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Analytics Quarterly

Autumn 2012

IN THIS QUARTER'S ISSUE: Predictive analytics makes its mark on Rugby • Lack of Analytics expertise • You are under arrest for a crime you have not yet committed • Analytics provides O.R. with fashion industry foothold • Keeping cool, the smart way • How much home insurance should you be paying?



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Predictive analytics makes its mark on Rugby

Nigel Cummings

Predictive analytics is increasingly being applied by professional sports teams to measure and grow performance levels, retain talent, detect risks and optimise game tactics.

One of the early adopters of sports analytics has been the Leicester Tigers, a nine times champion of English rugby union's Premiership and two times European champion. Rugby is one of the world's toughest sports - large men wearing little or no protective gear collide with each other at full speed. They leap, scramble and mash together in scrums, often at risk of injury - rugby's injury rates are nearly three times higher than soccer's.

So it makes sense to apply any new technology, in this case predictive analytics, which can reduce injury rates. According to Andy Shalton, Head of Sport Science for the Tigers, "Our data suggests that if we have a fully fit squad, we'll rival any team in Europe. If we have a lot of injuries, we'll have trouble competing with the best."



The Tigers' data analysis project is just one of many examples of analytics helping to transform the way professional sports teams operate. Statistics have long played an important role in sports, but deep analysis of data to spot unexpected patterns

became mainstream after Oakland A's manager Billy Beane built a top-flight baseball team on a shoe-string budget – a story told in the book and movie, *Moneyball*.

Professional rugby teams have long used analysis of game play to improve their performance and prepare for the upcoming rivals. Alex Martin, Head of Strength and Conditioning, has been gathering detailed data on player's individual fitness and performance. Now they're taking this a step further by evaluating each player's vulnerability to injury.

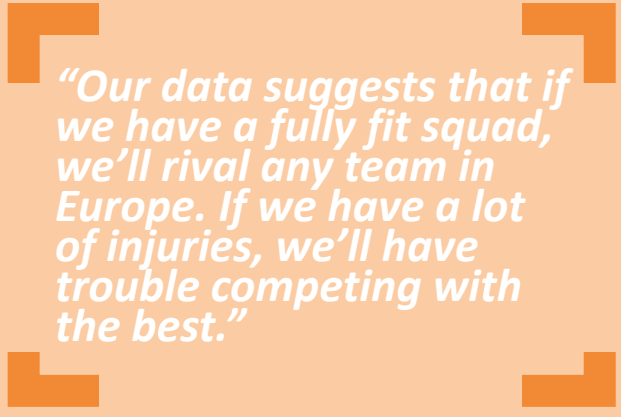
Data on the players is gathered in two ways. The Tiger's sports science team records every event involving player collisions, leaps, kicks and sprints. In addition, players wear small monitoring devices during games and practice that measure the intensity of their activity and transmit the data to a monitoring system.

Once the team has gathered appropriate detailed information, it can anticipate when each player is fatigued and is therefore more vulnerable to injury. That way, team coaches can take the player out of a game or reduce the intensity of their practice or fitness regimen before they become injured.

The Leicester Tigers have been using IBM SPSS Modeller predictive analytics software to gain insight into the likelihood of injury to players. This insight has then been used to deliver personalised training programs for players at risk. The ultimate aim for Leicester Tigers is to apply analytics in order to keep the team injury-free for longer, because in the modern game, losing key players can negatively impact team performance and potentially reduce spectator attendance.

Unlike spread-sheet-based statistical solutions, predictive analytics has allowed Leicester Tigers to broaden and deepen the analysis of both objective and subjective raw data, such as fatigue and game intensity levels. Armed with this technology, they are now able to rapidly analyse the physical and biological information of their entire squad of players in order to detect and predict patterns or anomalies.

The application of predictive analytics has allowed Leicester Tigers to gain more insight into which data is important to predict injuries on an individual basis and when an individual is likely to reach that threshold so appropriate action can be taken. For example, if a player has a statistically



“Our data suggests that if we have a fully fit squad, we'll rival any team in Europe. If we have a lot of injuries, we'll have trouble competing with the best.”

significant change in one or more of his fatigue parameters and the current intensity of training is likely to be high, the analytics software is able to show how the player is likely to become injured in the near future. Thus, strategies can be implemented to reduce fatigue or alter training accordingly.

