Chapter 5 - Basics

The personal side of ICT - What's in ICT for me?

Productivity

Has technology made us more productive? http://blogs.gartner.com/andrew_white/2016/08/10/are-we-more-productive/

The Productivity Paradox: https://en.wikipedia.org/wiki/Productivity_paradox

Measuring Productivity: Canada vs. USA: http://www.statcan.gc.ca/pub/15-206-x/15-206-x2014038-eng.htm

Social Media (SM)

Here's a great quote form a book on machine learning (which we disucss below in the context of algorithms). It introduces nicely the topic of Socla Media.

> "A few thousands of years ago, you needed to be a god or goddess if you wanted to be painted, be sculpted, or have your story remembered and told. A thousand years ago you needed to be a king or queen, and a few centuries ago you needed to be a rich merchant, or in the household of one. Now anybody, even a soup can, can be painted. A similar democratization has also taken place in computing and data. Once only large organizations and businesses had tasks worthy of a computer and hence only they had data; starting with the personal computer, people and even objects became generators of data.
>
> "A recent source of data is social media, where our social interactions have become digital; these now constitute another type of data that can be collected, stored, and analyzed. Social media replaces discussions in the agora, piazza, market, coffeehouse, and pub, or at the gathering by the spring, the well, and the water cooler.
>
> "With social media, each of us is now a celebrity whose life is worth following, and we are our own paparazzi. We are no longer allotted only fifteen minutes of fame, but every time we are online we are famous. The social media allows us to write our digital autobiography as we are living it. In the old times, books and newspapers were expensive and hence scarce; we could keep track of and tell the story of only important lives. Now data is cheap and we are all kings and queens of our little online fiefdoms. A baby born to gadget-loving parents today can generate more data in her first month than it took for Homer to narrate the complete adventures of Odysseus."

Source: Alpaydin, Ethem. Machine Learning: The New AI (The MIT Press Essential Knowledge series). The MIT Press.

Given that we (you and I but likely much more you than I) spend a lot (see below) of time on social media, maybe it's high time we took a look at how much return we're getting on it.

Let's start by quantifying, by example, what I mean by the term *social media*. According to ebizmedia.com, the top 15 most popular social media sites in October 2016 were:

1. Facebook (by far!)
2. YouTube
3. Twitter
4. LinkedIn
5. Pinterest
6. Google+
7. Tumblr
8. Instagram
9. reddit
10. VK
11. Flickr
12. Vine
13. meetup
14. ask.fm
15. ClassMates

And not a Snapchat among them. Interesting eh? Interested in a different view on Snapchat?

But here is a slightly different list, from Wikipedia but equally current, with some important differences:

1. Facebook 1,712,000,000 users.
2. WhatsApp 1,000,000,000 users.
3. Facebook Messenger: 1,000,000,000 users.
4. QQ: 899,000,000 users.
5. WeChat: 806,000,000 users.
6. QZone: 652,000,000 users.
7. Tumblr: 555,000,000 users.
8. Instagram: 500,000,000 users.
9. Twitter: 313,000,000 users.
10. Baidu Tieba: 300,000,000 users.
11. Skype: 300,000,000 users.
12. Sina Weibo: 282,000,000 users.
13. Viber: 249,000,000 users.
14. Line: 218,000,000 users.
15. Snapchat: 200,000,000 users."

Source

The differences between the lists underlines the difficulty in nailing down exactly what SM is and where SM is measured. With the folding of the SM site Vine this week, the field is changing.

While it may be changing, it is also enormous. Take a look at the range of SM sites and services available:

Figure DDSF. Social Media landscape

Source

Now let's look at some statistics on SM usage. Despite some really glaring thinko/typo errors in this infographic, it has an interesting story to tell.

Figure JDRB. Social Media Usage

Source

Now some more recent (2016) statistics from :

And this from growingsocialmedia.com:

FindTheCompany | Graphiq

Why do people use SM? Here is an interesting article: http://www.onepoll.com/10-reasons-people-use-social-media/

Despite the fact that the survey link is broken, this is an interesting place to start:

"A recent study [link broken] by Whiting and Williams interviewed a range of social media users and explored what keeps them coming back to social networks. [They found that people use SM for the following reasons (I assume not in any particular order.) I have added some editorial comment following each reason, to which we will later refer.]

Social interaction – social media, not surprisingly, allows people to be social. They meet new people and keep in touch with friends, acquaintances and family. [People are social animals - we need social interaction or at least *most* of us do - in order to validate our existence. SM provides such contact, albeit not very *rich* contact. Physical touch is essential.]

Information seeking – this refers to the process of finding information about products/services, keeping up to date with real-world social events, and learning new things. [Humans are innately curious about our surroundings. We have survived through the millennia by being constantly aware of what is in our surroundings and what is friend and what is foe.]

Passing time – social media is a great time killer and can cure boredom whether at home, at school, or in the work place. [See later stats about just how much of our online time at work is actually work!]

Entertainment – games, music and videos are all accessed through social media. Watching the stream of updates from people is also a form of entertainment – whether intentionally humorous or not. [We all need a break from time to time. essentially the same as Passing time (above) and Relaxation (below).]

