



Smart decisions. Lasting value.™

# Artificial Intelligence & Detecting Fraud in Governments

CSMFO Annual Conference  
January 11, 2019

# Agenda

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- Assess the Risk: Summary of 2018 ACFE Report to the Nations
- Overview of Tools: Data Science | Artificial Intelligence | Machine Learning
- Case Study: Procurement
- Other Applications: Other Areas Where Artificial Intelligence May Help
- Questions



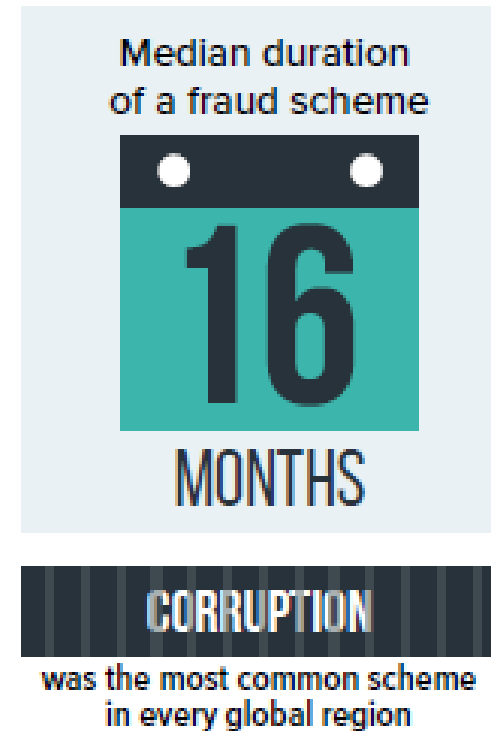
# Assessing the Risk



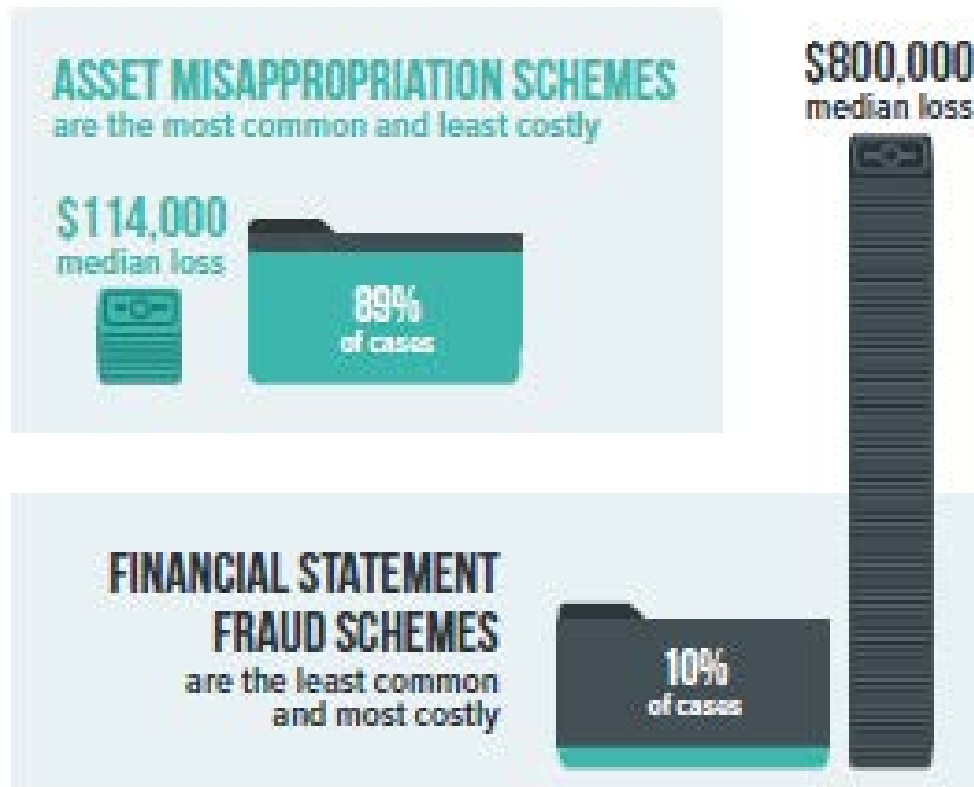
# ACFE Report to the Nations: Key Findings

## KEY FINDINGS

**2,690**  
real cases of  
occupational fraud  
from  
**125** countries  
in  
**23** industry  
categories



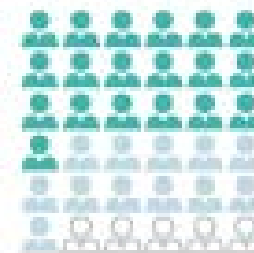
# ACFE Report to the Nations: Key Findings



**TIPS** are by far the most common initial detection method



**EMPLOYEES**  
provide over half  
of tips, and nearly  
1/3 come from  
**OUTSIDE PARTIES**



**ORGANIZATIONS WITH HOTLINES**  
detect fraud by tips more often



# ACFE Report to the Nations: Key Findings

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**INTERNAL CONTROL WEAKNESSES  
WERE RESPONSIBLE FOR NEARLY  
HALF OF FRAUDS**

