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GETTING THE MOST VALUE OUT OF YOUR TELEMATICS DATA

10:30 AM – 11:30 AM

Speakers: Scott Pettinger – Fleet Optimization Manager at Associated

Heather Clark – Vice President of Global Customer Success at Verizon Connect

Michael Watson – Partner at Opex Analytics

ASSOCIATED INTEGRATED SUPPLY CHAIN SOLUTIONS

#LSCLC18

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MICHAEL WATSON

- Partner at Opex Analytics
- Teaches Graduate level courses at Northwestern University
  - The courses cover such topics as managerial analytics, optimization, lean, supply chain, operations management, and managerial statistics
- Lead author of the books "Managerial Analytics" and "Supply Chain Network Design."
- Was an officer in the network design company LogicTools which was acquired by IBM in 2009 and then by LLamasoft in 2015. While at IBM, he was the world-wide business leader for the network design, inventory, and routing solutions. During this time, he was personally involved in all aspects of network design from helping customers implement to designing the software.
- Ph.D. from Northwestern University in Industrial Engineering and Management Sciences

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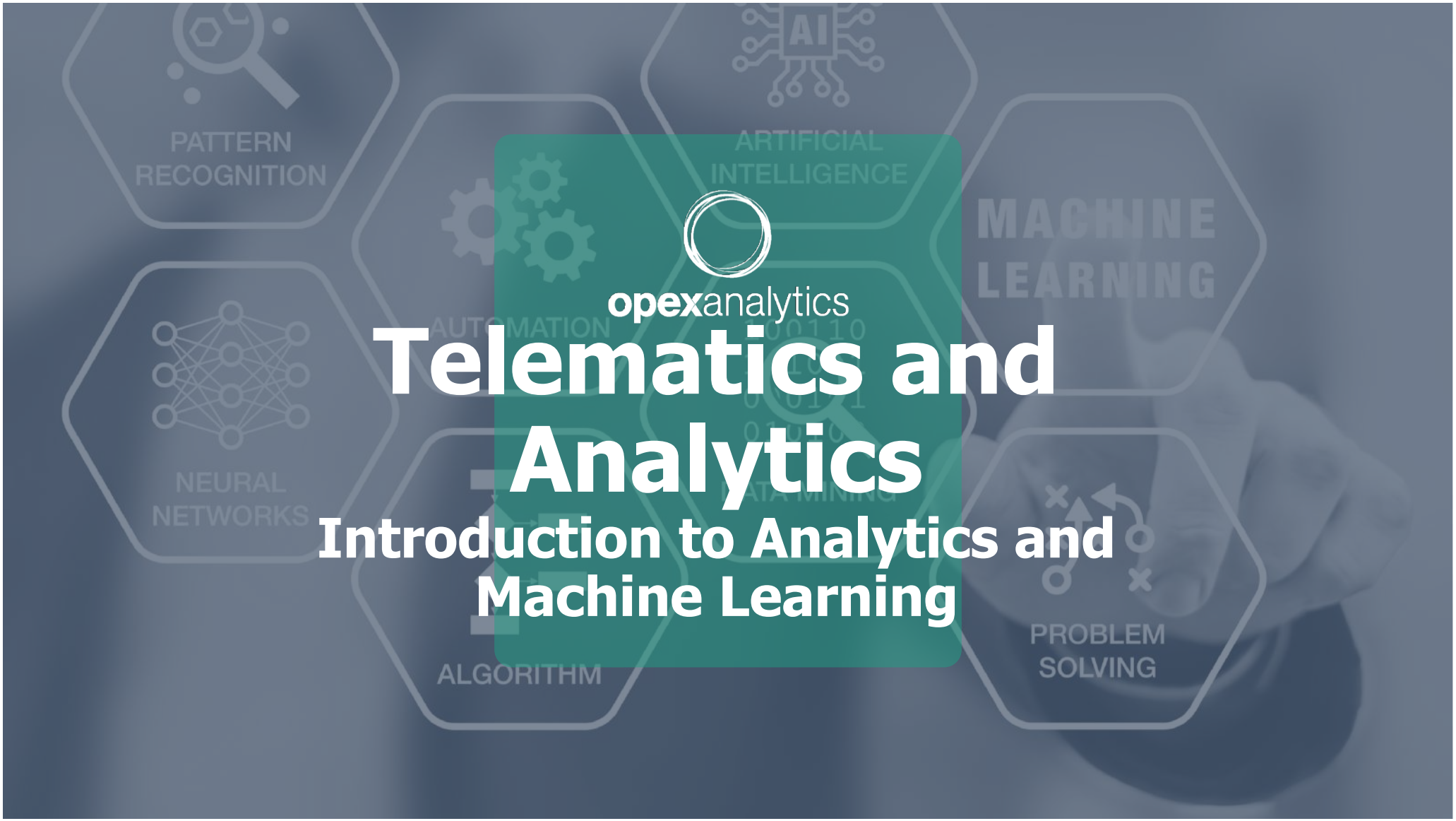

opexanalytics

Telematics and Analytics

Introduction to Analytics and Machine Learning

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"Though less visible, much of the impact of machine learning will be of this type — **quietly** but **meaningfully** improving core operations."

Jeff Bezos

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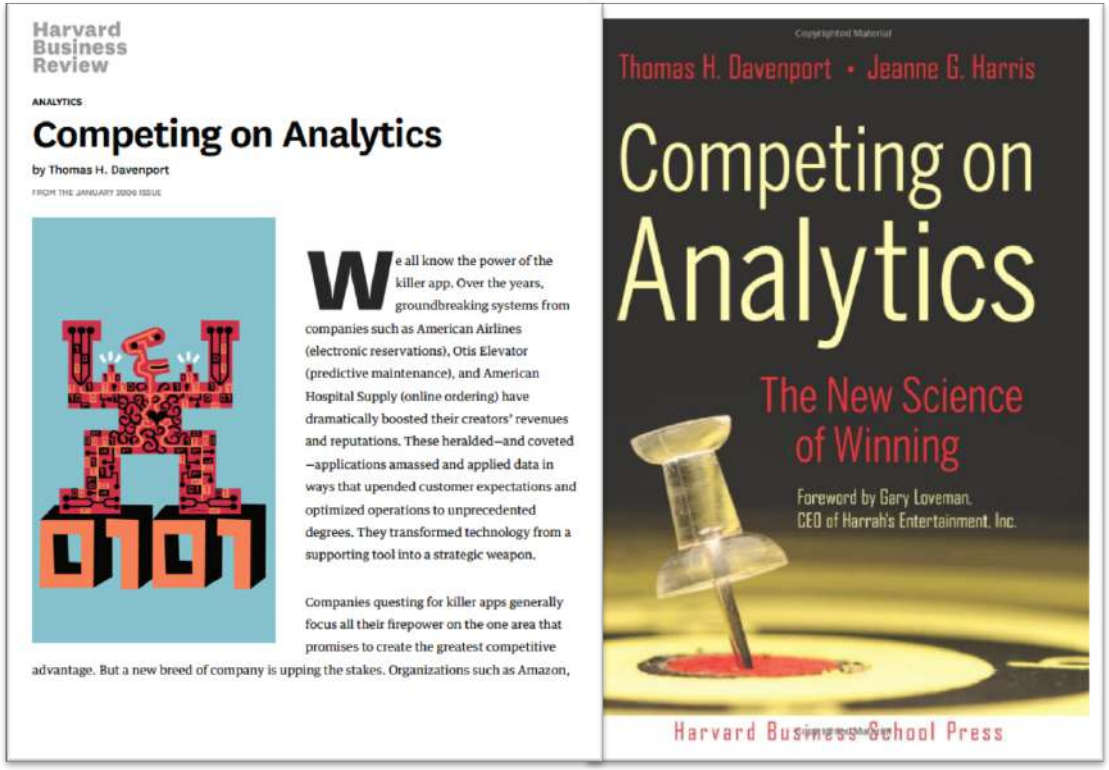
THE ARTICLE AND BOOK THAT MADE THE TERM "ANALYTICS": FAMOUS



Harvard Business Review

ANALYTICS

Competing on Analytics

by Thomas H. Davenport

FROM THE JANUARY 2006 ISSUE

We all know the power of the killer app. Over the years, groundbreaking systems from companies such as American Airlines (electronic reservations), Otis Elevator (predictive maintenance), and American Hospital Supply (online ordering) have dramatically boosted their creators' revenues and reputations. These heralded—and coveted—applications amassed and applied data in ways that upended customer expectations and optimized operations to unprecedented degrees. They transformed technology from a supporting tool into a strategic weapon.

Companies questing for killer apps generally focus all their firepower on the one area that promises to create the greatest competitive advantage. But a new breed of company is upping the stakes. Organizations such as Amazon,

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Thomas H. Davenport • Jeanne G. Harris

Competing on Analytics

The New Science of Winning

Foreword by Gary Loveman, CEO of Harrah's Entertainment, Inc.

Harvard Business School Press

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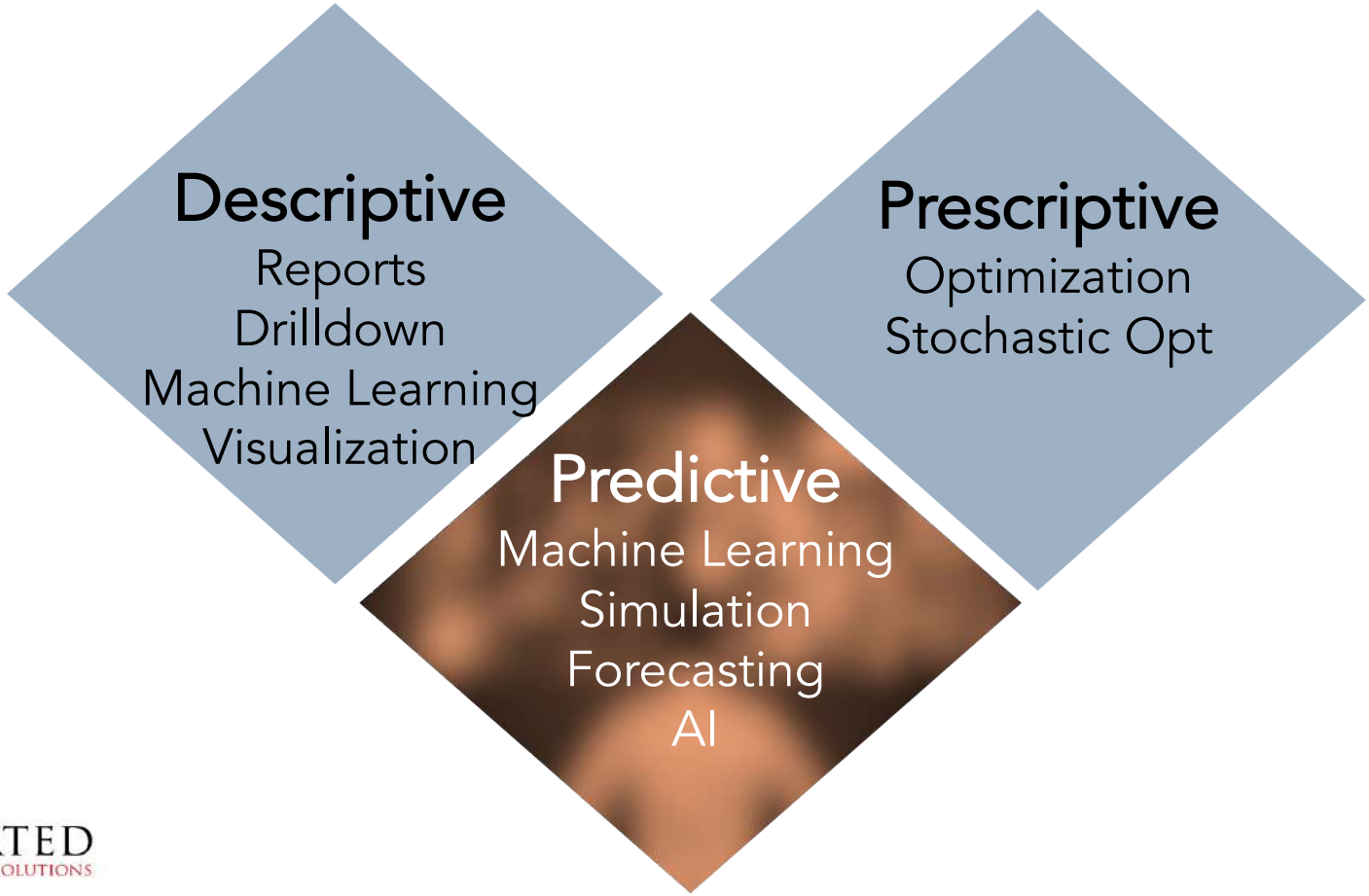
A BETTER DEFINITION



