How Shape-Based Intelligence Transforms Data Insights

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AGENDA

01	Data Analytics Trends
02	Data Monetization
03	Shape-Based Intelligence
04	Hype, Magic, and Myths
05	Case Studies
06	Summary

DATA ANALYTICS TRENDS
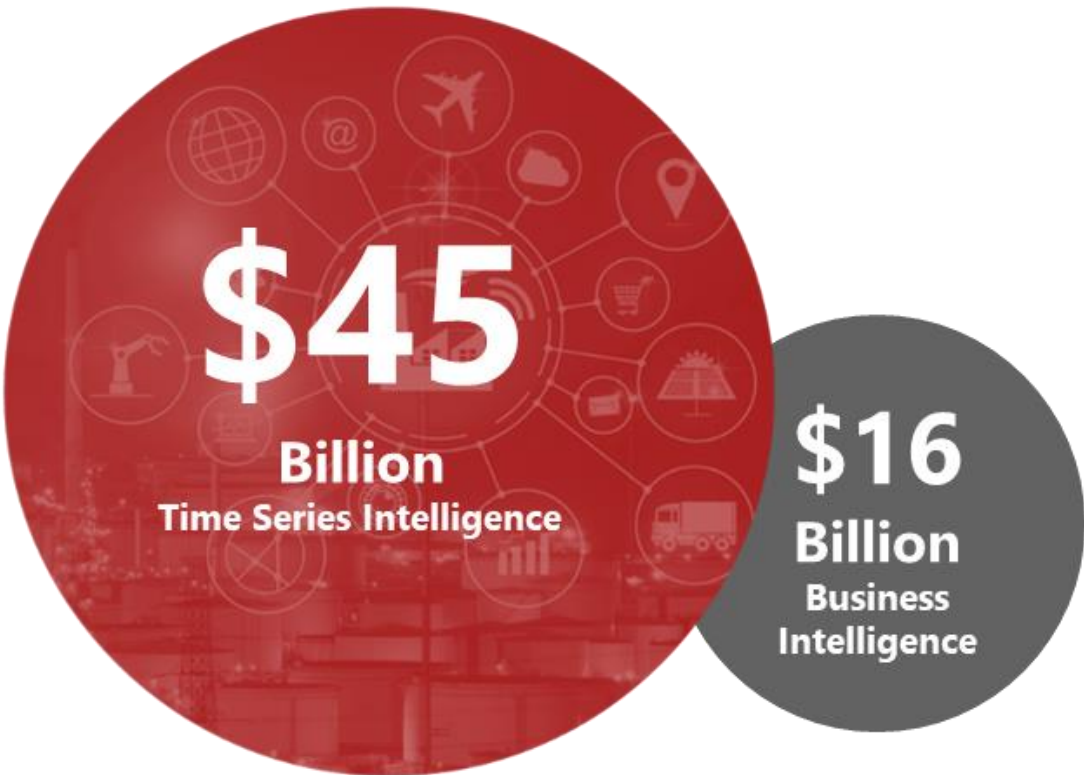
DIGITAL TRANSFORMATION ACCELERATED BY THE PANDEMIC

Remote

Contactless

Reliable

PATTERNS IN THE TIME SERIES DATA ARE THE NEW GOLD NUGGETS

!

Not the data that you have seen and are used to analyzing…

Sensors

Data Pipes

People

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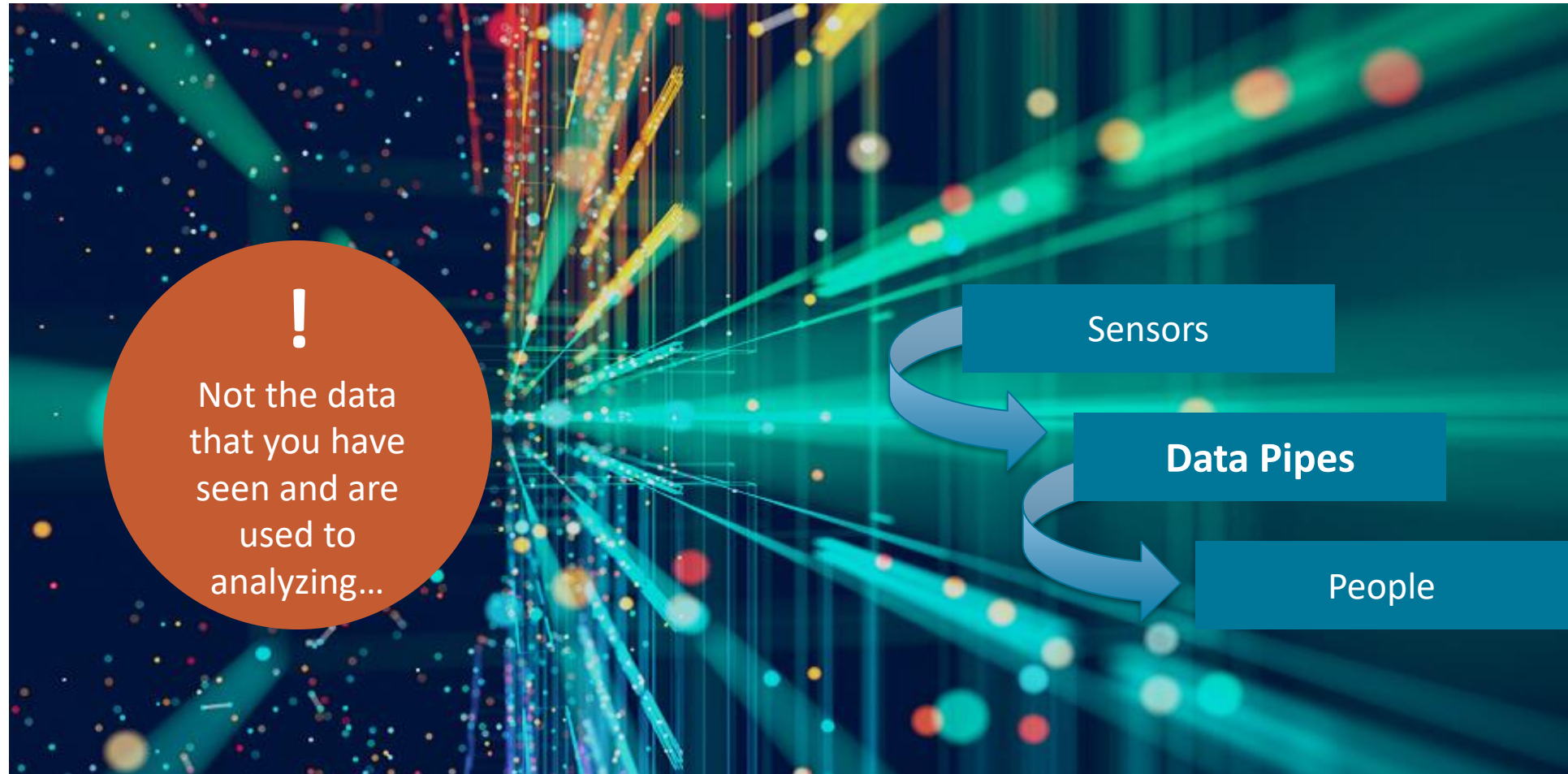
TIME SERIES DATA AND ANALYTICS ARE GROWING FAST

10X
Faster growth than traditional business data
4.4ZB-44.4ZB

Human data

50X
Machine data
.09ZB-4.4ZB

Business data
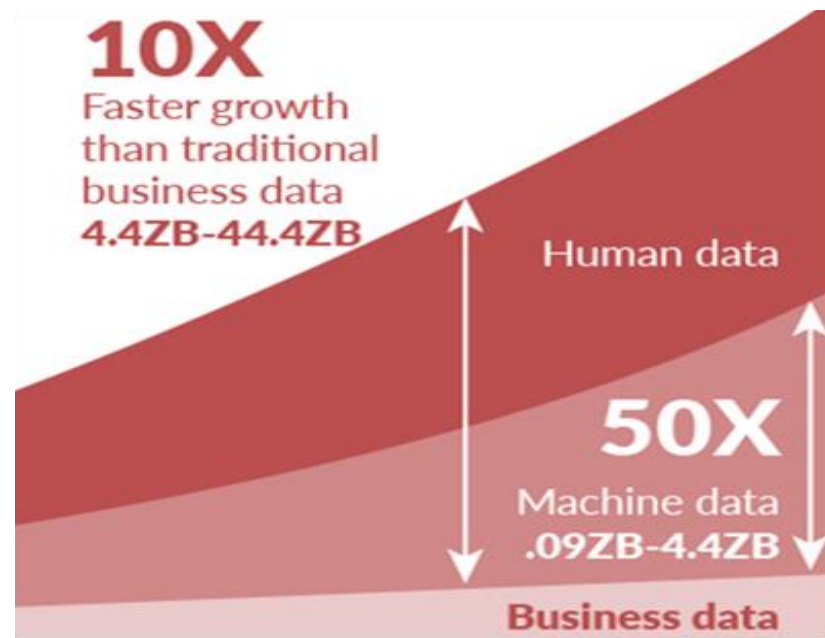
Source: Aureus Analytics Report

$45
Billion
Time Series Intelligence

$16
Billion
Business Intelligence

Source: Maximize Market Research

WHAT IS GRANULAR TIME SERIES DATA?