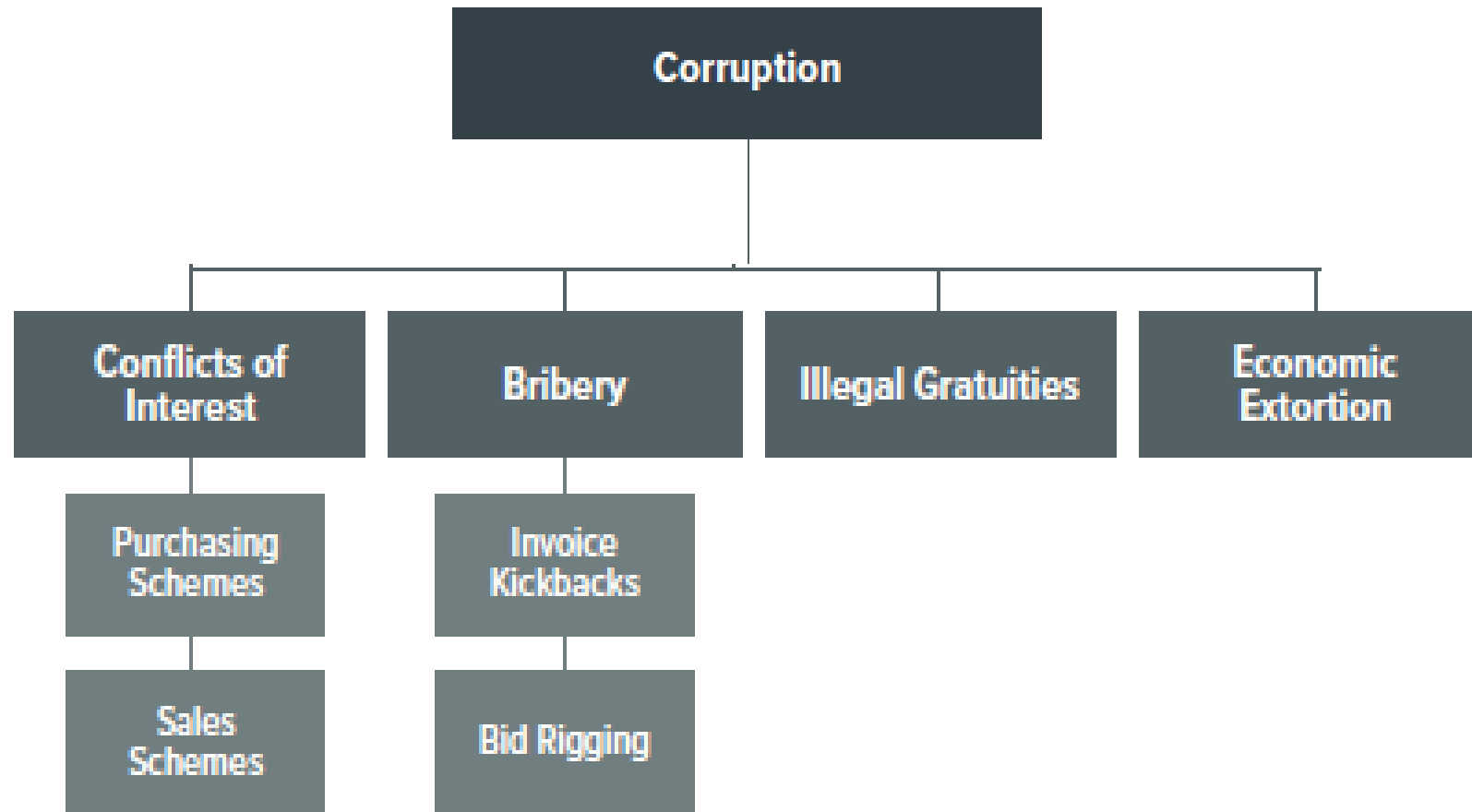


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**ALL 18 ANTI-FRAUD CONTROLS  
ANALYZED WERE ASSOCIATED  
WITH LOWER FRAUD LOSSES  
AND QUICKER DETECTION**



# ACFE Report to the Nations: Corruption







**“Because of ongoing employment negotiations with the vendor, I knew that a recusal was required. So when I attended project meetings, I did not listen, when people asked me for project advice, I did not respond, and when the vendor solicited contract modifications, I called in sick. I knew I was recused.”**





**“I know you’re thinking this was nepotism, but after reviewing all the applications and doing some interviews, I determined that my son was really the best qualified candidate.”**

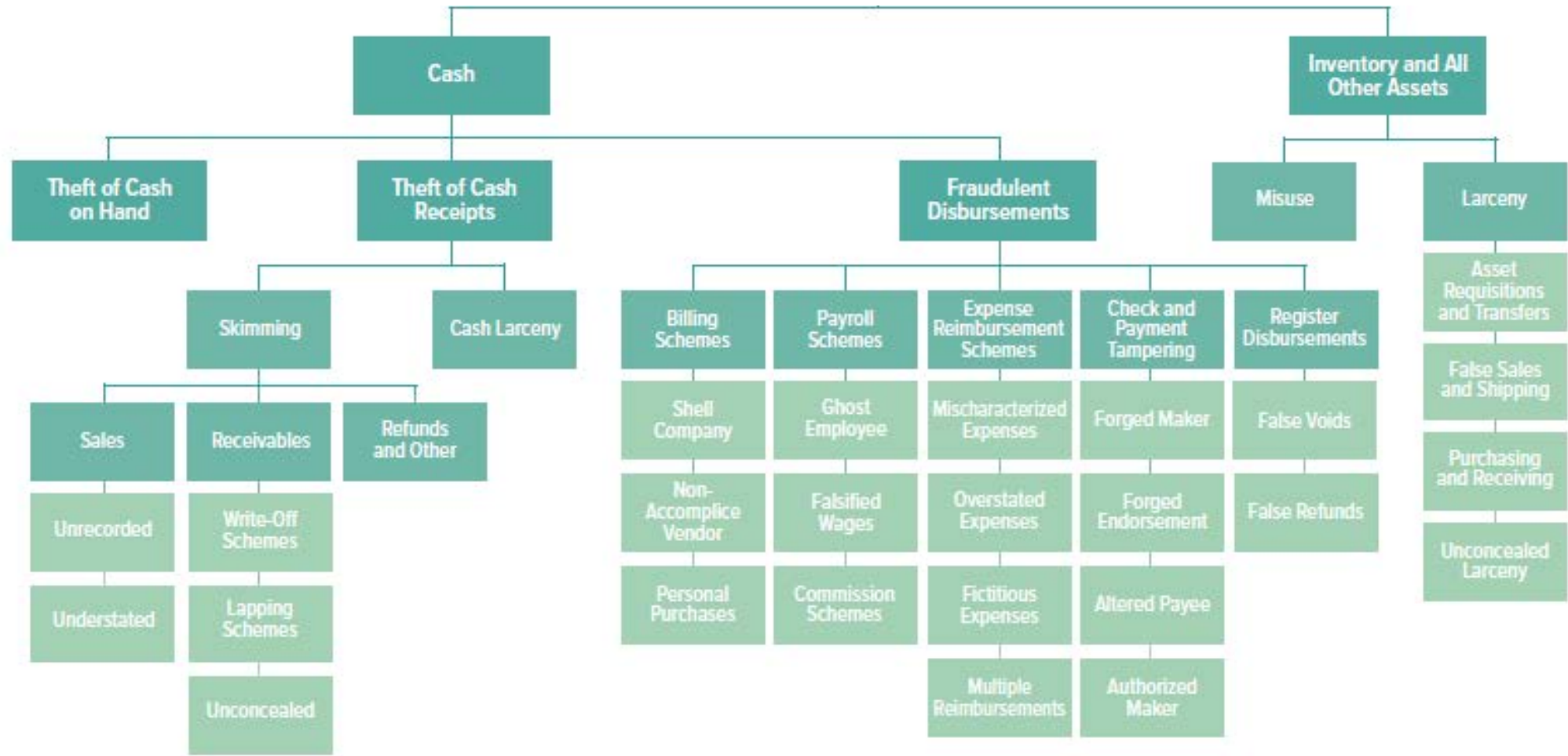




**“The gift from the vendor did not violate company ethics policies because we agreed that it would be delivered after the deal was signed.”**



