The Connected Business

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Starring role for movie-fan data

Hollywood studios are using digital analysis to create blockbusters, reports *Malcolm Moore*

One of this summer's most surprising blockbusters was *Warcraft*, a fantasy film based on a computer game, which bombed in the US but was a smash hit in China.

The Hollywood Reporter called *Warcraft* "the most lopsided Hollywood release in modern times" because it had taken only 11 per cent of its box office in the US — $46.6m — but racked up more than $220m in the Chinese market.

Matthew Marolda, chief analytics officer of Legendary Entertainment, the studio that made the movie, can explain at least part of the disparity, and it is not just that Chinese movie-goers are nerdier computer-game fans.

Mr Marolda runs a 70-strong data team, headquartered in Boston, whose remit includes advising on how to market Legendary's output. In China, unlike the US, he had access to detailed data on who was buying tickets for *Warcraft*, allowing his team to target similar fans with teases for the film.

It also helped that Legendary was bought in January by Dalian Wanda, the property and entertainment conglomerate that runs China's biggest cinema chain. "Because of our partners in China, we got data from the advance ticket sales," he says. "China is much more digital and people tend to buy their tickets more in advance because of price incentives."

Using those profiles, he went to a database of other likely fans and homed in on them. "We pour out cash to advertise [our films] on television in the US," he says. "In China, you can be so much more digitally-oriented and the cost is so much lower." China pulled in half *Warcraft*'s overall box office of around $433m. "Analytics is a broad toolset that can change outcomes. There is never a situation that it doesn't change," he says.

Mr Marolda, who joined Legendary after starting a company specialising in sports analytics and dynamic pricing, is an example of how Hollywood is fine-tuning its use of data. As in many creative industries, there has been initial caution over how to incorporate this new tool. Mr Marolda says that while writing and directing movies are "sacrosanct" processes that he does not try to influence, he can offer insights.

In another Legendary film targeted at China, *The Great Wall* directed by Zhang Yimou, Matt Damon was cast as the lead after he "over-indexed in web searches in China" compared to rivals, says Mr Marolda.

His team is involved at the start of the film-making process, in evaluating concepts, in working out likely audiences and in casting decisions, but steps back while the movie is made. Afterwards, the team can help shape a film's direction in post-production and decide on a targeted marketing strategy.

As trailers for a film hit the internet, his team analyse their reception in real time, crafting new messages to try to reach those people who can be convinced to buy a ticket. Typically, a movie has a marketing campaign costing tens of millions of dollars that runs for a couple of months before and during the release: this means the team must respond rapidly to new data to help the film catch the limelight.

Ahead of last year's reboot of *Star Wars*, Disney analysed every angle of the movie from a social media perspective, Wayne Peacock, the studio's vice-president of analytic insights, told the Variety Big Data Summit last November. "It is

Illustration: Øivind Hovland

The Connected Business

Excuse me, we need to talk mobile manners

OPINION

Jonathan
Derbyshire

In July, Nintendo launched the smartphone app Pokémon Go, an augmented reality game in which players hunt for animated monsters hidden at "PokeStops" in locations around the world.

Initially, Nintendo and the game's developer, Niantic, surfed a wave of global enthusiasm, particularly among smartphone-toting "kidults" who possibly should know better. But celebration curdled into opprobrium once it emerged that PokeStops had been placed in some culturally sensitive locations, including the Holocaust Museum and Arlington National Cemetery in Washington DC.

Its communications director responded: "Playing the game is not appropriate in the museum, which is a memorial to the victims of Nazism."

Meanwhile, officials at the cemetery, one of martial America's most sacred sites, regretted the breaches of "decorum" committed by those hunting virtual creatures among the headstones.

These episodes will have confirmed the worst fears of those who believe digital technology is sending us to hell in a handcart and generally portends, if not civilisational collapse, then at least the unravelling of centuries-old standards of civilised behaviour.

Such laments are probably overdone. The rules governing what counts as acceptable deportment in public are not eternal principles fixed once and for all, but norms that change over time, especially in the face of dramatic technological change.

It would be an exaggeration to say the old rules simply no longer apply. Behavioural norms — and I would include our idea of what constitutes good "manners" in this — are remarkably resilient. They bend rather than break under the pressure of rapid social transformation of various sorts. The early days of any technology,

whether it is the smartphone or the internal combustion engine, tend to be an ethical and behavioural free-for-all, after which a consensus on what is and is not acceptable eventually emerges.

