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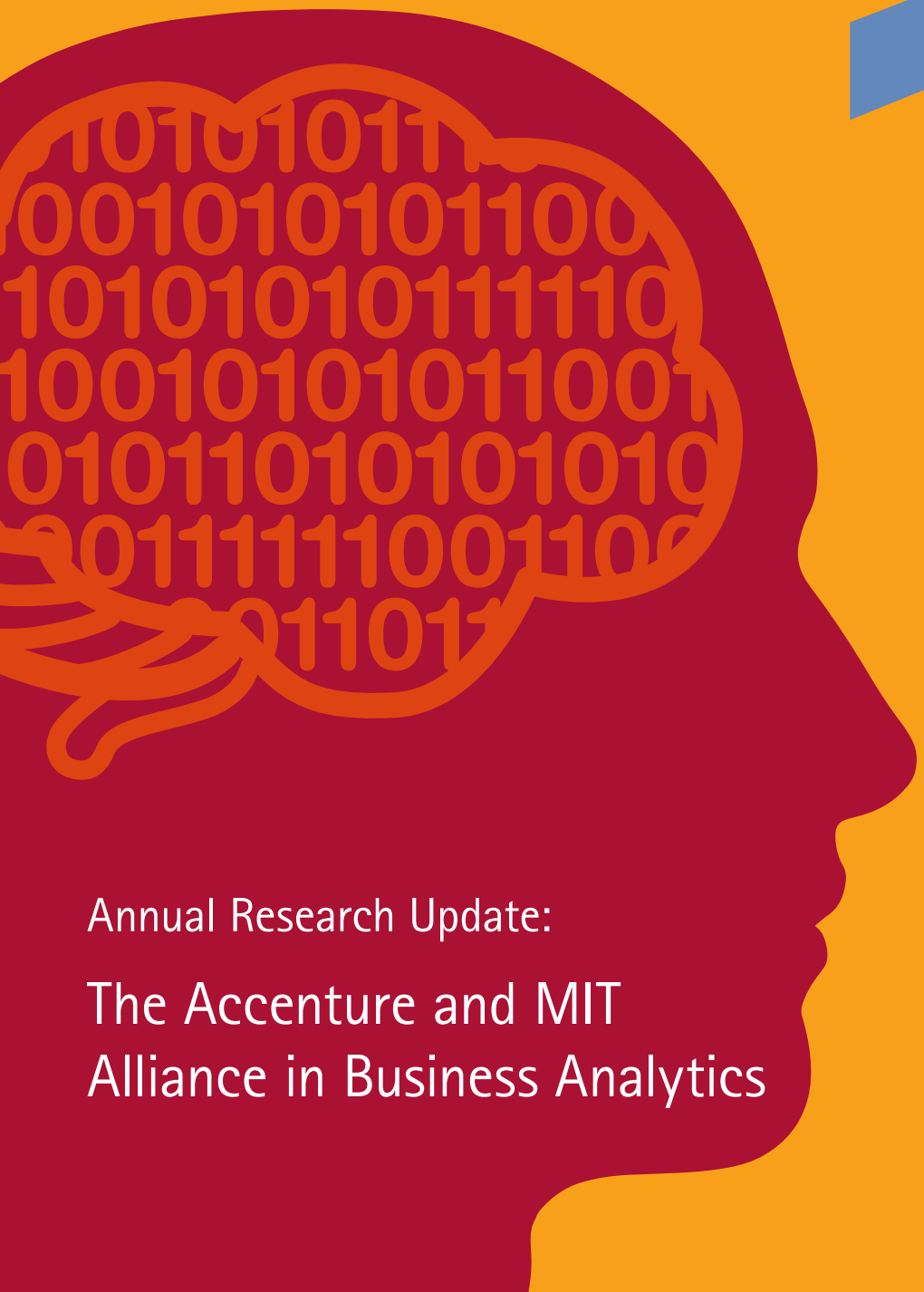


Annual Research Update:

The Accenture and MIT Alliance in Business Analytics

The Alliance

The Accenture and MIT Alliance in Business Analytics is an applied research collaboration focused on developing new business analytics solutions to help today's global companies solve some of their most critical challenges. The alliance harnesses Accenture's industry and analytics expertise and MIT's scientific and technological leadership to address the challenge of applying leading edge analytical techniques to solve practical problems with tangible value.

