Predicting the unpredictable

The future of localization

Olga Melnikova

Olga Melnikova has been in the industry for 11 years, first as a Russian linguist and then as a project manager and localization professor. She holds an MA in translation and localization management and is currently pursuing a graduate degree in computer science with a Canadian university.

We all want to know what the future will bring so that we are better prepared for it. However, it becomes harder to reliably predict the future even a few years ahead. This is because technology is progressing faster than ever.

The advancement of technology in the past several decades has changed everyone's lives. Many of us still remember the time when we did not have high-speed internet, or even the time when we had no internet at all. This seems unbelievable now, but it was only a couple of decades ago. Internet, social media, artificial intelligence (AI), machine learning and artificial neural networks in their modern state are all quite recent developments, and we have witnessed our lives change drastically due to these innovations.

Law of Accelerating Returns

Technology is moving so fast that its growth is not linear anymore — it is exponential, as defined by Ray Kurzweil's Law of Accelerating Returns.

What does it mean for our industry? As for all other industries, no one knows what to expect even in the nearest future.

This is due to the nature of the exponent. There are many domains that develop in a linear fashion (biology, neuroscience, computer science, physics and so on), then they reach the point where they start empowering and enhancing each other in a way no one could predict. This process results in emergence of new unforeseen technologies that start dominating the market.

One example is artificial neural networks that emerged at the intersection between neuroscience and computer science to later become a transdisciplinary approach now organically integrated into every industry, including localization.

According to Kurzweil, by the year 2045, this exponential growth will go beyond any control and will culminate in technological singularity. This will be a point of the utmost unpredictability where "our old models must be discarded and a new reality rules," according to science fiction author and computer science professor Vernor Vinge. It is expected to manifest in the recursive self-improvement of AI that will reach the point where machine intelligence exceeds that of humans.

We are still far from 2045, so let us try to analyze current trends to see what to expect in the near future and what this will mean for the translation industry.

Analysis of current trends

One of the reasons for the current exponential growth of technology was the growth of the world population in the twentieth century, which was also exponential. As of 1900, the total population of the world was about 1.6 billion people. In 2000, it reached 6 billion people. As of March 2019, it was at 7.7 billion, and counting.

There are two important factors that add to this: first, the share of educated people increased considerably. Second, scientific knowledge is now much better and much more accurate than 100 years ago.

This means that at the time when Albert Einstein published his famous article about the theory of relativity (1905), considerably fewer people were living on Earth (compared to now), and a very small number of them were educated. Last but not least, the science was very outdated, as opposed to what we have now. Since each new generation of technology improves over the previous one, the pace of progress from version to version speeds up. It means that all technological change becomes exponential. One of the main concepts describing this exponential change is Moore's Law that, in its current form, states that the performance of computers roughly doubles every two years.

Should we then be surprised by the exponential growth of technology? Probably not, because the number of highly educated engineers, scientists and researchers who simultaneously work on new technologies is so high now that this inevitably results in the emergence of mind-blowing technologies at a dizzying pace. The companies owning this tech are trying to cut time-to-market in order to win the consumer war against their competition.

As a result, many of these new technologies never achieve the point of sufficient maturity. Once an innovation is released at the market, there is already another one waiting in the pipeline.

Briefing for US Vice President Gerald Ford in 1973 on the junction-grammar-based computer translation model (AI Winter). Photo credit: Eldon Lytle.

Consider the advancement of technology in the 20th century. If we take TV as an example, it had more than 50 years to evolve and grow mature. It has gone a full cycle from its early emergence at the end of the 1920s to becoming mainstream by the 1990s when 98% of US homes had at least one TV set.

Now let us turn to the current technologies. After the movie *Avatar* was released in 2009, the digital 3D technology got universal acclaim. Many experts were certain that every single movie would be filmed using digital 3D technology going forward.

However, this approach to filming was never developed to the point of becoming mainstream. One of the most popular TV shows, *Game of Thrones*, was being made using visual effects that are less expensive and more efficient compared to 3D filming technology.

Other examples include Google Glass, QR codes, MapQuest, MySpace and many other technologies, apps and platforms. Each of them had huge potential, and some were even forecast to become "a dominant force in the tech industry," but failed to do so.

We now have a whole bunch of technologies that also have huge potential, but no one is 100% sure which one will be the next technological breakthrough. There is virtual reality, augmented reality, blockchain, 3D printers, quantum computers and robotics, to name a few.

Since no one knows what the next big leap in technology will be, tech giants have adopted the strategy of buying as many promising startups as possible just because each of these startups can potentially be a difference maker in the "winner takes all" race. The Big Five tech companies (Amazon, Apple, Facebook, Google and Microsoft), which used to focus on one type of product, are now developing literally everything: virtual assistants, chat bots, video streaming platforms, driverless cars and more.

Developments of AI

You may object that since all of the above is powered by AI, one thing about the future is quite predictable: AI is going to develop further.

It is true that machine learning and AI become must-have capabilities in every industry, but it is still unknown how exactly they will shape the future.

If we look at the history of AI, we will see that the field itself is relatively old. The term "artificial intelligence" was first coined by John McCarthy in 1956. It may be hard to believe, but AI is actually 63 years old! However, it was never broadly used until recently, due to the long "AI winter" that lasted for almost 40 years. This was caused by the fact that there was no digital data at the time that could power AI, make it learn and improve. The first machine translation project was completed in 1966, but it turned out to be an utter failure, much like many other AI projects. The AI concept did exist, but it was of little use.