- Granularity – This is the sampling rate, i.e., the rate at which measurements are taken. Typically expressed as minutes, seconds, milliseconds, nanoseconds.

- Dimensionality – The descriptors and metadata for the individual units of analysis, i.e., the SKU within a particular retail store, or sensor on a particular car engine, etc.

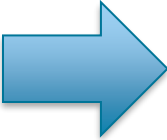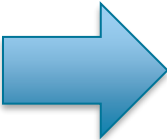# HOW IS THIS DIFFERENT FROM THE TIME SERIES DATA WE KNOW?

Traditional time series data for market performance

Highly dimensional time series data
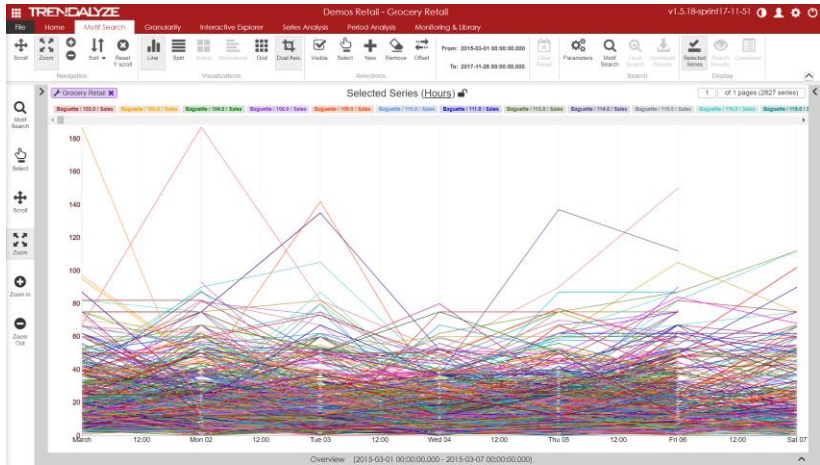

High frequency time series data
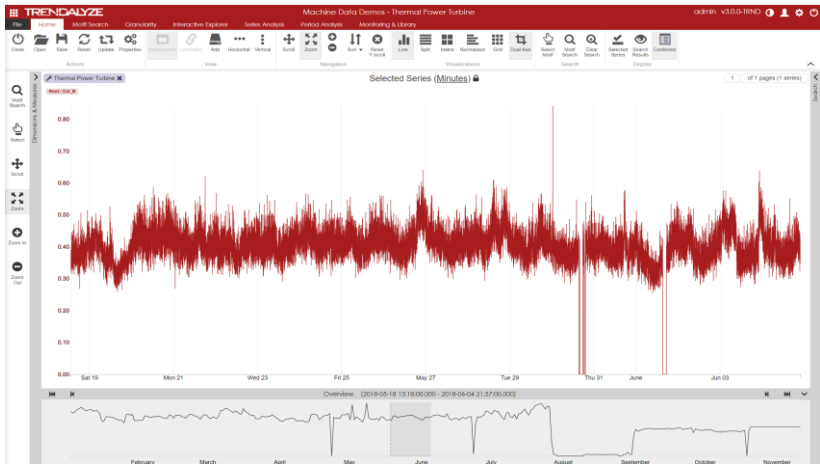
TIME SERIES DATA IN THE WORLD AROUND US

Vibrations
Predictive failure, maintenance

Trades
Buy / sell opportunities

Vehicle Operations
Driving patterns, maintenance

Vitals
Remote patient monitoring

Transactions
Promotion optimization

Data Traffic
Capacity and utilization

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DATA MONETIZATION

CONTEMPORARY ECONOMICS FAVORS DATA MONETIZATION

Smart:

| Factories | Cities | Banks | Retailers | Devices |

Granular Data

| Sensor | Machine | Records | Text | Audio | Image | Video | Vision | BIO |

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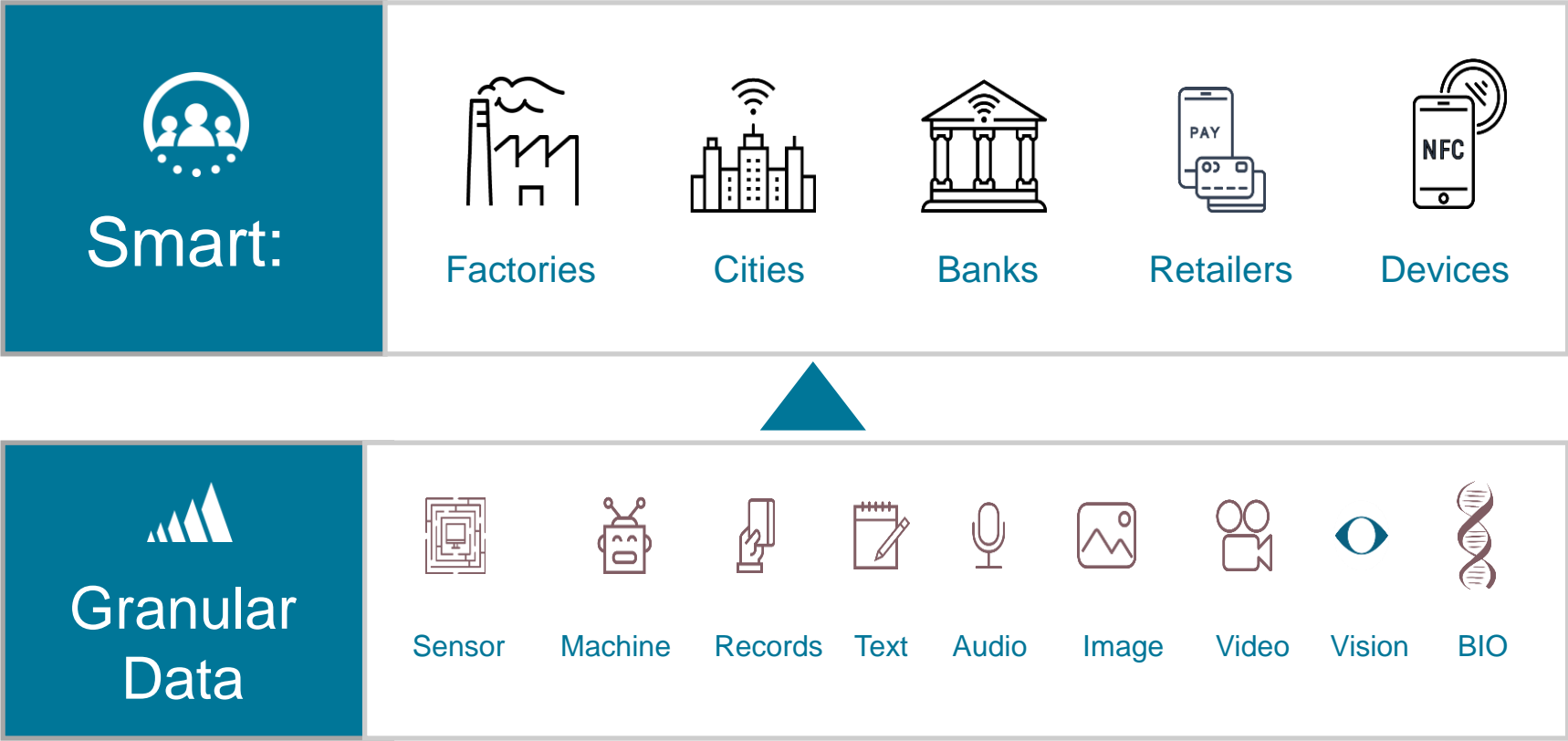
WHAT IS DATA MONETIZATION?