Relaxation – whilst people find others updates humorous, they also find them relaxing. Social media is a way to alleviate stress and escape from reality. [I'm not so sure this is any different from Entertainment...]

Expression of opinions – expressing thoughts and opinions, criticizing others and blowing off steam (either anonymously or named) is

regularly undertaken through social media. [But trolling is a nasty business.]

Things to talk about – like the daily newspaper, social media provide subject matter for people to talk and gossip about with others. [This is information seeking so doesn't merit a separate category.]

Convenience – social media is readily accessible, even more so as mobile devices become ubiquitous. Furthermore, people can talk to several people at the same time. [Convenience is not a human need as far as I understand. We like to be efficient, sometimes... The second part about multi-channel is valid but this is simply Sharing information (below) and Social interaction (above).]

Sharing information – people can use social media to broadcast things about themselves. By publishing updates, videos and pictures, people market their own personal brand or business. [The marketing part I agree with, but the broadcasting is too similar to expressing of opinions to warrant specific mention here.]

Knowing about others – social media allows a window into the lives of others. By checking out other profiles, they can be nosey or 'keep up with the Jones''. [Way too similar to Information seeking and Social interaction.]"

Here is a technical definition of social media from our friends at Wikipedia (accessed October 29, 2016) from the usage statistics entry cited above:

"Social media are computer-mediated technologies that allow individuals, companies, NGOs, governments, and other organizations to view, create and share information, ideas, career interests, and other forms of expression via virtual communities and networks. The variety of stand-alone and built-in social media services currently available introduces challenges of definition; however, there are some common features:

- social media are interactive Web 2.0 Internet-based applications
- user-generated content such as text posts or comments, digital photos or videos, as well as data generated through all online interactions, are the lifeblood of the social media organism
- users create service-specific profiles for the website or app, that are designed and maintained by the social media organization and
- social media facilitate the development of online social networks by connecting a user's profile with those of other individuals and/or groups."

They add further that:

"Social media use web-based and mobile technologies on smartphones and tablet computers to create highly interactive platforms through which individuals, communities and organizations can share, co-create, discuss, and modify user-generated content or pre-made content posted online. They introduce substantial and pervasive changes to communication between businesses, organizations, communities, and individuals. Social media changes the way individuals and large organizations communicate. These changes are the focus of the emerging field of technoself studies.

"Social media differ from paper-based or traditional electronic media such as TV broadcasting in many ways, including quality, reach, frequency, usability, immediacy, and permanence. Social media operate in a dialogic transmission system (many sources to many receivers). This is in contrast to traditional media that operates under a monologic transmission model (one source to many receivers), such as a paper newspaper which is delivered to many subscribers. Some of the most popular social media websites are Facebook (and its associated Facebook Messenger), WhatsApp, Tumblr, Instagram, Twitter, Baidu Tieba, Pinterest, LinkedIn, Gab, Google+, YouTube, Viber and Snapchat. These social media websites have more than 100,000,000 registered users."

So let's boil that down to what I think are the main reasons people use SM. Here's my list:

1. Social interaction
2. Data seeking and sharing
3. Diversion (entertainment, passing time and relaxation)
4. Marketing one's personal brand
5. And one that's *not* included above: creating *meaning* from our experiences

Looking first at #5 above, we have an interesting challenge. People will create meaning from their experiences whether they use social media or not, SM simply being one way to do that. But what do I mean when I write "create meaning"? Meaning is interpretation. Meaning involves perception and context. Humans are unlike all other creatures (we humans believe) because we alone are searching for answers to the big question of life: "Why?" We have created all kinds of explanations for things down through the ages. Science is but another tool for creating order and meaning in and among natural phenomena. And social media can assist. In order to create meaning, all we need is agreement on interpretation. Something happens (lightening strikes the earth) and someone creates an interpretation of it (the gods are unhappy with us for driving Volkswagens!). Interpretation is important to humans because we seek to understand cause and effect. We get a *Dopamine rush* when we search for meaning and an *opioid hit* when we find it. This *community of understanding* is vital to us. And SM allows us to create such communities and to come to shared understandings of the contextual soup in which we live.

Considering the first four above, there's nothing *particularly special* about social media as opposed to other forms of human interaction. We use SM in much the same way we have used newspapers, libraries, movie theatres, radio and TV in the past. But what *is* different is the ability SM gives us to reach out to a wide audience, and to receive from a wide variety of sources, both in real time. This *marketing of personal brand* is unprecedented in history. We do need to ask though, with everyone doing personal marketing on such a grand scale, is there enough time to listen?

In this regard, I'm reminded of research by British Anthropologist Robin Dunbar, discussed by Malcolm Gladwell in his iconic year 2000 book *The Tipping Point: How Little Things Can Make a Big Difference* (Back Bay Books, pp: 177-181, 185-86). Gladwell reports on Dunbar's findings that, all through history, humans have kept their optimal social group size surprisingly constant at around 150. Dunbar's research demonstrates that it is the size of the human neocortex (a region of the brain) that dictates the maximum number of *relationships* both direct and between the others in the group. This 150 figure is remarkably consistent across all manner of social groups (including military) over recorded history. Our little brain just can't handle any more complexity than that. The social fabric begins to unravel when numbers in a group get too far beyond this optimal level.