"Our alliance with one of the world's most prestigious research institutes will help industry and our clients achieve better outcomes driven by their analytics efforts."

Narendra Mulani, senior managing director-Accenture Analytics, and co-lead of the Accenture and MIT Alliance in Business Analytics

Follow the conversation at #AccentureMIT

Research That Impacts Industry

Our research spans a wide range of business issues. To date, an examination of Accenture, MIT and client priorities expressed in our research reveals four primary themes (Foundational, Industrial Operations, Retail Innovation and Risk Analysis):

- Wind Turbine Failure Prediction
- Hybrid Models for Gas Turbine Operational Mode Prediction
- Optimizing the Unconventional Drilling Process Through Field Data Analysis

- Fraud Detection Through Geographic Analysis and Visualization

- Revenue Optimization for Online Flash Sales
- Yield Management for Airline Ancillary Services
- Impact of Social Media on Online Retail Sales
- Social Media Buzz Forecasting
- Mobile Behavior Analysis
- Business Life Cycle Modeling for Service Demand

Each research project team consists of two principle investigators as lead researchers (co-led by MIT and Accenture) plus one or more MIT graduate students. The alliance selects its principal investigators from an elite pool of researchers within the MIT faculty and Accenture Analytics. The team collaborates with the participating company, which provides context, data and ongoing input to help shape the research outcomes.

Foundational Research

Data Science Challenge

The Accenture and MIT Alliance in Business Analytics launched the 2014 Data Science Challenge in partnership with the City of Chicago. The goal was to use the City of Chicago's open data sets on the *City of Chicago Data Portal* to develop solutions and ideas for delivering potential positive impact to the city's residents, visitors and businesses by developing creative solutions and visualizations.

Outcomes

Winners were selected by a panel of judges including MIT professors, Accenture Analytics leadership and executives from the City of Chicago, XPRIZE and Frost Venture Partners. The winning entries were reviewed by the City of Chicago as consideration for potential city planning initiatives.

Follow the conversation at #AccentureMIT

Linking Analytics to High Performance

David Simchi-Levi
MIT

Brian McCarthy
Accenture

Principal Investigators

David Simchi-Levi, MIT
Brian McCarthy, Accenture

Our first joint effort, Linking Analytics to High Performance, is an analysis of the link between a company's overall performance and the maturity of the company's analytics utilization. The research surveyed a global sample of more than 850 analytics executives in order to: identify high performance businesses and determine the relationship with analytics performance; explore the correlation between performance and analytics capabilities, investments, practices and technology; and determine what high performers do differently with regard to analytics and how they achieve business outcomes.

Outcomes

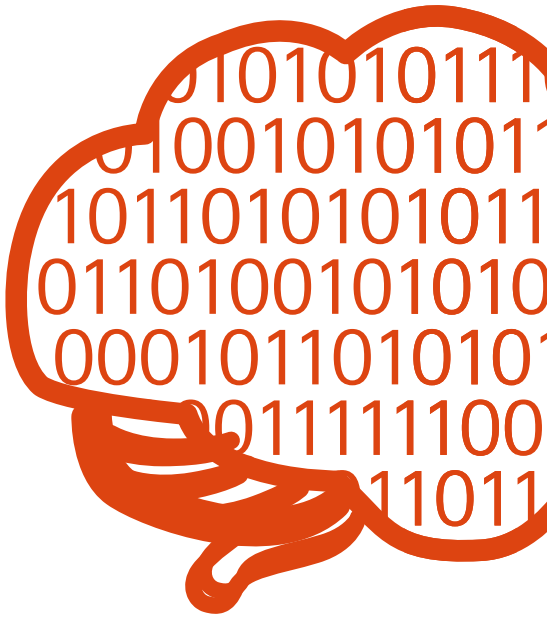
This research of cross-industry companies and practices concluded that high performers are indeed winning with analytics. These winning companies have common characteristics related to analytics, such as:

- Adopting analytics and adapting decision-making processes: Twice as many are using analytics in key areas and embedding analytics in decision-making.
- Committing to analytics investments: They spend more today, plan to spend more tomorrow and allocate spending more effectively.
- Deploying a multi-pronged talent strategy: They are better at managing talent end-to-end.
- Using more data sources and having better tools and techniques: They take on more complex analytics challenges because they have richer data, superior tools and more sophisticated techniques.
- Embracing the change journey: High performers navigate barriers to change, adapt their organizations for analytics and see better outcomes as a result.