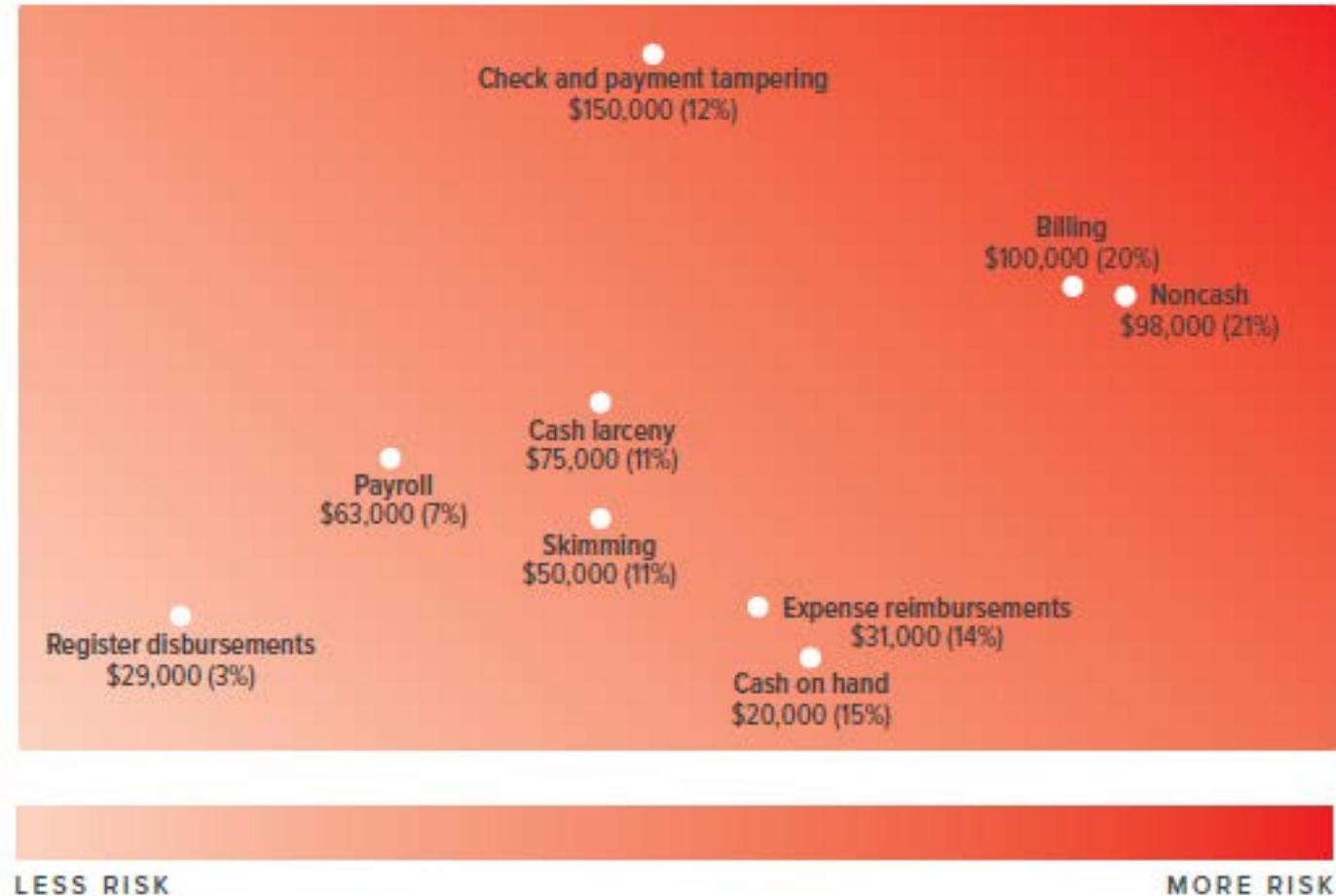
# ACFE Report to the Nations: Asset Misappropriation



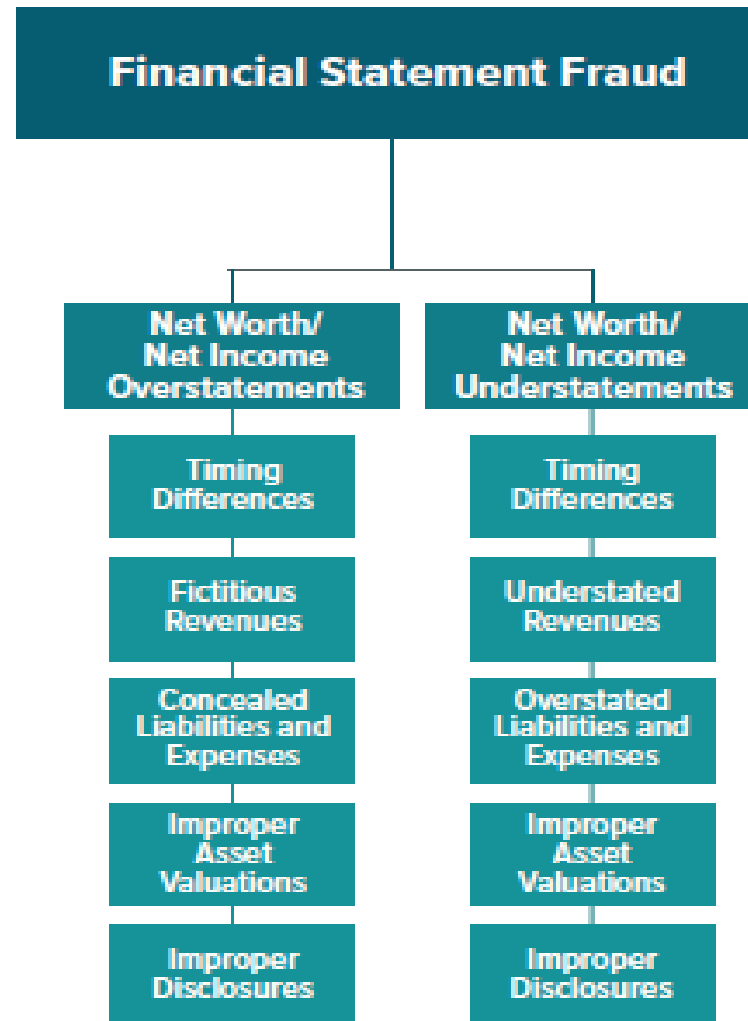


# ACFE Report to the Nations: Asset Misappropriation Heat Map

FIG. 6 What asset misappropriation schemes present the greatest risk?

