

Analytics: Revealing the Future for Business

Opening

Analytics stands on the shoulders of information traditions that date back even before the computer era. Although analytics represents the current set of tools that support automated decisions in an expanding number of industry settings, the attitude that gave rise to analytics—the “test and learn culture”—has its beginning in the scientific method.

Seen as an effective decision-support tool primarily for the military and financial services just 20 years ago, analytics has now attracted the attention of a growing range of client companies that see the field as a way to gain a competitive edge through strategic mining and analysis of stockpiled data. As an integral part of their business strategy, analytics can also improve their bottom line and—through real-time, interactive decision flow—enhance relationships with their customers, employees, and partners.

Analytics is employed by companies as diverse as professional sport teams that continually assess the strategic value of recruits and players, hospitality companies that widely implement revenue management systems to optimize occupancy rates and revenues, manufacturers that have gained new levels of control and decision-making through the use of visual analytics systems, consumer brands that need innovative ways to mine customer-feedback to learn about perceptions in the marketplace, and many more.

The Evolution of Analytics

Although quarreling over semantics often threatens to upend any overview of this type, “analytics” can be defined as the current evolutionary stage of providing decision support to an organization through the statistical analysis of existing data. In fact, decision support systems have paralleled the evolution of computer technology over the last fifty years, as we see below.

First Wave: Artificial intelligence (60s and 70s)

In the 1950s, computers occupied entire rooms and the prevailing vision in the burgeoning field of “artificial intelligence” revolved around making a machine think like a human. Although the state-of-the-art computers of the time were gargantuan, the data sets they could manipulate were, by today’s standards, both miniscule and simplistic in their structure. This severely compromised the range of decisions that machines could handle but brilliant minds and clear vision overcame these limitations and managed to move the field forward with many notable successes.

In 1956, Fair Isaac was founded on the belief that data, if analyzed in a systematic way, can assist with business decisions. Within two years, engineer Bill Fair and mathematician Earl Isaac had developed their first credit scoring system for a financial services client.

Second Wave: Business Intelligence (80s to mid 90s)

As the size of computers grew radically smaller and as the computing power for these machines grew exponentially larger (following Moore’s law that projected a doubling of power and halving of size every two years), we also saw the rise of applications that could handle large, structured data sets and perform sophisticated reporting and analysis. With the focus now shifting to machine learning based on rules, the field of “Business Intelligence” was fueled by the combination of powerful relational database software, coupled with the data analysis, reporting and visualization capabilities of BI applications.

Business Function	Technical Capability	Example
Data Warehouse	Relational Database Management System (RDBMS)	<ul style="list-style-type: none"> ▪ IBM DB2 ▪ Oracle ▪ Teradata ▪ Informix ▪ Sybase
Business Intelligence: data analysis, reporting and visualization	Online Analytic Processing (OLAP)	<ul style="list-style-type: none"> ▪ Brio ▪ Business Objects ▪ Cognos ▪ Hyperion ▪ MicroStrategy

At the same time, the expanded capabilities of computing power, applications, and data structures gave rise to whole classes of enterprise business applications—Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM), and more. One classic example of development during this wave was the airline reservation systems which significantly optimized the profitability and resource planning for participating airlines companies.

Business intelligence—sometimes referred to as “easy analytics”—continues to have wide applicability in business, delivering improvements to the bottom line by providing key insights through “data-based decision-making” and leading to more informed business decisions. These decisions give rise to new policies that are then embodied within an organization’s policy manual, pricing sheet, marketing campaign, or as business rules within enterprise applications.

Third Wave: Analytics (mid 90s to the present)

While consumers experienced a power boost in desktop computing, the scientific and IT communities saw several quantum leaps take place in the computational power of workstations and in the sophistication of network architectures, including the internet. Also fundamental to the explosion of analytics was the integration of neural network technology and other complex statistical algorithms into real-time business processes. As more analytics tools were developed and it became easier to link analytics into business processes via the internet and other modern IT architectures, business intelligence was elevated to “analytics.”

A key driver of analytics is data—structured and unstructured, historical and real-time. We live in a time of data proliferation. As more powerful analytics applications become available, more of this data yields to analysis and supports decisions. For example, unstructured text represents a huge body of data that has been probed by analytic tools in the just the last ten years to deliver real-time intelligence and decision support to businesses. With the advent of

new technologies like RFID, that accumulation of new bodies of data—along with the applications to unlock findings—will only accelerate.

