earth, the first step was the emergence of DNA, which provided a digital method to record the results of evolutionary experiments. Then, the evolution of cells, tissues, organs and a multitude of species that ultimately combined rational thought with an opposable appendage i. The first technological steps -- sharp edges, fire, the wheel -- took tens of thousands of years. For people living in this era, there was little noticeable technological change in even a thousand years. In the 19th century, we saw more technological change than in the nine centuries preceding it. Then in the first 20 years of the 20th century, we saw more advancement than in all of the 19th century. There has never been a more exciting time to be alive.

DOWNLOAD PDF PROGRESS ACCELERATES EXPONENTIALLY RAY KURZWEIL

Chapter 8 : Technological singularity - Wikipedia

Technology's relentless, predictable, and exponential growth will, according to the law of accelerating returns, bring humans into the era that Kurzweil is most closely associated with, the.

Against our natural process of lineal thinking and intuition, the future unfolds exponentially, making it challenging to predict just what will happen next and when. We must therefore prepare ourselves for the future by thinking exponentially. We used the same tools, ate the same meals, lived in the same general place. Though the pace of technology is progressing exponentially, the default mode of our caveman brains is to think linearly. This has led to unexpected degrees of technological and social change occurring not only between generations, but within them. Against our intuition, today the future is unfolding not linearly but exponentially, making it challenging to predict just what will happen next and when. This is why the pace of technological progress tends to surprise us, and we find ourselves in situations like this: What is exponential growth? This is why linear growth produces a stable straight line over time, but exponential growth skyrockets. However, setting anatomy aside, imagine you could double the length of your stride. Amazingly, by step number 30, doubling your stride will put you a billion meters from where you started, a distance equal to twenty-six trips around the world. That means that any of your previous steps look minuscule compared with the last few steps of explosive growth, and most of the growth happens over a relatively short period of time. The point is we often miss exponential trends in their early stages because the initial pace of exponential growth is deceptive â€" it begins slow and steady and is hard to differentiate from linear growth. Hence, predictions based on the expectation of an exponential pace can seem improbable. Ray Kurzweil gives this example: Yet the fifteen-year project was completed slightly ahead of schedule, with a first draft in See how most of the progress happens right at the end after years of doubling? Will exponential growth eventually end? In practice, exponential trends do not last forever. However, some trends can continue for long periods, driven along by successive technological paradigms. These S-curves overlap, and when one technology slows, a new one takes over and speeds up. With each new S-curve, the amount of time it takes to reach higher levels of performance is less. When one technology exhausted its potential, the next took over making more progress than its predecessors. Planning for an exponential future The rule of thumb here is: For example, what might the next five years look like? One way to forecast them would be to look at the last five and extend this pace forward. By now, the problem with this thinking should be clear: The pace itself is changing. A better forecast would be to look at the last five and then reduce the time it will take to make a similar amount of progress in the next five. Thinking linearly causes businesses, governments, and individuals to get blindsided by factors that trend to exponential growth. Big firms get disrupted by new competition; governments struggle to keep policy current; all of us worry our future is out of control. Exponential thinking reduces some of this disruptive stress and reveals new opportunities. If we can better plan for the accelerating pace, we can ease the transition from one paradigm to the next, and greet the future in stride. Berman is a writer, producer, and host at Singularity University. By Kit Digby T

Chapter 9 : The Law of Accelerating Returns | Kurzweil

Such exponential growth is actually described by "The Law of Accelerating Returns," a term coined by my friend and Singularity University Chancellor/Co-founder Ray Kurzweil.

