Morgan Stanley
INVESTMENT MANAGEMENT

Counterpoint Global Insights

Machine Learning[1]

EDGE | APRIL 2017

WELCOME TO THE EDGE.
Morgan Stanley Investment Management's Counterpoint Global shares their proprietary views on a big idea that has the potential to trigger far-reaching consequences—ideas such as autonomous vehicles, artificial intelligence, robotics and bioengineering.

Counterpoint Global's long-term ownership mindset emphasizes perspective, insight and thinking across categories, while our investment process focuses on identifying unique companies with sustainable competitive advantages. Through The EDGE, we share our framework for thinking about change and our process for recognizing patterns that may drastically alter the investment landscape over the longer term.

This work complements our team's more traditional, fundamental research to create a framework for long-term investing that is grounded in intellectual curiosity and flexibility, perspective, self-awareness and partnership.

Machine learning is a way to train computer systems to generate useful insights from data sets and apply those insights to new situations. This has the potential to revolutionize many fields, such as medical diagnoses and driving, by excising human discretion and error from the process. Although iterations of this technology have been around since the 1950s, in recent years the explosion of collected data, combined with an increase in computing power, has increased the abilities of this disruptive technology.

Machine learning describes a process by which computer scientists feed large sets of curated data to a computer in order to train it to deal with new situations. The computer "learns" by discovering complex patterns and relationships between the inputs and outputs in the dataset on which it has been trained. The relationships discovered by the computer are then applied to new data, allowing the computer to make useful predictions based on that new data. ▶

[1] This was written by a human. ← So was this.

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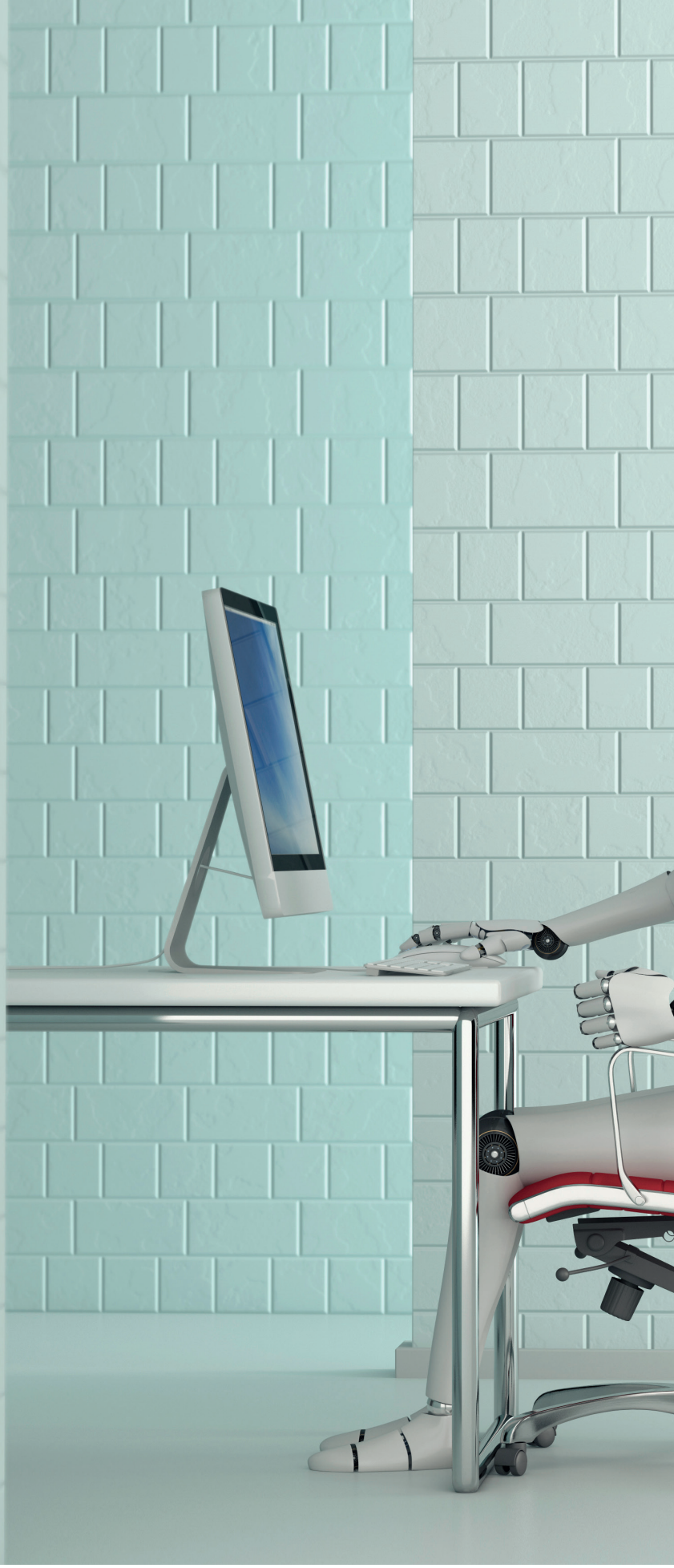