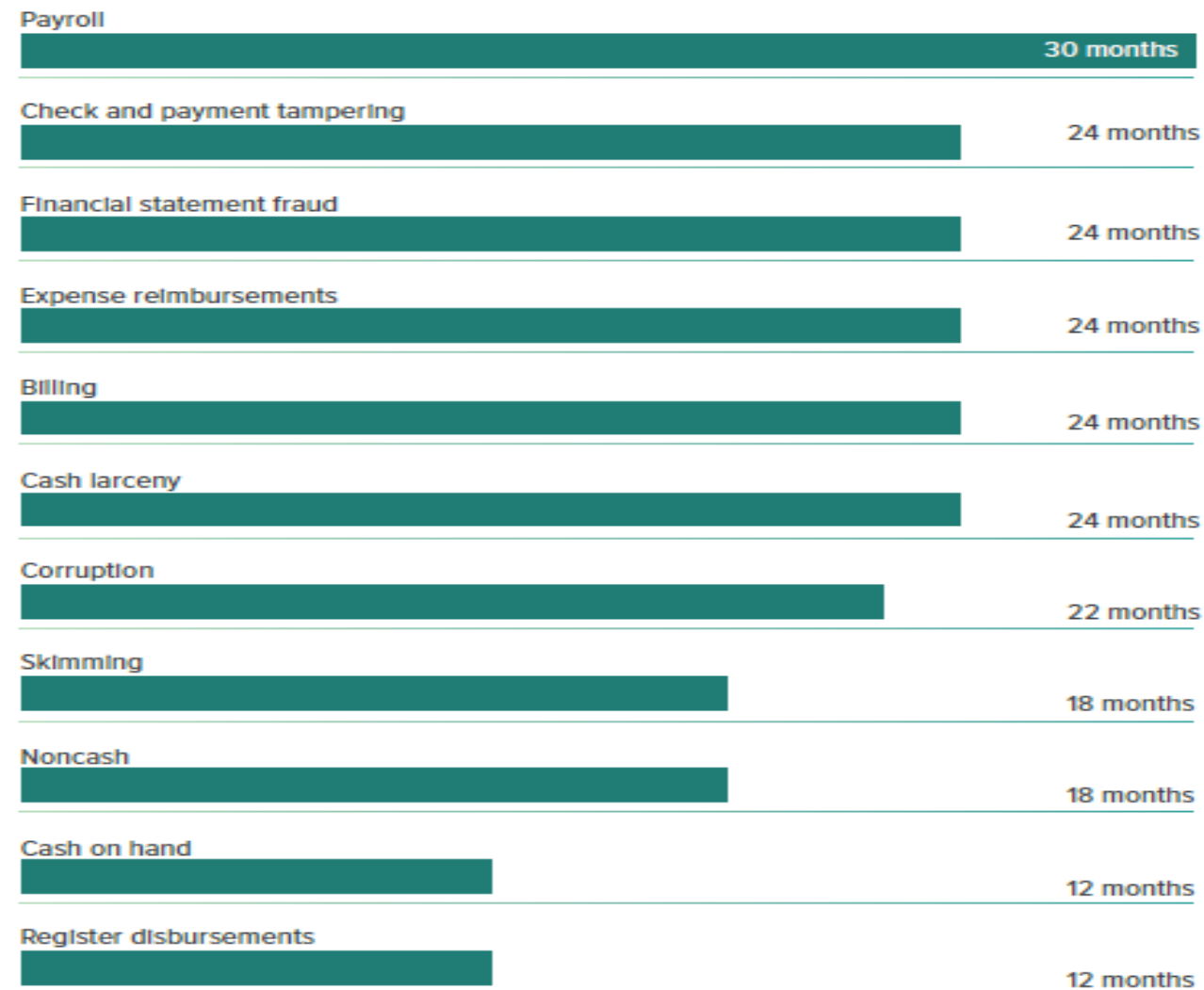


# ACFE Report to the Nations: Financial Statement Fraud



# ACFE Report to the Nations: How long do different occupational fraud schemes last?

FIG. 8 How long do different occupational fraud schemes last?