Within a few decades, machine intelligence will surpass human intelligence, leading to The Singularity â€" technological change so rapid and profound it represents a rupture in the fabric of human history. The implications include the merger of biological and nonbiological intelligence, immortal software-based humans, and ultra-high levels of intelligence that expand outward in the universe at the speed of light. For complete details, see below. Until I return to a further explanation, however, do read the first sentence of this paragraph carefully. Now back to the future: Our forebears expected the future to be pretty much like their present, which had been pretty much like their past. Although exponential trends did exist a thousand years ago, they were at that very early stage where an exponential trend is so flat that it looks like no trend at all. So their lack of expectations was largely fulfilled. Today, in accordance with the common wisdom, everyone expects continuous technological progress and the social repercussions that follow. But the future will be far more surprising than most observers realize: Bill and I have been frequently paired in a variety of venues as pessimist and optimist respectively. When people think of a future period, they intuitively assume that the current rate of progress will continue for future periods. However, careful consideration of the pace of technology shows that the rate of progress is not constant, but it is human nature to adapt to the changing pace, so the intuitive view is that the pace will continue at the current rate. Even for those of us who have been around long enough to experience how the pace increases over time, our unexamined intuition nonetheless provides the impression that progress changes at the rate that we have experienced recently. So even though the rate of progress in the very recent past e. It is typical, therefore, that even sophisticated commentators, when considering the future, extrapolate the current pace of change over the next 10 years or years to determine their expectations. But a serious assessment of the history of technology shows that technological change is exponential. In exponential growth, we find that a key measurement such as computational power is multiplied by a constant factor for each unit of time e. Exponential growth is a feature of any evolutionary process, of which technology is a primary example. One can examine the data in different ways, on different time scales, and for a wide variety of technologies ranging from electronic to biological, and the acceleration of progress and growth applies. What it clearly shows is that technology, particularly the pace of technological change, advances at least exponentially, not linearly, and has been doing so since the advent of technology, indeed since the advent of evolution on Earth. I emphasize this point because it is the most important failure that would-be prognosticators make in considering future trends. That is why people tend to overestimate what can be achieved in the short term because we tend to leave out necessary details , but underestimate what can be achieved in the long term because the exponential growth is ignored. The Law of Accelerating Returns We can organize these observations into what I call the law of accelerating returns as follows: Evolution applies positive feedback in that the more capable methods resulting from one stage of evolutionary progress are used to create the next stage. As a result, the rate of progress of an evolutionary process increases exponentially over time. In another positive feedback loop, as a particular evolutionary process e. This results in a second level of exponential growth i. Biological evolution is one such evolutionary process. Technological evolution is another such evolutionary process. Indeed, the emergence of the first technology creating species resulted in the new evolutionary process of technology. Therefore, technological evolution is an outgrowth ofâ€"and a continuation ofâ€"biological evolution. A specific paradigm a method or approach to solving a problem, e. When this happens, a paradigm shift i. If we apply these principles at the highest level of evolution on Earth, the first step, the creation of cells, introduced the paradigm of biology. The subsequent emergence of DNA provided a digital method to record the results of evolutionary experiments. Then, the evolution of a species who combined rational thought with an opposable appendage i. The upcoming primary paradigm shift will be

