Executive Summary

Embracing ‘the Matrix’ and the Machine Intelligence Era

David Moschella

March 2016
In recent years, much of our research has stressed how the combination of the cloud, mobile, social/open communities and the overriding importance of the customer’s digital experience is forcing companies to become much more outside-in, as the centre of information technology innovation moves well outside the walls of the firm.

This report takes this thinking an important step further. What we have labelled ‘the Matrix’ is the synergistic combination of cloud computing and machine intelligence (MI). Taken together, these two rapidly improving capabilities will increasingly be able to perform just about everything that companies and individuals do, and many things that we cannot.

Of course, business leaders have already experienced the power of the cloud with its 24/7 availability, scalable performance, global operations and variable costs. But the merger of these capabilities with artificial/machine intelligence is not sufficiently appreciated. Indeed, there is nothing ‘artificial’ about what machines are doing today. Software, data and algorithms increasingly run the digital and physical worlds. And while human intelligence remains wondrous and deeply mysterious, it is not magic. One way or another, most of our talents can be mimicked by technology, at machine speeds and cost.

Today, we often don’t feel the extent of these changes because once a function can be done by computers – be it crunching numbers, Googling queries, playing chess, or identifying a song – it no longer seems like artificial intelligence (AI). But it is. We are already surrounded by, and dependent upon, software and algorithmic control in countless ways, and these changes have only just begun.

Our full report will help clients embrace these developments through detailed checklists of particular Matrix/MI capabilities. Our goal in this summary is to explain the enormous progress that is now being made, in a manner accessible to both technology professionals and business/IT leaders. The rollout of the Matrix is the biggest economic initiative of our time, and those firms and individuals that embrace these changes will enjoy exciting opportunities, while those who resist will increasingly fall behind.

New words emerge to describe new realities

Over the last year, we have been using the term ‘the Matrix’ to describe today’s emerging technology landscape, with a deliberate nod to the iconic 1997-2003 film trilogy. We decided to do this because new words can help us appreciate new realities, as shown in the figure below.
Consider that the term internet was originally a shortened alternative to internetworking – which described the ability to link private incompatible computer networks via gateways. In the late 1980s, Tim Berners-Lee took this concept a major step further by making it easy to link not just systems, but individual pages and documents, via a web of hypertext. More recently, the use of ‘the cloud’ caught on as a way to capture the fact that networked computers were no longer just connecting systems and pages; they were also an on-demand platform that could transform computing into a utility service. While the internet, the web and the cloud are now used interchangeably, in each case new terminology emerged to reflect a major new phase of digital innovation.

We believe that new words are needed once again. While the cloud suggests something ‘out there’, we are all now part of a vast and increasingly intelligent matrix of systems, software, data and algorithms. Whether the Matrix catches on as industry terminology or not, it captures the driving technology dynamic of our times: the extraordinary merger of machine intelligence and cloud economics, and all that this will entail. This potent combination will also be the theme of this year’s LEF Study Tour (24-30 September 2016), as well as a major ongoing LEF research focus.

**The cloud becomes a Matrix**

For decades, the dominant pattern of computer usage was for companies to build, secure and operate their own systems, applications and services. This approach started to change, first with outsourcing, and then with the dramatic growth of the public internet in the 1990s, and it has been gaining momentum ever since. The growing importance of external IT services and cloud infrastructure has required technology professionals to increasingly think outside-in.

For much of this time, Enterprise IT organizations saw these developments primarily from a sourcing perspective. Should their firm use virtual servers, public networks, SaaS, hosted messaging, open source software and so on? In these areas, companies could often make direct cost/service comparisons because the gap between what firms could buy and what they could do for themselves was relatively narrow. Tech-savvy organizations felt that they had a reasonably firm grip on the technologies most important to their operations, and could make sound decisions in these areas.

But as summarized in the figure and as we detail in the full report, Matrix capabilities are expanding on more than 100 fronts, not just in traditional areas such as infrastructure, SaaS and eCommerce, but in social communications, open innovation, smart products, quantified self, machine intelligence, new business models and advanced cyber security, and in most of these newer areas there is no internal company equivalent. Additionally, the upper half of the figure is where the business impact will be greatest, and in these areas companies must not just leverage the Matrix, but must also help build it out in areas such as APIs, open data, electronic health records, smart grids, the blockchain and more.

‘The Matrix’ is re-defining how firms operate and innovate
Consumerization and the cloud are driving MI progress

For many years, AI researchers focused on developing general-purpose learning systems. But because progress in areas such as robotics, neural networks and natural language processing was slow, the field shifted to using specialized data sets to build AI systems for specific purposes — facial recognition, language translation, emotion analytics, and so on. What is especially exciting today is that both approaches are now making rapid progress. Google’s 2014 acquisition of the British firm DeepMind — which develops systems that can teach themselves from scratch to master fixed-rule games from Pong to Go — is the poster child of the rejuvenated general-purpose MI approach (and indeed DeepMind’s AlphaGo programme has just won four out of five games against a world champion Go player).