Interested in neocortex? https://en.wikipedia.org/wiki/Neocortex

Interested in Dunbar's Number? https://en.wikipedia.org/wiki/Dunbar%27s_number

So we need to ask. Are we expanding our network by using SM or are we simply spreading ourselves thinner? Or maybe we are expanding our network but at the expense of the quality of our closest relationships? The *social platform* we use (Facebook, Twitter, Instagram, etc.) keeps track of much of what we would otherwise need to process in our little brains. It allows us to scroll back through our timeline to see what was happening and what we and others were thinking and talking about last week or last month or last year. We are freed from having to keep all that detail in our own memory - the cloud does it for us. Perhaps this allows us to artificially extend our network beyond the 150 mark?

There is also some greater potential collective good that can come of social media use. Have a read:

> "Or consider the Arab Spring of 2011, and the anniversary of the revolution in Egypt this year. The question has repeatedly been posed as to whether the Internet, specifically social media platforms like Facebook and Twitter, had caused the revolution. Two kinds of answers typically follow. First, the qualified yes: these technological media were necessary but not sufficient, they provided new capacities for organization that previous revolutions did not possess. Second, the concerted no: the technologies are important, but the necessary and sufficient cause of the revolution was "the people." No one (except Biz Stone and Mark Zuckerberg) believes that these tools actually cause revolutions.

> "Both answers miss the mark, but they nonetheless point to one of those well-worn paths of argument. On the one hand there are technologies that create new relationships, new capacities, or re-arrange existing relationships of knowledge and power. On the other hand, there are the reassuringly familiar collectivities—like "the people" or "the public" or "the community." Sometimes information technologies are invoked as a threat to older forms of collective life; other times, especially in response to inflated claims about the power of those technologies, they are seen as irrelevant to the power of known collectives. Do information technologies connect existing collectivities or do they generate the conditions of possibility for new collectivities—maybe even new kinds of collectivity?"

Interested?

But let me share something with you. I have as of October 25, 2016, 1,592 connections in my LinkedIn network. And I ask myself "Why?" I spend some part of nearly every day simply maintaining that network, saying "Congrats on the new job!" or approving (or more likely rejecting) new requests for inclusion in my *exclusive network* of 1,600 close associates (#sarcasm). I recently approved a request from an HR Project Coordinator at the Royal College of Physicians and Surgeons of Canada. And I don't know why. I took the time to examine her profile and to check our common connections and then said yes to her request. But I'm not sure what it gives me at this point in my career. I'm not going to change jobs and we have little or nothing in common (except my background in Epidemiology I suppose) that would lead to a synergistic relationship. So what kind of collective or community is this LinkedIn thing of mine? And what kid of community created the Arab Spring? And what kind of community comes together around a public tragedy such as a shooting or a hurricane or an earthquake? Are such communities artificial in comparison to those crowds that assemble physically and have a palpable presence and can cause the ground to shake. Is the community formed by those watching a Blue Jays game on TV different from the crowd that assembles on the lakeshore in Toronto when the Jays play the Rogers Centre? Certainly they are different, but in what ways? One is virtual and one is physical and that distinction frames the disctinction between them.

This distinction defines the hit we take on the quality of our *physical* interactions. We maintain these artificially-outsized networks in an increasingly insular way. How many times have you seen a scene such as below? People not interacting on a personal level, even given the opportunity, because they are occupied with their device, either answering some sort of correspondence, updating their status or snapping a selfie for *posterity*. I'm willing to wager that upwards of 95% of all photos taken today are *never looked at again*. Ever. And we missed the moment by trying to preserve it. Next time you watch an Olympic opening ceremony on TV (unless you are lucky enough to actually *be there*), note how many are watching it through their smartphone or other tech device. We need to return to *being there*. Just saying.

Image SECC. People in the moment?

Social Media ROI

Are we getting value from our use of Social Media? There's no reason not to use the same metrics that firms use to measure their ROI on their efforts to get their message out there. Let's use some standard tools and see what your personal ROI on social media is.

Step 1: I will define social media as *any technology tool that allows the sending and/ or receipt of messages to and/or from one or more members of your relevant social network of family and either existing or potential friends, contacts, employers, lovers or haters.* (A long list of SM appears above in this Chapter).

Step 2: A simple definition of *ROI* as:

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ROI = (return - investment) / investment
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Step 3: Define *investment*. For personal users of social media, those who aren't *selling something* in the commercial sense, the investment we make in social media can only be measured in *time*. How many minutes we spend in a defined time period engaging in social media activities. Those minutes are your investment. Your resource spend. Let's quantify this arbitrarily. Some fairly specific data suggest that young people (18-34) spend 3.8 hours a day on social media, and some quick calculations yield that females spend 32% more time on SM than do males. This is in part due to their higher propensity to actually *use* SM, but also due to their increased time spend when on. So not only do females participate more often than males, but they also spend more time per person than males. Ladies? What's up with that?