During this wave of the evolution, we have seen the emergence of new phenomena, notably online applications like social networking, web analytics, sophisticated search strategies, and new models of commerce, driven by a company's ability to operate confidently in the web environment.

This analytics wave has also been characterized by diversity—with new branches of analytics serving entirely new industries in entirely new application areas. Indeed, no business seems beyond the grasp of analytics. One example of this includes video analysis, which applies content analysis principles to broadband video data.

Technology trends fueling the proliferation of analytics into more business processes include:

- Internet-enabled, real-time querying and decision support, making analytic services readily accessible to employees and customers
- “Electronification” of business processes—via ERP, CRM, SCM and the internet—generating increasingly more detailed data on employee, customer and supplier behavior, providing raw material for analysis
- Converting long-established algorithms into automated and processor-intensive data-mining tools and integrating these into a business workflow for executive decision support
- Service Oriented Architecture (SOA), facilitating the connectivity of analytic services to existing software applications
- XML, making large amounts of data “cullable” and sharable across applications
- Continued growth in computing power and data storage capabilities
- Ever-increasing complexity of business rules, driven by competitive and regulatory forces

Whereas earlier waves of business intelligence aimed to have machine learning mimic human learning, machine learning in the current environment typically outstrips what humans could even perceive. Through the use of sophisticated tools, analysis of disparate and seemingly unstructured data sets can result in subtle discriminations and not obvious decisions.

Although analytics seems to be an expanding field with few limitations, there are, in fact, real-world problems that do not yield to an analytics approach. Analytics works best in those areas where historical data is large and where analytic decisions are applied in large-scale, repeatable, high-value decision areas.

Consumer goods marketing, for example, is an excellent candidate for application of analytic techniques: there are many potential offers, many potential customers, and there is an opportunity to perform numerous “tests” to learn which offers are most appealing to a sample of customers before applying them to the entire customer base. In contrast, one-time strategic decisions—such as whether or not to merge with a particular competitor—are poor candidates for analytics, as there is typically little or no historical data upon which to model the outcome.

Mortgage fraud represents a good area for the application of analytics principles. Predicting winners and final scores for NFL games is considerably tougher.

Detecting fraud related to telecommunications roaming charges represents a good fit for analytics, again because the data sets are considerable and they reflect behavioral models that can be analyzed to reveal fraudulent patterns. Predicting which bagel varieties will sell out first at a small Mom-and-Pop deli next to a bus station gets complicated pretty fast—and the payoff for the analytical effort required would be relatively insignificant.

Click fraud—a relatively new anti-competitive behavior related to search engine marketing—reveals itself through behavioral patterns that also can be detected through analytics. And here we could cite any number of real-world counter-examples that we'd categorize as “Does Not Compute.”

Customer feedback—whether collected online or through e-mails—has been data mined to provide companies with real-time market “buzz,” competitive information, desired feature sets for products, and even instant “brand snapshots.” Can iterative analysis of voice and visual feedback be far behind?

Analytics have been widely adopted across industries and firms that best leverage analytics are increasingly leading their industries.ⁱ Capital One (consumer finance), Harrah's (casinos), and The Boston Red Sox (baseball team) are all recognized leaders in their respective industries and who cite their use of analytics as a principal component of their competitive strategy.ⁱⁱ In fact, “data analysis” is now seen as a fundamental basis of innovation—as able to create a sustainable competitive advantage as innovations in cost, design, logistics, or line-extension.ⁱⁱⁱ

Next Wave: What will this look like?

Seeing the progression of decision-support technology as it has progressed from the 50s up to the present, one's curiosity naturally turns to the future, wondering what new developments might unfold. The question was posed to several members of the San Diego analytics community who helped in the development of this paper. Their thoughts are presented below:

Bruce Hansen, ID Analytics:

We see the field moving toward real-time analytics. Automated real-time decision flow, as an aspect of machine to machine processes that build on themselves, will reach higher levels of power and sophistication.

Operationalizing analytics makes it powerful. It's important to see that analytics works hand in glove with the software industry. Data and software, together, fuel analytics.

Although there will be more flavors of the technology, much of it will still be based on human neural networks—a landmark technology but just one of dozens of new models for machine learning. The academic community will push the envelope by developing more models for machine learning.

As these new decision frameworks are brought to bear on existing data collections, more companies and service providers will gain a return on their IT investment which, for many years, consisted of amassing and structuring data. Now those data assets provide for the payoff through sophisticated, automated, and self-learning decision flow.