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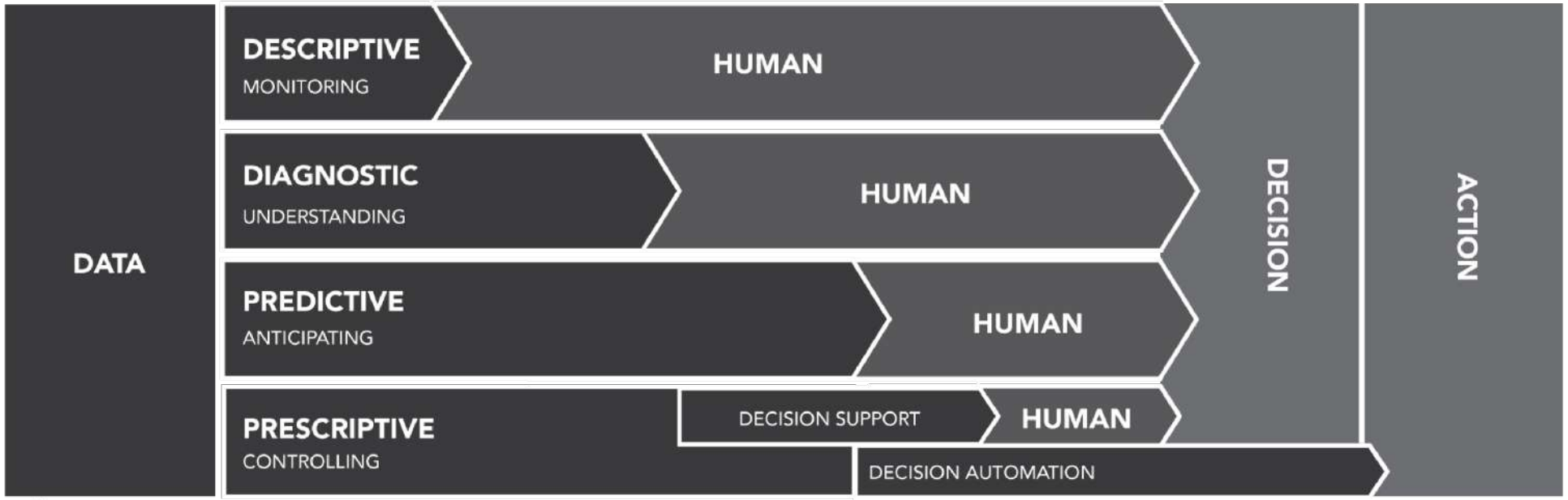
ANOTHER TAKE ON THE DEFINITION



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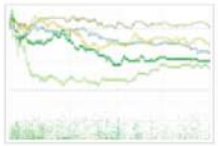
BUSINESS INTELLIGANCE (BI) SYSTEMS ARE DESCRIPTIVE



Big Data Analysis

Visual analysis tools to investigate trends and outliers in big data.

Case study

Business Dashboards

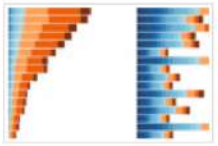
Drag and drop to create interactive dashboards, then share in a browser.

Case study

Data Discovery

Investigate data at speed-of-thought, asking and answering questions as you go.

Case study



Data Visualization

See your analysis "pop" versus combing through spreadsheets for insight.

Case study

Mapping

Add "where" to your analysis for more insight, fast answers.

Case study

Mobile Business Intelligence

Provide on-the-go iPad access to published dashboards and reports.

Case study

Survey Analysis

Create interactive analysis so results can be investigated by your team.

Case study

Time Series Analysis

Drill in – and out – of time dimensions to zero-in on trends.

Case study

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Source: Tableau Software

ADIENT (JOHNSON CONTROLS)

Sensors on Returnable Containers

Problem: Thousands of racks and containers disappearing every year

Solution: RFID tags to track them. Found "1000s" of missing ones
Savings (estimated): ~$500K to $3M a year

Long Term: Can start to find root causes and predict problems

Source: Wall Street Journal

VISUALIZATION IS ABOUT GETTING INSIGHTS FASTER

Starbucks Annual Report 2007

REVENUE COMPONENTS

The following table shows the Company's revenue components for the fiscal year ended October 1, 2006:

REVENUES	% of Total Net Revenues	% of Specialty Revenues
Company-operated retail	85%	
Specialty:		
Licensing:		
Retail stores	7%	45%
Grocery and warehouse club	4%	24%
Branded products	<1%	2%
Total licensing	11%	71%
Foodservice and other:		
Foodservice	4%	27%
Other initiatives	<1%	2%
Total foodservice and other	4%	29%
Total specialty	15%	100%
Total net revenues	100%	

And if you read the "narrative" annual report from that year, the first thing you saw was this:

We all have a Starbucks we call our own.

For customers, it may be based on a cherished coffeehouse experience. A smiling barista who remembers how they prefer their morning latte. Or the welcoming vibe they feel each time they enter their neighborhood store.

For coffee farmers, this sense of shared ownership may evolve as we work together to make their farms more productive and their communities more prosperous.

And for our employees, whom we call "partners," it may represent something altogether different—a company with an enduring commitment to be caring, upfront and fair.

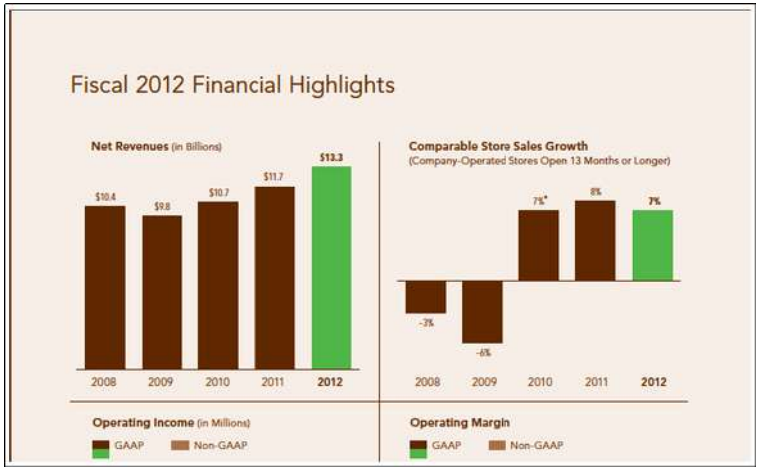
But no matter how you define *your* Starbucks, each unique meaning stems from the commitment that we've made to do business in a different way. A way that truly values individuals and their contributions. A way that balances good business practices with a passion to improve this world we share.

A better way.

HBR Blog Network

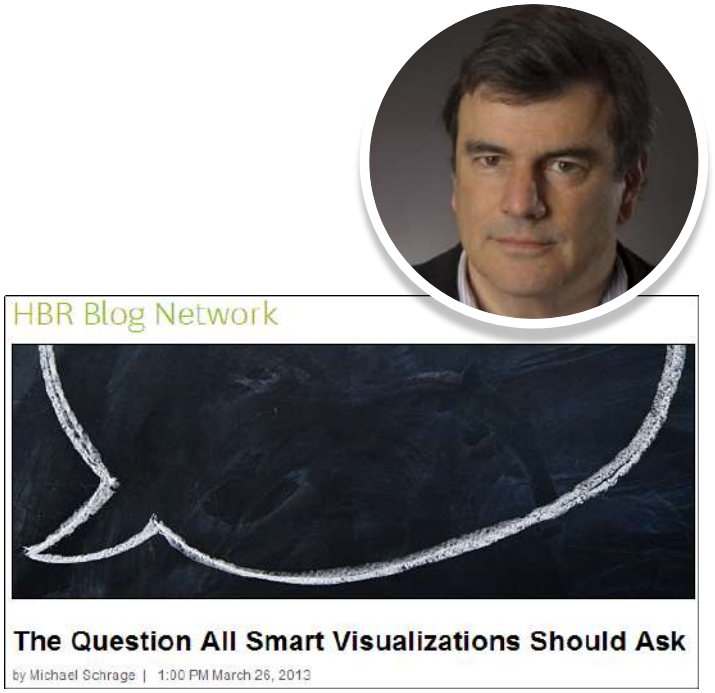
Your Business Needs Insight, Not Just Pretty Pictures

by Scott Berinato | 11:25 AM March 19, 2013



ANOTHER TAKE: VISUALIZATION IS ABOUT CONVERSATIONS

- **Not**: "What Is The Best Way…of Presenting The Data"
- **It Is**: "What Kinds Of Conversation And Interaction Should Our Visualization Evoke?"
- Should Provoke Conversations Like: Where Are We? Where Are We Going? Do We Want To Go There?
- Should Be Interactive Portals That Allow Teams To Delve Deeper Into The Issue And Interact With Each Other In More Meaningful Ways
- Don't Over-emphasize Design And Lose Ability To Interact With Data



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WHAT IS MACHINE LEARNING?