Anyone who has travelled regularly on buses in London will have confirmed a relatively recent period when journeys often unfolded to the tinny accompaniment of music played through the speakers of phones belonging to sulky-looking adolescents. Only those willing to invest

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The rules governing what counts as acceptable deportment in public are not eternal principles

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considerable sums in noise-cancelling headphones were protected from this aural contagion.

At least one social commentator attempted, heroically, to argue that "sodcasting", as this practice was known, was a way for the

disenfranchised and downtrodden to strike a blow against bourgeois hegemony — or something like that. I have to say, though, that it never struck me as likely that young people would take to the barricades to defend their right to test their phones' broadcasting capacities in public.

In any event, at least from my vantage point on the top deck of the number 40 bus, it seems the practice has largely died out under pressure of social disapproval. Most people riding the bus these days, whether 16 or 60, will know that sodcasting is decidedly *de trop*.

A report last year by the Pew Research Center on "mobile etiquette" and the "new contours of civil behaviour" in the US reveals a similar picture. Although there is inevitable generational variation in people's tolerance of smartphone use in public places (18-29-year-olds tend to be more permissive than other age groups), "Americans of all ages generally trend in the same direction about when it's OK or not to use [them] in public settings," the report's authors say.

Social scientist Sherry Turkle has

argued that widespread use of smartphones leads to people living "alone together", each of us locked in our own virtual universe. Indeed, 22 per cent of those surveyed by Pew admitted to sometimes using their phones "to avoid interacting with others who are near them". Similarly, 82 per cent of all adults thought that smartphone use "hurts the conversation and atmosphere" at social gatherings.

One problem with the survey is it did not specify what "using" a mobile phone entails. After all, you can do more with a smartphone than make a call — a surreptitious look at your email is surely less socially disruptive than a bellowed conversation with someone at the office.

There was one idea on which nearly all respondents were agreed, however: 96 per cent said that using your smartphone at church or during some other kind of religious service was "not OK". We can be fairly sure they would have said the same about chasing Pokémon in a cemetery.

The writer is the FT's executive comment editor

A starring role in Hollywood for audience data analytics

such a massive amount of data — it is energising to my team," said Mr Peacock, who previously worked for Visa and Netflix.

Star Wars: The Force Awakens flouted conventional movie-marketing wisdom by keeping most of the film's details under wraps. In trailers and TV commercials, Disney showed just half the footage it would normally reveal for a release. Instead, the campaign reassured film-goers their experience would mimic that of the original *Star Wars* trilogy.

Legendary has spent heavily to build a database that covers the whole of the US while also breaking down the population into small segments. The database is built from dozens of sources, Mr Marolda says. "There are many things that people declare digitally that are out there in the public domain. But we do not target people individually, we cluster them into microsegments and then try to reach them through social media, search, display advertising and sometimes television."

The entertainment industry — and other industries including consumer products — has noted Legendary's ability to improve on predicted box office and Mr Marolda's team is now selling some of its services externally.

Eli Roth, a director and producer of horror films, told the Variety Big Data Summit that, rather than shaping ideas, "you use data to find your audience". He described shooting short films and posting them on Facebook to test how people would react. The films that went viral might be developed further. He also uses Facebook's analytics to help identify what sort of people a film would appeal to, and spends money to reach more of them.

The data showed him how quickly his audience changes. "What you know is fresh for 90 days. The data are constantly refreshing because people's interests change so fast."

Blockchain can create jobs as well as kill them

Employment Some roles will vanish, but new skills will create opportunities, reports *Sarah Murray*

Some see it as the biggest change in technology since the advent of the internet. Others say claims for what blockchain can do are overblown. But those among the former group are now asking how the blockchain technology that underpins so-called cryptocurrencies, which include bitcoin, will affect jobs, particularly in the financial sector. Banks, clearing houses and exchanges are already eyeing the potential savings.

Blockchain technology provides a way to continuously maintain and verify digital records in "blocks" that can be shared between various parties. Also called "distributed ledger technology", it means ledgers can be updated instantly in any number of locations. The information can never be erased.

"In basic terms, the blockchain is a public record of transactions," says Amy Webb, founder of the Future Today Institute, a US-based forecasting and strategy firm. "This may seem less secure than a private record but as that transaction is made, the transaction itself becomes part of the ledger and all the data around that is encrypted."

Blockchain has the potential to

handle a wide range of transactions managed by humans. "If you're buying a house, there's a mountain of paperwork and authentication and it requires a person to do it," says Ms Webb. Blockchain makes it easier and more secure, and reduces the need for real estate brokers.