Only after we got big data did AI bloom. However, it is still not as powerful as it can be. The AI that we have now is called "weak AI" or "narrow AI." All existing AIs are narrow. No matter what technology you take, AI is only focused on one narrow task, whether it is machine translation, speech recognition, flying planes or driving cars.

"Strong AI" (or "full AI," "general AI" and "deep AI") is still a sci-fi concept, but we are getting there. Strong AI will combine multiple AIs together and is said to be about as capable as human. It is as if Siri one day started understanding any instruction, including those given in a strong or unusual accent, but additionally and more importantly, she would be able to create her own music (based on your musical preferences), accurately forecast business trends and choose the best-fitting clothes for you online.

The third, and the most powerful version of AI, is called "super AI" (or ASI). It is something we can only speculate about. The definition is simple: whereas strong AI could

be as powerful as human intelligence, super AI would surpass all human intelligence, and its limits will be unknown and barely conceivable by a human mind.

This is exactly what Ray Kurzweil's technological singularity is about: recursive self-improvement of the strong AI that will result in the super AI being born. Machine intelligence will exceed human intelligence and go beyond our control.

Will this actually happen? No one knows. We do not even know if strong AI is possible, not to mention super AI. Will we reach singularity? Will AI reach superpower, meaning that machines will be smarter than humans? No one can tell. If you are curious, just wait until 2045 — there are only 26 years left, after all.

BRAIN Initiative: One possible scenario of the future

One of the subjects receiving broad interest now is mapping neural connections of the human brain. This technology is known as *connectome*. It used to belong exclusively to the medical domain, however, with the advent of artificial neural networks, the brain has become the foremost inspiration for the AI field and all the industries where AI is being used.

Applied to our industry, this technology resulted in a boost of neural machine translation (NMT). Quality of NMT is now substantially higher compared to previously used statistical and rule-based MT models. However, the current state of machine learning is only using one dimension of brain functioning, specifically multilayered neural networks performing transformations of sensory inputs, exactly as our brain does when it processes information through multiple stages of transformation and representation.

One of the examples is how we build visual images: all we see is actually a raw sensory input (photons of light), but our brain then does its complex, multi-layered work that consists in building bigger shapes out of smaller elements. Photons hitting the eye retina send a signal to the visual cortex that starts processing the new information. The brain first builds small dots, it then moves to building edges, then primitive shapes, then object parts and, finally, objects.

This whole process of moving from teeny-tiny photons up to gradually more complex visual shapes is mirrored in machine learning.

If we take image recognition (one of the focal points of AI research), this is exactly how artificial neural networks operate. According to the technical report "Learning Deep Architectures for AI" by Yoshua Bengio, they transform "the raw pixel representation into gradually more abstract representations, e.g., starting from the presence of edges, the detection of more complex but local shapes, up to the identification of abstract categories associated with sub-objects and objects which are parts of the image."

However, this is the only aspect of brain function that is used in machine learning. Overall, our brain is still a "black box" and our understanding of how it works is still very limited. Not for long, though.

On April 2, 2013, the Obama administration announced the BRAIN Initiative, aimed at full understanding of brain function. This is a medical initiative in the first place: its goal is mapping neural connectivity in the brain in order to treat "neurological and psychiatric disorders, such as Alzheimer's disease, Parkinson's disease, autism, epilepsy, schizophrenia, depression, and traumatic brain injury."

The timeline of the project established in 2014 is as follows:

- 2016-2020: technology development and validation

The movie Avatar *(2009) was the first digital 3D movie that was going to revolutionize the entertainment industry, which never happened.*

• 2020-2025: application of these technologies in an integrated fashion to make fundamental new discoveries about the brain

This means that if all the brain mysteries get unlocked, we will be able to extrapolate the laws of brain functioning to artificial neural networks, exactly as we did with the multlayer principle.

This will result in emergence of strong AI, which means that artificial intelligence will become much smarter and reach the point where it is as capable as the human brain. Applied to our industry, it will mean that the quality of machine translation output will be comparable to human translation quality. It will also mean other AI-powered technologies, such as automated simultaneous interpretation, will considerably improve and reach human levels of quality.

Which puts us only a step away from singularity.

Conclusions

This was only one of many possible scenarios. As mentioned earlier, no one knows how AI will develop.

Bill Gates named Ray Kurzweil "the best person I know at predicting the future of artificial intelligence." He is right: according to various sources, the accuracy score of Kurzweil's predictions vary from 50% to 89%. Does it mean singularity will happen for sure?

No, it does not. Due to the nature of technological progress that we are witnessing now, no one knows what will happen even in five years, not to mention ten or 25 years from now.

We can only speculate about the future. We can assume that artificial neural networks, machine learning and automation will develop further, but no one knows how far AI will go, what form it will take and what will be the next groundbreaking technology to change the world in the same fashion as internet, social media and big data did.

However, instead of being afraid of what the unknown future holds for us, we can assume an explorative and inquisitive approach. Isn't it exciting to see so many disruptive technologies going viral one after another, changing our world forever? Isn't it captivating to be witnessing the rapid growth in technological advancements that science fiction writers could only dream of a couple of decades ago? I think it is quite fascinating, no matter what the future brings, and we are all very lucky in this regard. [M]