from biological thinking to a hybrid combining biological and nonbiological thinking. If we examine the timing of these steps, we see that the process has continuously accelerated. The evolution of life forms required billions of years for the first steps e. During the Cambrian explosion, major paradigm shifts took only tens of millions of years. Later on, Humanoids developed over a period of millions of years, and Homo sapiens over a period of only hundreds of thousands of years. With the advent of a technology-creating species, the exponential pace became too fast for evolution through DNA-guided protein synthesis and moved on to human-created technology. Technology goes beyond mere tool making; it is a process of creating ever more powerful technology using the tools from the previous round of innovation. In this way, human technology is distinguished from the tool making of other species. There is a record of each stage of technology, and each new stage of technology builds on the order of the previous stage. The first technological steps-sharp edges, fire, the wheelâ€”took tens of thousands of years. For people living in this era, there was little noticeable technological change in even a thousand years. In the nineteenth century, we saw more technological change than in the nine centuries preceding it. Then in the first twenty years of the twentieth century, we saw more advancement than in all of the nineteenth century. Now, paradigm shifts occur in only a few years time. The paradigm shift rate i. So, the technological progress in the twenty-first century will be equivalent to what would require in the linear view on the order of centuries. So the twenty-first century will see almost a thousand times greater technological change than its predecessor. Toward this end, I am fond of telling the tale of the inventor of chess and his patron, the emperor of China. The Emperor quickly granted this seemingly benign and humble request. One version of the story has the emperor going bankrupt as the 63 doublings ultimately totaled 18 million trillion grains of rice. At ten grains of rice per square inch, this requires rice fields covering twice the surface area of the Earth, oceans included. Another version of the story has the inventor losing his head. It should be pointed out that as the emperor and the inventor went through the first half of the chess board, things were fairly uneventful. The inventor was given spoonfuls of rice, then bowls of rice, then barrels. It was as they progressed through the second half of the chessboard that the situation quickly deteriorated. This is the nature of exponential growth. Although technology grows in the exponential domain, we humans live in a linear world. So technological trends are not noticed as small levels of technological power are doubled. Then seemingly out of nowhere, a technology explodes into view. For example, when the Internet went from 20, to 80, nodes over a two year period during the s, this progress remained hidden from the general public. A decade later, when it went from 20 million to 80 million nodes in the same amount of time, the impact was rather conspicuous. As exponential growth continues to accelerate into the first half of the twenty-first century, it will appear to explode into infinity, at least from the limited and linear perspective of contemporary humans. The progress will ultimately become so fast that it will rupture our ability to follow it. It will literally get out of our control. Can the pace of technological progress continue to speed up indefinitely? Is there not a point where humans are unable to think fast enough to keep up with it? With regard to unenhanced humans, clearly so. But what would a thousand scientists, each a thousand times more intelligent than human scientists today, and each operating a thousand times faster than contemporary humans because the information processing in their primarily nonbiological brains is faster accomplish? One year would be like a millennium. What would they come up with? Well, for one thing, they would come up with technology to become even more intelligent because their intelligence is no longer of fixed capacity. They would change their own thought processes to think even faster. This, then, is the Singularity. The Singularity is technological change so rapid and so profound that it represents a rupture in the fabric of human history. My view is that despite our profound limitations of thought, constrained as we are today to a mere hundred trillion interneuronal connections in our biological brains, we nonetheless have sufficient powers of abstraction to make meaningful statements about the nature of life after the Singularity. Most importantly, it is my view that the intelligence that will emerge will continue to represent the human civilization, which is already a human-machine civilization. This will be the next step in evolution, the next high level paradigm shift. Singularity is a familiar word meaning a unique event with profound implications. In mathematics, the term

implies infinity, the explosion of value that occurs when dividing a constant by a number that gets closer and closer to zero. In physics, similarly, a singularity denotes an event or location of infinite power. At the center of a black hole, matter is so dense that its gravity is infinite. As nearby matter and energy are drawn into the black hole, an event horizon separates the region from the rest of the Universe. It constitutes a rupture in the fabric of space and time. The Universe itself is said to have begun with just such a Singularity. From my perspective, the Singularity has many faces. It represents the nearly vertical phase of exponential growth where the rate of growth is so extreme that technology appears to be growing at infinite speed. Of course, from a mathematical perspective, there is no discontinuity, no rupture, and the growth rates remain finite, albeit extraordinarily large. But from our currently limited perspective, this imminent event appears to be an acute and abrupt break in the continuity of progress. In other words, we will become vastly smarter as we merge with our technology. When I wrote my first book, The Age of Intelligent Machines, in the s, I ended the book with the specter of the emergence of machine intelligence greater than human intelligence, but found it difficult to look beyond this event horizon. Now having thought about its implications for the past 20 years, I feel that we are indeed capable of understanding the many facets of this threshold, one that will transform all spheres of human life. Consider a few examples of the implications.