For more information about these and other research findings in this brochure, contact the *Accenture and MIT Alliance in Business Analytics* to be connected with the Principle Investigators.

Retail Innovation

Fifteen years after the rise of eCommerce, advances such as social networking, mobility and daily deal sites continue to challenge the retail and consumer packaged goods industries.



David Simchi-Levi
MIT

Matthew O'Kane
Accenture

Revenue Optimization for Online Flash Sales

Principal Investigators

David Simchi-Levi, MIT
Matthew O'Kane, Accenture

RueLaLa operates in the high growth industry of online fashion flash sales. Their business model is based upon maximizing sales of limited inventory at the optimal price, preferably in the first sales period of the product's listing. MIT worked with RueLaLa to understand how machine learning and optimization techniques could be used to maximize revenues in this model. The MIT team developed new techniques aimed at forecasting the demand for a new product before sale commenced and employed price optimization techniques in order to maximize revenue. Accenture helped implement the resulting models for RueLaLa, which is now realizing significant financial benefits.

Outcomes

Forecasting techniques using regression trees and clustering together with price optimization resulted in a 10% increase in revenue. This leading-edge research was honored with the *2014 INFORMS Revenue Management Pricing Section Award*. *Listen* as Murali Narayanaswamy, Vice President, Pricing and Operations Strategy at RueLaLa, discusses how this research will fundamentally impact their business.

Yield Management for Airline Ancillary Services

Principal Investigators

David Simchi Levi
Matthew O'Kane

How should Ryanair price checked baggage? Optimal pricing of such ancillary services is critical in the airline industry. And it's the problem that Navitaire together with Ryanair brought to the alliance. This research builds on the work done for RueLaLa. Both cases involve a yield management problem with limited information about the demand for the particular items in question – goods that have never been offered by RueLaLa and services by Ryanair for specific flights with little purchase history. The challenge is the tradeoff between the time taken to "learn" the optimal price by exploring the response to different possibilities and the time left to exploit the optimal price. Spend too much time learning, and you won't have the time to benefit from exploiting optimal price. Settle on an approximation too quickly, and you may be leaving money on the table. An important focus for this work is to develop approaches that optimize the tradeoff between learning the optimal price and deploying it.

Outcomes

Actual performance is pending a proof of concept deployment with Ryanair in the fall of 2014.

Georgia Perakis
MIT

Marjan Baghaie
Accenture

Impact of Social Media on Online Retail Sales

Principal Investigators

Georgia Perakis, MIT
Marjan Baghaie, Accenture

Canadian online retailer SHOP.CA has its own well-developed social platform. But what impact does it have on sales? Customers treat endorsements from friends and acquaintances differently than ads. This research is intended to identify more precisely the impact of social activities on shopping behaviors. Which kinds of social behaviors can best promote sales? How effectively can we predict sales based on their social and purchasing history? Using SHOP.CA data, we have so far identified features that can predict the buying probability of a customer based on their social activity and purchasing history. Ultimately the objective is to identify ways of promoting social interactions associated with profitable customers.

Outcomes

Predictive models that provide the probability of a customer purchase given social and sales history. Furthermore, using these predictive models of customer buying behavior, the project also provides targeted discount recommendations to different groups of customers with the goal to incentivize them to buy and become repeat customers.

Tauhid Zaman
MIT

Andrew Fano
Accenture

Social Media Buzz Forecasting

Principal Investigators

Tauhid Zaman, MIT
Andrew Fano, Accenture

Your company suffers an embarrassing episode. It's all over social media. What do you do? Overreact, and you fuel a story that might have died on its own. Fail to respond, and the story takes on a life of its own while you sit back helplessly. An effective social response strategy depends on the ability not only to detect those events, but to forecast how they will progress. This research is focused on enabling the forecast of Twitter activity for a subject as early as possible into an event of interest. The developed models break the progression into two periods – the "trending" phase, which can be characterized by a log/normal distribution, and a "quiet" phase where tweets follow a Poisson process.