NETFLIX

amazon

Google Translate

Self Driving Cars

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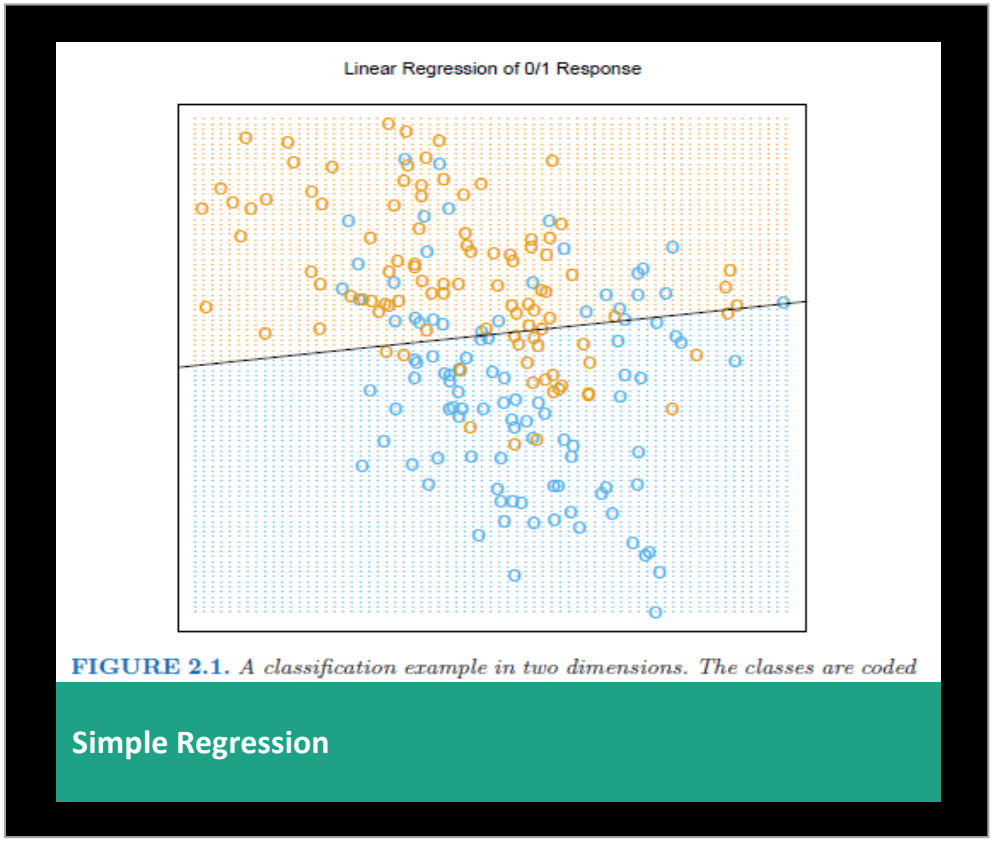
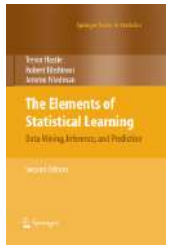
DEFINITION

Machine Learning Algorithms Can Do Better?





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DEFINITION

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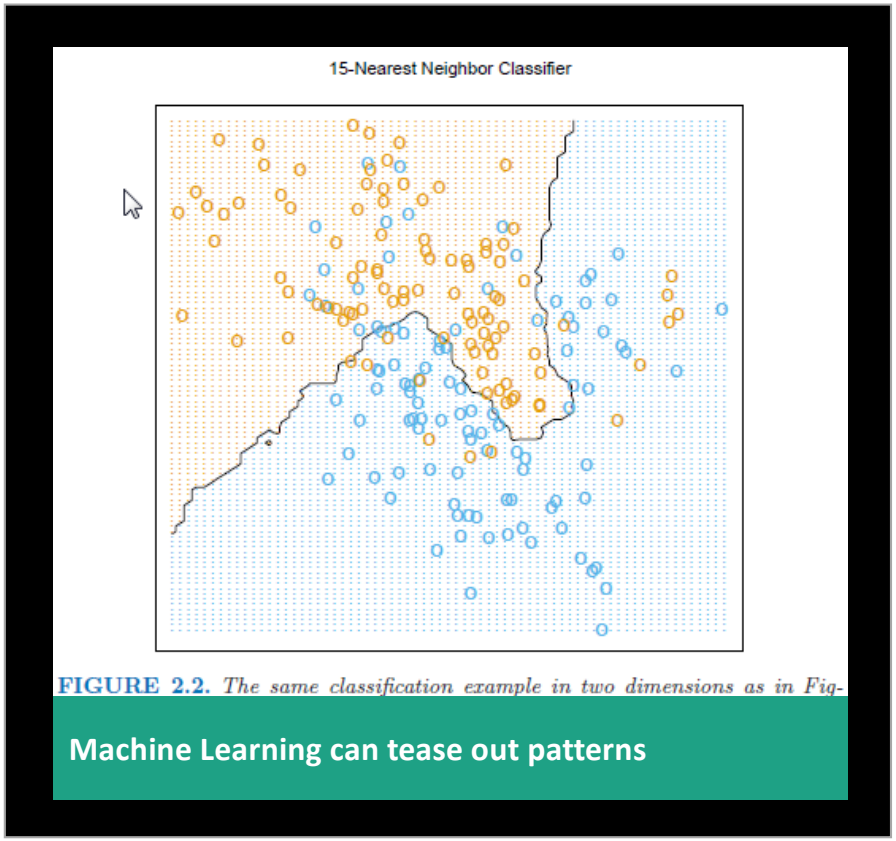

FIGURE 2.2. *The same classification example in two dimensions as in Fig-*

Machine Learning can tease out patterns

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DEFINITION

What Do We Mean By Learning?

RULES BASED: Not Learning

- Build out all cases of what a bad chip looks like

PROBLEM – Too many rules, too many cases and you still miss a lot

LEARNING: As in Machine Learning

- Provide a database of pictures of chips with a 'good' vs 'bad' label. The algorithm (not a person) then figures out the rules – that is the learning.

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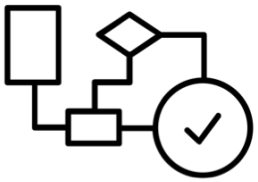
SUPERVISED

Predicting Models To Find Bad Potato Chips

1

2



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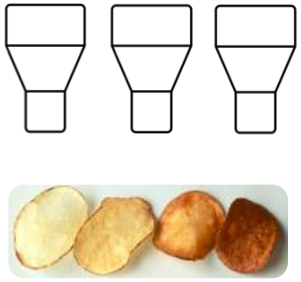

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TYPES
Unsupervised Learning Can Uncover New Insights
This Is How We Got "Soccer Moms"

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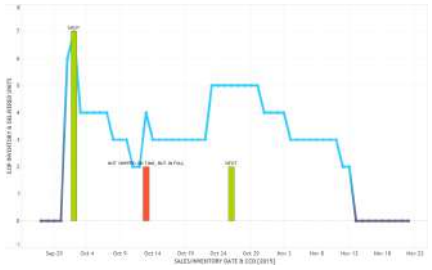
UNSUPERVISED

Automating Root Cause Analysis

Convert Visual Cues To Data Features

Density Based Algorithm To Find Out-of-stock Patterns

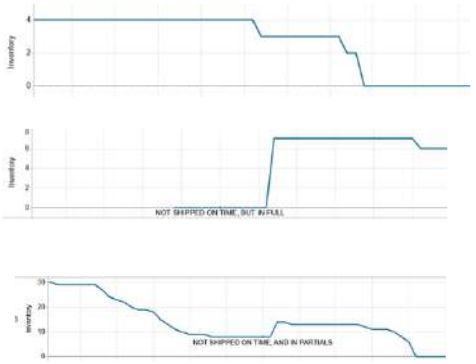
Inventory Time-Series Data & Shipment Dataset



Feature Set

SKU	DC Inv	Store Inv	Ship Qty	Status	INFERRED ROOT CAUSE
SKU 124	42	22	null	null	STORE CAPACITY
SKU 345	42	25	10	NOT SIFOT	LATE SHIPMENT
SKU 452	42	30	10	NOT SIFOT	LATE SHIPMENT
SKU 746	42	46	2	SIFOT	ALLOCATION
SKU 599	0	12	2	SIFOT	BUY QUANTITY

Root Cause Patterns



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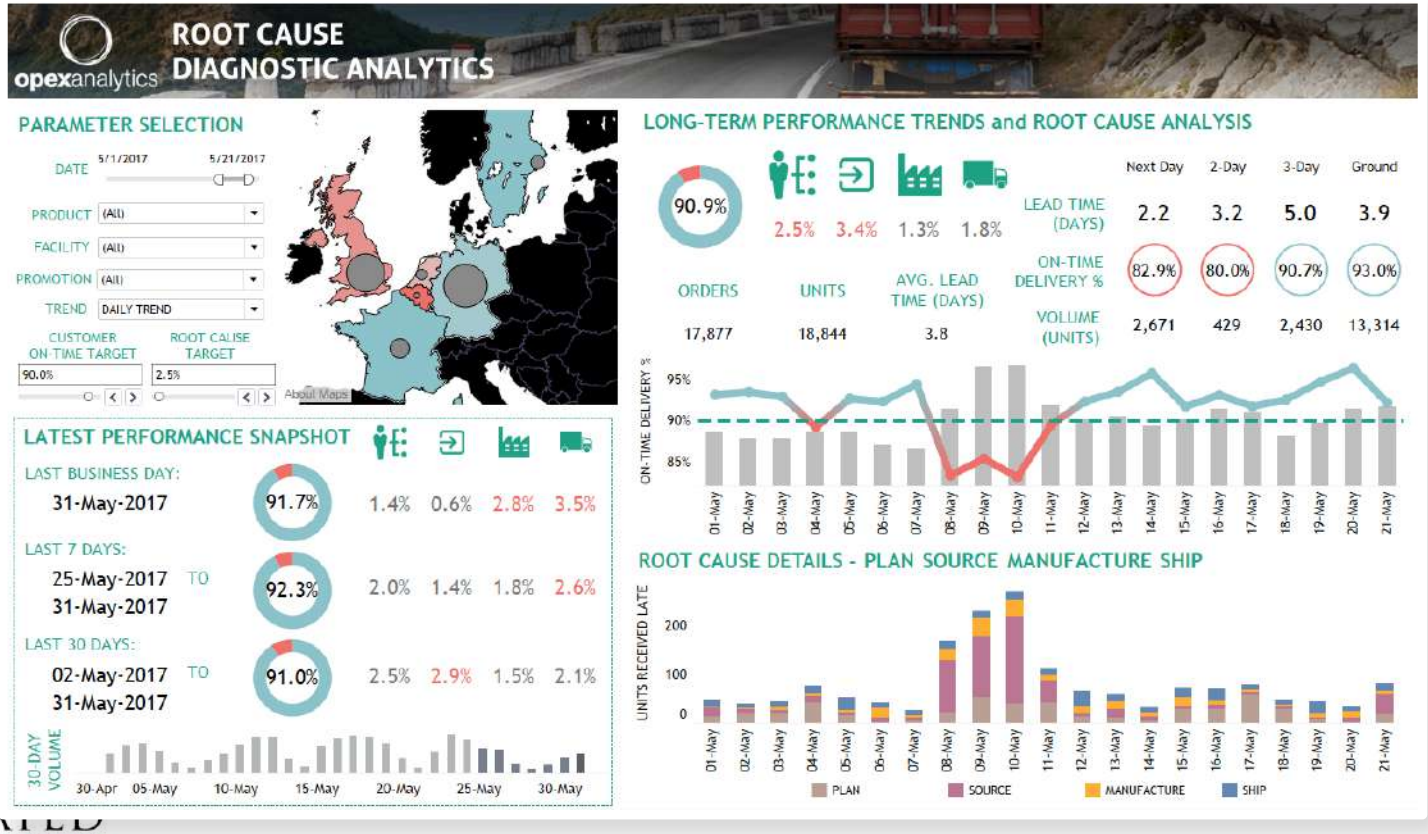
UNSUPERVISED

Automating Root Cause Analysis



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TELEMATICS

Predicting

- Var. in mileage
- Odom. Reading
- Earnings
- Engine Speeds
- Shifts Worked
- Sick Time
- Truck Location

- DRIVER RISK
- FUEL EFFICIENCY
- CHURN
- MAINTENANCE

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SOURCE : http://www.truckinginfo.com/article/story/2012/07/using-analytics-for-proactive-predictions.aspx

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SUPERVISED

Forecasting Demand (or Market Conditions)

TIME SERIES DATA

+

External Variables

- Demographics
- Events
- Weather
- Social Media
- Web Activities
- Latent Variables
- Telematics
- Competition
- Economic Factors
- Transformations

+

Engineered Features

- Lag Features
- Window Features
- Date Time Features
- Creative Grouping
- Creative Summary

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FEATURE ENGINEERING (SYNTHETIC VARIABLES): EXAMPLE

What Used Car Is A Good Buy In An Auction?