Most applications are in the experimental stages, says Leda Glyptis, a director at Sapient Global Markets, a US-based capital and commodities markets technology consultancy: "It has been able to cope with everything we've thrown at it, but we haven't thrown that much at it outside the laboratory."

However, banks, insurers and other financial institutions are interested in blockchain as a way to increase security and efficiency and to lower costs. Last month, four of the world's biggest banks, UBS, Deutsche Bank, Santander and BNY Mellon, and broker ICAP, said they had teamed up to develop an industry standard to clear and settle financial trades over blockchain.

In June, Allianz Risk Transfer, part of Allianz Group, and Nephila Capital, a specialist investment manager, said they had piloted the use of blockchain for processing and settling transactions in bonds and swaps (financial instru-

ments that transfer risk from insurers to investors or other insurers) for natural catastrophes. Earlier in 2016, the Australian Securities Exchange said it would work with US-based Digital Asset Holdings to create a system based on blockchain for clearing and settling trades in the Australian equity market.

"If it could be made to work there, it could be copied within a year or two all around the world," says David Yermack, professor of finance and business transformation at NYU's Stern School of Business. Blockchain's peer-to-peer model of transaction verification has important implications for financial services jobs, he says: "When you think of anyone who is keeping track of assets, I'd say their job is very much at risk, because of this technology."

Jobs potentially in jeopardy include those involving tasks such as processing and reconciling transactions and verifying documentation. Blockchain, says Ms Glyptis, allows transactions to be time-stamped and finalised, with a mathematically proven method for confirming a transaction is valid. "The first area that would be hit would be any reconciliation or post-reconciliation activities — you just wouldn't need to do it."

Others are more circumspect about potential workplace upheaval. Steve Wilson, principal analyst at Silicon Valley-based Constellation Research, says blockchain technology decentralises only the verification of the order of entries in a ledger, and not its contents. Auditors and agents will still be checking the truth underlying the entries.

Nevertheless, the nature of such jobs is likely to evolve. "You'd be hard-pressed to believe it's not going to dismantle some of the infrastructure in the financial services sector and remove jobs," says Vaughan Jenkins, a financial services specialist at PA Consulting Group.

An example of the new skills blockchain could require is security: Ms Glyptis says that while blockchain creates an immutable record that is resistant to tampering, fraud may still occur at any stage in the process but will be captured in the record and therefore easily detected. This is where she predicts new job opportunities. "I can see a whole class of professions around encryption and identity protection," she says.

"Even though some jobs will disappear, we're acquiring needs we've never had before around things that are more valuable than they ever were before."

The job of anyone who is keeping track of assets is very much at risk

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Audience metrics
Views on viewers

The US entertainment industry was slow to gather data on who likes its shows, preferring to rely on the gut instinct of executives and viewer surveys at pre-release screenings.

"When it comes to media, film and television the biggest change started a few years ago, when the [cable] set-top box data came in," says Bill Franks, chief analytics officer at Teradata, a US-based analytics company. "You could tell that this advert or show was watched by this many subscribers." He cites finding an overlap in viewers for Friday night fights on sports channel ESPN and those for a show on the History Channel featuring people wrestling alligators. To advertise on the latter was far cheaper.

Such data are closely guarded by the US cable companies, and studios making shows and films have had to rely on other, patchier sources of data from websites or apps they set up, or from mining social media channels and the web.

With the arrival of internet streaming, companies such as Netflix, Hulu and Amazon Prime now have a huge quantity of data to draw on. "If I was a Hollywood studio, I would want to have deals with Netflix or Amazon Prime [to see their data]," says Mr Franks.

Some Hollywood executives are still reluctant to rely heavily on data. But the availability of internet data, and the desire of investors for a firm analysis of a possible audience, is slowly changing the way films are made.

Mr Franks cites shows that invite viewers to engage on how they should progress, such as the "Story Sync" feature on AMC's *The Walking Dead*, which polls viewers as the show airs. "It may be a tiny fraction of viewers but they are the really committed ones," he says.
Malcolm Moore

New technology is not always a sign of progress

A new book challenges assumptions that we have the best possible gadgets, writes *Maija Palmer*

Is the computer the least efficient machine humans have ever built? Technology journalists often unthinkingly pick up a narrative of progress in which each generation of technology is an improvement on the last, from abacus to iPhone. We marvel that we carry more computing power in our pockets than was used to put a man on the moon in 1969.