More on gender: http://www.pewresearch.org/fact-tank/2013/09/12/its-a-womans-social-media-world/

Interested in up-to-date stats on social media use by gender?:

Figure NAFL: Social media use by platform and gender, 2015

Step 4 - Define *return*. What does it mean in terms of your personal efforts? What do you want/expect to achieve by spending time on social media? What's a return on using Facebook, for example? What's the return on a tweet? For marketing or sales firms, those answers are a little easier (though not much) to nail down. A new *follower*? A re-tweet? A product brochure download? A sale? Some of these are more concrete than others, but there's a progression, culminating in the ultimate for a business: revenue. But for you or I, personally, what kind of meaningful return can we measure?

I don't have an answer. I get nothing back from LinkedIn that is of any value to me personally or professionally. I don't participate in Facebook anymore (I did at the very beginning but it became just overwhelming, maintaining my network and keeping up - there was no value). I stopped years ago, long before my own mother got an account. At 93, she's on Facebook. That's a great reason for me *not* to be. When your mother wants to friend you, it's time to bail. I use Twitter sparingly. I got in early on Snapchat, but, as you might imagine, I don't get much use from it. I don't have an Instagram account, though one of my dear friends spends part of the little time we can manage to spend together at a quarterly lunch in maintaining his pictorial account of the exotic vacations upon which he and his wife go. I sometime say "Hey! I'm talking to you!" It doesn't phase him.

Thus we need also to determine what our goals are for using SM. What do you expect to achieve? http://www.socialmediaexaminer.com/measure-social-media-roi/

Hootsuite has this to say about measuring the value of a social media programme for business:

> "Measuring your social media ROI is important for countless reasons, including, but not limited to:
>
> 1. Proving the value of social media to your organization's overall goals and business objectives
> 2. Allowing you to clearly see where efforts and resources are being used efficiently
> 3. Enabling you to evaluate where resources are being wasted, or not used as efficiently as possible
> 4. Allowing you to recognize gaps in strategy, key messages, and content
> 5. Showing where your social media budget is being used most effectively, and showing areas where it can be pulled back"

Let's look at these from a personal perspective.

1. How would you, personally, go about the task of proving the value of social media to your overall objectives? And what are your overall objectives for using SM? FOMO (Fear of Missing Out)? Meeting people? Having quality relationships? Getting a job or a promotion? Staying in touch? Relaxation? Make a list. Which goals can you quantify? Can you measure relaxation? Does playing a fast-paced action game count

as relaxation, entertainment or diversion? So make your list and then attach some kind of value to each one. But what value? I'll leave that to you.

2. Can you easily see which resources (time) are being spent effectively? Which SM interaction using which platform is contributing to your efficient and effective achievement of a goal?
3. The mirror image of #2. Where are you wasting time (your only input resource)? How do you know when it's time to cut and run?
4. Can you identify where you are missing your targets and how will you get back on track?
5. Can you metricise your inputs and outputs and calculate an ROI?

In unsolicited response to #5 above, I'm going to say no. You can't. There's no clean and defensible way to calculate the ROI from social media use. Yet we use it. We spend countless hours at it. I did a quick estimate using Life Tables (sometimes called mortality tables) for Ontario males and females, and came to some startling conclusions. Using the most conservative estimates (about 3 hours/day for those aged between 0 and 18) and 2 hours/day thereafter, I calculate that you will have spent 228 *full 24-hour days* on social media by your 18th birthday. Furthermore, you will have spent 743 (more than *two full years at current rates) by the time you complete your 35th year on this rock of ours. If you live to the ripe old age of 65, you will have spent nearly 2,200 full, 24-hour days on social media (if anything remotely similar still exists in that faraway future).

Just think about it. Exactly what kind of return on that time would be worth it? How will you get back the value of more than two full years of your life by age 36? It's mind-boggling. All the more since it is the platforms that are being enriched in tangible assets (real dollars) from your participation. We are left to imagine and *artificially create* (call it rationalise) the value we derive from our participation.

Returning to the Wikipedia article quoted above, here are some final thoughts on social media.

> "Observers have noted a range of positive and negative impacts from social media use. Social media can help to improve individuals' sense of connectedness with real and/or online communities and social media can be an effective communications (or marketing) tool for corporations, entrepreneurs, nonprofit organizations, including advocacy groups and political parties and governments. At the same time, concerns have been raised about possible links between heavy social media use and depression and even the issues of cyberbullying, online harassment and "trolling". According to Nielsen, Internet users continue to spend more time with social media sites than any other type of site. At the same time, the total time spent on social media in the U.S. across PC and mobile devices increased by 99 percent to 121 billion minutes in July 2012 compared to 66 billion minutes in July 2011."

Imagine what the numbers are today.

Interested in the positive effects of SM?

Interested in the negative effects of SM?

You can see the complete life table that I used to derive these figures for males, Ontario, 2009-2011 here. Same for females here.

Finally, perhaps you might be interested in which Canadian city has the happiest Tweets? (spoiler alert - it's Ottawa!)

Time for some XKCD.