It is important to realize that MI capabilities can often be turned into global cloud services at effectively zero marginal cost — as in the music recognition app Shazam. This is why the AI/MI field must be seen in a Matrix/cloud context. It’s the combination of advanced software, rich data sets, cloud economics and ever-improving algorithms that makes the potential of the coming era so great. Consider the way language translation is now bundled into Skype at no additional charge, or the way ‘cloud robotics’ will enable the machines of the future to have access to just about everything Google knows, at little to no additional cost.

In line with the overall consumerization of IT, many MI advances are emerging in mass markets first. Machine intelligence leadership often depends upon having access to the largest and most relevant data sets, and consumer markets are increasingly where the best data resides. For example, Facebook may prove to be better at facial recognition than even the most advanced government agencies because it has the faces. Consumerization is a major reason why MI is now progressing so rapidly.

Because each MI capability has great value on its own, there is now a powerful MI business model. This has resulted in an explosion in specialized MI firms, in addition to giants such as Google, Apple, IBM, Facebook, Amazon and Microsoft who are engaged in multiple MI areas. For example, most insiders think that Microsoft got a bargain when it paid $250 million for the UK firm SwiftKey and its predictive keystroke technology. A new MI/AI gold rush is clearly under way.

The major forms of MI

In our research, we have identified more than 50 forms of intelligence, and this list could easily be expanded. Humans have evolved to do a great many things because each of these things has been useful to our species, and it is our view that virtually all of these same capabilities will prove useful when done by machines. While some MI capabilities will mature earlier than others, it would be unwise to bet against any of them over the longer term, as data, processing power and algorithms all improve. The bottom line is that machine intelligence is now matching or exceeding human capability across an astonishing range of activities, including those shown below.
As in any complex field, a system of classification can help us see, understand and track the overall environment. A simple such system is shown in the figure above; it provides a high-level check point for our clients, who can use these groupings to think about which broad areas (and which of the underlying items) are likely to be most important to their firm.

A few of these items might need additional explanation. For example, while readers might initially wonder if machines can really taste or smell, they might more easily accept that machines will become quite good at identifying the molecules in the surrounding air and their likely affects, or testing various foods or liquids to see if they are safe for human consumption. Similarly, there is growing interest in algorithmic accountability — the ability of systems to be able to articulate and even visually portray how their conclusions have been reached. WatsonPaths is a good example.

The figure also depicts the different nature of human and machine intelligence. At the risk of over-simplification, humans have proved to be effective learners, but our individual intelligences are seen as relatively fixed and tending to follow a bell curve distribution. In contrast, machines have historically been pretty poor learners, but their inherent capacity for intelligence improves exponentially, as per Moore’s Law. The key question is when machine learning will reach its tipping point. It seems that we are close to this time, hence the rising societal concerns regarding job losses, inequality, and even human obsolescence voiced by Stephen Hawking, Elon Musk, Bill Gates and many others.

All of us are part of the Matrix

One of the reasons we expect that the term ‘the cloud’ will start to feel increasingly archaic is that its underlying metaphor implies a technology environment that is floating in the sky, and thus not directly connected to people down on earth.

But the reality is we are the most important part of the Matrix. Our purchases, browsing histories, locations, credit scores, contacts, followers, biometrics, reputations, software agent and other digital interactions are essential to the powerful machine intelligence capabilities now being developed. Personal data and usage accounts for 18 of our 100 Matrix items, and these are arguably the greatest sources of its value.

Taken together, the items above suggest the true meaning of the term quantified self (QS). While this concept stems from the health and fitness industries (calories consumed/burned, heart/blood pressure measurements, etc.), we should think about personal information more broadly. Aggregated individual data provides an unprecedented picture of who we really are, and has a vast range of potential applications. The Matrix will understand us better than any one company — perhaps better than we know ourselves.

Of course, this level of personal data inevitably raises concerns about privacy, misuse and potentially coercive social control. Many of us already feel the need to curate, promote and maintain our LinkedIn, Twitter, Facebook, Amazon, Uber, Open Table, Klout and other digital reputations, just as we have managed our credit scores in the past. For better or worse, the virtual world is pushing us to become our own digital PR agents, and some of us will push back. Similarly, there may well be limits to our willingness to fully trust autonomous machines and algorithmic control in areas such as flying planes, driving cars, performing surgery, military operations, and more. Much remains to be seen.

But similar ‘Big Brother’ fears have come with every stage of IT industry progress, and have generally not proved to be insurmountable barriers. Thus, although there will be heated public policy debates about areas such as the right to forget, trans-border data flows, personalized marketing and machine accountability, history says that these problems will prove manageable, and customers will accept the overall cost/benefit equations. Thus, at least for the foreseeable future, companies must assume that the overall QS and algorithmic movements will press ahead.
Questions for your firm

An entire digital universe is evolving outside the walls of your organization. While there may be areas where you can shape the Matrix to your advantage, you can never control it. The Matrix plays by its own rules and you must adapt to them; this requires a strong tech-savvy and outside-in culture that will increasingly resemble that of the Matrix firms themselves.