Using data and analytics
to create new data products
and business models

WHAT DIGITAL ASSETS ARE USED TODAY?

WHAT DATA PRODUCTS ARE USED TODAY?

HOW IS DATA USED TODAY TO OPTIMIZE COSTS?

Avoid the consequences of component or system failure

Clean and restore components before performance degrades

Improve reliability and predictability

Replace worn components before they fail

Preventive Maintenance

Train experts on proper procedure and techniques
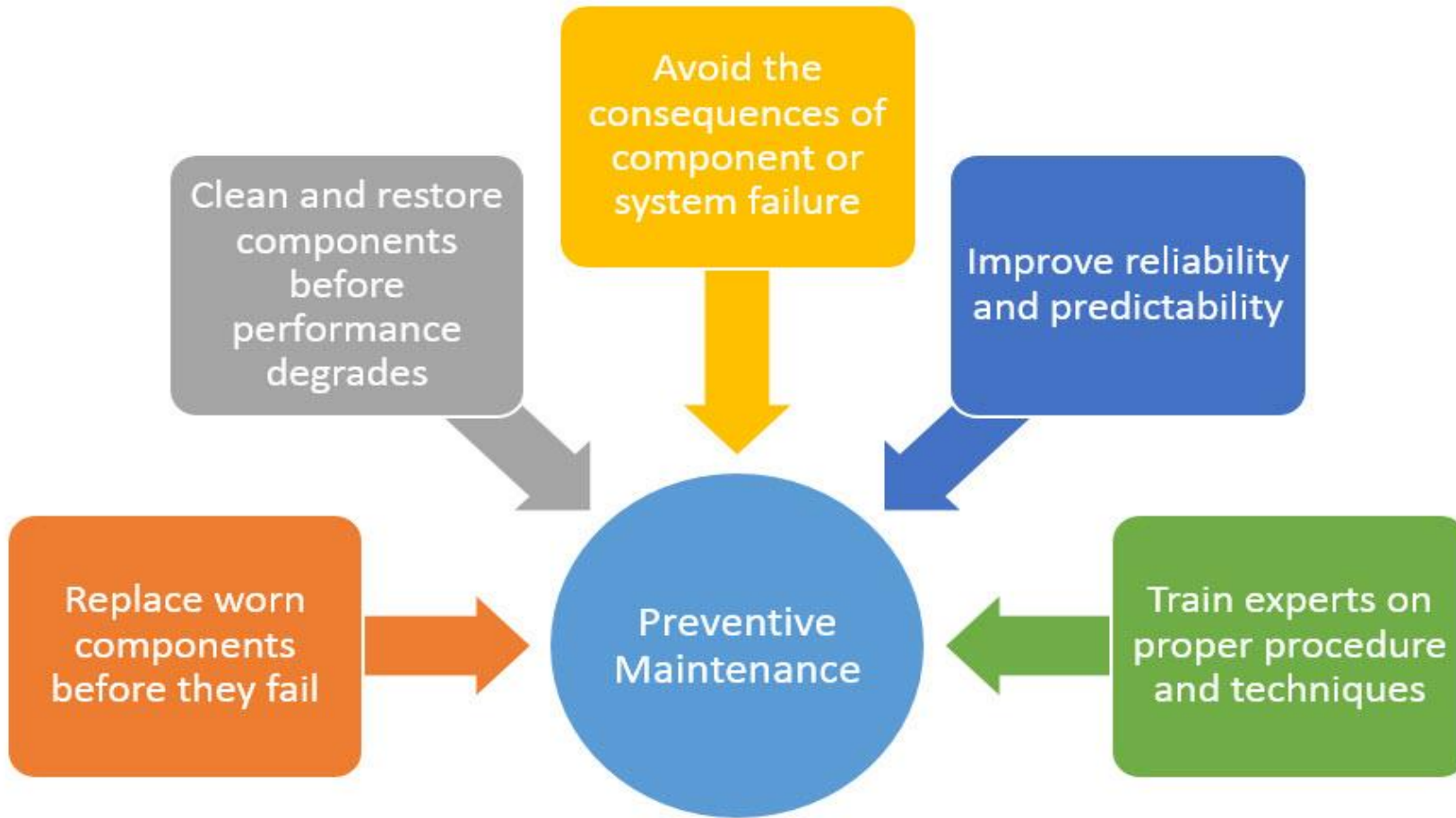
WHAT TYPE OF DATA SUPPORTS MONETIZATION?

Raw Data	Processed Data	Granular Data
Data capture, data streams	BI data, analytic summaries	Detailed temporal data
Asset with potential, actionable value is TBD	**Descriptive, diagnostic, predictive value**	**Trend and pattern-based actionable value**

Prime opportunity for data monetization!

WHAT ARE THESE OPPORTUNITIES FOR MONETIZATION?
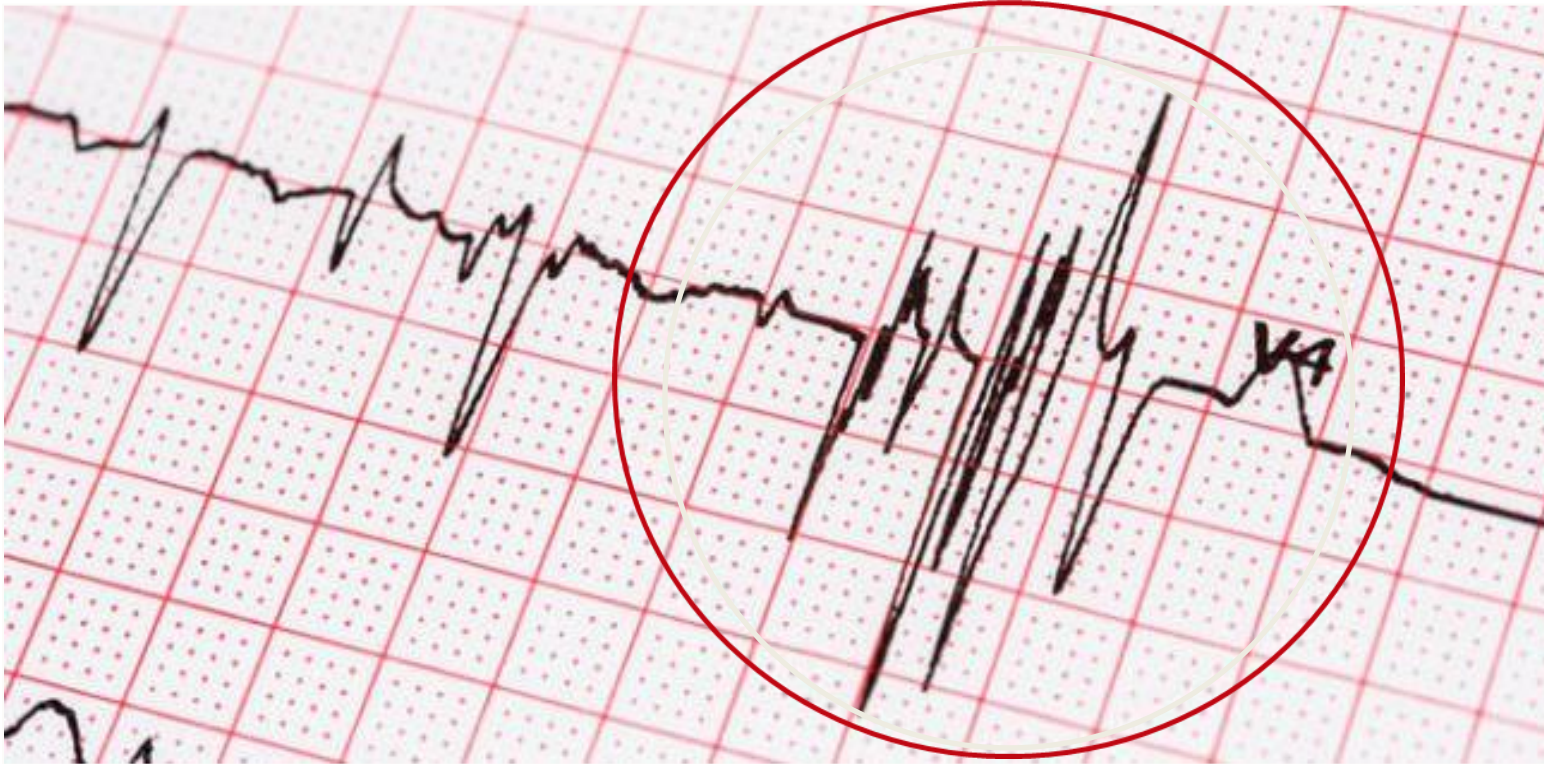
- Sensors and devices collect the "heartbeats" of everything