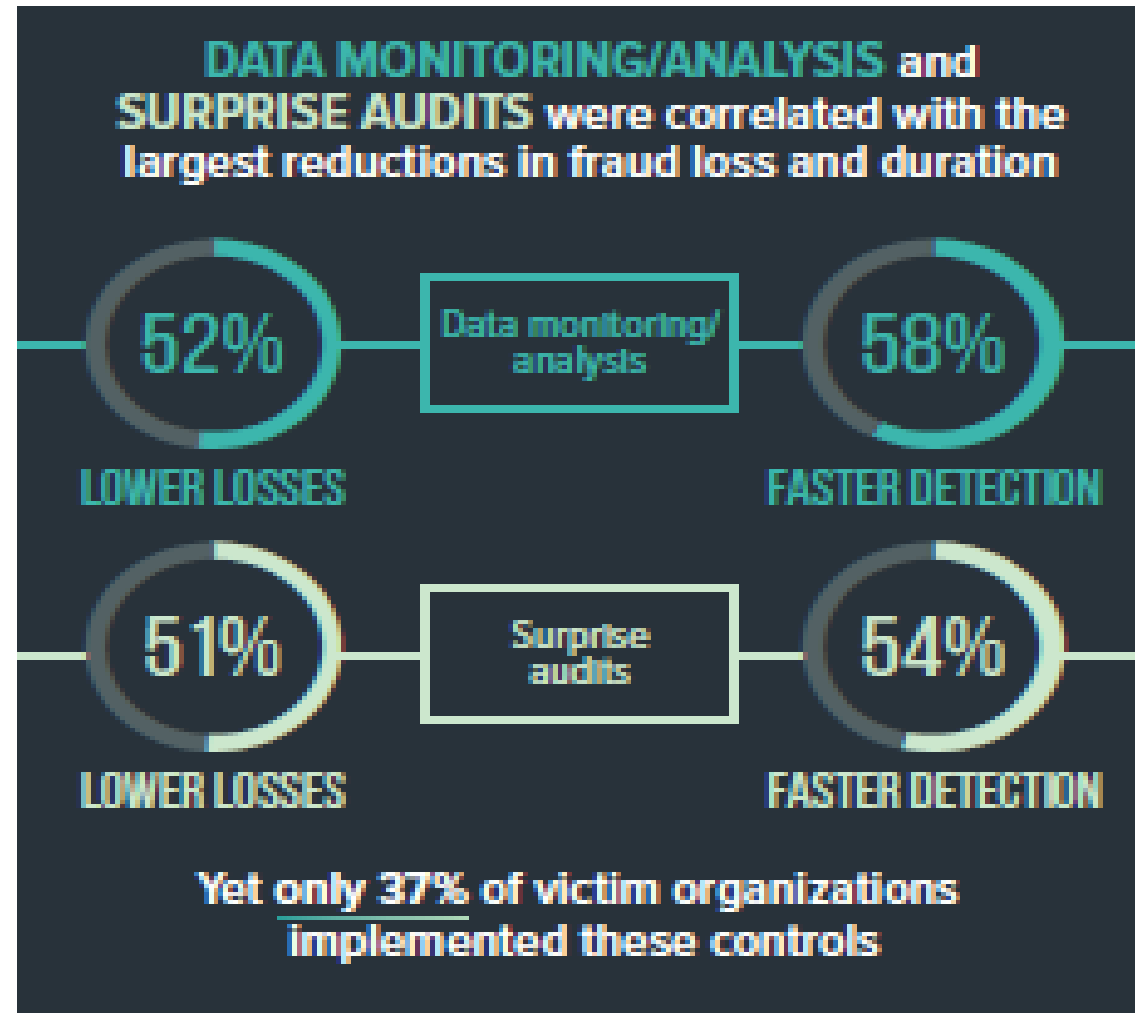


# ACFE Report to the Nations: Anti-Fraud Controls

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- Code of Conduct (80%)
- External Financial Statement Audit (73%)
- Internal Audit (73%)
- Management Certification (72%)
- External Audit of Internal Controls
- Management Review
- Hotline
- Independent Audit Committee
- Employee Support Programs
- Anti-Fraud Policy
- Fraud Training – Employees
- Fraud Training – Managers/Executives
- Dedicated Fraud Department
- Formal Fraud Risk Assessments
- Surprise Audits
- Proactive Data Monitoring
- Job Rotation/Mandatory Vacation (19%)
- Rewards for Whistleblowers (12%)

# ACFE Report to the Nations: Effectiveness Anti-Fraud Controls





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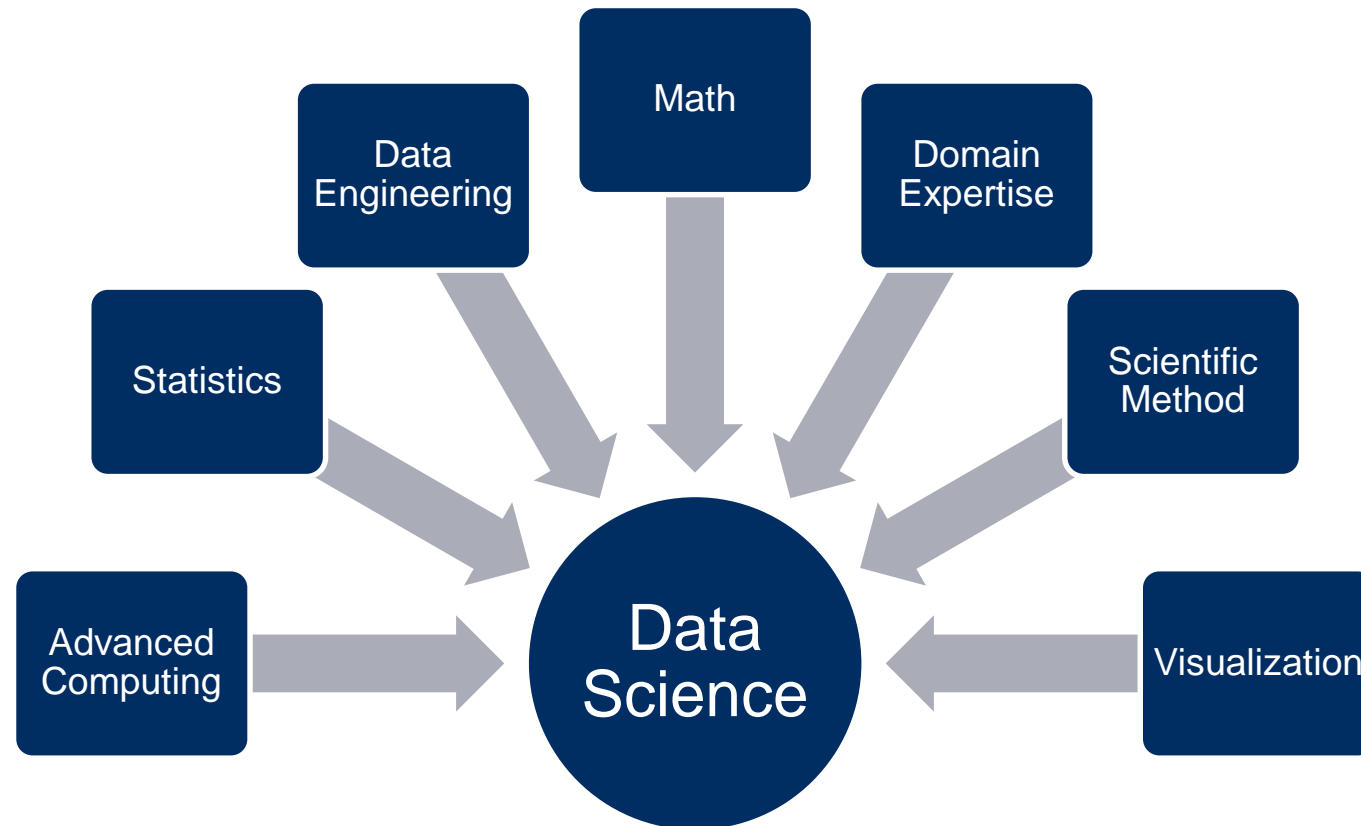
# Overview:

Data Science  
Artificial Intelligence  
Machine Learning



# What is Data Science?

Data science is an interdisciplinary field that utilizes scientific methods, processes, and systems to extract knowledge or insights from structured or unstructured data.