Predictive analytics technologies also allow for the analysis of psychological player data - this can reveal other key factors which may affect performance such as away games, social or environmental stress. These may significantly change the way players perform during a match or predispose a player to injury.

Leicester Tigers believes that investing in adequate training programs, tailored according to players' physical and psychological stress, provides cost benefits to the club and promotes a better duty of care to team members. Nurturing new talent is an important aspect of team success too, and analytics applied at the very early stages of each player's career can ensure a team has the best selection of rugby talent.

Very much a work in progress for the Tigers, the software will soon be applied across the club's under-19 Academy players to create a more refined selection process and to ensure a higher percentage of young talent is brought into the first team. The project between the Leicester Tigers and IBM is part of a growing trend among all types of organisations striving to uncover hidden patterns in data in order to predict or prevent outcomes for competitive advantage.

Advanced analytics can offer powerful insight and enhanced decision making to organisations across various industries, from healthcare and energy conservation to retailing and public safety.

Lack of Analytics expertise Nigel Cummings

Slowing growth predicted for business analytics.

Software that businesses use to analyse ever-rising volumes of data - and then use that analysis to improve business - has helped drive growth for IBM, Oracle and SAP, some of the largest makers of business software. According to a survey conducted by IDC, the sector's annual sales growth is predicted to fall to single digits this year. It blames a slowing global economy coupled with a maturing market and a lack of workers trained to make the best use of the analytics.

'The market has definitely matured,' said IDC analyst Dan Vesset. 'It's primarily macroeconomics. But there is a level of complexity (with the software) and we are generally finding a lack of a sufficient number of analytics experts.'

According to IDC, Global sales growth of business analytics software, used by banks, retailers, and others, will fall to 9.8% this year from 14.1% last year. Sales will remain healthy though as a reduction to 9.8% still equates to predicted worldwide sales of around \$50.7 billion in 2016, up from \$35.1 billion this year.

A growing emphasis on industry and business process-specific analytic applications is going to take hold over the forecast period.

Helping to drive this growth is media attention focused on Big Data, putting broader business analytics on the agenda. Additionally, new business analytics software options based on non-relational data management technology are forcing vendors to accelerate research and development on new

tools and applications and the integration of new and existing technologies.

Of the three primary segments of the worldwide business analytics software market, the data

warehousing platform software segment grew the fastest in 2011 at 15.2%, followed by the analytic applications segment, at 13.3% and the BI and analytic tools segment, which only managed a 13.2% growth.

Additional findings from IDC's research include:

As more organisations with less business analytics experience are becoming interested in this technology, vendors and users will have to devote more resources to business analytics services.

A growing emphasis on industry and business process-specific analytic applications is going to take hold over the forecast period. Recent acquisitions by large business analytics vendors such as IBM and SAP will require ever finer segmentation of target audiences by industry, region, and organisation size.

The growth in outsourcing deals for business analytics technology will likely mean that end users will pay increasingly less attention to specific technology components, instead focusing on business value and overall functionality.

The study, Worldwide Business Analytics Software 2012-2016 Forecast and 2011 Vendor Shares (IDC #235494) examined the business analytics software market for the period from 2007 to 2016, with vendor revenue trends and market growth forecasts.

More information pertinent to the study can be located at: www.idc.com



You are under arrest for a crime you have not yet committed

Nigel Cummings

In 2002 a sci-fi film called 'Minority Report' depicted a future where special police units would be able to arrest murderers and other criminals before they committed crime. Ten years on that sci-fi has become sci-fact.

What seemed farfetched ten years ago, now appears to have become reality as predictive analytic and artificial intelligence technologies are now routinely utilised by law enforcers to track potential terrorists.

The field of Artificial Intelligence research started at Dartmouth College in 1956, when computer experts of the time - men like John McCarthy and Herbert Simon and their students produced computer programs that could perform mathematical and logical tasks that most people thought only humans were capable of.