While crises are isolated events, other important business events follow a regular sequence, e.g. product announcements, product launches, reviews and sales figures. Beyond predicting the traffic for a given event, this research is examining the degree to which activity for one event predicts the amount of activity that will occur for subsequent events in the series.

Outcomes

Predictive models for the social media response planning.

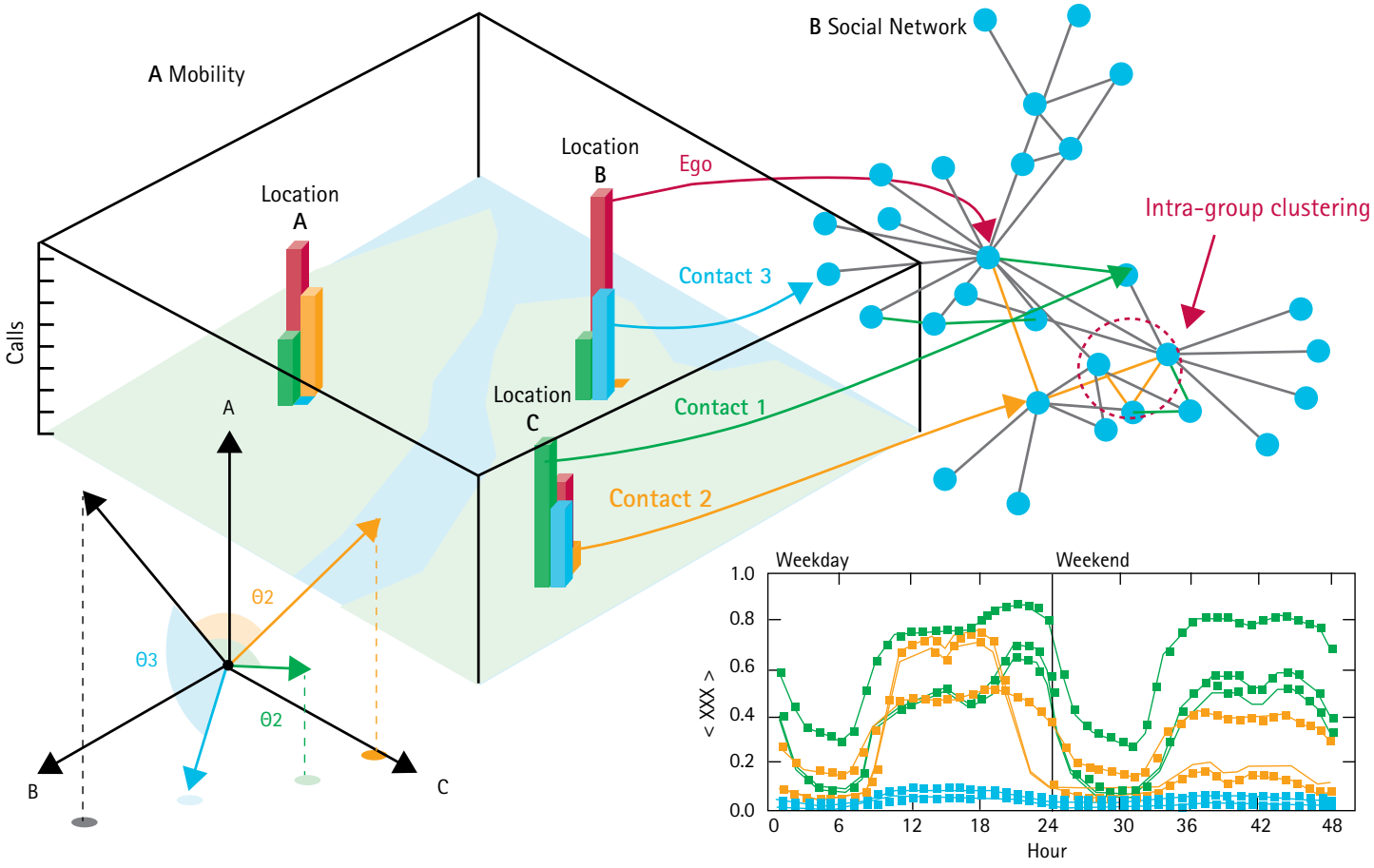
Marta Gonzales
MIT

Mobile Behavior Analysis

Principal Investigators

What can mobile phone location data tell us about the behavioral patterns of their owners? Mobile phones report their location, generating a wealth of data. Translating that data into useful behavioral patterns is not a trivial matter. Prof. Gonzales' work is focused on taking noisy mobile location data and developing models that allow this data to be understood in terms of behavioral patterns that can inform a range of applications. What are people's commutes? How long do they spend in different locations? Are they interacting with family and friends or business associates? Models that provide answers to these questions are relevant to urban traffic planning, business location optimization, capacity planning and advertising to name a few.

Clustering Social Contacts Based on Mobility Similarity



C Cosine Similarity

D Temporal Signal