What we have at our fingertips is smaller, faster and more complicated than before. But is it necessarily better?

In his new book *The Bleeding Edge*, Bob Hughes, an activist and former academic, takes a refreshingly critical look at assumptions about technology – the subtitle is "Why technology turns toxic in an unequal world".

It has already become fashionable to question the accepted narrative of capitalism – thoughts perhaps best crystallised by Thomas Piketty's *Capital in the Twenty-first Century*. We are living

at a time when inequality in incomes and living standards is rising. But at least we have iPhones, the thinking goes. There may be collateral damage from technological progress, but the end-product elevates us all.

We can read stories about how small farmers are using WhatsApp to find buyers for their crops or how South American fishermen use their mobile phones to check spot prices and we assume that technology overall is moving business forward.

Mr Hughes unpicks some of this thinking. From a historical perspective, technological progress has not always resulted in the betterment of humanity. Take the example of watermills for grinding corn, which began around 1000AD in Europe. Watermills have always been presented as an example of enlightened development, enabling people to grind much larger quantities of grain at once.

Yet milling by hand preserves more nutrients in the grain than mechanised milling, and a move to watermills – generally owned by feudal lords – was imposed by force on a reluctant peasant population. Around this time the average height of European peasants began to decrease, indicating a worsening diet.

The Bleeding Edge
by Bob Hughes
New Internationalist
Publications £10.99
336 pages

In the computer age, we are similarly spun into cycles of obsolescence and upgrades that benefit us little but which are difficult to opt out of. Anyone still mourning the loss of their BlackBerry to an iPhone may feel a stab of sympathy when they read Mr Hughes.

The economics of microchip production – where factories must operate at enormous scale and only the very latest products make a profit – dictates a relentless pace of device upgrades, regardless of what consumers really need.

Understanding this helps to explain the mysterious "productivity paradox" – the fact that all the new computer and mobile technology of the past 20 years has not led to an increase in productivity. Employees must constantly learn new ways to perform

the same task over and over again as technology changes. However, this does not necessarily increase the speed at which jobs are done.

Moreover, modern computers and mobile phones – for all their functionality – are hampered by a design flaw that dates back to the 1940s: a clock that dictates that only one tiny process can happen at a time. Clocks have sped up since British codebreakers at Bletchley Park built the Colossus machine during the second world war, but the principle remains the same: only a small amount of frenetic activity happens at a time, while most of the device remains idle.

There are other routes that we could have taken with technology. Until the 1960s around half the world's computers were still analogue: in fact, it was analogue computers that enabled that first moon landing.

Analogue computers had many advantages. They could be more intuitive to use and even in the 1980s were significantly faster and cheaper than their digital rivals. They could be made from a variety of materials. The Monetary National Income Analogue Computer (Moniac), which was built in 1949, used water to model aspects of the UK economy. Another system, which

was built by the University of the West of England's International Centre of Unconventional Computing, was based on slime mould.

Mr Hughes, who co-founded a group campaigning for migrant rights in 2003, is more of an activist than a technologist. He is not offering a clear way out of the technological dead end he describes – apart from a move away from the current capitalist system.

There are many small acts of technological subversion Mr Hughes might have mentioned: villages that set up their own broadband internet connections when commercial companies deem it uneconomic, individuals running peer-to-peer alternatives to the conventional internet, or companies such as Fairphone that are building mobile phones that have longer shelf lives because components are easy to replace and swap out.

Such projects are small, obscure and often poorly funded but they exist and an assessment of whether they might offer viable alternatives would have been interesting.

Still, the author provides a useful counterpoint to breathless extolling of the latest gadget and the book is worth a read for that reason alone.

The Connected Business

Parcel services plan to deliver any time, any place

Logistics From drones to algorithms, the aims are speed and convenience, reports *Michael Pooler*

Online shoppers in the UK increasingly expect that they can click on "place order" late into the night and still take delivery of their purchases the next day. Not only are they demanding speed, but they want to get their hands on the goods at a convenient time and place.

"You can buy online later and later in the day for a next-day delivery," says Mark McVicar, transport analyst at Barclays bank: "A lot of retailers can take orders up to midnight, so the time you've got to draw products from an etailer to local distribution centres and on to a dedicated parcel round is much shorter."

The response by parcel companies is to invest tens of millions of pounds in technology, from physical machinery to software.

