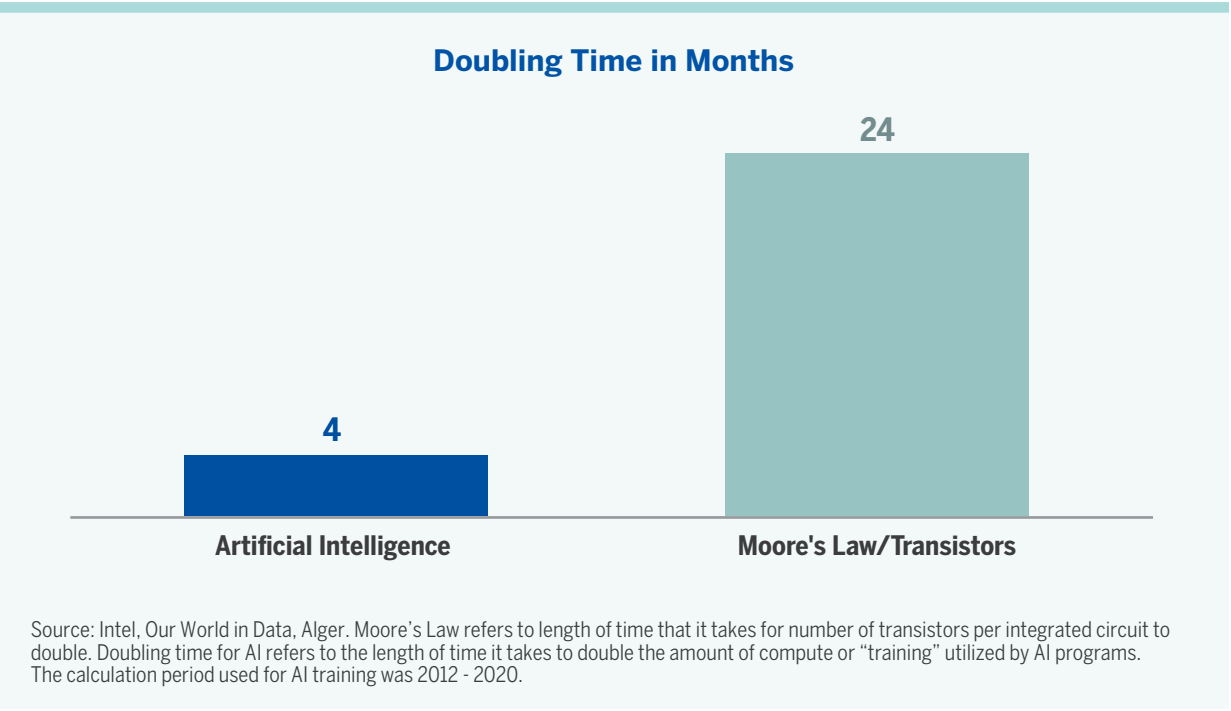
Beyond Moore's Law

The topic of Artificial Intelligence (AI) has been exploding in popularity since the November 2022 release of ChatGPT. This chatbot prototype developed by OpenAI is giving us a glimpse of how AI could revolutionize the way we live and work in the future. How does AI compare to other technological feats and how might this impact the global economy going forward?



Source: Intel, Our World in Data, Alger. Moore's Law refers to length of time that it takes for number of transistors per integrated circuit to double. Doubling time for AI refers to the length of time it takes to double the amount of compute or "training" utilized by AI programs. The calculation period used for AI training was 2012 - 2020.

- Moore's Law states that the speed and ability of computers doubles every two years as the number of transistors on a microchip increases. When Gordon Moore wrote his revolutionary paper in 1965, there were only 64 transistors on an integrated circuit. Nearly six decades later, Apple's M2 chip has approximately twenty billion transistors[1], generating productivity that we could not fathom in the early days of integrated circuits.
- While the pace of Moore's Law is impressive, this pales in comparison to the speed at which AI programs can "train" themselves (i.e., how much computation they can utilize) by doubling every four months, as indicated in the chart above. Over a ten-year period, this implies that AI training may grow by more than 100,000,000x faster than Moore's Law.
- In our view, the speed of AI innovation should continue to accelerate, with the potential to significantly change how we utilize software and improve our lives. We believe companies that are at the forefront of AI innovation, such as the major cloud platforms or leaders in the hardware that drives the cloud technology forward, may benefit as we enter the next frontier of technological advancement.

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OpenAI is an artificial intelligence research laboratory consisting of the for-profit corporation OpenAI LP and its parent company, the non-profit OpenAI Inc. The company conducts research in the field of AI with the stated goal of promoting and developing friendly AI in a way that benefits humanity as a whole.

The following positions represent firm wide assets under management as of November 30, 2022: Apple, Inc. 3.00%; Intel Corporation 0.00%; OpenAI 0.00%.

The chart calculation of AI's growth rates compares the training computation between Dropout (2012) and GPT-3 (2020), based on PetaFLOPS /day per second. PetaFLOPS is a unit of computing speed, equal to one quadrillion FLOPS (floating operations per second) and serves as a measure of computer performance. Dropout is a regularization technique for reducing overfitting in deep neural networks and was proposed by Hinton et al. in their paper "Dropout: A Simple Way to Prevent Neural Networks from Overfitting" in 2012. Generative Pre-trained Transformer 3 (GPT-3) is an autoregressive language model released in 2020 that uses deep learning to produce human-like text, developed by OpenAI. This calculation should be considered a rough estimate.

[1] Apple company data (June 6, 2022, press release).

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