XKCD Source

Life Logging and the Quantified Self (TK) https://en.wikipedia.org/wiki/Lifelog also: http://mashable.com/2014/03/20/lifelogging-experiment/ also: http://www.computerworld.com/article/2499169/enterprise-applications/is-the--quantified-self--movement-just-a-fad-.html and for the negative, see: http://www.computerworld.com/article/3048497/personal-technology/lifelogging-is-dead-for-now.html

Listen to the first 2.00 minutes of this podcast. on big data, security and privacy.

Algorithms go here? Marketing algorithms also?

Algorithms

If you are in BUSI 2400, you will have already (or will soon) be learning the fundamentals of programming. You may already be an accomplished coder and, if so, you know a good algorithm when you see one. For those new to the field, let's define what we mean. A simple Google search of the term yields the following: "A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer." So algorithms are technology, broadly defined. They are a set of rules or procedures, collected together and tested and which produce a quantifiable and expected result.

Thus when Twitter reports what's *Trending*, they are reporting the results obtained by applying an algorithm to their tweet data. When I think of what's trending on Twitter, I think of what's most popular at the moment. What hash tag is most prevalent (most frequently occurring) over the past

minute or 5 minutes or hour. But it's more complex than that, according to Twitter.

A simple *incidence algorithm* would look something like:

```
for x = 1 to all hashtags
    trending(x) = hashtag(x) / total_hashtags
next
sort trending(x) descending
for x = 1 to n
    show hashtag(x)
next
```

Twitter might set 'n' to be 10 or 15, let's say, and then the top 10 or 15 hashtags would be displayed. The algorithm could be run every minute or five minutes or at whatever interval Twitter deemed appropriate. Here's what the result of that might look like:

Figure TTAP. Trending on Twitter, October 28, 2016 ~ 4PM

But when the Twitter hash tag #*occupywallstreet* did not trend despite the Occupy movement being the top news story at the time, there were cries of *censoring* from the blogosphere. But hold on.

> "Twitter explains that *Trends* is designed to identify topics that are enjoying a surge, not just rising above the normal chatter, but doing so in a particular way. Part of the evaluation includes: Is the use of the term spiking, i.e. accelerating rapidly, or is its growth more gradual? Are the users densely interconnected into a single cluster, or does the term span multiple clusters? Are the tweets unique content, or mostly retweets of the same post? Is this the first time the term has Trended? (If not, the threshold to Trend again is higher.) So this list, though automatically calculated in real time, is also the result of the careful implementation of Twitter's judgments as to what should count as a "trend.""

Source

Apparently, Twitter's algorithm is quite a bit more sophisticated. Not only does it matter that a hashtag is popular, it must also be *increasingly* and not just *persistently* popular. This is *spiking*. Not just *up* but persistently *on the way* up. And it can't be popular in isolation. It needs to be popular across what Twitter calls *clusters* of users. And it just can't be any old recurring and spiking and popular story... it's got to have something more. Like not being censored. Sounds like gobbledygook to me. Twitter was trying to hide something IMHO. But who am I to say?

Now take a listen to the first 10 minutes of this CBC Spark podcast (this is examinable content so please do plug in and listen).

A deeper look at algorithms

ZDNET (a tech publishing service) has this to offer on algorithms. Reporting on a talk given by Peter Sondergaard, a research chief at well-respected tech consultancy Gartner, they wrote:

> "'Big data is not where the value is,' said Sondergaard. 'Algorithm is where the real value lies. Algorithms are where the action lies. Data is dumb. Algorithms define the way the world works.'"

They further shared that:

> "'A market for algorithms will emerge,' said Sondergaard.
>
> The platforms that enterprises rely on will be powered by algorithms. Cortana, Siri and the like are just precursors to what's coming. [...] Technology giants such as Microsoft may not provide apps, but algorithms and analytics. Is there any wonder why IBM, Microsoft, Google and Amazon Web Services have all spun their clouds with an analytic bent?
>
> Here are my [the ZDNET author's] thoughts about the promise of perils of this algorithmic nirvana.
>
> Algorithms are only going to be as good as the humans producing them. Some companies are going to go digital, algorithm happy and merely scale bad processes and models.
>
> Vendors are going to spin magic bullets with algorithms and analytics. It's one thing to evaluate user interfaces, software, processes and integration. It's quite another to dig into the data science to validate vendor claims.
>
> Big data is looking increasingly like a backend plumbing topic. If data science can't find the signals and real business use, all you're going to have is a big lake of information. [I would say *data* but hey, who am I?]
>
> Transforming to this algorithmic business isn't going to be easy. Companies are going to need new suppliers, ways to invest and approach to

innovation. Every company is going to need to be about technology as well as a venture investor. Sondergaard urged enterprises to use "techquisitions," acquisitions of IT companies that can boost traditional businesses.

Algorithms as a scene setter this year was a different tack from the previous two themes from Gartner. In 2014 and 2013, digital business was the key theme with smart machines and algorithms viewed as something developing in the future."

Interested?

Thus algorithms are the future, according to Gartner. I agree. Big data is big data. It's just a relentless, jet-speed stream of data. Without some way to make sense of the data, without a way to create the necessary *context*, big data cannot be leveraged to value.