Risk Analytics

Measuring risk is a critical capability across many industries. There has been a rapid growth in data in a wide range of domains that can potentially improve risk models. Transactions, social media, supply chain sourcing and health care are just a few examples of the data that can improve the ways we estimate risk.

John Williams
MIT

Oonagh O'Shea
Accenture

Fraud Detection Through Geographic Analysis and Visualization

Principal Investigators

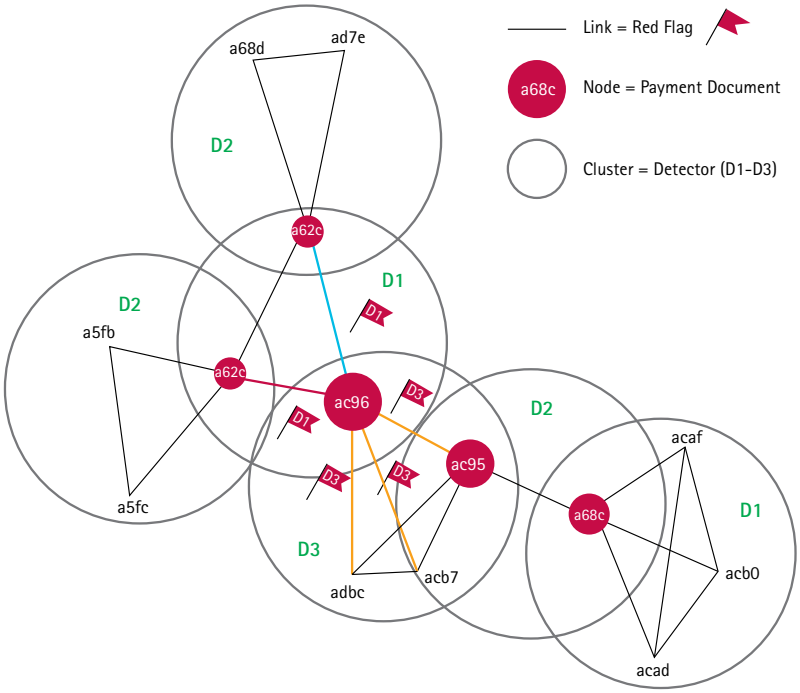
John Williams, MIT
Oonagh O'Shea, Accenture

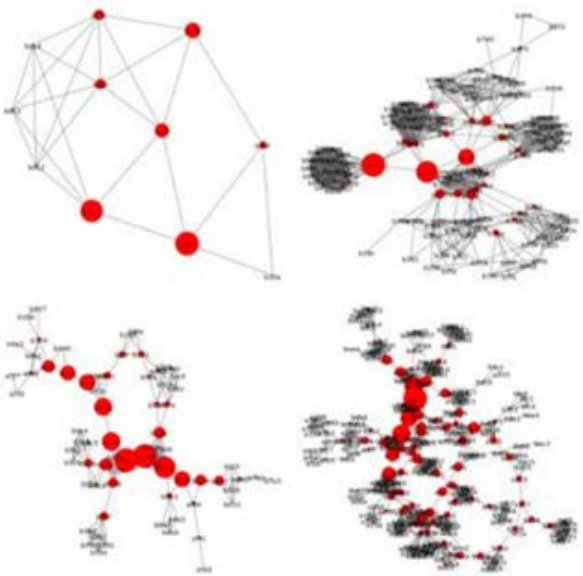
The Commonwealth of Massachusetts, Office of the Comptroller deals with a very large number of vendors for an extremely wide range of products and services. They came to the alliance seeking novel approaches to identifying fraud. Part of the challenge is that they had very few examples of known fraud cases in their data. This research has developed a novel fraud detection platform that enables a range of strategies to be deployed and the results visualized. Of particular interest thus far has been the integration of a geographical analysis module that highlights unusual collocations of businesses or business members, which may indicate problematic relationships. This work has combined the fraud domain expertise of the Accenture Analytics Innovation Center in Dublin with MIT's technical expertise.

