CUBICASSET MANAGEMENT, LLC

2018 4th Quarter Stock Market Commentary

AI: HYPER-INTELLIGENCE OR JUST HYPE?

"Maybe if we start telling people the brain is an app they will start using it."
- Anonymous

You might think that the sentence "This conversation can serve no purpose anymore" refers to the Congressional debate at the Kavanaugh hearing, but it was actually uttered by Hal, the malevolent computer in Stanley Kubrick's visionary masterpiece *2001: A Space Odyssey.* In the movie, released in 1968, Kubrick foresaw advances in both robotics and artificial intelligence (AI). The movie follows a journey to Jupiter by two astronauts and three scientists (who are in suspended animation), to discover the origin of a strange black monolith discovered on the moon. The basic functions on the spaceship are controlled by Hal. When things mysteriously start to go wrong, the astronauts decide to shut down the computer. But Hal, discovering that his own existence is threatened, moves to eliminate them. After shutting down life support for the scientists, he murders one of the astronauts by severing his oxygen hose while he is outside the vehicle. The remaining astronaut, Bowman (played by Keir Dullea) goes outside to retrieve his colleague, but is locked out by Hal. His entreaties are met with the opening quote.

The movie, based upon a short story by Arthur C. Clarke, is one of the greatest movies ever made. It is remarkable in its prescience when you realize that it predates the invention of the personal computer by more than a decade. Artificial intelligence has come a long way since then, moving from a figment of the writer's imagination to a ubiquitous business tool.

The term artificial intelligence was first coined by John McCarthy of IBM in conjunction with a convention on the topic at Dartmouth University in 1956. The topic advanced in fits and starts, and first burst into the public eye in 1997 when IBM's chess playing computer Big Blue defeated world champion Gary Kasparov. For the first time, even skeptics had to take note.

But even more stunning was the victory of IBM's Watson computer in 2011 over *Jepoardy!* champions Ken Jennings and Brad Rutter. Jennings held the record for the longest winning streak in *Jepoardy!* history (74 weeks) while Rutter had won a record dollar amount ($4,355,102). Watson had to interpret answers in natural language, many of which involved plays on words, and state the question which led to those answers. This was a tour-de-force of computer programming.

The success of artificial intelligence in general, and Watson in particular, has led many technology-watchers to forecast a future in which most knowledge workers are made obsolete by computers, in the same way that industrial robots have reduced the need for factory workers. In

fact, several prominent Silicon Valley executives are urging the implementation of a universal basic income to deal with what they think will be widespread unemployment.

But if early results are any indication, it will be quite some time before we are all lying on the sofa eating bon-bons instead of driving to the office. Consider the first commercial application of IBM's Watson. After several years of development, in 2014 IBM announced Watson for Oncology, a tool developed in conjunction with oncologists at New York's Memorial Sloan Kettering to recommend the best cancer treatments to doctors around the world. According to internal IBM documents reviewed by the journal STAT, customers assert that Watson for Oncology produces frequently inaccurate recommendations that pose "serious questions about the process for building content and the underlying technology." These documents further demonstrate that IBM executives knew its product was making recommendations that conflicted with national treatment guidelines that physicians did not find useful. Comments by outside early adopters were much less restrained, and in many cases are unprintable.

Lately there has been considerable press about the possibility that artificial intelligence will ultimately obviate the need for portfolio managers and analysts. Computers have played a prominent role in the investment world for decades. They permit investors to sift quickly through data on thousands of companies to find those meeting specified criteria related to valuations, growth rates or trading patterns. But such uses are not artificial intelligence – they are static. The criteria are set out in advance, then used to filter the data base of securities. In order to understand whether AI will replace portfolio managers, or simply be one tool available to them, it would be helpful to understand how it works.

Imagine that you are walking down the street in a large city. All around you are sensory inputs – other pedestrians, drivers honking horns, the gentle breeze blowing on the back of your neck, the angle of the sun, and so on. Some of this data, such as the gentle breeze, do not usually evoke a response, because they are of little importance. Others, such as the sound of a car backfiring, might cause a startle response, since it could potentially be an explosion. Computers using AI are programmed to mimic this biological neural network. An AI system trying to predict the direction of Apple stock might sift through an enormous data base containing fundamental information about the company, such as earnings, growth rates, margins or cash flow generation. It might simultaneously analyze literally millions of pieces of economic and political data, such as unemployment rates in countries where Apple sells or manufactures, prices of rare earths used in chip making, trade wars with trading partners, or even the fact that sales of blue cars are rising sharply. Such facts are known as the input layer.

By considering whether historical changes in any of these variables were associated with changes in the stock market or the price of Apple during a particular period, the computer assigns a weight to each variable. Those which are below some threshold are ignored, while those that have more significance are passed along to the next layer. Eventually, the code produces a collection of variables it deems significant, with specific weightings indicating their presumed relative importance. This is the output layer.