Algorithms are, however, not static. They evolve, morph and *learn*. The technical term for algorithms that evolve in this way is *machine learning*. Here's a rather long passage from the Forward of a book I'm currently reading called *The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World* by Domingos, Pedro. (Basic Books).

"You may not know it, but machine learning is all around you. When you type a query into a search engine, it's how the engine figures out which results to show you (and which ads, as well). When you read your e-mail, you don't see most of the spam, because machine learning filtered it out. Go to Amazon.com to buy a book or Netflix to watch a video, and a machine-learning system helpfully recommends some you might like. Facebook uses machine learning to decide which updates to show you, and Twitter does the same for tweets. Whenever you use a computer, chances are machine learning is involved somewhere. Traditionally, the only way to get a computer to do something— from adding two numbers to flying an airplane— was to write down an algorithm explaining how, in painstaking detail. But machine-learning algorithms, also known as learners, are different: they figure it out on their own, by making inferences from data. And the more data they have, the better they get. Now we don't have to program computers; they program themselves. It's not just in cyberspace, either: your whole day, from the moment you wake up to the moment you fall asleep, is suffused with machine learning.

"Your clock radio goes off at 7: 00 a.m. It's playing a song you haven't heard before, but you really like it. Courtesy of Pandora, it's been learning your tastes in music, like your own personal radio jock. Perhaps the song itself was produced with the help of machine learning. You eat breakfast and read the morning paper. It came off the printing press a few hours earlier, the printing process carefully adjusted to avoid streaking using a learning algorithm. The temperature in your house is just right, and your electricity bill noticeably down, since you installed a Nest learning thermostat.

"As you drive to work, your car continually adjusts fuel injection and exhaust recirculation to get the best gas mileage. You use Inrix, a traffic prediction system, to shorten your rush-hour commute, not to mention lowering your stress level. At work, machine learning helps you combat information overload. You use a data cube to summarize masses of data, look at it from every angle, and drill down on the most important bits. You have a decision to make: Will layout A or B bring more business to your website? A web-learning system tries both out and reports back. You need to check out a potential supplier's website, but it's in a foreign language. No problem: Google automatically translates it for you. Your e-mail conveniently sorts itself into folders, leaving only the most important messages in the inbox. Your word processor checks your grammar and spelling. You find a flight for an upcoming trip, but hold off on buying the ticket because Bing Travel predicts its price will go down soon. Without realizing it, you accomplish a lot more, hour by hour, than you would without the help of machine learning.

"During a break you check on your mutual funds. Most of them use learning algorithms to help pick stocks, and one of them is completely run by a learning system. At lunchtime you walk down the street, smart phone in hand, looking for a place to eat. Yelp's learning system helps you find it. Your cell phone is chock-full of learning algorithms. They're hard at work correcting your typos, understanding your spoken commands, reducing transmission errors, recognizing bar codes, and much else. Your phone can even anticipate what you're going to do next and advise you accordingly. For example, as you're finishing lunch, it discreetly alerts you that your afternoon meeting with an out-of-town visitor will have to start late because her flight has been delayed.

"Night has fallen by the time you get off work. Machine learning helps keep you safe as you walk to your car, monitoring the video feed from the surveillance camera in the parking lot and alerting off-site security staff if it detects suspicious activity. On your way home, you stop at the supermarket, where you walk down aisles that were laid out with the help of learning algorithms: which goods to stock, which end-of-aisle displays to set up, whether to put the salsa in the sauce section or next to the tortilla chips. You pay with a credit card. A learning algorithm decided to send you the offer for that card and approved your application. Another one continually looks for suspicious transactions and alerts you if it thinks your card number was stolen. A third one tries to estimate how happy you are with this card. If you're a good customer but seem dissatisfied, you get a sweetened offer before you switch to another one.

"You get home and walk to the mailbox. You have a letter from a friend, routed to you by a learning algorithm that can read handwritten addresses. There's also the usual junk, selected for you by other learning algorithms (oh, well). You stop for a moment to take in the cool night air. Crime in your city is noticeably down since the police started using statistical learning to predict where crimes are most likely to occur and concentrating beat officers there *[Rob: Take note as we will discuss this later]*. You eat dinner with your family. The mayor is in the news. You voted for him because he personally called you on election day, after a learning algorithm pinpointed you as a key undecided voter. After dinner, you watch the ball game. Both teams selected their players with the help of statistical learning. Or perhaps you play

games on your Xbox with your kids, and Kinect's learning algorithm figures out where you are and what you're doing. Before going to sleep, you take your medicine, which was designed and tested with the help of yet more learning algorithms. Your doctor, too, may have used machine learning to help diagnose you, from interpreting X-rays to figuring out an unusual set of symptoms.