Outcomes

To date, MIT and the Accenture Analytics Innovation Center in Dublin produced an approach that identified previously unknown relationships in the client's data. The research team has developed a situational awareness fraud detection framework that integrates different perspectives of massive, unlabeled and heterogeneous sources of financial data called SAFARI (Situational Awareness FrAmework for Risk ranking) to detect suspicious transactions, improper payments or potential fraud.

Safari integrates data sources and highlights transactions in need of closer review





"These are not 'ivory tower' theoretical exercises. Our alliance is unique in its focus on sponsoring joint research on applied client problems with client data to produce practical solutions. Clients actively shape the definition of the problem."

David Simchi-Levi, Professor of Engineering Systems, MIT, and co-lead of the Accenture and MIT Alliance in Business Analytics

Industrial Operations: M2M

The rise of machine data from industrial installations is providing unprecedented visibility into their operation. Alliance research is focused on exploiting this data to solve a range of business problems. Maximizing “up time” and machine life through improved maintenance is a common goal for companies in this space. There is often a bit of a paradox in predictive maintenance applications. The more critical and expensive the equipment, the more effort has gone into making failures few and far between. The fewer failures there are, the harder it is to predict failures. So companies are often left in the situation of being able to predict failures that are of relatively high frequency and low value or, conversely, of having little data to predict the infrequent but costly failures.

Cynthia Rudin
MIT

Cristian Corbetti
Accenture

Wind Turbine Failure Prediction

Principal Investigators

Cynthia Rudin, MIT
Cristian Corbetti, Accenture

Global utility Enel Green Power operates a range of wind turbines. The problem posed to the alliance was to improve failure predictions in order to maximize asset value, increasing plant availability and reducing unplanned maintenance costs. In practice, wind turbine failure predictions vary in usefulness depending on their accuracy, specificity and timeliness. This research involved the application of machine learning algorithms such as decision trees to predict general failures, i.e. undifferentiated failures using a binary classifier, as well as categorical failures that identify the probability of failure for specific components with different lead times.

Outcomes

The research has yielded models with varying accuracy for different components with time to failure predictions to optimize production and extend the useful life of the facilities. A new statistical model for reliability analysis was also studied to distinguish the latent internal vulnerability state of the equipment from the vulnerability caused by temporary external sources. The current emphasis is on determining how Enel can exploit these forecasts to improve, the asset availability and reduce operating and maintenance costs.

Saurabh Amin
MIT

Jesús Gabaldón
Accenture

Hybrid Models for Gas Turbine Operational Mode Prediction

Principal Investigators

Saurabh Amin, MIT
Jesús Gabaldón, Accenture

As a large natural gas utility, Gas Natural Fenosa also must contend with costly turbine failures produced by rotor health issues. With few failures to predict, the research focused on developing hybrid models that combine dynamical models with probabilistic learning models. These models are not used to predict failures directly. Instead the emphasis is on predicting transitions between normal and abnormal operating modes that could be aligned to such root cause. Given these predictions, the emphasis is now on determining operating and maintenance policies for how these operating transitions can affect the health of the rotor.

Outcomes

The research team developed an approach for predicting transitions between operating modes that can be easily incorporated into a prognostics framework. Current efforts are focused on how it is possible to utilize the indicators provided by the model for making operational strategic decisions.