By the 1960s, computers and the idea of artificial intelligence soon entered into the realm of national security, when both the United States and the Soviet Union became concerned that the other side would establish an advantage over the other.

AI is no less a national security concern today than it was back in the 1960s, today however the 'enemy' is the cyber-terrorist, or the foreign state with intent to cause damage to Western computer networks, or influence the integrity of the growing, interconnected system of data communications and data storage.

This concern was documented in a 1962 CIA document describing several secret Soviet documents leaked by a Soviet source. The documents were all marked with code name IRONBARK and came under Richard Helm's tenure as CIA Director. The documents detailed soviet research into artificial intelligence – in particular work done by Colonel P. Savinskiy in devising 'Methods of Achieving Tactical Surprise in Ground Troop Operations'.

In that article, Savinskiy wrote: 'For this all possible means of deceiving the enemy will be used: setting up of mock-ups; simulated activities of



communications means and radio technical stations, which service subunits using nuclear means; creation of artificial intelligence indicators of the location of nuclear means, such as, for example, evacuation of the civilian population and reinforced security in specific areas...'

Savinskiy's work referred to a careful analysis for areas potentially requiring civilian evacuation and enhanced security. However, what the use of the term in this document shows is that the concept of 'artificial intelligence' was in use within intelligence circles and academia long before it became a commonly used term throughout society and in the media.

Artificial intelligence was always a concept under study and development by U.S. academia and the intelligence community.

On 3 April 2001, John C. Gannon, National Security Telecommunications and Information Systems Security Committee, said: 'These changes [pace of change in information technology] could improve processing power, information storage, and bandwidth enough to make possible application of advanced software technologies-such as artificial intelligence-to cyber warfare. Such technologies could provide the defender with improved capabilities for detecting and attributing subtle malicious activity, or could enable computer networks to respond to attacks automatically.'

Outbreaks of terrorism in recent years have stimulated academia to look more closely into how artificially intelligent systems can be applied to the detection of potential terror attacks via 'pre-crime data mining'. The terrorist attacks of 9/11 in New York City only served to fuel that interest and intensify efforts to make better use of IT technologies and to focus on further developing artificially intelligent prediction tools – particularly those applied to intelligence collection and analysis.

By 2003, the National Science Foundation had established the Artificial Intelligence and Cognitive Science (AICS) program which has the primary focus of 'advancing the state of the art in Artificial Intelligence and Cognitive Science.' Around the same time COPLINK was launched in the United States. COPLINK used techniques from artificial intelligence and other fields to help detect 'faint trails' woven through vast databases, potentially across police divisions or other agencies, and provide investigators with leads for their cases.

COPLINK was one of the first systems to actively use predictive analytics to anticipate criminal activity and pinpoint likely geographic locations where crimes were most likely to be committed. Today variations on the original COPLINK software are in use in Great Britain and Europe – such software is proving invaluable in identifying criminal clusters and anticipating the likelihood, whereabouts and timings of acts of crime and/or terrorism before they actually occur.

AI pre-crime data mining applications can undertake behavioural profiling of individuals suspected of being crime or terrorism oriented. With every call these people make on their cell phone and every swipe of their debit and credit cards, a digital signature of 'when, what, and where' is incrementally built every second of every day in the servers of their credit card providers and wireless carriers.

Monitoring the digital signatures of these consumer DNA-like codes are models created with data mining technologies, these codes look for deviations from the norm, which once spotted instantly and routinely issue silent alerts to monitor cards and phones for potential theft. Behavioural profiling, by the way, is not racial profiling, which is not only illegal, but a crude and ineffective process; race is simply too broad a category to be useful, it is one-dimensional.

What is important however is suspicious behaviour and related digital information found in diverse databases, which data mining applications can use to analyse and quantify. Behavioural profiling provides us with the capability to recognise patterns of criminal activity, to predict when and where crimes are likely to take place and to identify its perpetrators. Pre-crime detection is no longer science fiction; it is the objective of data mining techniques based on AI technologies.