"Machine learning plays a part in every stage of your life. If you studied online for the SAT college admission exam, a learning algorithm graded your practice essays. And if you applied to business school and took the GMAT exam recently, one of your essay graders was a learning system. Perhaps when you applied for your job, a learning algorithm picked your résumé from the virtual pile and told your prospective employer: here's a strong candidate; take a look. Your latest raise may have come courtesy of another learning algorithm. If you're looking to buy a house, Zillow.com will estimate what each one you're considering is worth. When you've settled on one, you apply for a home loan, and a learning algorithm studies your application and recommends accepting it (or not). Perhaps most important, if you've used an online dating service, machine learning may even have helped you find the love of your life. Society is changing, one learning algorithm at a time. Machine learning is remaking science, technology, business, politics, and war. Satellites, DNA sequencers, and particle accelerators probe nature in ever-finer detail, and learning algorithms turn the torrents of data into new scientific knowledge. Companies know their customers like never before. The candidate with the best voter models wins, like Obama against Romney. Unmanned vehicles pilot themselves across land, sea, and air. No one programmed your tastes into the Amazon recommendation system; a learning algorithm figured them out on its own, by generalizing from your past purchases. Google's self-driving car taught itself how to stay on the road; no engineer wrote an algorithm instructing it, step-by-step, how to get from A to B. No one knows how to program a car to drive, and no one needs to, because a car equipped with a learning algorithm picks it up by observing what the driver does.

"Machine learning is something new under the sun: a technology that builds itself. Ever since our remote ancestors started sharpening stones into tools, humans have been designing artifacts, whether they're hand built or mass produced. But learning algorithms are artifacts that design other artifacts. "Computers are useless," said Picasso. "They can only give you answers." Computers aren't supposed to be creative; they're supposed to do what you tell them to. If what you tell them to do is be creative, you get machine learning. A learning algorithm is like a master craftsman: every one of its productions is different and exquisitely tailored to the customer's needs. But instead of turning stone into masonry or gold into jewelry, learners turn data into algorithms. And the more data they have, the more intricate the algorithms can be.

"*Homo sapiens* is the species that adapts the world to itself instead of adapting itself to the world. Machine learning is the newest chapter in this million-year saga: with it, the world senses what you want and changes accordingly, without you having to lift a finger. Like a magic forest, your surroundings— virtual today, physical tomorrow— rearrange themselves as you move through them. The path you picked out between the trees and bushes grows into a road. Signs pointing the way spring up in the places where you got lost.

"These seemingly magical technologies work because, at its core, machine learning is about prediction: predicting what we want, the results of our actions, how to achieve our goals, how the world will change. Once upon a time we relied on shamans and soothsayers for this, but they were much too fallible. Science's predictions are more trustworthy, but they are limited to what we can systematically observe and tractably model. Big data and machine learning greatly expand that scope. Some everyday things can be predicted by the unaided mind, from catching a ball to carrying on a conversation. Some things, try as we might, are just unpredictable. For the vast middle ground between the two, there's machine learning.

"Paradoxically, even as they open new windows on nature and human behavior, learning algorithms themselves have remained shrouded in mystery. Hardly a day goes by without a story in the media involving machine learning, whether it's Apple's launch of the Siri personal assistant, IBM's Watson beating the human Jeopardy! champion, Target finding out a teenager is pregnant before her parents do, or the NSA looking for dots to connect. But in each case the learning algorithm driving the story is a black box. Even books on big data skirt around what really happens when the computer swallows all those terabytes and magically comes up with new insights. At best, we're left with the impression that learning algorithms just find correlations between pairs of events, such as googling "flu medicine" and having the flu. But finding correlations is to machine learning no more than bricks are to houses, and people don't live in bricks.

"When a new technology is as pervasive and game changing as machine learning, it's not wise to let it remain a black box. Opacity opens the door to error and misuse. Amazon's algorithm, more than any one person, determines what books are read in the world today. The NSA's algorithms decide whether you're a potential terrorist. Climate models decide what's a safe level of carbon dioxide in the atmosphere. Stock-picking models drive the economy more than most of us do. You can't control what you don't understand, and that's why you need to understand machine learning— as a citizen, a professional, and a human being engaged in the pursuit of happiness.

"This book's first goal is to let you in on the secrets of machine learning. Only engineers and mechanics need to know how a car's engine works, but every driver needs to know that turning the steering wheel changes the car's direction and stepping on the brake brings it to a stop. Few people today know what the corresponding elements of a learner even are, let alone how to use them. The psychologist Don Norman coined the term conceptual model to refer to the rough knowledge of a technology we need to have in order to use it effectively. This book provides you with a conceptual model of machine learning.

"Not all learning algorithms work the same, and the differences have consequences. Take Amazon's and Netflix's recommenders, for

example. If each were guiding you through a physical bookstore, trying to determine what's "right for you," Amazon would be more likely to walk you over to shelves you've frequented previously; Netflix would take you to unfamiliar and seemingly odd sections of the store but lead you to stuff you'd end up loving. In this book we'll see the different kinds of algorithms that companies like Amazon and Netflix use. Netflix's algorithm has a deeper (even if still quite limited) understanding of your tastes than Amazon's, but ironically that doesn't mean Amazon would be better off using it. Netflix's business model depends on driving demand into the long tail of obscure movies and TV shows, which cost it little, and away from the blockbusters, which your subscription isn't enough to pay for. Amazon has no such problem; although it's well placed to take advantage of the long tail, it's equally happy to sell you more expensive popular items, which also simplify its logistics. And we, as customers, are more willing to take a chance on an odd item if we have a subscription than if we have to pay for it separately.