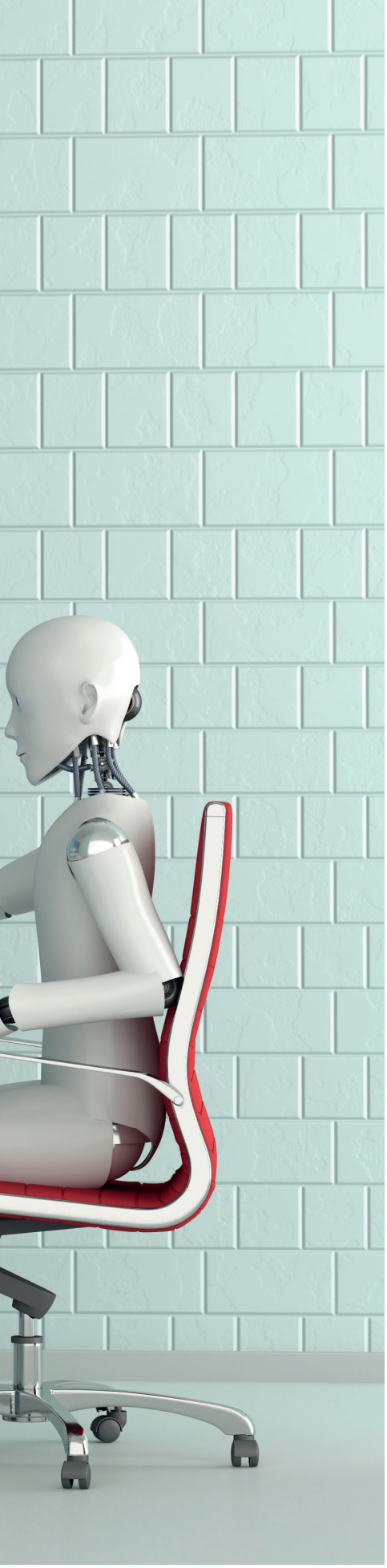

For instance, a computer that is given millions of labeled pictures of faces and then presented with a set of new photos that include both faces and non-faces could identify which pictures contain faces. The important difference versus traditional computing is that the computer is not programmed, but rather trained with data. This requires a large number of examples.

One popular method of machine learning uses neural networks. These networks consist of individual nodes ("neurons") that continually recalibrate themselves with each example so that the input data correlates with the correct output as it passes through the computer algorithm. What a neural network is trying to do is create the best set of "rules" to describe the data so that the computer can use those "rules" to make useful predictions in new, but related, situations. Often, the machine-learning process is a black box, where the exact method is not cognizable by humans and therefore requires significant testing to ensure that the system's predictions are accurate.

The opportunities here are immense—this form of artificial intelligence has the potential to breed new industries and create efficiencies in existing ones. One of the most studied applications of machine learning is in the medical field. Instead of training a computer to recognize patterns in faces or handwriting, medical researchers in conjunction with computer scientists are training computers to recognize patterns in medical images to detect illnesses like cancer. Preliminary research in this area makes a compelling case that algorithms are better than pathologists or radiologists at spotting cancer.

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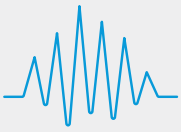
Autonomous vehicles are another dynamic field that relies on machine learning. The cause of most accidents on the road today—over 90 percent—is driver error. Machine learning promises to reduce traffic fatalities by removing human error from the equation. Developing an autonomous vehicle requires training it on data collected from billions of miles of driving. This data includes everything from images of the road, to GPS signals that give the position of the car, to the decisions drivers make. Once trained, an autonomous vehicle uses a suite of sensors to continuously gather data about its surroundings. Using that data and the insights gathered from its training, it then determines the best way to drive the car given the constraints of its environment.

To be sure, there are a number of technological, regulatory and social factors that could impede adoption. First, for a given application, there may not be enough data available to train the computer to ensure that it reaches accurate conclusions. For instance, a rare disease might not have enough cases to provide a computer with a sufficiently large sample set on which to train. Second, given the "black box" nature of the computer's decision-making, adequate testing to ensure the computer's insights are accurate could prove challenging—the more life-critical the application, the more testing



OTHER DISRUPTORS

Other themes the team is currently researching include

- Blockchain
- Virtual/Augmented Reality
- Autonomous Vehicles

it requires. If a language translation application makes an error, it isn't as problematic as if an autonomous car fails to recognize a stop sign. Third, regulators and legislators could look askance at disruptive technologies. Incumbent industries can seek new regulations and other protections that raise the costs of starting new businesses and protect incumbents from new entrants, especially in already regulated fields like medicine or transportation. Finally, humans may not trust machine learning solutions in certain areas of their lives. It may simply be a human prerogative that they would prefer being treated by a human doctor or trust their own judgement more than a computer's when it comes to driving.

As these technologies begin to be tested and adopted, however, these concerns will be ameliorated. One example is next generation online translation. Given the millions of examples of translations that could be used as training, Google switched to neural networks for its translation application in 2016. For other applications that could impact human safety, there is a more cautious and slower path to adoption. For instance, the technology to drive cars autonomously exists today, but it will take four to five more years of testing to ensure their safety before we could see cars without drivers on our roads. Medical applications could take as long, if not longer. Ultimately, lower accident rates and fewer missed diagnoses will be demanded by society if technologically possible. This does not mean that the road to algorithmic industries is a straight and smooth one, but rather that there is an underlying impetus for its existence.

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