- Knowing the good and the bad "heartbeats" is precious

- Monitoring "heartbeats" is the key to saving or making money

THE OPPORTUNITIES FOR MONETIZATION EXIST IN EVERY INDUSTRY
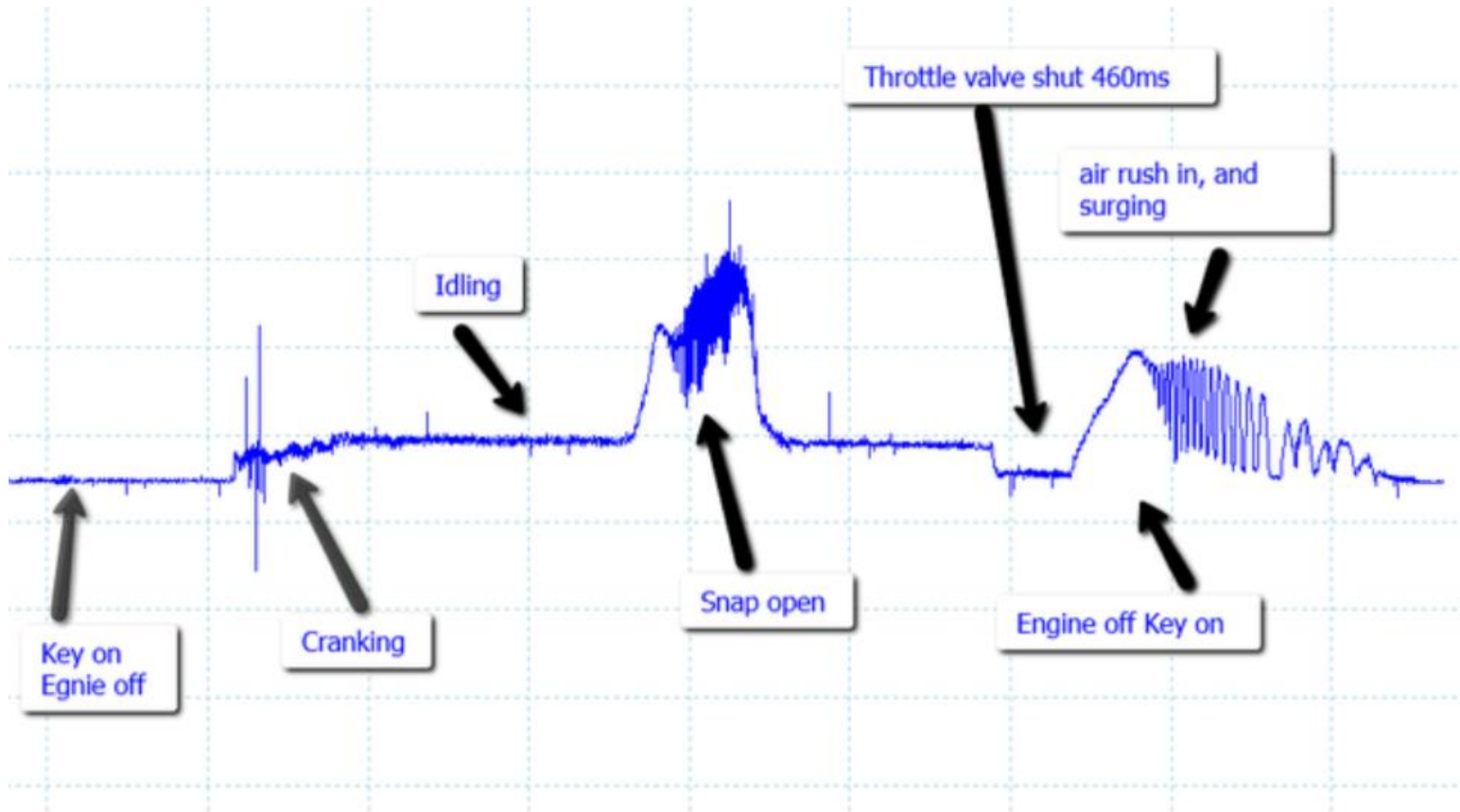
- Engine diagnostics in fleet management sector

- New car mechanics are like doctors knowing the "heartbeats" of the engine

- Each of these cycles produce distinct "heartbeats" used to detect faults

SHAPE-BASED INTELLIGENCE

WHAT IS SHAPE-BASED (MOTIF) INTELLIGENCE?

A single pattern/anomaly or first discovery is not a motif
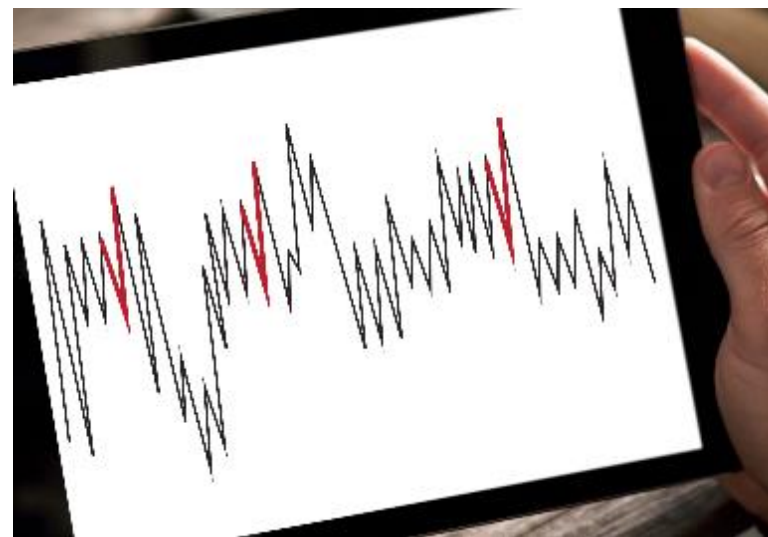
Motifs are recurring patterns that could be mined and leveraged

WHAT DO MOTIFS REALLY REPRESENT?