Car Color Appears To Be Very Important Factor.

This Is An Engineered Feature By Creative Grouping

… But Not The Color Itself, But The Unusual Vs. Standard Color Grouping

Standard Color

Unusual Color

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HEATHER CLARK

- VP of Global Customer Success at Verizon Connect
- Responsible for leading a team of over 400 customer advisors who serve more than 75,000 customers worldwide.
- Leads the customer experience transformation program designed to improve the end-to-end customer experience from commercial supply chain management to consumer driver safety.
- Bachelors in Business from Western Washington University and completed the General Management Program at Harvard Business School.
- Previous professional roles include VP of Sales Coverage Strategy and Execution at Grainger and VP of the Pacific Mountain Region for FedEx Kinko's.

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More Stops, Less Miles

- Mobile Technicians Can Get More Jobs Done With Less Time Behind The Wheel.

Dispatchers And Customer Service Reps All Get The Latest Information About:

- Who Is Available
- What Jobs Need To Be Done
- Where The Jobs Are
- What Skills Or Equipment Are Needed
- They Can Easily Reorganize Workers When There Are Delays Or Emergencies To Minimize Waiting And Driving Time.

“It used to take us up to 12 hours to schedule a new job. Now we can dispatch in minutes. Our fleet’s total capacity increased by 20%, and we are seeing a 35% increase in actual deliveries being made”

- Poolsure

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Improved Safety & Accountability

- Many Government Agencies Are On The Front Line
  Of Dangerous Situations. The Officer's Safety Is Critical.

- Gain Insights Into:
  - Driver Behavior Reporting, Including Seat Belt Use
    Or Speeding*
  - In-cab Alerts
  - Historical Route Replay
  - Self-coaching On Driving Behaviors

*Can Be Set To Adapt For Situations Where A Lightbar Is Activated.

"So far in 2017, there has been a 45% drop in total accidents and a 57% decrease in preventable accidents from the same period in 2016."

- Undersheriff, Snohomish County Sherriff Department

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Safer Driving To Reduce Liability And Risk

- Branded Vehicles Driven Badly Can Turn Into Negative Publicity. Unsafe Driving Increases The Risk Of Costly Accidents And Company Liability.

Driver Safety Is About Highlighting Problem Areas, Including Drivers And Driving Behaviors, To Help Tailor A Training Program That Will:

- Self-coach
- Improve Awareness
- Earn Recognition For Driving Well

"[It] has helped in overall driver behavior. We found a decrease in auto accidents and a decrease in speeding alerts."

- American Environmental Group

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Having Visibility Into The Who, What And Where

- Managing Your Fleet In The Dark Can Be Unsafe And Costly.

Successful Fleets Need:

- A Single Dashboard View Of All Tracked Vehicles And Assets
- All Assets And Personnel On The Same Map
- Custom Markers For Important Sites, Like Wells, Pipelines, Key Infrastructure And Remote Locations
- Integration With Third-party Suppliers

"The ease of being able to get the reports out—the statistics and those numbers that they need, it has helped tremendously."

- Director, Health & Safety, American Environmental Group

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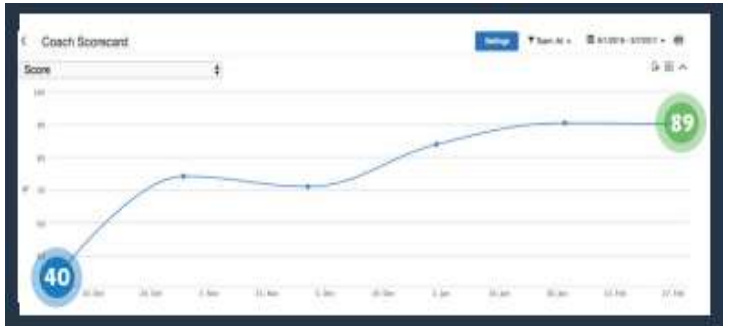
DEEP DIVE: SAFETY WITH PUGS RETAIL

After Setting Up A Safe Driver Program Pugs Retail Saw:

- 40% Decrease In Speeding Events
- 74% Decrease In Harsh Driving Events Like Hard Stopping And Rough Accelerations
- An Average Safe Driving Score Increase Of 40 To 89



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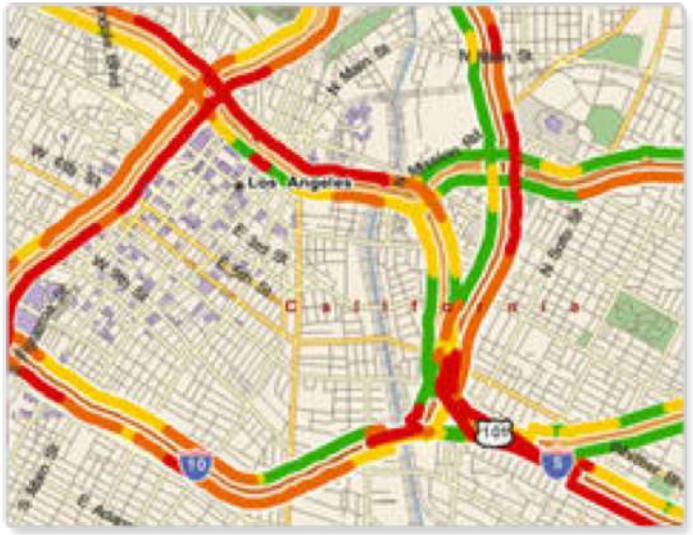
DEEP DIVE: PRODUCTIVITY IS UP AND COSTS DOWN FOR POOLSURE

With The Use Of Telematics, Poolsure Was Able To:

- See A 20% Increase In Productivity And A 35% Increase In Deliveries Without Having To Add Overhead
- Recognize A 35% Increase In The Companies EBITA
- Fulfill 40% Of Call-in Delivery Requests Through A Route Optimization Feature, Picking Up More Business Each Day

poolsure



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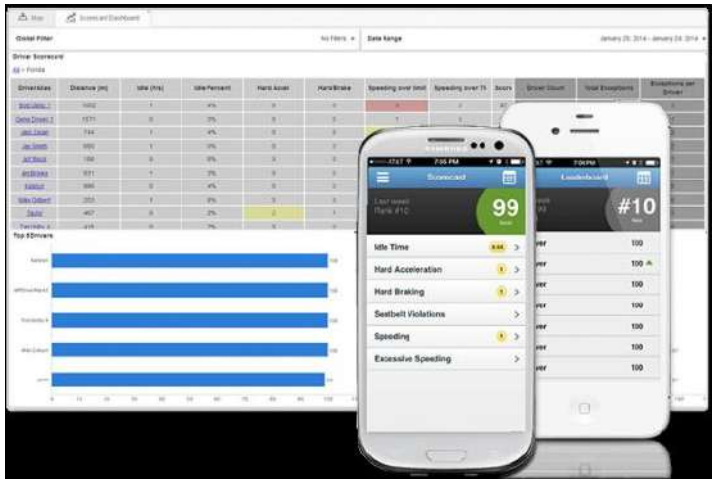
DEEP DIVE: ZAYO SERVES CUSTOMERS BETTER THAN EVER

zayo®

Zayo Uses Telematics To:

- Improve Customer Service By Getting Technicians On-site Faster
- Decrease Fuel Spend By 11% In The First Month ($110,000 Savings)
- Dramatically Change Their Operations Department To A More Efficient Process



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SCOTT PETTINGER

- Manager – Fleet Optimization at Associated
- 25 Years Of Technical And Operations Experience Helping Clients Effectively Manage Fleets Of All Sizes Over A Variety Of Industries
- Responsible for leading a team that manages over 5,000 assets across the United States.
- Seasoned technical professional in automotive and material handling equipment.
- Over 10 years of experience in managing data analysts.

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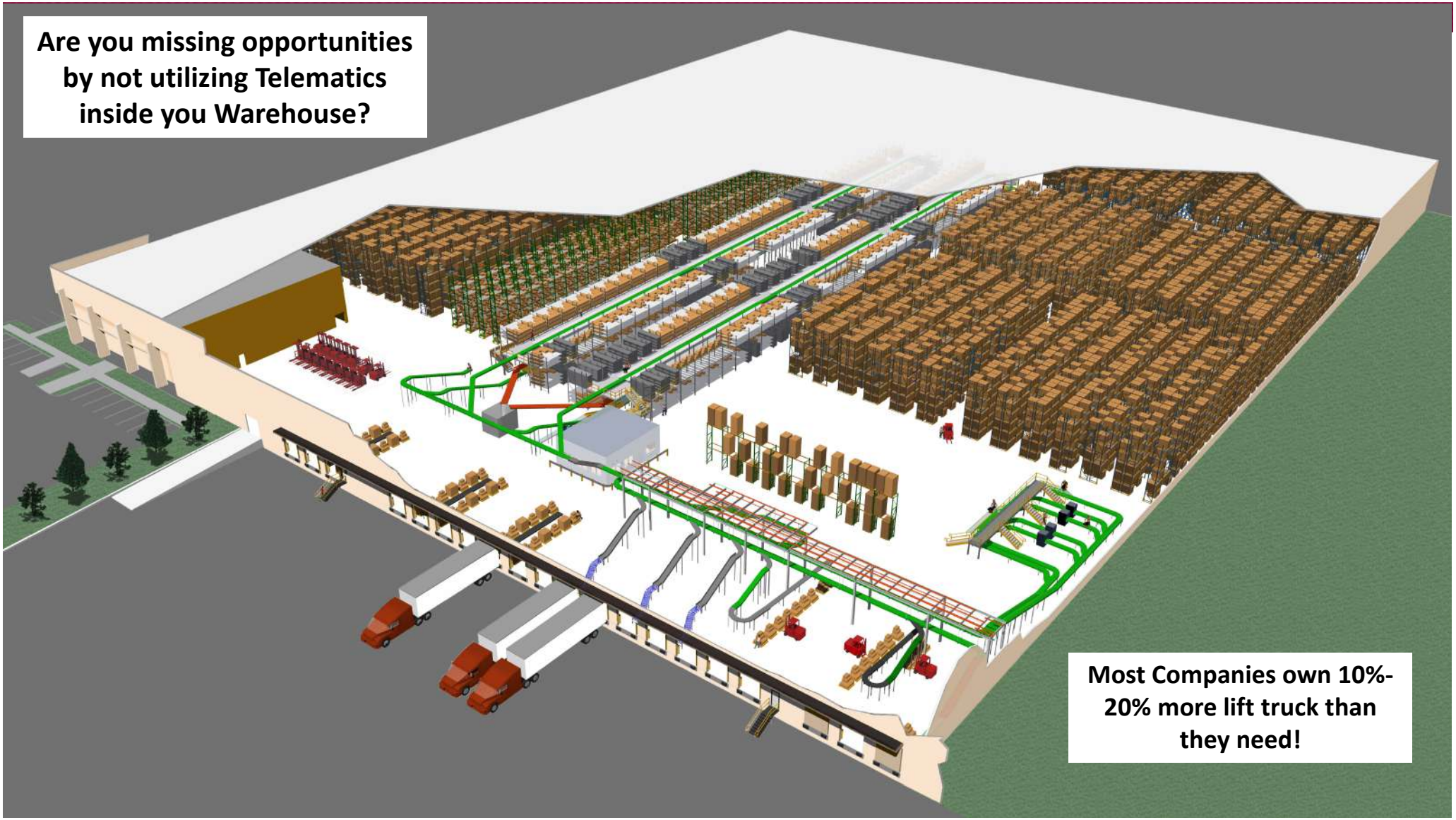
Are you missing opportunities by not utilizing Telematics inside you Warehouse?
Most Companies own 10%-20% more lift truck than they need!