How should your firm begin? Companies need a clear sense of which Matrix developments are of most importance, how they stack up against their competitors, and who in their firm is leading these areas. Every industry has its own set of important matrix/MI players and capabilities. We recommend that clients use the detailed spreadsheets provided in the full report to frame these discussions. The questions below provide a high-level management starting point:

1. How will the Matrix and MI change the way we operate and innovate?
2. Which Matrix/MI capabilities are most important to our firm, now and in the future?
3. How well do we track emerging Matrix/MI capabilities and challenges?
4. Are there areas where we should be helping to build out the Matrix?
5. How well do we stack up against our competitors in these areas?
6. Do we make a distinction between disruptive and sustaining Matrix/MI innovations?
7. Who in our firm is most responsible for Matrix/MI-related strategies/leadership?

If the answers to these questions are generally positive, congratulations. But from our experience, most firms do not think systematically about technology change in this way. Once your firm has identified which areas are most important, we recommend using our value chain mapping framework to examine each area more closely and better anticipate likely market developments. Mapping the Matrix for your firm can be a valuable and eye-opening exercise. While the future can never be fully predicted, there is much that can be anticipated.

Finally, we recommend that you try to formally articulate and reach consensus on the questions above. Otherwise, digital cohesion can be easily lost. The LEF is always available to help clients develop these strategy narratives, which can assure that your organization tells a compelling digital story.

In short, while the future will always remain unpredictable even with the smartest of machines, there are clearly a great many digital adventures ahead, and we encourage clients to embrace the MI path. As Morpheus famously challenged Neo early in the first Matrix film:

‘There is no turning back. You take the blue pill – the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill – you stay in Wonderland and I show you how deep the rabbit-hole goes.’
Worldwide CSC Headquarters

The Americas
3170 Fairview Park Drive
Falls Church, VA, 22042
United States
+1 703.876.1000

Asia
20 Anson Road #11-01
Twenty Anson
Singapore 079912
Republic of Singapore
+65.6221.9095

Australia
Level 6/Tower B
26 Talavera Road
Macquarie Park, NSW 2113
Sydney, Australia
+61(0)2.9034.3000

Europe, Middle East and Africa
One Pancras Square
London
N1C 4AG
United Kingdom
+44(0)203.696.3000

Leading Edge Forum

Asia Pacific and Australia
Level 3/380 Docklands Drive
Docklands, VIC 3008
Australia
+61(0).3.8695.1111

Belgium, Luxembourg and The Netherlands
Orteliuslaan 1004
3528 BD Utrecht
The Netherlands
+31.30.6574.574

France
Immeuble Le Balzac
10 place des Vosges, 92072
Paris La Défense Cedex
France
+331.55.70.52.80

Germany, Austria
and Switzerland
Römerstrasse 11
D-82049 Pullach
Germany
+49(0).89.793.00.79

United Kingdom, Ireland,
Iberia, Italy, The Nordic
Region and South Africa
One Pancras Square
London
N1C 4AG
United Kingdom
+44(0).203.696.3000

United States and Canada
3170 Fairview Park Drive
Falls Church, VA, 22042
United States
+1 703.608.9489

About CSC
The mission of CSC is to be a global leader in providing
technology-enabled business solutions and services.

With the broadest range of capabilities, CSC offers clients
the solutions they need to manage complexity, focus on core
businesses, collaborate with partners and clients, and
improve operations.

CSC makes a special point of understanding its clients and
provides experts with real-world experience to work with them.
CSC leads with an informed point of view while still offering
client choice.

For more than 50 years, clients in industries and governments
worldwide have trusted CSC with their business process and
information systems outsourcing, systems integration and
consulting needs.

The company trades on the New York Stock Exchange under
the symbol “CSC”.

About the Leading Edge Forum
The Leading Edge Forum (LEF) is a global research and
thought-leadership community dedicated to helping large
organizations identify and adopt Next Practices at the growing
intersection between business and information technology. We
believe that as business and IT become inseparable, virtually every
aspect of work and the modern firm will need to be re-imagined,
and this creates exciting new digital opportunities.

Through an annual membership programme of research,
events, onsite workshops and advisory services, we support
Chief Information Officers and other senior digital business
leaders in areas such as strategy, organizational change, executive
education, staff development and the future of the Central IT
function. Members enjoy personalized access to our global
network of thought leaders, clients and leading practitioners.

The Leading Edge Forum is part of CSC. For more information,
please visit leadingedgeforum.com.

© 2016 CSC. Printed in the U.K. 03/16. All rights reserved.