Humans talk in words

Devices talk in time-series data

Search Words
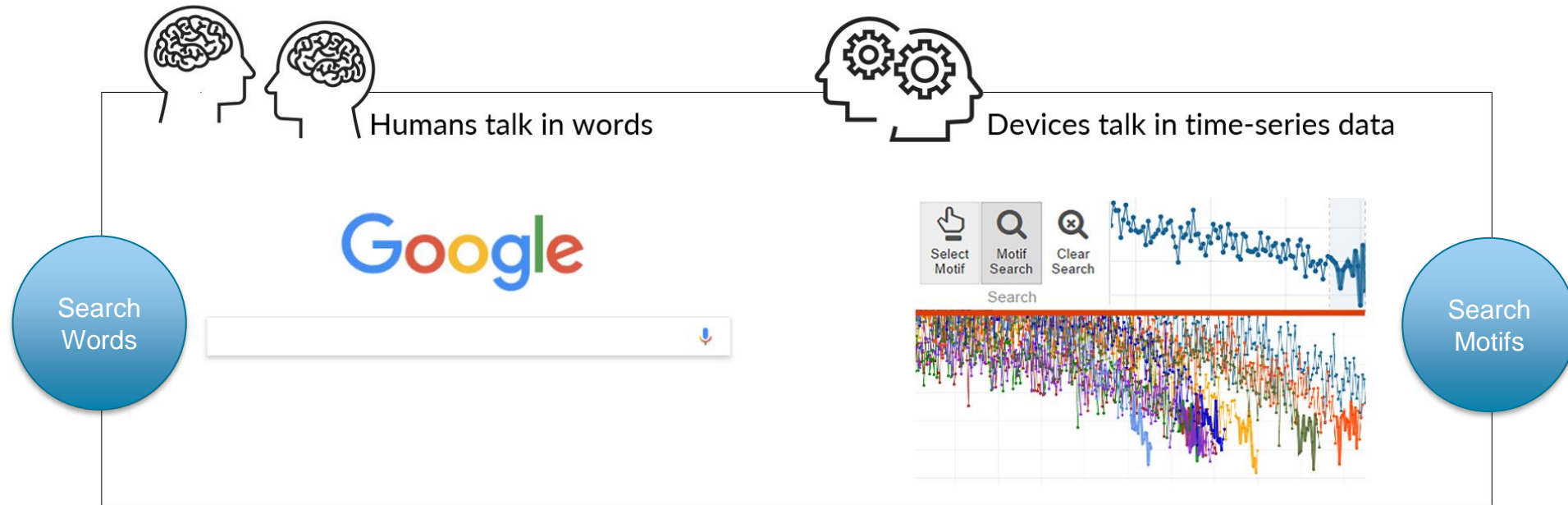
Search Motifs

Motifs are searchable patterns, which makes them monetizable

MOTIFS ARE ALL AROUND US
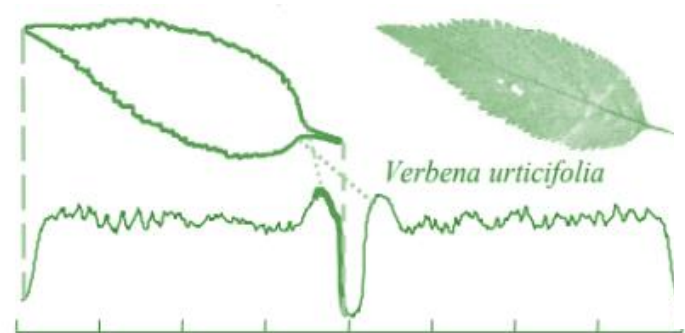
Plant or animal recognition and growth

Language processing
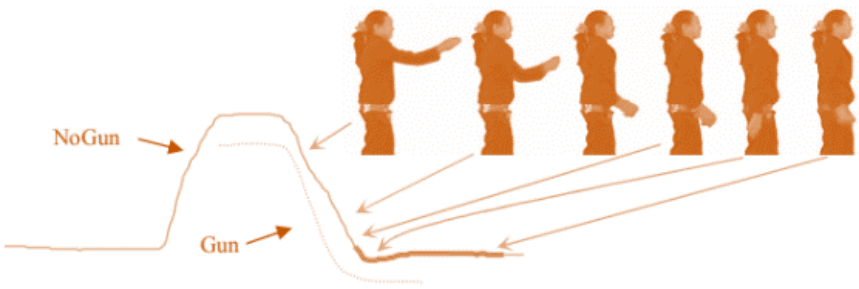
Movement/gesture sensing and identification
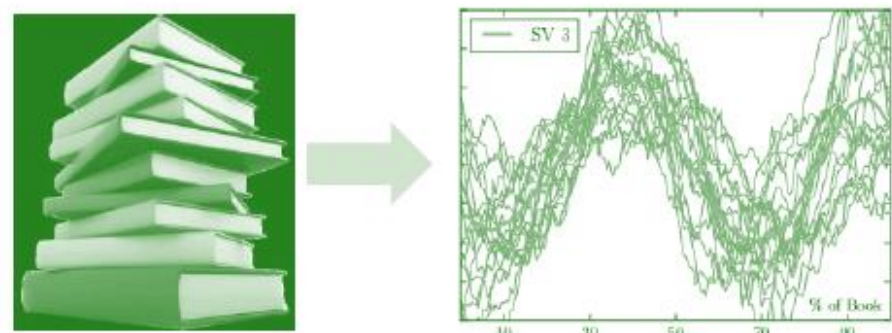
Text analysis

Remote medical diagnostic and monitoring
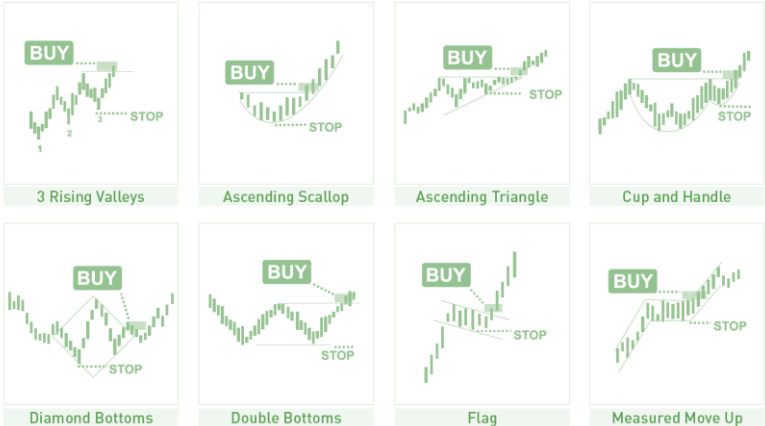
Stock trading and anti-money laundering

HYPE, MAGIC, AND MYTHS

FUNDAMENTAL FLAWS IN MACHINE LEARNING

Machines learn on their own

Machines are faster than humans

Machines are very reliable in recognizing patterns

DIFFERENCES BETWEEN HUMAN AND MACHINE LEARNING

HOW DO HUMANS AND MACHINES LEARN THE DIFFERENCES BETWEEN THESE TWO SHAPES?

Human Learning:

- Recognize shape differences immediately
- Learn from a few examples the differences
- Identify known shapes instantly
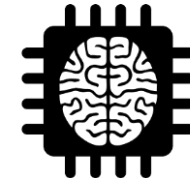
Machine Learning:

- Requires thousands of picture to train the model
- All pictures have to be labeled precisely by humans
- Small shape differences confuse machines

THE CHOICE OF AN AI SOLUTION DEPENDS ON FOUR MAIN FACTORS

Cost   Time   Resources   Reliability
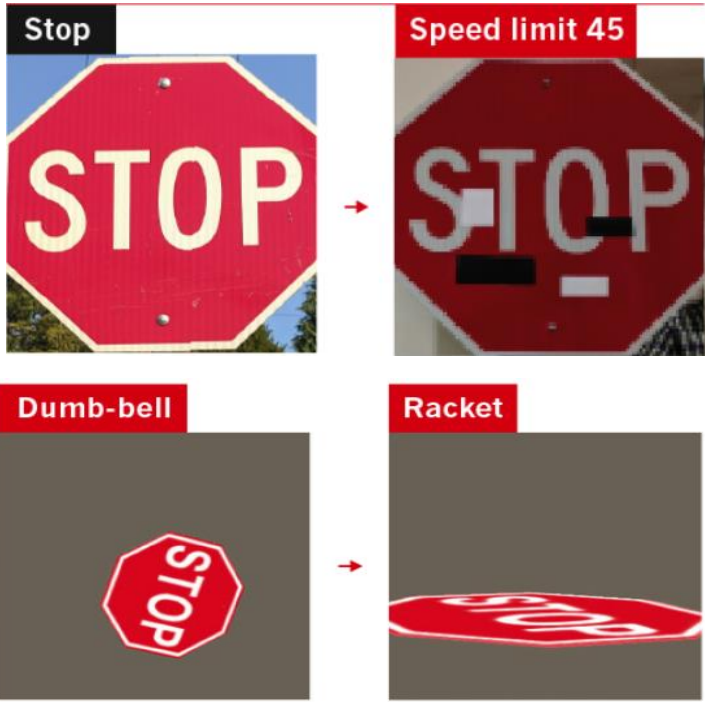
WHAT YOU NEED TO KNOW ABOUT MACHINE LEARNING

A recent MIT Sloan survey found that only 10% of companies obtain significant financial benefits and achieve ROI with AI, and these companies are not alone.

Harvard Business Review

Small Data Can Play a Big Role in AI

by H. James Wilson and Paul R. Daugherty

February 17, 2020
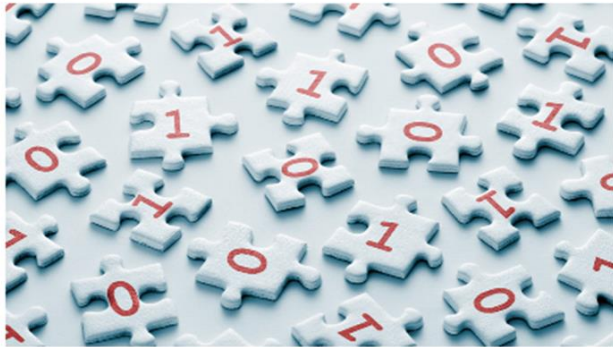
The way we train AI is fundamentally flawed

The process used to build most of the machine-learning models we use today can't tell if they will work in the real world or not—and that's a problem.