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TELEMATICS AND MATERIAL HANDLING EQUIPMENT

- **Increase Fleet Utilization**
  - Lift Truck Hour meter readings
  - Operator Hour meter readings
- **Improve Safety & Accountability**
  - Impact Data
  - Operator Checklists
- **Reduce Maintenance Costs**
  - Scheduled Maintenance
  - Battery information
  - Fault Codes

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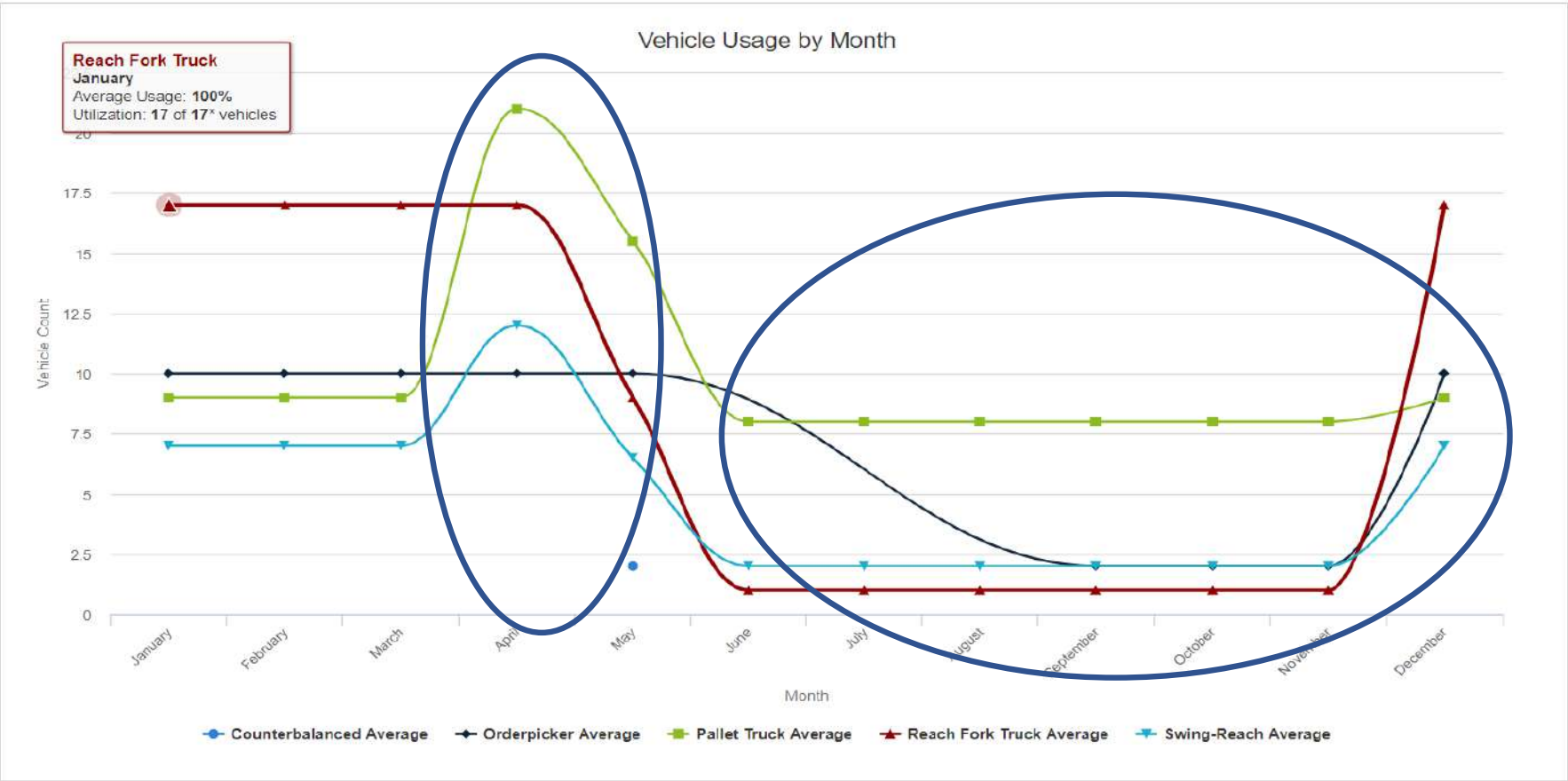
UTILIZATION



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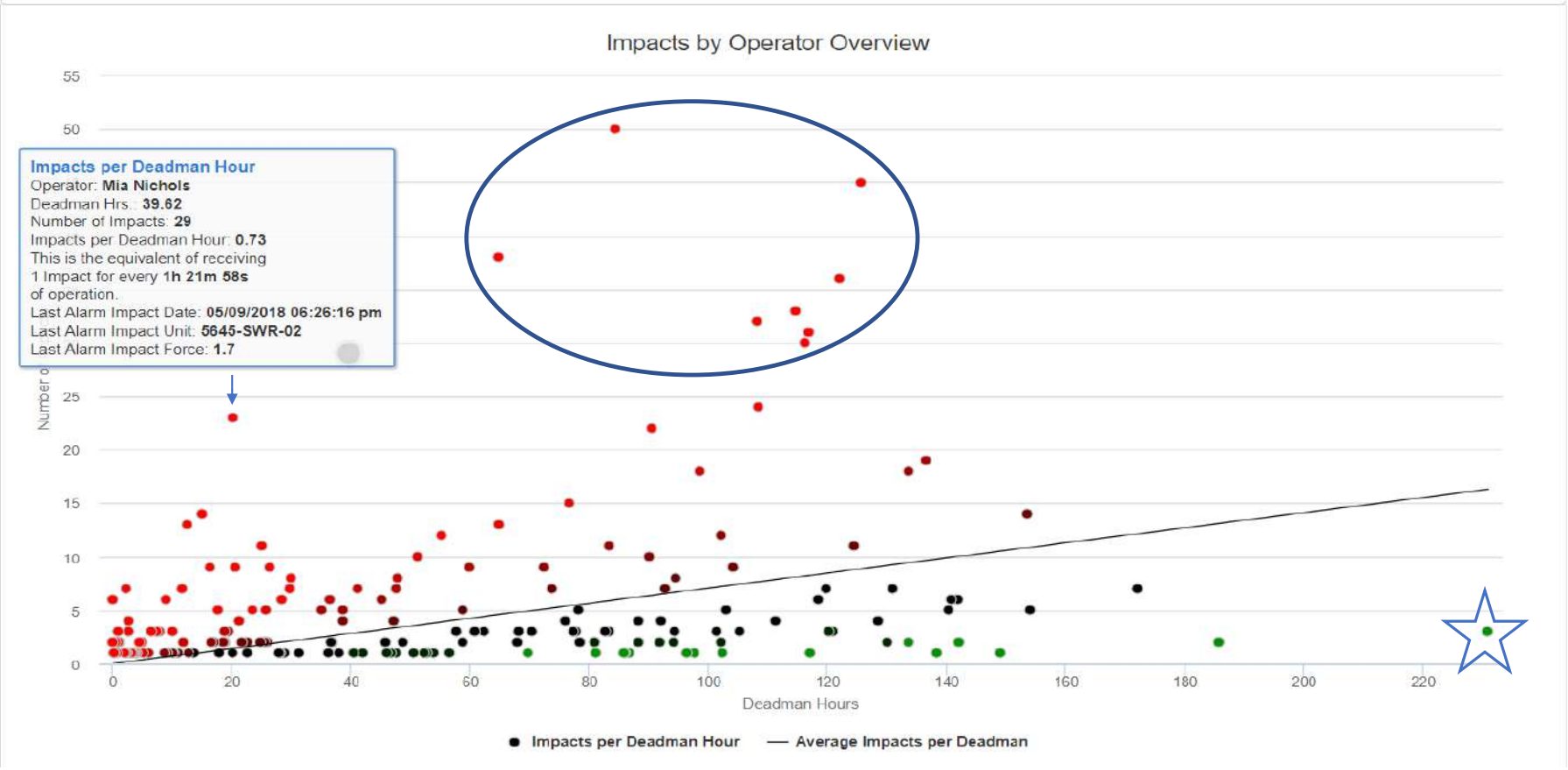
UTILIZATION

SAFETY AND ACCOUNTABILITY– IMPACT DETAILS



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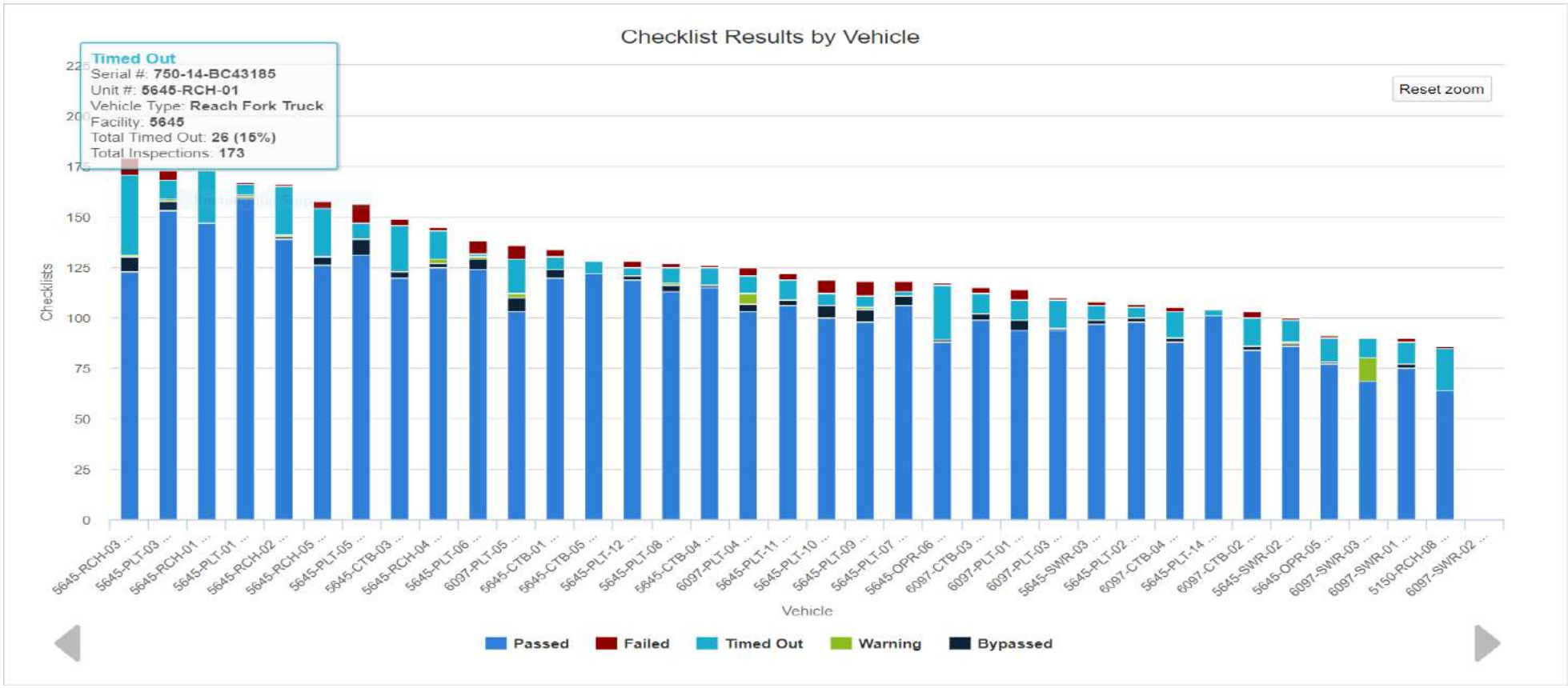
SAFETY AND ACCOUNTABILITY- OPERATOR CHECKLISTS