Todd Gutschow, HNC Co-founder:

As computers get faster and smaller, we will see reasonably capable autonomous systems moving into the activity domain previously reserved for human beings.

Russ Mann, SEMDirector:

Analytics as a field will include more automation of the end action arising from analysis—not just producing the decision to act.

Predictive analytics, up till now, has been a misnomer in some ways. It's actually been more reactive analytics—that is, “based on behaviors in the past, when certain conditions were present, a person will most likely do this.” Thus, analytics will be employed to find and correct points of failure in a system and analytics will be used as a self-perfecting system—with integrated feedback for continued learning and self-healing.

Analytics tools may evolve to include/analyze/act on data from more of the senses — olfactory, touch, taste, etc. Bioanalytics are already becoming deployed around disease detection and prevention and bio-warfare.

RFID and Geospatial mapping revolutions will create amazing new data sets going far beyond financial or numerical data for all kinds of additional insights and actions

We tend to think of data in structured and unstructured forms: as more known structures evolve, they will bring more flexible, breakthrough analytics models, and as we learn how to better categorize, handle and leverage unstructured data, more interesting things will happen.

Guy Jones, Island Data

Whereas we've focused on existing text data—streaming in from online customer feedback utilities or from e-mails—to provide real-time decision support, we are moving into helping businesses create online user communities. This sharpens the conversation and can empower a company to follow through on the number-one rule of business: “Listen to your customer.”

We see a true 360-degree view of the customer as an approaching reality for businesses. We intend to lead this development by providing business owners and executives with better dashboards, characterized by less data and more knowledge.

The level of excitement that new analytics developments continue to generate amazes me every day. It's not over by a long shot!

HNC History

One company figures so prominently in the development of the San Diego analytics community that, by taking a closer look at its history and its cross-fertilization with other companies, we gain an understanding of the community as a whole. **HNC**, or Hecht-Nielsen Neuro-Computing Company, was founded in 1986 by Robert Hecht-Nielsen. His pioneering work in neural networks technology at UCSD was central to HNC's first products and services. His work continues to inspire new analytics applications today. Hecht-Nielsen and

co-founder Todd Gutschow, having worked together at **TRW**, were joined by Robert North, who rounded out the executive team as CEO.

Since desktop PCs at the time were not powerful enough to handle the processor-intensive neural network modeling, HNC developed their own multi-processor hardware configurations which they sold as products to financial services companies interested in developing predictive analytics models as a way to reduce risk and fraud. After selling off their handwriting and alpha-numeric character recognition business in 1990 (to **Mitek**), HNC focused their business on credit card fraud detection, realizing revenue through three channels:

- 1) Hardware and software products, such as proprietary neural network processor boards
- 2) Financial modeling tools
- 3) Government contracting services

In 1992, the products associated with visual inspection capabilities—e.g., for apple and potato-chip sorting—were discontinued leading to the formation of a new company, run by former employees: **N-Space Technologies**, now **Certona**. Through continued focus on the credit scoring business, HNC deployed its powerful Falcon product to First USA, First Data Resources, Wells Fargo, and Advanta. A breakthrough product, Falcon pooled regional data across the country to construct predictive models with enhanced accuracy on a national level. HNC grew with its Falcon product and went public in 1995, posting revenues of \$44M.

- 1996: **Aptex** formed, focusing on text analysis. Products included SelectCast and SelectProfile. Brought back into HNC in 1999.
- 1997: HNC acquired **Risk Data** and **Retek**, allowing expansion into the insurance and retail sectors.
- 1998: HNC acquired **CompReview**, a software company serving the payment and medical billing market.
- 2000: HNC acquired **CASA**, a provider of services and software solutions in financial, retail, and agriculture sectors.

Already providing software solutions to three vertical markets—financial, insurance, and retail—HNC acquired New Mexico-based CASA in 2000, further strengthening its financial offerings with expanded predictive modeling in consumer banking, specifically personal bankruptcy and credit card delinquency.