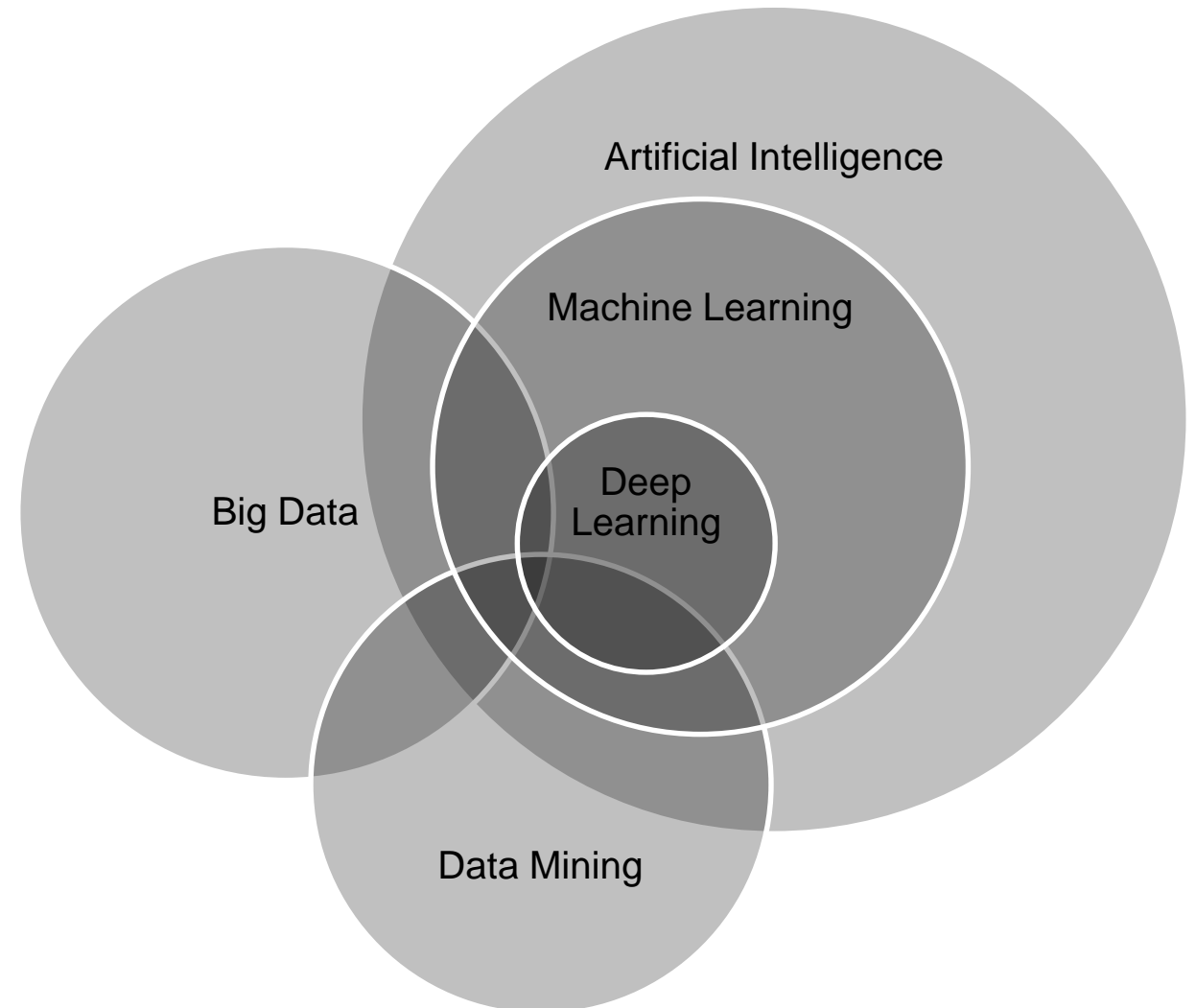


# Buzzword definitions

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## Terminology

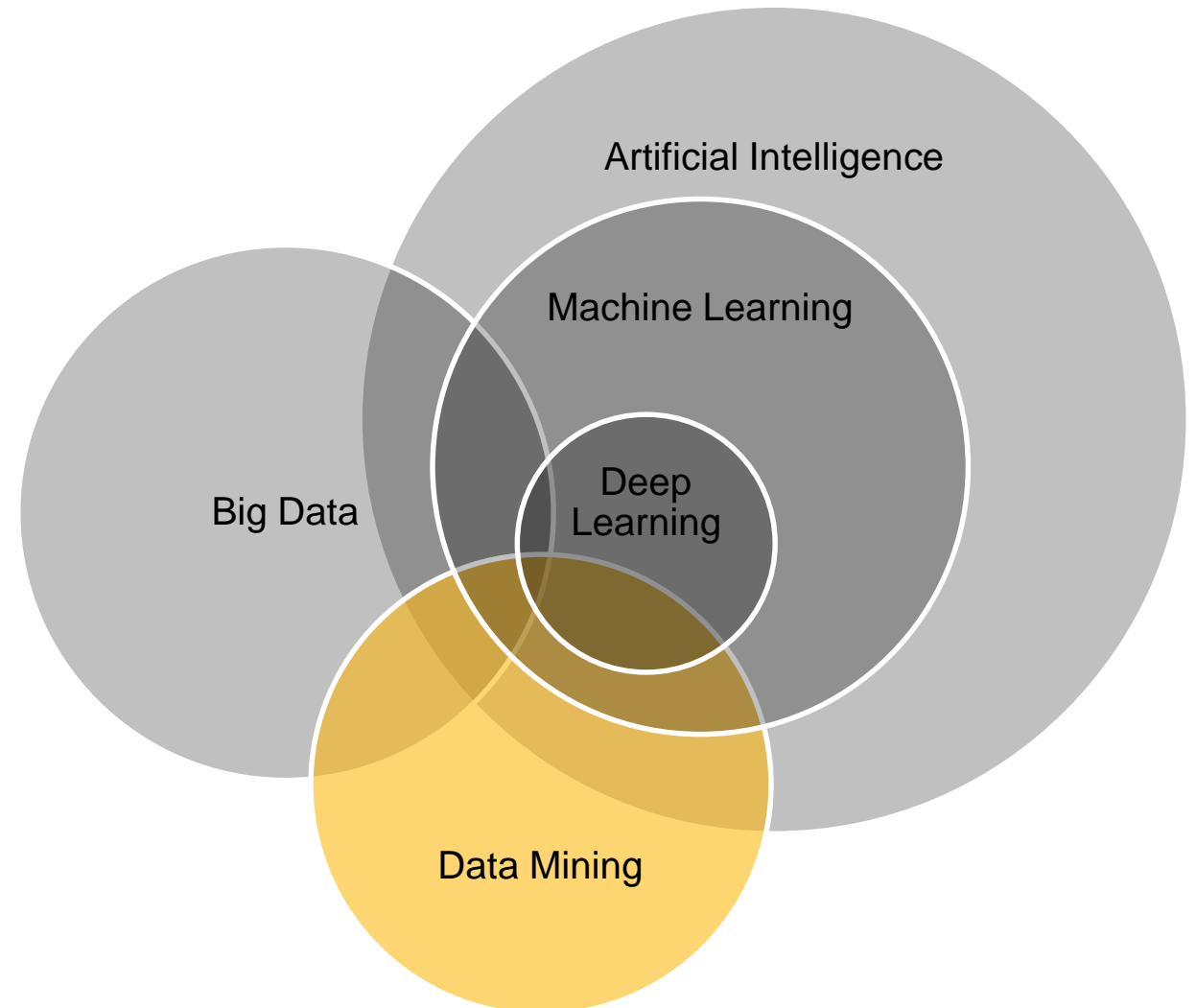
The technologies and disciplines in the machine learning space are continually evolving, but here are some of the key terms and their relationships to one another...