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REDUCE COSTS - SCHEDULED MAINTENANCE

Vehicle Maintenance

Overdue: 56	Due: 7	Completed: 38

Maintenance by Deadman Hour

Show 10 entries Show Columns Search All Columns

Serial #	Unit #	Vehicle Type	Facility	Deadman Hours	Hours Till Due	Due At	Expected Date
5A399879	5150-PLT-23	PALLET TRUCK	5150	34.03	465.97	500	December, 15 2019 00:00:00
425-14-40008	5645-CTB-03	Counterbalanced	5645	3806.39	193.61	4000	June, 26 2018 00:00:00
425-14-40017	6097-CTB-01	Counterbalanced	6097	3113.9	386.1	3500	August, 14 2018 00:00:00
5A800100	5150-PLT-18	PALLET TRUCK	5150	145.07	354.93	500	September, 18 2018 00:00:00
960-09-01127	5150-SWR-18	SWING-REACH	5150	9941.18	-441.18	9500	May, 31 2018 00:00:00
752-14-BD45565	5150-RCH-15	REACH FORK TRUCK	5150	1803.85	196.15	2000	June, 26 2018 00:00:00
425-14-40007	5645-CTB-04	Counterbalanced	5645	3963.22	-463.22	3500	March, 28 2018 00:00:00
540-15-B22500	5150-OPR-09	ORDERPICKER	5150	610.08	389.92	1000	December, 05 2018 00:00:00
102-14-29915	5150-PLT-29	Pallet Truck	5150	89.3	410.7	500	November, 29 2018 00:00:00
540-14-A19065	5645-OPR-03	Orderpicker	5645	2256.83	243.17	2500	July, 16 2018 00:00:00

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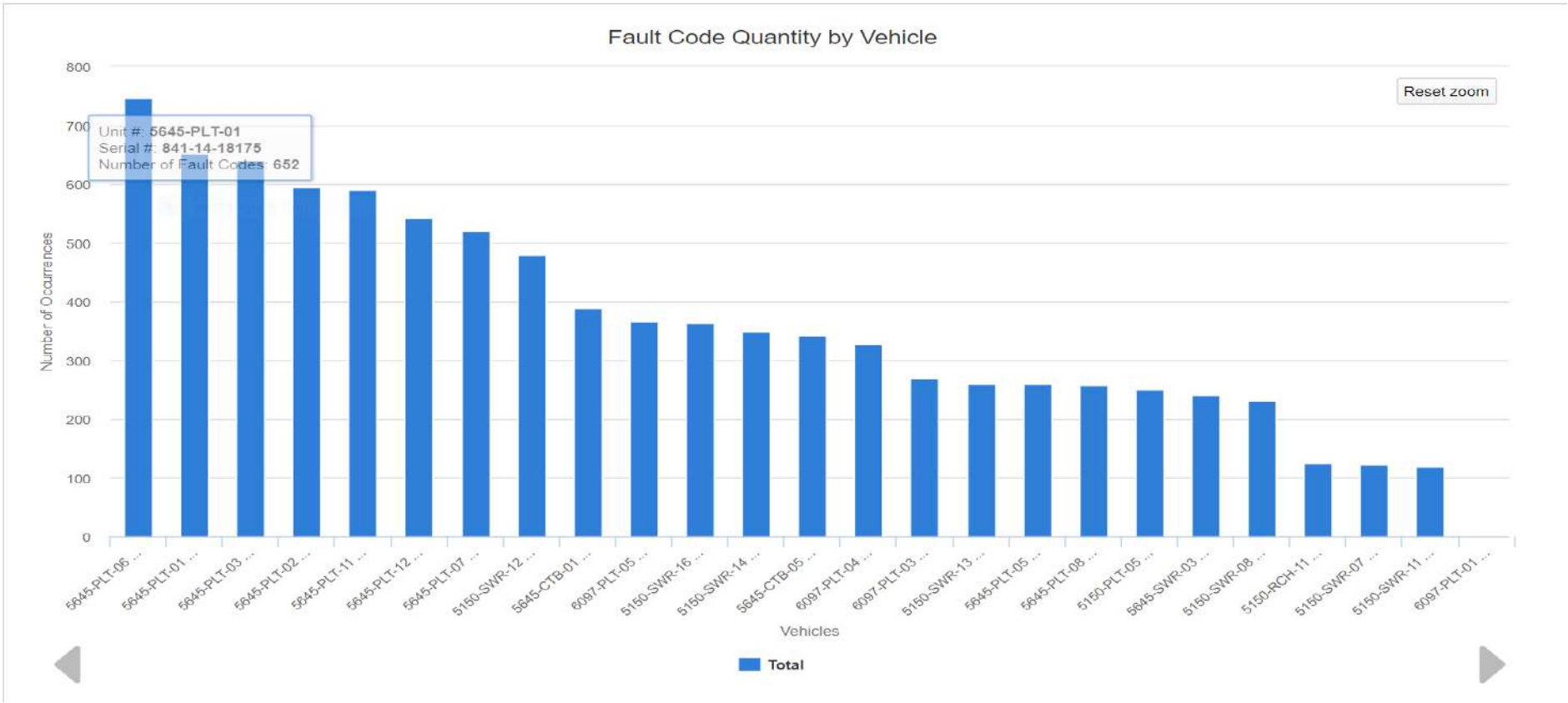
REDUCE COSTS – DOWNTIME DATA



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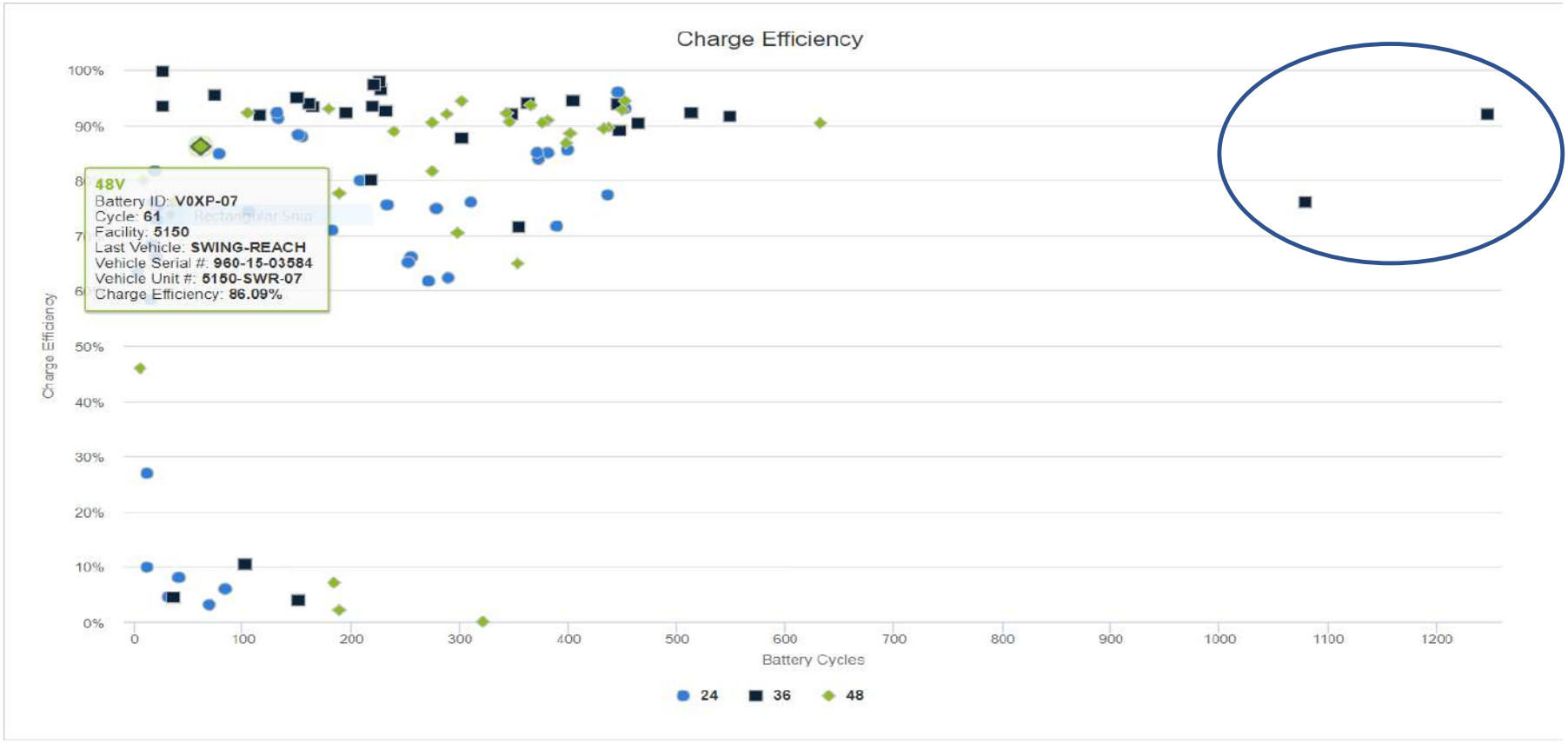
REDUCE COSTS - BATTERY DATA