DPD, part of French state-owned group La Poste, is among the companies leading the innovations. Last year the express delivery group opened one of Europe's biggest parcel hubs, a £100m facility in England, with the latest automated "sortation" technology. Inside the 470m-long building, workers load parcels from lorries on to chutes, which ascend to conveyor belts whirring overhead. Electronic scanners direct the parcels, which can reach one of 172 exits within 90 seconds of entering the hub.

Such equipment is becoming standard across the UK parcels sector, says Frank Proud, analyst at Apex Insight, involving "very significant investments".

In another sign of the rapid changes under way in Britain's £9bn parcel market, Amazon is trialling flying drones to drop off purchases. The US technology company's programme is still in development, but it hopes the small, unmanned air vehicles will eventually deliver packages up to 10 miles from its warehouses within half an hour.

The fierce competition is spurring modernisation at Royal Mail, the UK's dominant postal group, privatised in 2013. While it lags behind some smaller rivals on tech, the FTSE 100 group has introduced devices such as "finger scanners" that enable workers to pick up and scan parcels more efficiently. An increasing proportion of the packages it handles are sorted by machine, labelled and tracked electronically.

Technological transitions do not always pass off smoothly, however. At UK Mail, another operator, automatic sorters fitted at a new hub turned out last year to be the wrong size for some parcels, which had to be manually sorted.

Software innovation is under way too. In parallel with efforts to narrow delivery times, companies are developing ways for consumers to track orders, as well as selecting a time slot or designating a collection point other than home.

DPD has been rolling out an app that gives recipients until 1am on the day of delivery to select a one-hour slot. Later, they can divert the item to a neighbour or "pick-up shop", or change the date. "One of the biggest things we allow people to do is tell us if they want to try to avoid the school run," says Dwain McDonald, UK chief executive.

The app sends a notification when a driver is 30 minutes away and displays the van's location on a map in real time. Drawing inspiration from Uber, the carhailing app, customers can rate the service, with the data used to create internal league tables for drivers.

Even so, Mr Proud suggests delivery apps in general have a way to go, as some consumers report disappointment.

Giving consumers flexibility on timing also creates challenges around planning routes for drivers. Larger companies use algorithmic software to determine the most efficient routes and how the vans should be packed.

Hermes, one of the UK's biggest parcel companies after Royal Mail, is investing £18m in 21,000 handheld devices for couriers and parcel shops that will include route planning software as it moves towards a two-hour delivery window. The company, part of Germany-based Otto Group, already uses a system called "full-trailer telemetry" that tracks vehicles through geolocation technology and monitors driving styles.

Five or so years ago its couriers worked weekdays using paper documentation, and tracking data became available 48 hours later, says Hermes UK. Soon, it adds, its couriers will work any day of the week, "have the latest technology to do their job and real-time tracking will be available".

DPD opened one of Europe's biggest parcel hubs in the UK last year — Stephen Daniels

Man and machine pair up for packing

Warehouse automatons are working more closely with their human counterparts, reports *Michael Pooler*

The robots that roll around Amazon's vast warehouses do not fit the stereotyped image of an automaton worker, with a humanoid appearance and clumsy movements. An army of 30,000 square orange machines — 16in tall but weighing 320lbs — negotiate the floors of the US technology company's warehouses. They lift and carry entire shelving units of goods to the human employees, who pick and pack the items into boxes for shipping.

Since acquiring the technology in its $775m takeover of Kiva Systems in 2012, Amazon has become a leading users of warehouse robots. It has also stopped selling the machines to other retailers and logistics companies.

More robotics companies are now working on systems for moving and handling goods in warehouses. However, Andreas Koller, a robotics scientist, warns: "It's still quite early days in terms of capabilities [and] there's no widespread adoption yet."

In what is still a labour-intensive industry, the potential for change is vast. A recent report by German logistics group DHL found that 80 per cent of logistics facilities are still manual because of the complexity of the operations.

Simple and repetitive processes in logistics, often using equipment in fixed positions, have long been automated. The hope now is that sophisticated mobile robotic systems that register and respond to their environment can raise productivity by taking on the heavy and mundane activities, leaving delicate tasks that need judgment and dexterity to humans.

DHL this year began a trial of two collaborative robots designed to work safely alongside humans. Made by Rethink Robotics, they have long arms with rubber grippers and perceptual recognition for detecting human presence; they can be guided by their flesh-and-blood counterparts.

They can open a box, take out the items, put a sticker on and repack them. "A worker can teach the robot how to pack the items together so the robot handles the repetitive part of the task, supported by a human," says Matthias Heutger, senior vice-president of strategy, marketing and innovation at DHL.