The next step might be to re-examine these variables during a different period, modifying the assigned weightings based upon the additional data. And then do it again and again. In this way the computer "learns" to produce a better and better forecast.

This description points out one of the principal flaws inherent to AI. There are many variables which are highly correlated, but where there is no causality. For example, the divorce rate in Maine for the ten years 1999-2009 had a greater than 99% correlation with per capita consumption of margarine. During the same period per capita cheese consumption had a 95% correlation with the number of people who died by becoming tangled in their sheets at night. But it is hard to imagine that one of these variables affects the other. One well-known correlation is per capita ice cream consumption and the murder rate. In this case, it is likely that both are driven by high temperatures.

In the investment world, there are an almost endless number of variables which might affect stock prices. A computer could thus mine this data looking for correlations with stock price movement. To a computer, high correlation implies importance. An example is the nonsensical "Super Bowl Indicator." First introduced by a New York Times sportswriter, the indicator forecasts a rising stock market in any year in which the Super Bowl is won by a team from the original National Football Conference, and a declining market if an American Football Conference Team wins. At the time of its "discovery," this indicator had more than a 90% success rate. Not surprisingly, since there is no logic underlying the correlation, it has had a 50% success rate in the last decade.

In reality, most of the variables which strategists scrutinize have little or nothing to do with the value of any particular company, just like the Super Bowl winner has no predictive value for stock prices. Warren Buffett has famously stated that "forming macro opinions or listening to the macro or market predictions of others is a waste of time." A computer program is unlikely to be able to assess the qualitative factors like management integrity and intelligence at which investors like Warren Buffett have most excelled.

But the problems with AI as a money management tool run much deeper than identifying spurious correlations. The variables with the highest predictive value change from time to time. During the period of high inflation in the early 1980s investors used to eagerly await the release of the money supply figures M1 and M2 every Thursday afternoon. Rapid growth in those measures signified increased inflation in the future, prompting a steep selloff, while a drop was seen as good news. The market moves were so severe as to cause the Federal Reserve to change the time of release of the data until after the market's close. And yet, as important as that data seemed at the time, there is no one who uses it as a trading tool today. At other times the number of new unemployment claims, or the price of a barrel of oil assumed outsized importance, which quickly faded. Data mining is essentially backward looking, while investment managers try to peer into the future.

There is actually one ETF, called the AI Powered Equity, driven by IBM's Watson and run by San Francisco based EquiBot. It was launched October 18, 2017. In its first 2+ months of operation it trailed the Standard & Poor's 500 by 2%, 3.1% to 5.1%. This year it is trailing by another 2% at the time of this writing. Art Amador, one of EquiBot's founders, points out that the program beat the market when tested against historical data. But that is my point exactly. It is easy to fit past data, but not easy to have confidence that it will fit future data as well.

Many money managers, including many quants (short for "quantitative" investors) are quite skeptical that AI is anything more than a marketing gimmick. Ewan Kirk, founder of Cambridge, England based hedge fund Contab Capital, speaking of AI, said "Everyone wants the Holy Grail, something they can invest in and it will make 1% a month forever. I don't want to

be cynical, but I am skeptical." Robert Hillman, founder of Neuron Capital, also speaking of AI, mused "Will this be a paradigm change for investing? I don't think so … It's not a fundamental change, it's an efficiency improvement."

Robert D. Arnott is one of the most well-known American investors, as well as a financial writer and editor focusing on quantitative investing. Arnott says that when it comes to managing long-term equity portfolios, there are simply too many moving parts in financial markets for AI to get its mechanical head around, and too many humans with flaws, motivations and unpredictable behavior doing the moving. He says markets are far more complex than games like chess, backgammon and Go, that AI has mastered.

Consider, for example, the "January Effect" first discovered by investment banker Sidney Wachtel. This is the observation that stocks in general, and small cap stocks in particular, outperform in January. Support for this was based upon more than 70 years of trading data. The logic underlying it was that investors typically harvested tax losses in December, depressing stock prices, which then rebounded the next month. But as this effect gained adherents, investors began scooping up stocks in December in anticipation of a rally. Then they started buying in November to preempt the December buyers. Currently the January Effect is too weak to be investable.

Another trusty rule of thumb over the past several years was to invest in companies likely to beat earnings expectations prior to the release of their earnings reports. Such upside earnings surprises produced outsized gains. But as investors began flocking to buy the handful of stocks which consistently beat estimates, a funny thing happened. They no longer outperform. In the most recent quarter, companies beating estimates have declined an average of 5.5% from two days before the earnings release to two days after.

These last two examples illustrate the flaw in data mining. Anomalies are quickly discovered by many people almost simultaneously, and once discovered get acted upon in a way which causes them to disappear.

Isaac Newton was the greatest quant of his time, but was a notoriously bad investor. "I can calculate the motions of the heavenly bodies, but not the madness of people." Superior computational skills are not sufficient to make a great investor. For the foreseeable future, Warren Buffett has job security.