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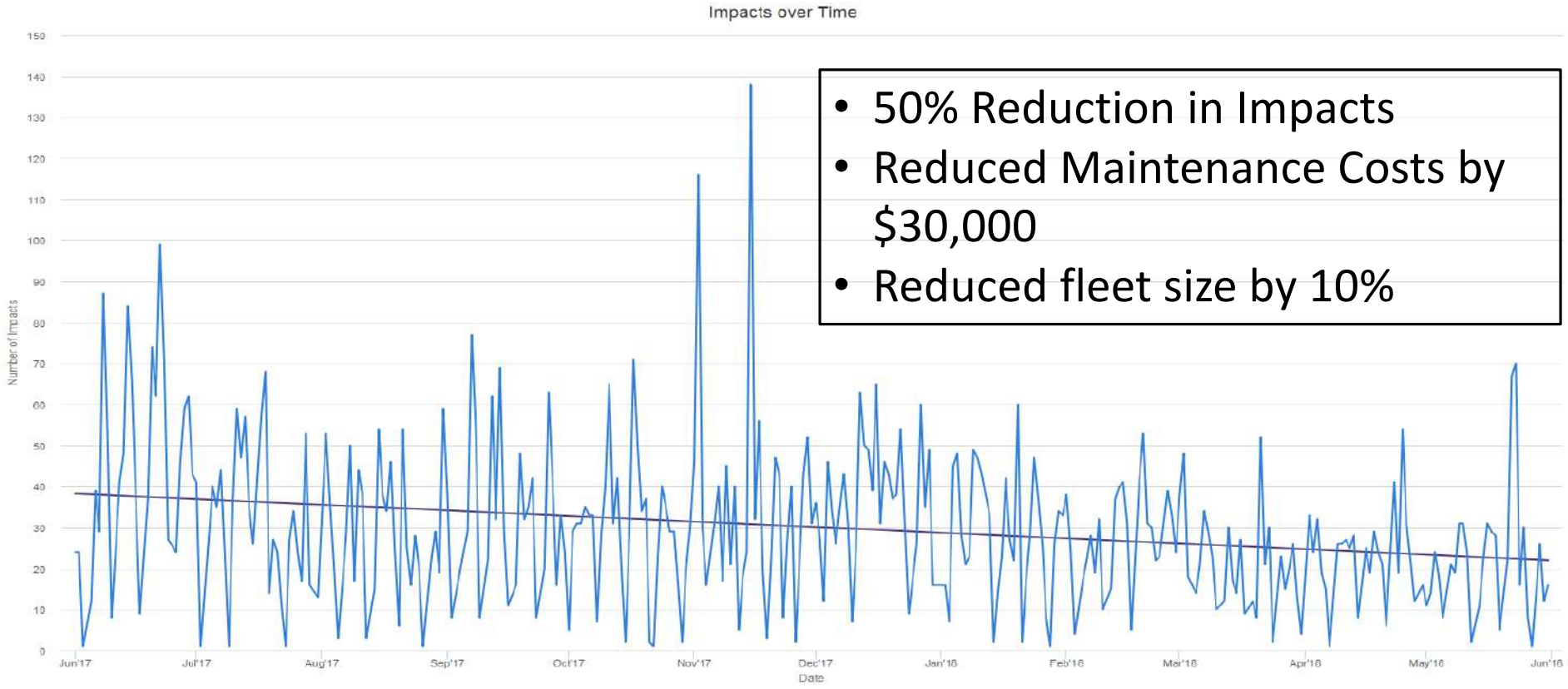
CLIENT EXAMPLE – AUTOMOTIVE PARTS DISTRIBUTOR



- 50% Reduction in Impacts
- Reduced Maintenance Costs by $30,000
- Reduced fleet size by 10%

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MICHAEL WATSON

- Partner at Opex Analytics
- Teaches Graduate level courses at Northwestern University
  - The courses cover such topics as managerial analytics, optimization, lean, supply chain, operations management, and managerial statistics
- Lead author of the books "Managerial Analytics" and "Supply Chain Network Design."
- Was an officer in the network design company LogicTools which was acquired by IBM in 2009 and then by LLamasoft in 2015. While at IBM, he was the world-wide business leader for the network design, inventory, and routing solutions. During this time, he was personally involved in all aspects of network design from helping customers implement to designing the software.
- Ph.D. from Northwestern University in Industrial Engineering and Management Sciences

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Wrap Up- Building a Team

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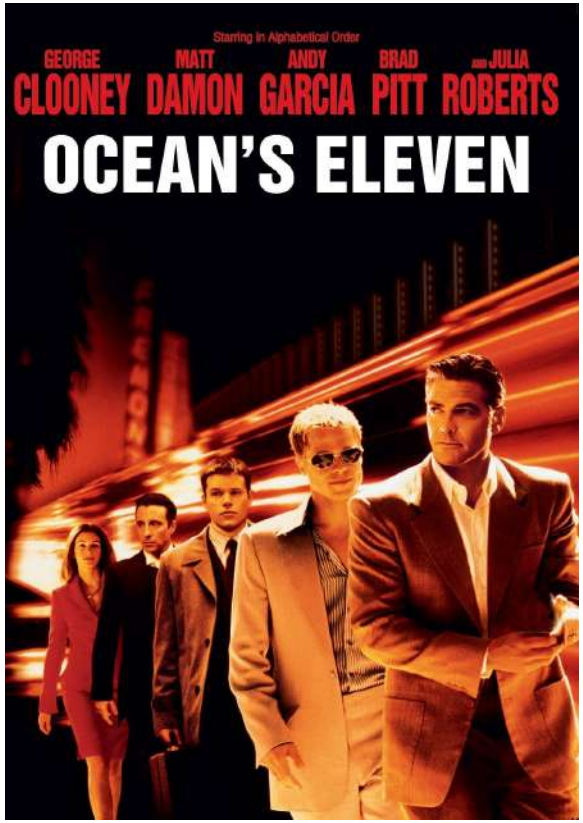
SETTING UP AN ANALYTICS TEAM

HARD SKILLS

- Optimization
- Data Science
- Software Engineering
  - Data engineering
  - Open Source
  - Deployment



SOFT SKILLS

- Curiosity
- Product Management and Design
- Business to Science Translation
- Storytelling

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WHAT TYPES OF PROJECTS TO EXPECT

1 One Time Decisions

2 Build tools for Business Users

3 Research Sprints

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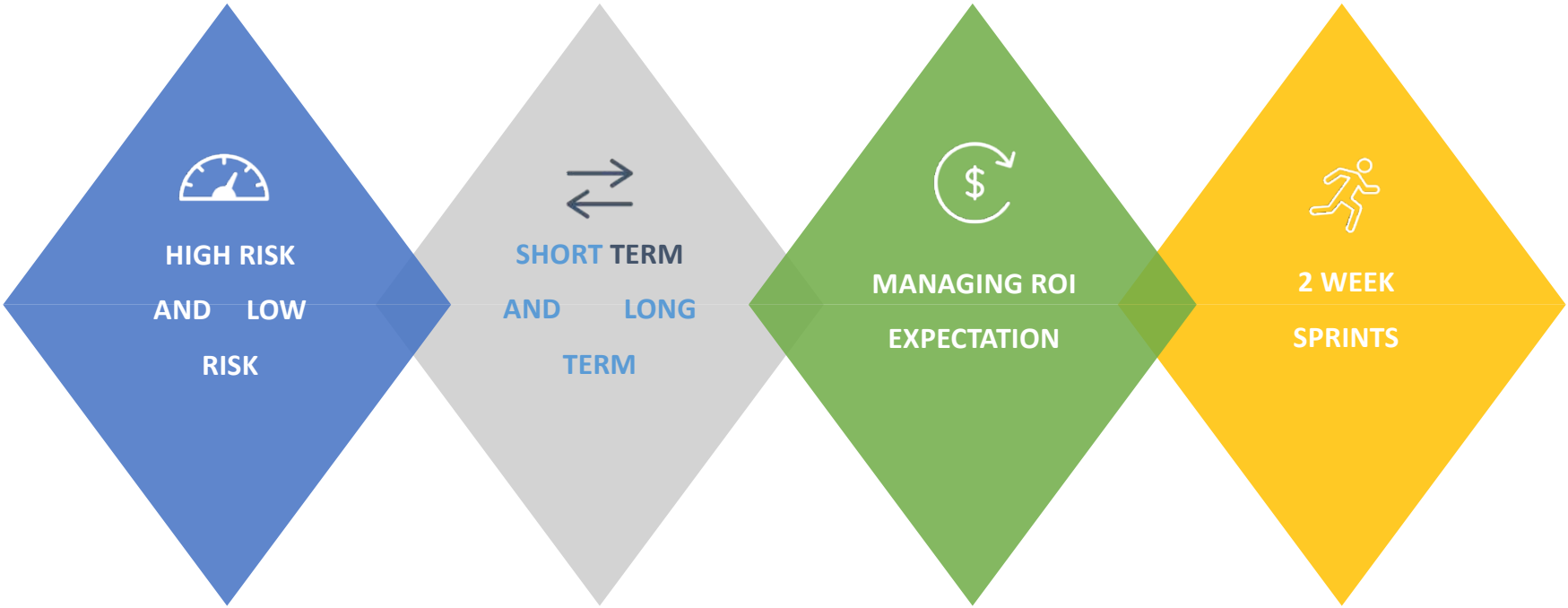
HAVE A MIX OF PROJECTS



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CONSIDER OPEN SOURCE SOFTWARE TO COMPLIMENT

Stay Biased Towards Open Source

Algorithms + Programming	Data Management	Application Build and Deploy	Visualization
TensorFlow, Spark, R, python	PostgreSQL, hadoop	Angular, docker	D3

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ANALYTICS SHOULD BE PART OF HOW YOU MAKE DECISIONS

Analytics is NOT some other function.

It should be embedded within the business and part of how you make decisions business

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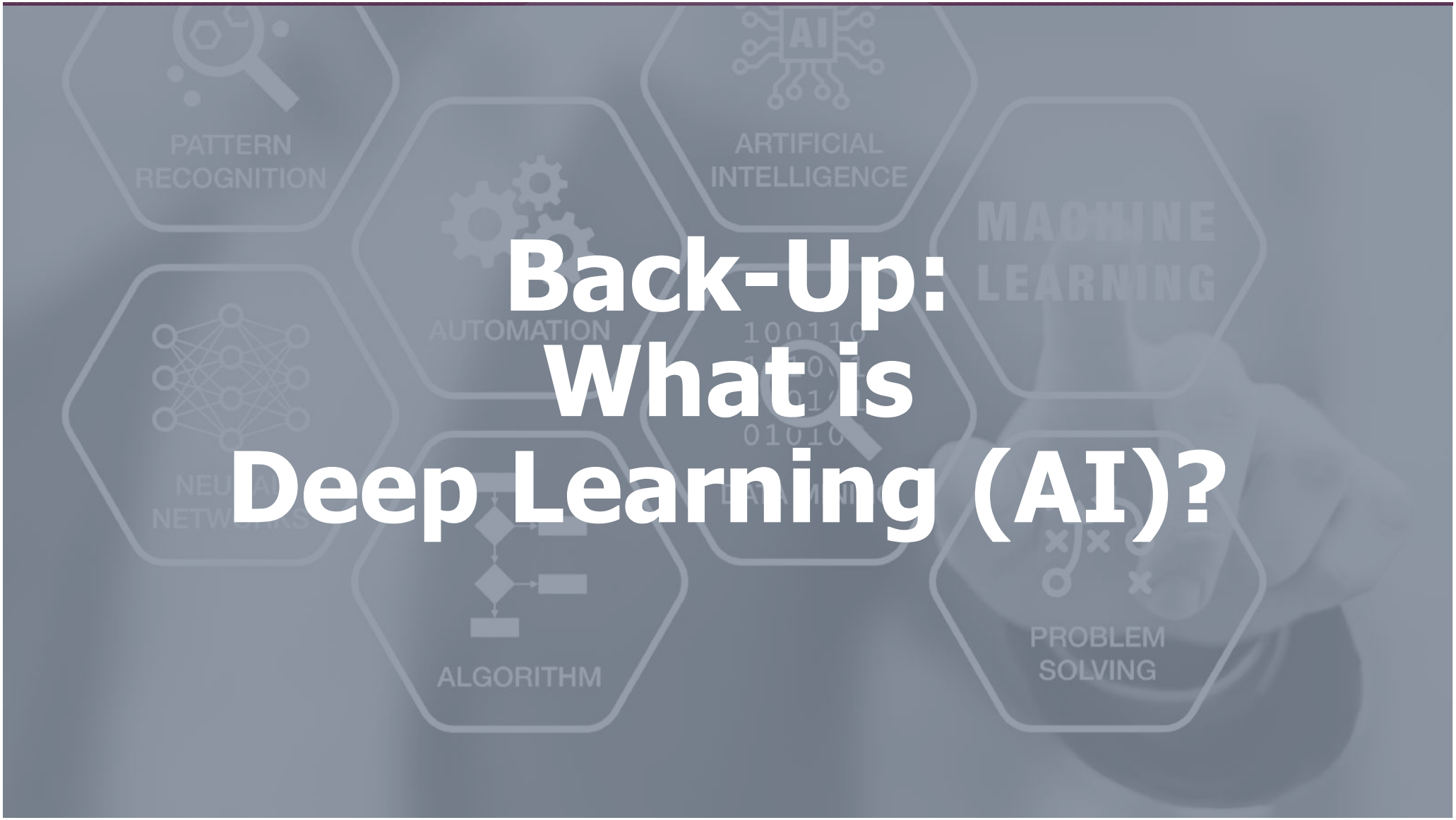

Back-Up: What is Deep Learning (AI)?