As HNC developed a solid foundation across different markets, it continued investing in its Falcon product—the recognized gold standard for reducing credit risk and improving fraud detection. Falcon by this time was deployed throughout the U.S., Europe, South Africa, Japan, and Latin America. An internet division, **eHNC**, was spun off as a separate company and eFalcon leveraged HNC's intellectual property to bring fraud detection capabilities to the growing community of internet-based merchants. Although eHNC was brought back into HNC by 2000, a changing of the guard in the CEO position—John Mutch replacing Bob North—heralded a new set of acquisitions, all in 2000:

Onyx—Atlanta-based ASP provider of credit and fraud checks

Systems/Link—fraud detection related to telecommunications using real-time call data

CardAlert—fraud detection services for ATM network clients

Blaze Advisor—a business rules management system (BRMS) for managing and deploying business logic

Also in 2000, HNC spun off the **Retek** which brought in more than \$2B for parent HNC and shareholders. In 2002, Fair Isaac Corporation acquired HNC. Much of the HNC product portfolio—especially Falcon—has been integrated with the Fair Isaac product offering and the HNC San Diego offices have become a Fair Isaac divisional headquarters. Many HNC alumni have moved on to run vibrant, young analytics companies: **Basepoint**, **SEMDirector**, **ID Analytics**, **Global Analytics**, and **Edgeware Analytics**, to name a few.

During the years 1986 to 2002, HNC was a center for the growth of analytics capabilities in San Diego. Through the ebb and flow generated by its own acquisition, growth, and spin-off cycles, HNC magnetized the San Diego analytics community, infusing it with the entrepreneurial energy that fueled its expansion, attracted new talent, and brought it to its current prominence on the national stage.

San Diego Analytics Community Infrastructural Pillars

Academic Resources: Jacobs School of Engineering

Recognizing that engineering is at the core of our technology-driven society, Jacobs School of Engineering, established in 1986 at University of California, San Diego, prides itself on educating students who will become innovators in their field, creative thinkers able to participate on multi-disciplinary teams, and strong communicators who can adapt to the rapidly changing job market.

Underscoring the importance of this academic institution to the San Diego analytics community, Robert Hecht-Nielsen conducted his seminal work on neural networks—also known as neurocomputing—while at UCSD’s Jacobs School of Engineering. His work launched a major branch of analytics not just here in San Diego but around the country.

Below are a sample of companies that have contributed to making San Diego the analytics hub it is today.

Government and Defense Contractors

Company	Product and/or Service Focus
SPAWAR	Communications, intelligence, surveillance and warfare systems
General Dynamics	Information technology communications, computing, intelligence
SAIC	Technological solutions for national security, intelligence and homeland defense

Public Companies

Company	Product and/or Service Focus
Fair Isaac Corporation	Enterprise decision management
Teradata	Analytics solutions in data warehousing, customer management, finance and performance management, etc.
Mitek	Software to improve business solutions and business performance
Visual Sciences	Provider of real-time analytics applications

Private/Smaller companies

Company	Product and/or Service Focus
SEMDirector	Search marketing automation solutions for global organizations
ID Analytics	Identity fraud and risk reduction
Veoh Networks	Video content analysis
Island Data	Enhanced business intelligence through customer service feedback
Certona	Powerful though generic analytics modules for small to medium-size companies
Salford Systems	New generation data mining and consulting services

Service and Capital Providers

San Diego is fortunate to have many national and international professional service providers and financial services institutions. Many of these organizations support the efforts of SDSIC.

The Future is Analytics

The Forum on Analytics: From Data to Decision

As analytics professionals and companies gather in San Diego to attend The Forum on Analytics, hosted by the San Diego Software Industry Council (SDSIC), attendees will see that the applicability of analytics continues to expand, reaching into more business and industry sectors and unlocking findings in databases that only recently could be probed with sophisticated software applications. The tools of analytics—hardware solutions, algorithms, and real-time decision support software—continue to evolve and grow more powerful.

Companies in San Diego have become a driving force in that evolution. Over the last 20 years, this region has become home to the nation’s pre-eminent analytics community. With the right mix of large, established companies alongside a constellation of smaller, niche-focused companies that are pushing back the boundaries of analytics applications, San Diego also boasts an unmatched academic resource with UCSD’s Jacobs School of Engineering and an experienced professional services community to support the community’s growth.

The future of business is analytics. And the future of analytics is taking shape in San Diego where an optimum mix of academic resources, large and small analytics corporations, and an analytics-savvy support community of legal, financial, and marketing firms have come together to support growth, to help launch new companies, and to attract companies and individuals drawn to this area's ideal blend of community factors.

ⁱ "Math will Rock Your World", *BusinessWeek* magazine, January 23, 2006

ⁱⁱ "Competing On Analytics", Thomas H. Davenport, *Harvard Business Review*, January 2006.

ⁱⁱⁱ "Innovate, Yes - But Where?", Rich Karlgaard, *Forbes.com*, March 13, 2006