German start-up Magazino, whose investors include Siemens, has built a robot, Toru, that can pick an object from a shelf, if it is rectangular. This is ideal for common ecommerce goods, it says, such as books and boxed items. Resembling a mobile food vending machine, Toru places the items on an internal shelf, where sensors and a 3D camera enable it to make independent decisions about what to do next, say its

> **'It's easier to build an autonomous car than a robot for a warehouse'**

creators. "It's a big change in robotics and we are applying it to logistics," says Frederik Brantner, chief executive and founder of Magazino. "We aren't picking a whole tray of shoeboxes, but a single [box]. We do it in parallel to humans, as robots aren't there yet to do all the complicated things, such as pick up a small screw or fridge."

However, warehouses with lots of moving people and objects still present technical challenges for robotics. Perhaps the biggest hurdles are localisation and mapping, says Mr Koller. "To know where you [the robot] are and where you are going in all possible circumstances is very hard," he says. "Warehouses, because of their variety, are less structured than highways and freeways — it's easier to build an autonomous car than a robot for a warehouse."

If you liked Seth Rogen in that, you will love this

The quality and quantity of data gleaned from online customers enable ever more bespoke buying suggestions, reports *Jessica Twentyman*

Recommendation engines help Amazon to suggest books you might like, LinkedIn to flag up jobs you could apply for and Facebook to suggest friends to contact. They also make proposals for the 125m hours of films and television that users of online streaming service Netflix watch every day.

As Carlos Gomez Uribe, Netflix's vice-president of product innovation, and Neil Hunt, chief product officer, wrote this year in an academic paper: "Humans are surprisingly bad at choosing between many options, quickly getting overwhelmed and choosing 'none of the above' or making poor choices."

They reckon that algorithmically generated recommendations account for about 80 per cent of hours streamed to Netflix subscribers, with the rest coming via search. By their estimates, recommendation engines that pique viewers' interest and engage them with the service save the company about $1bn a year lost through customer churn. Netflix's 2015 annual revenues were $6.8bn.

Companies selling products or services online have been using such techniques for a while, whether off-the-peg programs or tailor-made versions. What has changed is the science behind the recommendations, the sheer volume and variety of data fed into the engines and the sophistication of the algorithms used to analyse them. This means users are receiving more helpful suggestions and therefore buying more, says Sean Owen, director of data science at US-based data software company Cloudera.

"A sales uplift in the region of 20 per cent to 25 per cent is what a company like Amazon might be aiming for from its recommender systems," he says. "That's pretty consistent with what I hear from other ecommerce companies that do this well."

Recommendation algorithms broadly fall into two categories. One is content-based filtering, driven by the attributes of items. If you view a comedy starring Seth Rogen, a content-based recommender will propose other films in which the actor appears.

The other kind, collaborative-based filtering, analyses user behaviour. It analyses data about users' activities and engagement with items to cluster them into groups. If you buying a carrying crate for a puppy, you may soon receive a recommendation for a particular book on dog training or a certain harness because other people who bought

View a Seth Rogen comedy, and a content-based recommender will propose other Rogen films

the crate also bought that book or harness.

"Collaborative filtering tends to do a better job of presenting new ideas to the customers," says Mr Owen. However, collaborative filtering also requires a great deal more data.

Ted Dunning, chief application architect at data software company MapR, advises any companies just starting to use recommendation techniques to avoid wasting time on implementing lots of complex algorithms before they understand what a few simple ones reveal. They should also be ready to maintain a quest for ever-better data to feed into the recommendation engine.

The approach a company takes will depend on the kind of item being sold. UK-based start-up Artfinder, an online art marketplace, introduced a recommendation engine this year and, on the basis that any artwork is unique, chose a collaborative filtering approach. It felt that suggestions based on similar items would not be as effective as basing them on algorithmic observations of how different groups of buyers responded to works by the same artist or belonging to similar genres.

Zalando, the Germany-based online fashion retailer, with annual sales of €3bn, uses both approaches, says Mikio Braun, who heads its recommendation and search operations. With collaborative filtering "we can derive similarities between items that might not be observed solely through product data," he says. Such data used in content-based filtering will not reveal that customers think a certain top goes well with a certain skirt, but collaborative filtering, based on customer behaviour, can reveal they make a good outfit.

Overall, while companies may seek greater insights into online customers' preferences, they should remember this may not always be welcome. As Jason Gordon, a consumer analytics expert at professional services firm Deloitte, says: "There's a fine balance to be struck between relevance and creepiness."

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