MIT Technology Review

They trained 50 versions of an image recognition model on ImageNet, a dataset of images of everyday objects. The only difference between training runs were the random values assigned to the neural network at the start. Yet despite all 50 models scoring more or less the same in the training test—suggesting that they were equally accurate—their performance varied wildly in the stress test.

Gartner's research has found that 85% of ML projects fail. Worse yet, Gartner predicts that this trend will continue through 2022 and beyond.

THE RISK OF NOT DOING VS. DOING AI WRONG

Sure Profit:

Doing AI right ensures effectiveness and competitiveness

Safe Trials:

Without competitive pressure, there is time to do it right

Money Bleed:

Doing it wrong can lead to failures, litigation, and other costly mistakes

Money Waste:

Experiments lead to dead ends and only increase future risks

Risk of Not Doing It

High

Low

High

Risk of Doing It Wrong

CASE STUDIES

CASE STUDY 1: REMOTE CARDIO PATIENT MONITORING

Problem

50% sudden death

17 million

More than 50 percent of sudden deaths in the world are caused by heart-related conditions

17 million premature deaths (under the age of 70) are due to non-communicable diseases
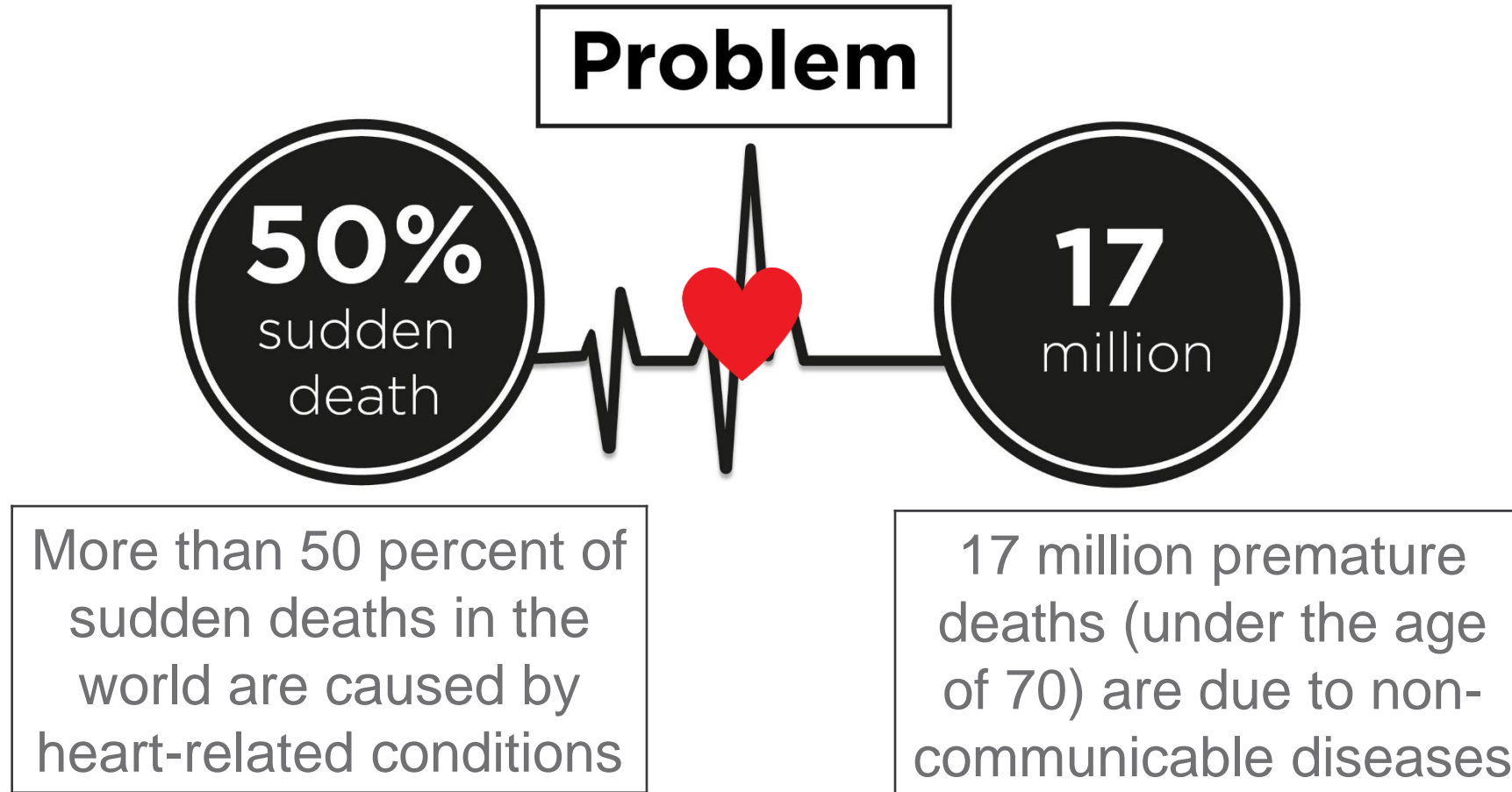
Source: Medical Research Check Point Cardio 2015

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CASE STUDY 1: REMOTE CARDIO PATIENT MONITORING (CONTINUED)

In the News

24 часа.bg

НОВИНИ | МНЕНИЯ | СПОРТ | РЕГИОНАЛНИ | СПРАВОЧНИК | ОЖИВЛЕНИЕ

Докторе кажи | Сила за живот | Клуб 100

140-грамова машинка спаси живота на мъж минути преди да се качи на самолета

09.12.2017 10:59; Анна Ботинова ⊙ 15388; 💬 0;

Устройството за телемедицина прави и анализира кардиограма в реално време

Електронно устройство с големина на кибритена кутийка засече опасно ритъмно нарушение при пациент на 61 г. и го "прати" в болница, докато той чакал самолета си на софийското летище в четвъртък, научи "24 часа".

"Това е отличен пример за ползите от телемедицината.

Пациентът е

получил камерна

тахикардия за

около 3-4 минути Това е

Комуникационният модул, който приема през блутут връзка данните от холтера и изпраща сигнала през GSM мрежата, е с размерите и формата на мобилен телефон и може да се носи в джоба. Само на най-възрастните пациенти се дава специален колан, в който да го поставят, но това е по-скоро за да не го забравят някъде. СНИМКА: Йордан Симеонов

Source: Bulgarian Newspaper 24 Hours

The patient was going to the airport

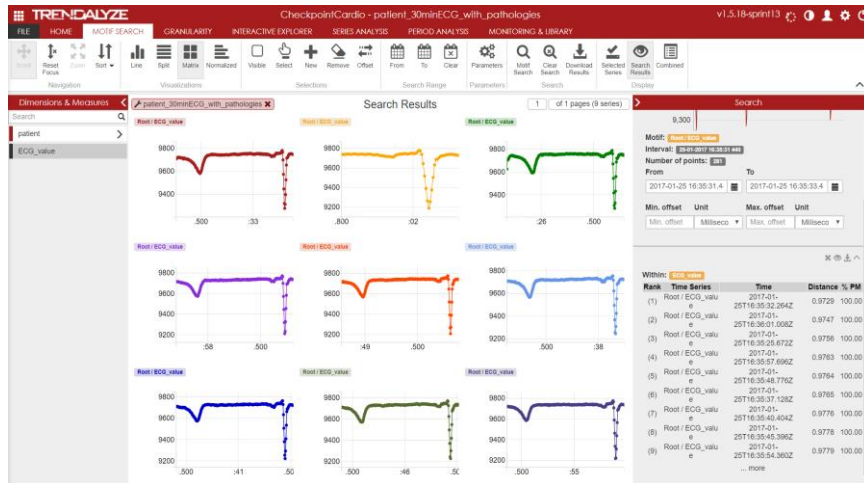He received a call from the remote diagnostic center