Similar data mining technologies have been used by marketers for years to provide 'personalisation' - the exact placement of the right offer, to the right person at the right time, now similar techniques can be used for providing the right inquiry to the right perpetrator at the right time: before they commit the crime. Investigative data mining is the visualisation, organisation, sorting, clustering, segmenting and prediction of criminal behaviour using data attributes such as age, previous arrests, modus operandi, type of building, household income, time of day, location, countries visited by the potential perpetrators, length of residency, utility usage, IP address, VISA type, number of children, place of birth, average usage of ATM card, number of credit cards, etc.

Pre-crime detection is an interactive process of predicting criminal behaviour by mining this vast array of data using several AI technologies, including:

Link Analysis for creating graphical networks to view criminal associations and interactions;

Intelligent Agents for retrieving, monitoring, organizing and acting on case related information;

Text Mining for searching through massive amounts of documents in search of concepts and key words;

Neural Networks for recognising patterns of criminal behaviour and anticipating criminal activity; and

Machine Learning Algorithms for extracting rules and graphical maps of criminal behaviour and perpetrator profiles.

Analytics provides O.R. with fashion industry foothold

Nigel Cummings



The fashion industry generates billions and brightens the lives of many by maintaining cutting-edge designs, and continually re-inventing itself.

Every season, fashion companies from Paris to Bombay and beyond, launch new styles, fabrics and colours into a hungry marketplace – it is one of the few industries unaffected by the economics of austerity. The fashion market's reaction decides which new fashions to produce for the new season and which ones will become the next 'must have' items for trend-setters the world over.

Determining which designs to mass-produce is only one element out of many that defines success for fashion companies though. Some fashion companies use forecasting technologies to predict likely sales for every variation of a potential 'hit' item. Prediction is a useful anti-waste tool, since unsold products at the end of season are either sold at huge discounts, or destroyed in an attempt to protect the exclusivity of brand name.

Surprisingly, on average, fashion companies are behind similar industries when it comes to their use of business analytics tools. According to information obtained from a recent SAP Performance Benchmarking analysis, fashion companies on average are able to track fewer strategic Key Performance Indicators and less able to use analytics than their peers in the retail and consumer products industries.

Fashion companies traditionally have a hard time getting an accurate and highly detailed read on supply and demand in their world, as trends and tastes tend to be fickle. Most fashion companies have procurement lead times of 6 to 8 weeks, and this makes it hard to anticipate and respond strategically

to lower or higher than expected demand for certain Stock Keeping Units (SKUs) or styles.

Some fashion and clothing-design companies are however utilising analytics to improve their forecasting and potential profitability. *Under Armour*, for instance, is able to plan in detail for the next 3-4 seasons by collecting critical market forecasts and inputs in quick and accurate manner. Another fashion house trading mainly on the web, *Bluefly*, is using business intelligence tools to help its marketing team monitor the performance levels of multiple marketing channels, in near real-time. These tools allow the company to identify best- and worst-performing partners and affiliates. *Zara*, the fashion chain owned by Inditex, is apparently able to take information from the shop floor on changing demand and get new designs to stores in a week.

According to SAP, and based on leading examples from fashion and other industries, five key characteristics consistently stand out in companies that have taken analytics on board:

- Their business analytics systems provide visibility into multiple parameters, such as colour, size, style, season, theme, and so on;
- Analytics technologies allow them to optimise markdowns to improve profitability and reduce inventory;
- Their systems have the ability to predict performance of new products (even with no sales history) by leveraging attributes like colour, collar size, etc. from other products;
- These companies utilise user-friendly tools to collect information from key people in their organisation; and
- Their analytics systems can handle large amounts of data, including information from social websites such as Facebook and Twitter, to provide a richer sense of what people are saying about fashion trends, products, strategies and brands.

The impact of using analytics in fashion has been dramatic. SAP Performance Benchmarking shows that companies with the greatest use of business intelligence have on average 54% higher operating margins than companies with low adoption. With those levels of value, Business Intelligence may be the next hot trend for the fashion industry.

Keeping cool, the smart way Nigel Cummings

Switzerland's largest retailer is working with IBM's business analytics to turn its refrigerated warehouses into part of a future, smart, electricity grid.