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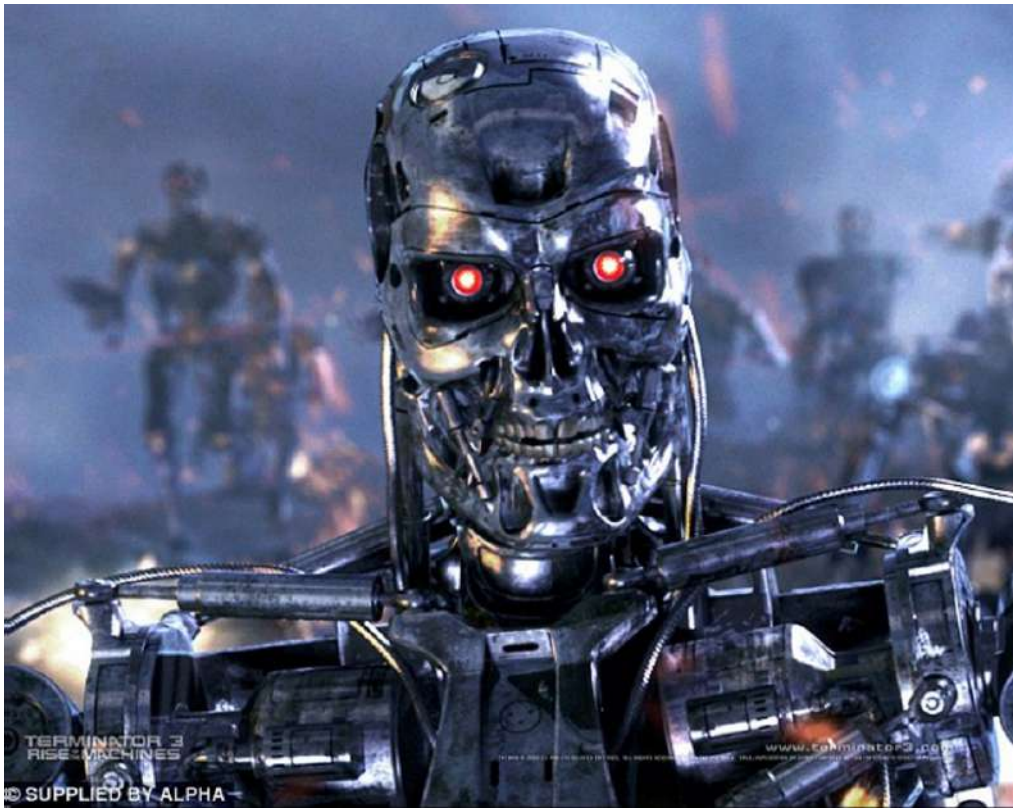
DEEP LEARNING: HOLLYWOOD AND POPULAR MEDIA VIEW



Source: http://www.dailymail.co.uk/sciencetech/article-3935788/How-AI-world-Researchers-reveal-four-ages-smart-software-tech-game-playing-self-awareness.html

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DEEP LEARNING: A LOT OF HYPE IN BUSINESS COMMUNITY TOO

Rise of "Bots"- Using AI to Solve Problems

IBM Watson

Lots Of New Start Ups In This Space – Customer Service, Financials

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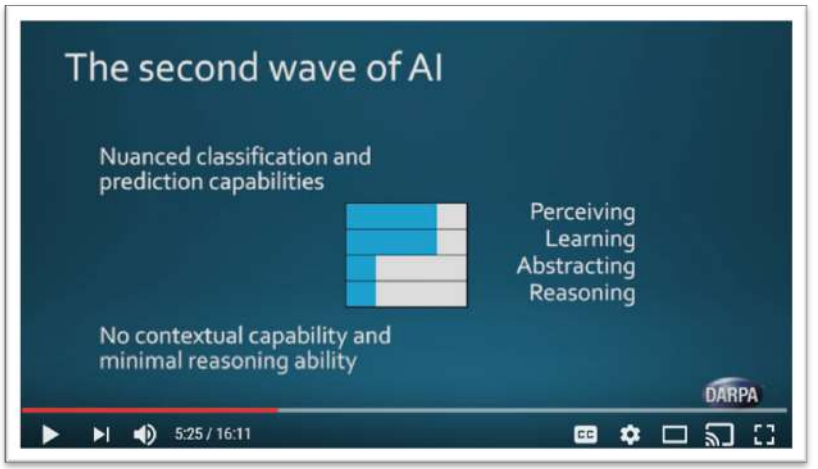
DEEP LEARNING: A MORE NUANCED VIEW FROM DARPA



Discusses That There Is A Lot Of Engineering To Make This Happen!

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DEEP LEARNING: SOLVING PROBLEMS THAT REQUIRE SEVERAL LAYERS OF COGNITION

What is this picture?

Regular Learning = Lion
Deep Learning = Real Lion in Field

What is this picture?

Regular Learning = Lion
Deep Learning = Toy Stuffed Animal

Deep Learning Gives Computer Models, Human Like Cognitive Power

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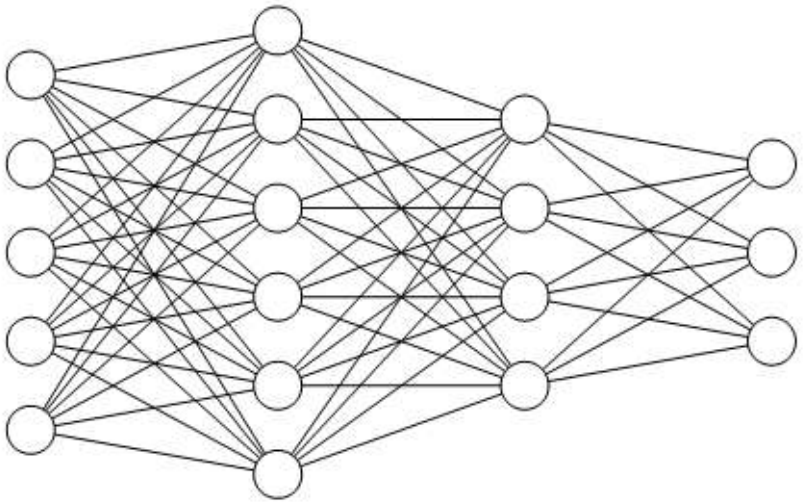
DEEP LEARNING



How Deep Learning Works

Traditional Machine Learning

100 Of Parameters

Deep Networks

Tens Of Millions Of Parameters

Does Not Overfit

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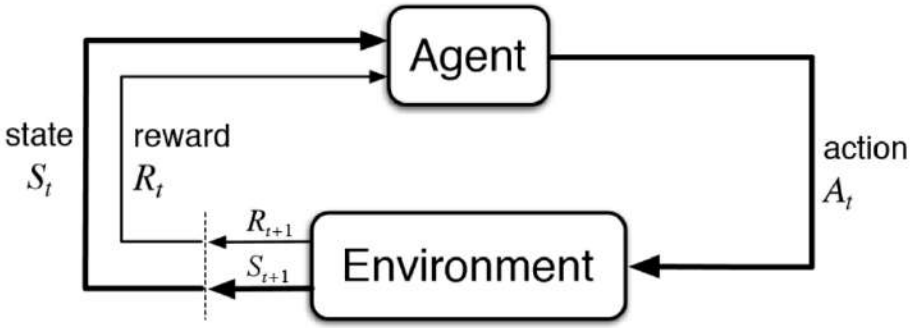
REINFORCEMENT LEARNING



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REINFORCEMENT LEARNING

After just a few games, playing the wholesaler, it held way too much inventory (60 in this picture), and the upstream node had big back orders (-38)

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REINFORCEMENT LEARNING

After just a few thousand games, playing the wholesaler, it was much better, but maybe a little light on inventory (-9), and the upstream node had smaller back orders (-8)

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REINFORCEMENT LEARNING

After even more games, playing the wholesaler, it figured out that a base stock policy was optimal and that it could keep low inventories.

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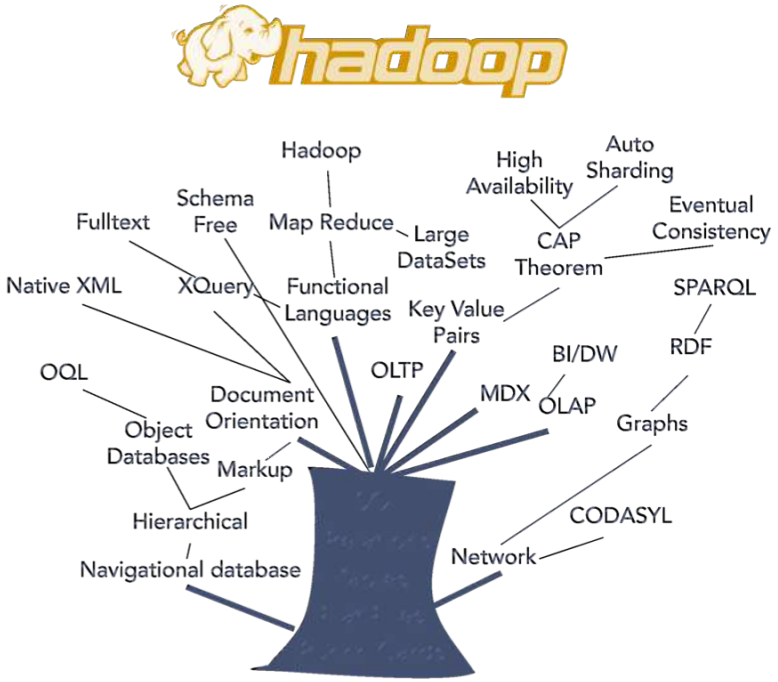
DEEP LEARNING: WILL BE A PART OF YOUR BUSINESS



Source: CIO's Guide to NOSQL, Dan McCreary, June 2012

WASTED BUSINESS DATA

Daily Snapshots:

DEMAND PLAN

PRODUCTION PLAN

INVENTORY LEVELS

ORDERS AND CHANGES

WORKFORCE

…

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DEEP LEARNING:
WILL BE A PART OF YOUR BUSINESS

DEEP LEARNING WILL SOLVE OPERATIONAL PROBLEMS

- UPCOMING ISSUES IN YOUR BUSINESS
- FINDING NEW PATTERNS TO MAKE BETTER DECISIONS
- REPLACE BUSINESS INTUITION

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