Francis O'Sullivan
MIT

Brian Richards
Accenture

Optimizing the Unconventional Drilling Process Through Field Data Analysis

Principal Investigators

Francis O'Sullivan, MIT
Brian Richards, Accenture

How can Shell identify the most effective field processes for unconventional drilling? The development of unconventional oil and gas fields requires drilling intensive campaigns with rapid learning and refinement of practices based on feedback. At the same time there is currently an unprecedented amount of data being generated by increasingly digital drilling rigs. Given rapidly evolving drilling practices and technologies and the varied range of environments in which they operate, many of the more effective processes have yet to be identified, let alone codified. This work is focused on studying drilling operations data to identify processes associated with successful operation. The intent is to understand and deploy these processes more broadly to improve productivity and lower costs.

Outcomes

This research has shown that Approximate String Matching (ASM) is a tool that can be used to measure standardization between wells for the first time by using a new metric - operational variability. The ability to measure and record standardization can inform the design of incentives for planners and field workers in order to balance the differing nature of risk for standardization and continuous improvement.

"The real value to these companies is in the experience of doing the work."

Andy Fano, managing director-Accenture Analytics and program director of the Accenture and MIT Alliance in Business Analytics

Follow the conversation at #AccentureMIT

Analytics Innovation Consortium

"These companies are among the handful who are currently applying advanced analytics in innovative ways. Their input on the research agenda for the alliance is critical and invaluable."

Brian McCarthy, managing director—information and strategy, Accenture Analytics

To ensure that our research is meaningful and relevant, the alliance brought together the top analytics minds in business with subject matter experts at MIT and Accenture.

The Analytics Innovation Consortium is an exclusive network of chief analytics officers and their executive equivalents from around the world. The objective of the consortium is to provide a cross-industry forum focused on:

- Expanding frontiers in the discovery and application of business analytics to drive business outcomes.
- Shaping future research projects for the Accenture and MIT Alliance in Business Analytics.
- Defining and shaping the role of leaders in the emerging area of analytics.

Members of the consortium have the unique opportunity to:

- Gain insight from and provide feedback on highly-targeted research projects conducted by MIT and Accenture and shape future research topics.
- Receive research extracts prior to industry publication.
- Collaborate with an international network of analytics peers from organizations that use analytics to compete in the most sophisticated ways across industries and geographies.
- Discuss the impact of emerging trends in analytics, operations research and big data with MIT professors and Accenture analytics experts, who participate in the consortium as peers and subject matter experts.
- Access all of the activities, leadership and resources of the Accenture and MIT Alliance in Business Analytics.

Members

Members of the Accenture and MIT Analytics Innovation Consortium come from across the globe and represent such industries as oil & gas, consumer goods, banking, insurance, pharmaceuticals and communications. It is this cross-industry and cross-geography approach that makes the forum unique and the collaboration and dialogue so valuable. There are currently nearly twenty members, including:

AIG

Siddhartha Dalal

Chief Data Scientist and Senior Vice President of Advanced Research and Technology Science

Anheuser-Busch InBev

Terry Hemken

Senior Director Analytics and Innovation

Bayer AG

Franz-Josef Toelle

Vice President, BBS Supply Chain Planning

Bank of Ireland

Damien Daly

Director, Marketing and Customer Analytics

Gas Natural Fenosa (GNF)

Vicente Gil Chimeno

Coordinator, Generation Technologies

National Australia Bank

Gautam Bose

General Manager, Customer Strategy & Analytics

Philip Morris International

Ralph Bielser

Vice President

IS Strategy and Planning

Sanofi

Paul Jansen

Global Head of Medical Devices, Sanofi – Aventis

Shell

Bob Palermo

Vice President, Performance Excellence & Enterprise Architecture

Travelers

Julie Trowbridge-Dillman

Executive Vice President, Enterprise Business Intelligence & Analytics

Telstra

Liz Moore

Analytics Lead for CMO

Visa

Raghav Lal

Global Head of Analytics

About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with more than 305,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world's most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US$30.0 billion for the fiscal year ended Aug. 31, 2014. Its home page is www.accenture.com.

Contact Information

For more information about the Accenture and MIT Alliance in Business Analytics, including research opportunities and the Innovation Consortium, please contact:

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