"Hundreds of new learning algorithms are invented every year, but they're all based on the same few basic ideas. These are what this book is about, and they're all you really need to know to understand how machine learning is changing the world. Far from esoteric, and quite aside even from their use in computers, they are answers to questions that matter to all of us: How do we learn? Is there a better way? What can we predict? Can we trust what we've learned? Rival schools of thought within machine learning have very different answers to these questions. The main ones are five in number, and we'll devote a chapter to each. Symbolists view learning as the inverse of deduction and take ideas from philosophy, psychology, and logic. Connectionists reverse engineer the brain and are inspired by neuroscience and physics. Evolutionaries simulate evolution on the computer and draw on genetics and evolutionary biology. Bayesians believe learning is a form of probabilistic inference and have their roots in statistics. Analogizers learn by extrapolating from similarity judgments and are influenced by psychology and mathematical optimization. Driven by the goal of building learning machines, we'll tour a good chunk of the intellectual history of the last hundred years and see it in a new light.

"Each of the five tribes of machine learning has its own master algorithm, a general-purpose learner that you can in principle use to discover knowledge from data in any domain. The symbolists' master algorithm is inverse deduction, the connectionists' is backpropagation, the evolutionaries' is genetic programming, the Bayesians' is Bayesian inference, and the analogizers' is the support vector machine. In practice, however, each of these algorithms is good for some things but not others. What we really want is a single algorithm combining the key features of all of them: the ultimate master algorithm. For some this is an unattainable dream, but for many of us in machine learning, it's what puts a twinkle in our eye and keeps us working late into the night.

"If it exists, the Master Algorithm can derive all knowledge in the world— past, present, and future— from data. Inventing it would be one of the greatest advances in the history of science. It would speed up the progress of knowledge across the board, and change the world in ways that we can barely begin to imagine. The Master Algorithm is to machine learning what the Standard Model is to particle physics or the Central Dogma to molecular biology: a unified theory that makes sense of everything we know to date, and lays the foundation for decades or centuries of future progress. The Master Algorithm is our gateway to solving some of the hardest problems we face, from building domestic robots to curing cancer.

"Take cancer. Curing it is hard because cancer is not one disease, but many. Tumors can be triggered by a dizzying array of causes, and they mutate as they metastasize. The surest way to kill a tumor is to sequence its genome, figure out which drugs will work against it— without harming you, given your genome and medical history— and perhaps even design a new drug specifically for your case. No doctor can master all the knowledge required for this. Sounds like a perfect job for machine learning: in effect, it's a more complicated and challenging version of the searches that Amazon and Netflix do every day, except it's looking for the right treatment for you instead of the right book or movie. Unfortunately, while today's learning algorithms can diagnose many diseases with superhuman accuracy, curing cancer is well beyond their ken. If we succeed in our quest for the Master Algorithm, it will no longer be.

"The second goal of this book is thus to enable you to invent the Master Algorithm. You'd think this would require heavy-duty mathematics and severe theoretical work. On the contrary, what it requires is stepping back from the mathematical *arcana* to see the overarching pattern of learning phenomena; and for this the layman, approaching the forest from a distance, is in some ways better placed than the specialist, already deeply immersed in the study of particular trees. Once we have the conceptual solution, we can fill in the mathematical details; but that is not for this book, and not the most important part. Thus, as we visit each tribe, our goal is to gather its piece of the puzzle and understand where it fits, mindful that none of the blind men can see the whole elephant. In particular, we'll see what each tribe can contribute to curing cancer, and also what it's missing. Then, step-by-step, we'll assemble all the pieces into the solution— or rather, a solution that is not yet the Master Algorithm, but is the closest anyone has come, and hopefully makes a good launch pad for your imagination. And we'll preview the use of this algorithm as a weapon in the fight against cancer. As you read the book, feel free to skim or skip any parts you find troublesome; it's the big picture that matters, and you'll probably get more out of those parts if you revisit them after the puzzle is assembled."

Heady stuff. A master algorithm. I'll let you ponder that for the moment. We will revisit big issues like this in Chapter 6.

Algorithmic Trading

https://en.m.wikipedia.org/wiki/Algorithmic_trading

Segmentation

Analysis tools?

Visualisation?

Browser / OS usage

App Annie

Backup - Nuclear reactor

E-commerce & frictionless economy (see Chrome tab on this)

co-creation

Privacy - security issues see OneNote

History of retail innovation wk04ch07

The frictionless economy

Types of e-commerce

Addictive apps

Malleable brain and conditioning

Wearables

Green IT

Buying IT

Machine Learning

Traditionally, the only way to get a computer to do something— from adding two numbers to flying an airplane— was to write down an algorithm explaining how, in painstaking detail. But machine-learning algorithms, also known as learners, are different: they figure it out on their own, by making inferences from data. And the more data they have, the better they get. Now we don't have to program computers; they program themselves.

Domingos, Pedro. The Master Algorithm: How the Quest for the Ultimate Learning Machine Will Remake Our World. Basic Books. Kindle Edition.