Migros, Switzerland's largest retailing company, owner of the largest supermarket chain and one of the largest employers in Switzerland has teamed up with IBM in a project involving electricity utility BKW and national grid operator Swissgrid. The aim of this cooperative venture is to use Migros warehouses as a buffer to cope with the unpredictability of renewable energy sources.

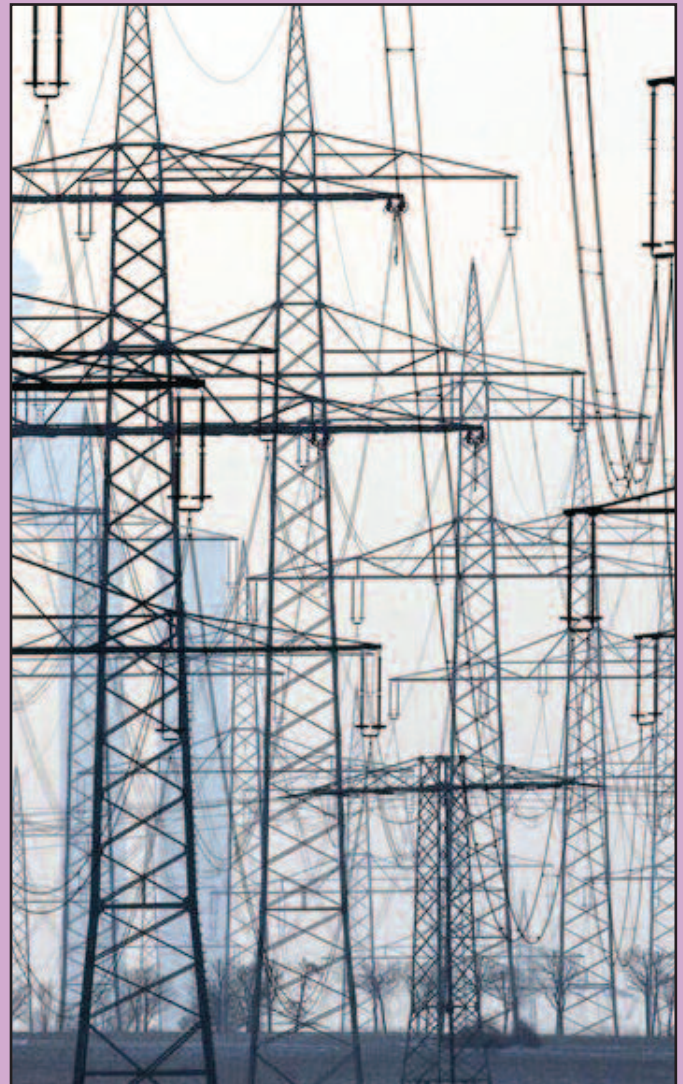
Unlike conventional fossil fuels, generating electricity from wind or solar power is unpredictable and varies according to the weather. For energy providers, this means they need to have the flexibility to balance supply and demand in new ways.

Migros is a huge consumer of electricity using more energy than the entire Swiss city of Bern. Most of this power is used to hold its three enormous warehouses, covering some 20 hectares, at the correct temperatures. Good insulation obviously helps but most of the heat gains occur during the movement of stocks due to the doors being opened allowing cold air to escape and because the incoming stock may be warmer than that being held.

Small fluctuations in temperature within the warehouses are not a problem so when power is available it can be used to lower temperatures to the bottom of the acceptable range. When power is not available, the movement of stock can be reduced and doors can be kept shut thus reducing the amount needed. The clever bit is matching the balancing between the peaks and troughs in power generation against those in demand from outside Migros with the movement of stock in and out of the warehouses.

Acting as a power buffer would help reduce Migros's energy costs, as its provider would pay to gain the flexibility it needed. Thus the consortium, which is called Flexlast, is working on developing analytical models that predict the energy needs of Migros warehousing, and allowing the electricity provider to divert resources elsewhere at times of lower consumption.

In simple terms, when the wind blows and the sun shines, there will be abundant energy that Migros



can use. When the weather changes, the utility firm can direct resources elsewhere.