# Buzzword definitions

## Data Mining

- A process for extracting information from data
- The three main steps:
  - Loading the data (big data or small data)
  - Analyzing the data
  - Presenting the results

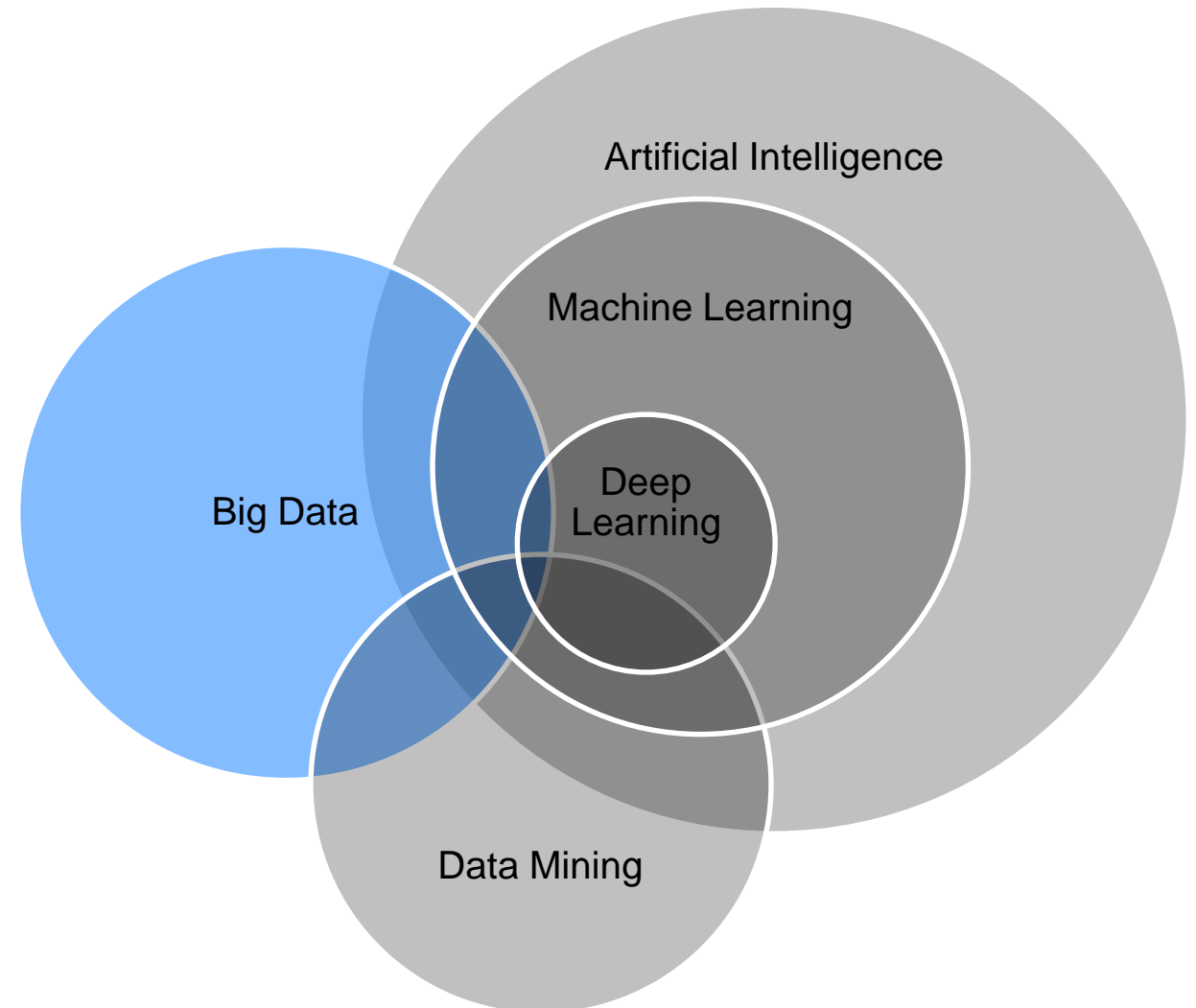




# Buzzword definitions

## Big Data

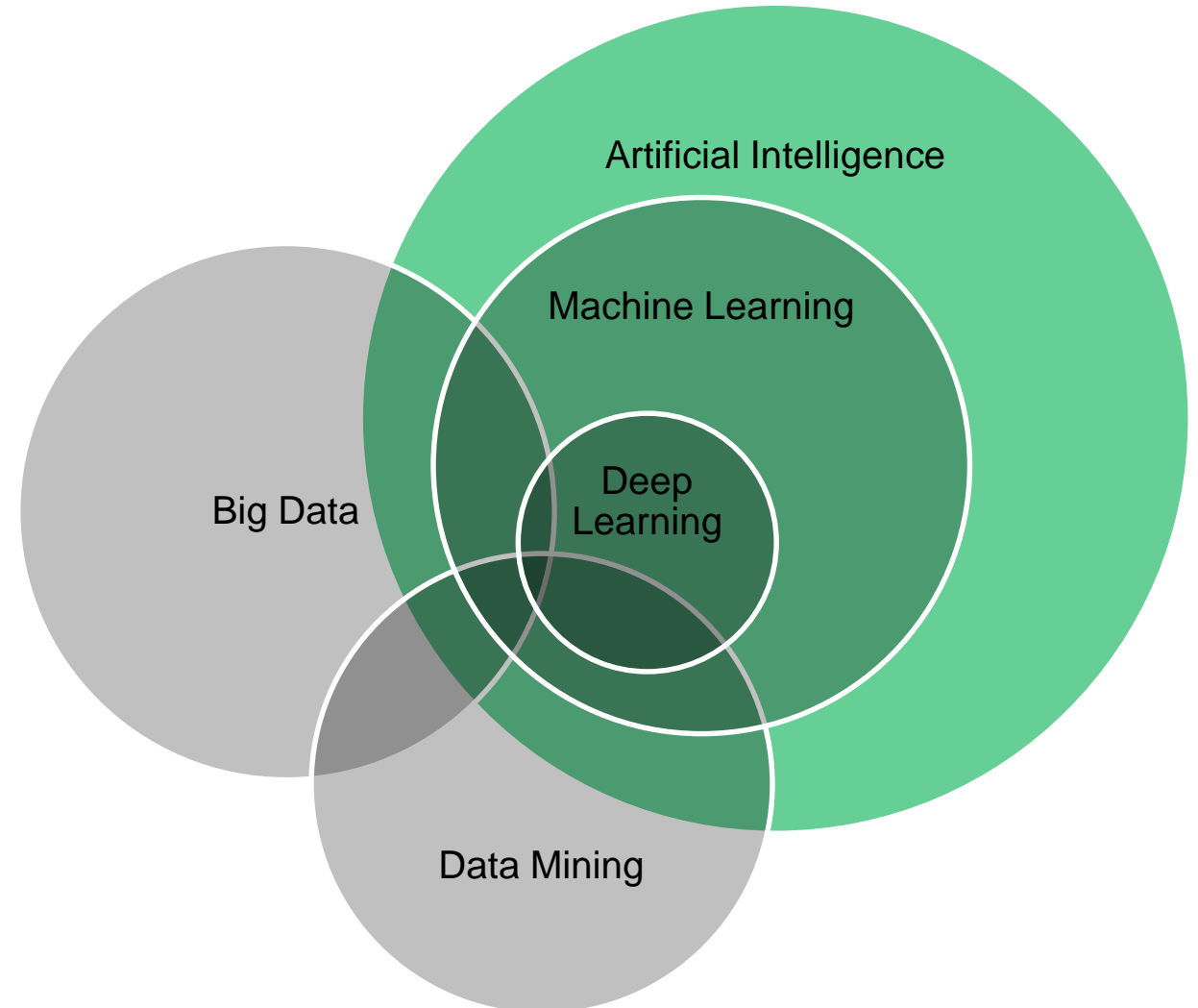
- The V's of big data
  - Volume (size of the data set)
  - Variety (multiple types of data sets)
  - Velocity (speed of new data added to the data sets)