He was taken to hospital

Saved from certain death

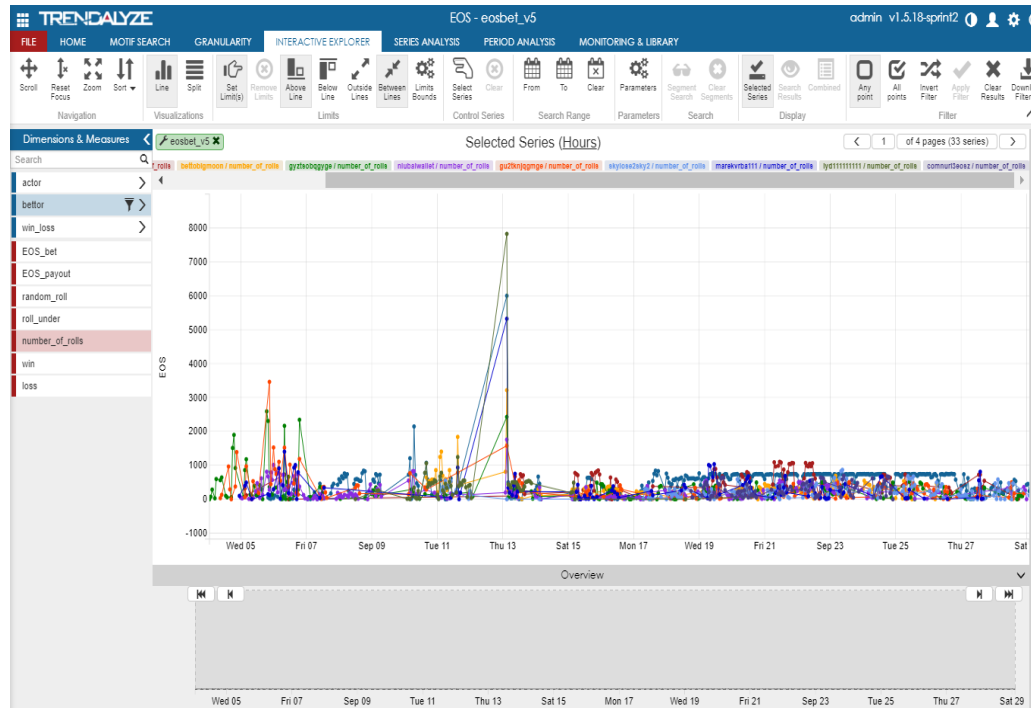# CASE STUDY 1: REMOTE CARDIO PATIENT MONITORING (CONTINUED)

Source: Trendalyze, Inc.

Cardio pathology detection

- Pathology motif (yellow) vs. normal heart beats motifs (green)

- A single heartbeat contains 360 data points

- The pathology motif is detected within a single heartbeat – it has only 180 points

CASE STUDY 2: AUTOMATE BACK OFFICE PATTERNS FOR MONITORING

1 A common ISO scam is to pump the value of an asset using bots to generate fake activities

2 The challenge is to pull the bad patterns from within millions of actively trading wallets

Source: Trendalyze, Inc.

Suspicious Patterns Detection

- The proliferation of digital banking and crypto assets have led to significant increase in the amount and variety of financial crimes

- The cost of monitoring and investigating these crimes has skyrocketed, while clever methods clog the system with false positives

- Like fingerprints, time series patterns reveal price manipulation, AML, and other crimes

CASE STUDY 3: CONDITION BASED MAINTENANCE

97% Preventive Failure Detection without modeling

The two key problems in implementing predictive modeling for Condition Based Maintenance (CBM) are its cost and the accuracy of the results. Traditional machine learning and statistical approaches require highly trained data scientists who are both expensive and in short supply. For CBM, the data scientists need time to familiarize themselves with all the nuances of the specific business cases and to understand them. Hence, they have to discuss these with the subject matter experts (SMEs). Furthermore, all traditional approaches require long histories of equipment failures in order to build accurate models. As a result, money, time and accuracy frequently deter the implementation of CBM.

CASE STUDY 3: CONDITION BASED MAINTENANCE (CONTINUED)
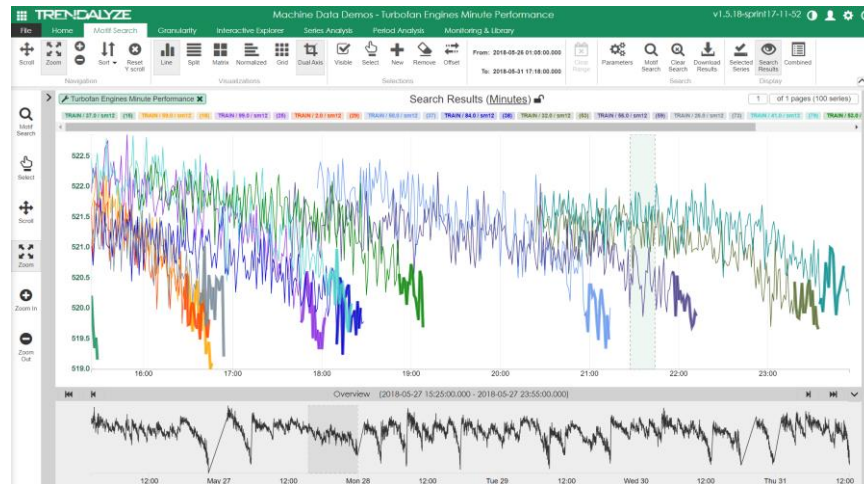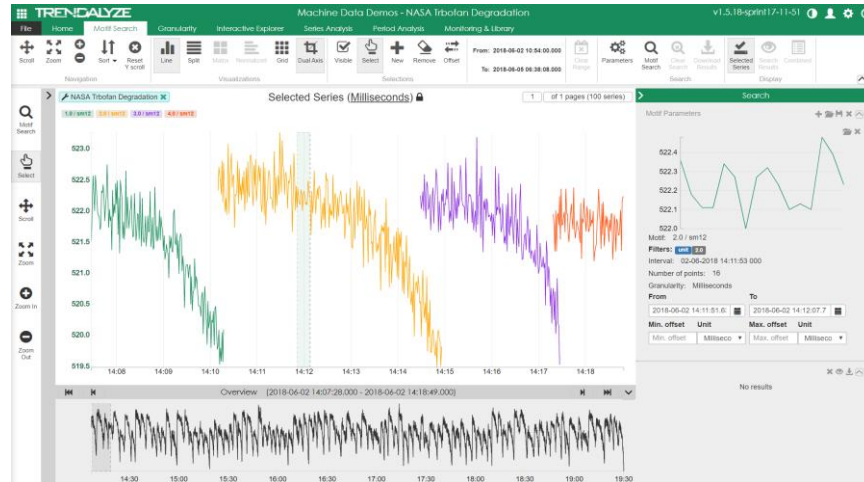
Source: Trendalyze, Inc.

Just-in-time maintenance

- Engineers can select a normal operations motifs or examples of single observations

- Motif search allows to find all similar cases

- Governed libraries of machine operation motifs enable fast monitoring and CBM solutions

CASE STUDY 4: SAMPLE SOLUTION OFFERING

Path to Macro Objectives:

- Proactive monitoring to prevent outages

- Quicker resolution of outages that already occurred

- Predictive maintenance to lower costs

Unified platform for all decisions:

AI and Big Data solution for better utilization and data monetization in streamlining operations

MONITOR

Process information collected by millions of sensors in real time to maintain highly efficient operations

MANAGE

Provide management dashboards, KPIs and reports to ensure resource alignment and goals attainment

MAINTAIN

Predictive maintenance increases the life span of assets and lowers costs by just-in-time equipment repair

MONETIZE

Leverage AI, consumption, market and customer data to optimize pricing and capitalize on newly discovered opportunities
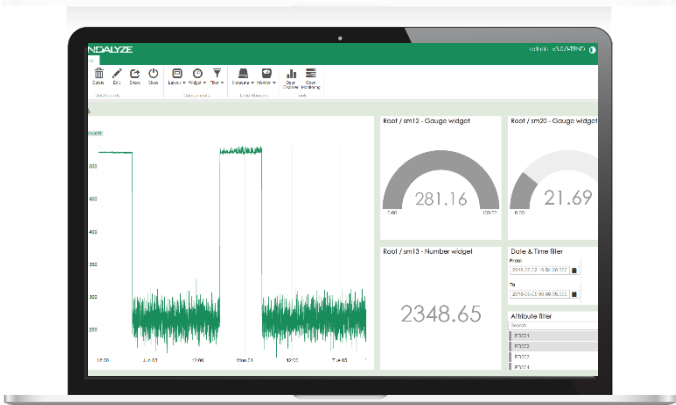
What Producers Need:

AI-based solutions that are integrated into "Operations and Maintenance" programs, to prevent power outages and lower costs of equipment repairs

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CASE STUDY 4: AI2ENERGY SAMPLE SOLUTION OFFERING (CONTINUED)

Self-service IoT analytics tools
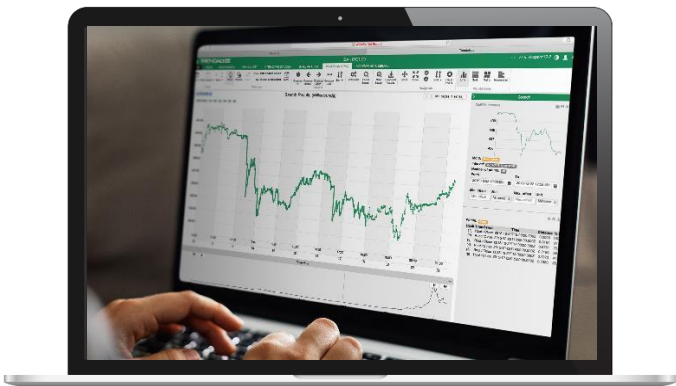
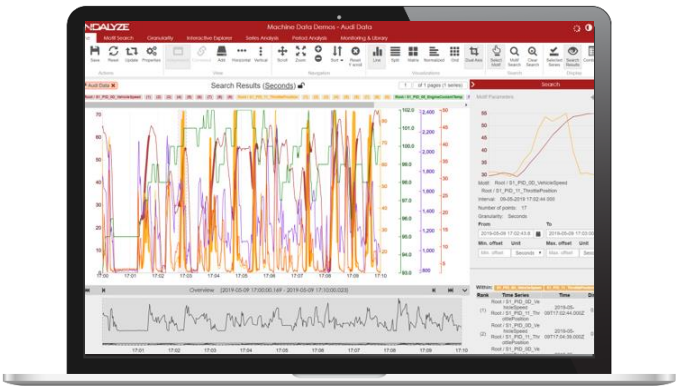**AI identifies patterns and trends for analysis**

Search for patterns in real time and get alerts

Search engine for IoT and industrial data

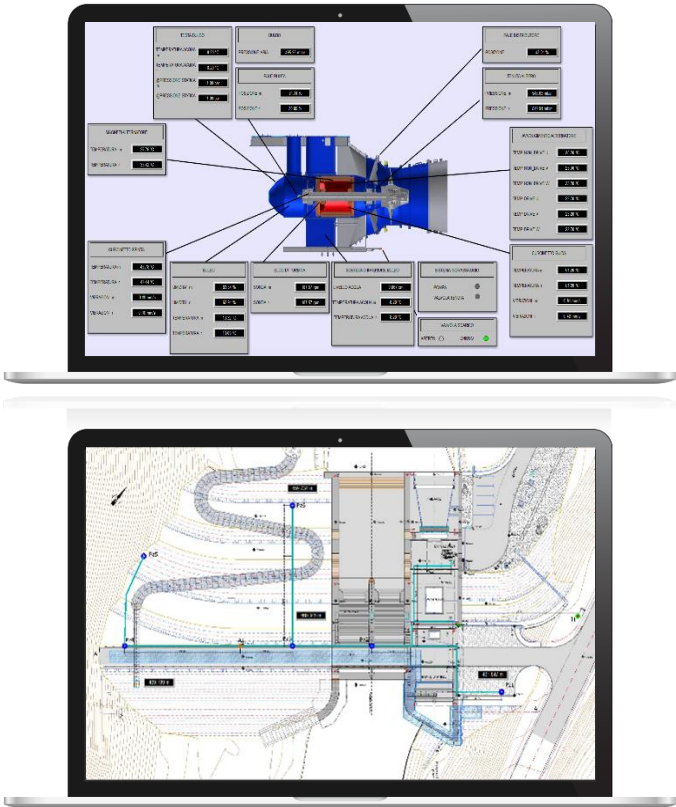**Search for complex patterns in data streams**

Search for correlated patterns in machine data

Source: Trendalyze, Inc.

CASE STUDY 4: AI2ENERGY SAMPLE SOLUTION OFFERING (CONTINUED)

Real-time operational and environmental monitoring

Business Intelligence and system monitoring

Operational monitoring and management of every single component

Real-time BI for power, generation, demand, and distribution

Monitoring of environmental and geographic conditions

Real-time main units monitoring and control

Source: Trendalyze, Inc.

SUMMARY

SHAPE-BASED INTELLIGENCE IS ABOUT CONTEXTUAL ADAPTATION

"Past DARPA* AI investments facilitated the advancement of 'first wave' (rule based) and 'second wave' (statistical learning based) AI technologies. DARPA-funded R&D enabled some of the first successes in AI, such as expert systems and search, and more recently has advanced machine learning algorithms and hardware.

DARPA is now interested in researching and developing "third wave" AI theory and applications that address the limitations of first and second wave technologies."
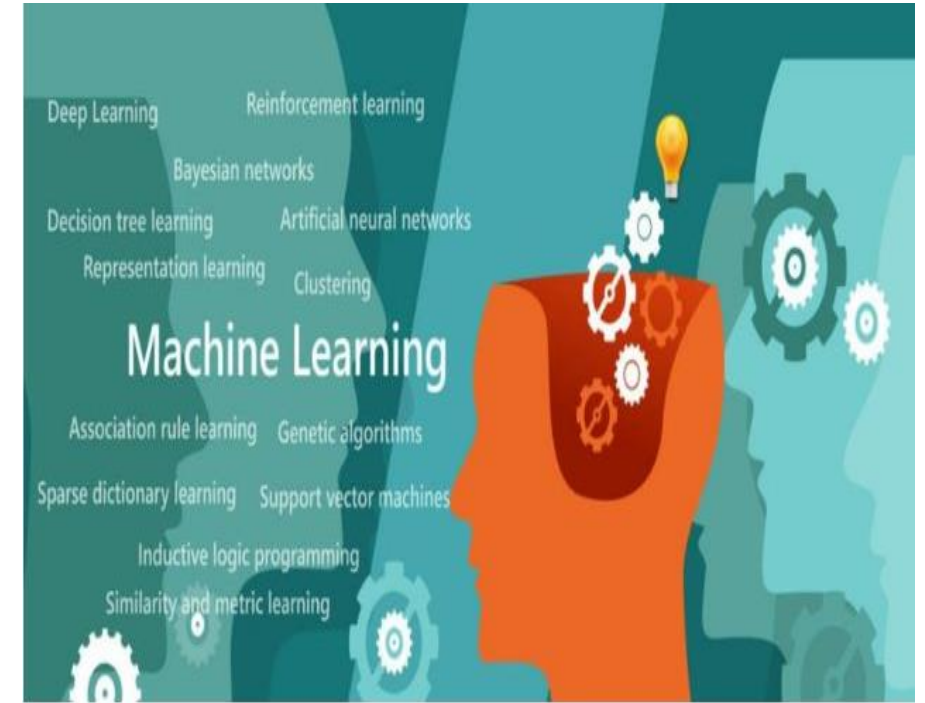
*Defense Advanced Research Projects Agency (DARPA) is the central research and development organization for the US Department of Defense

WHY SHAPE-BASED INTELLIGENCE TRANSFORMS DATA INSIGHTS

Contextual Adaptation:

Wave 1: "No learning capabilities"

Wave 2: "Statistically impressive, but individually unreliable"

Wave 3: "Systems that construct contextual explanatory models for classes of real-world problems"

a young boy is holding a baseball bat

Wave 3 Platform's Advantages:

- Put the "human in the loop" to select contextual patterns for specific problems

- All patterns are completely explainable and can be used for decision automation

- Learn and monitor with just one example or small data sets

- Users can start monitoring applications instantly without model training

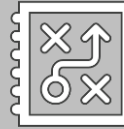- Predictions are based on artificial logical networks with transparent reasoning

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EVOLUTION OF AI-BASED DECISION SUPPORT SYSTEMS

AI 1.0

Expert systems

Expert crafted rules

AI 2.0

Machine learning and deep learning

Statistical learning

AI 3.0

Shape-based discovery

Shape-based learning

QUESTIONS

THANK YOU

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