The project aims to have a fully live version of the system running early in 2013. IBM is also looking into how other electrical consumers can be used to buffer the irregular production of renewable energy, and has already demonstrated how electric vehicles, appliances and homes can contribute to a future smart grid. IBM's energy analytics takes into account real-time conditions and increases the use of renewable energy, to balance grid load, reduce failures, and accommodate consumer preferences and their desire to reduce energy consumption.

How much home insurance should you be paying?

Nigel Cummings

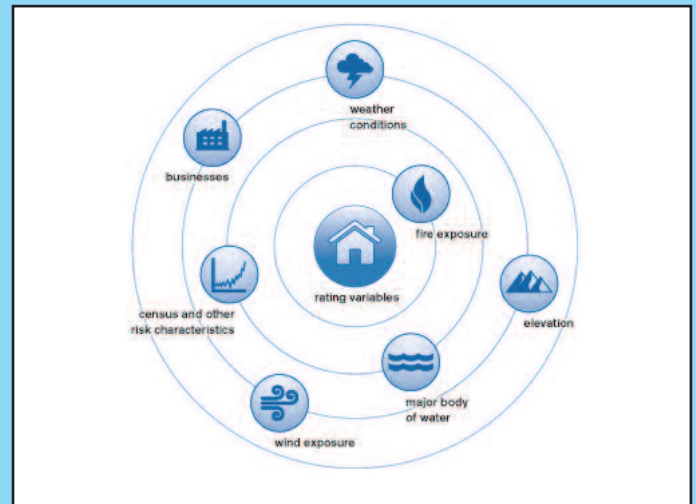
Predictive Analytics is allowing insurers fighting for a share of an increasingly competitive marketplace to increase profitability without sacrificing insurance cover to its customers.

Insurers see predictive analytics as a means of gaining a better understanding how closely their premiums match their risks. They are constantly looking for better ways to predict future losses so they can identify their best risks and price all the risks in their book of business more accurately. So it no surprise that predictive analytics is currently their de facto choice in wringing the best profits from insurance sales whilst minimising risk and providing value for the insured.

Home insurance is a highly complex business. On the one side are the risks: fire, theft, flood, accidental damage, and so on. On the other side are the customers: how likely are they to claim; how likely are they to take their business elsewhere; by how much can we increase their premiums before we lose their custom and hence do we really want this person on our books. What additional benefits can we offer this person knowing there is an extremely low probability they will claim against them.

Advanced analytics has proven an effective means to increase predictability and develop new underwriting and rating approaches for insurance, and in particular for the homeowners' insurance market. Some insurance companies are using advanced analytics on homeowners to develop rating plans that rate separately for the individual risks covered by the homeowners' policy, as opposed to the traditional approach of rating all risks as a package.

The relative importance of risks can vary for a number of reasons. For example, risks from flooding can now be determined from studying 3-D maps which identify, at a glance, local minima (i.e. places in which flood water can accumulate and to what depth). Fire damage is likely to be more serious in properties of a certain type but also in more remote areas where fire appliances are likely to take longer to reach the scene. Again there are



maps which show the number of burglaries by street; houses in *cul de sacs* are particularly vulnerable particularly if there is footpath access to closed-off end. 'Crimewatch' areas are, however, less prone but are areas on the periphery more prone as a result?

Needless to say there are software packages available that can produce risk ratings for any of a whole load of factors. One such 'off-the-shelf' analytics solution is 'ISO Risk Analyzer Homeowners' produced by a U.S. company based in New Jersey. It features an environmental module which can be easily modified to encompass risk factors associated with UK and European home owners' insurance needs. The environmental module supplied with ISO's 'Analyzer', once configured, can analyse and predict potential loss costs for nine separate risks at the level of census block group by public protection classifications for base policies. There are also modules which can deal with other types of risk including car insurance both for private and commercial owners.

Perhaps every self-respecting burglar should carry an ISO Analyzer as well as a gemmy and a 'swag' bag!

More information about the ISO range of predictive analytics applications can be found at: <http://www.iso.com/>