  - Veracity (quality of the data)
  - Variability (changing characteristics of the data sets)



# Buzzword definitions

## Artificial Intelligence (AI)

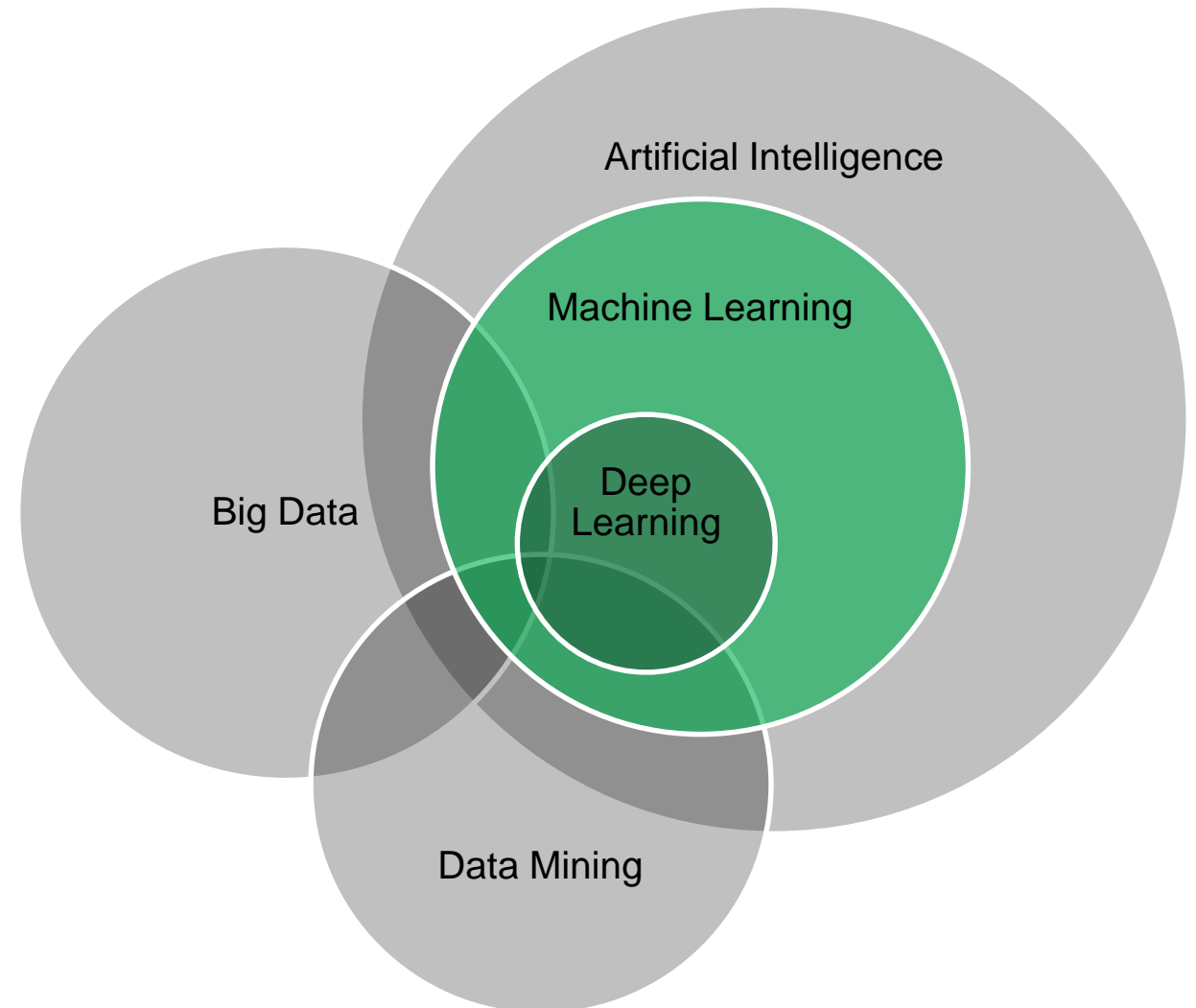
- Artificial *General* Intelligence:
  - Machines programmed to teach itself new tasks
- Artificial *Specific* Intelligence:
  - Machines programmed to accomplish “smart” specific tasks



# Buzzword definitions

## Machine Learning (ML)

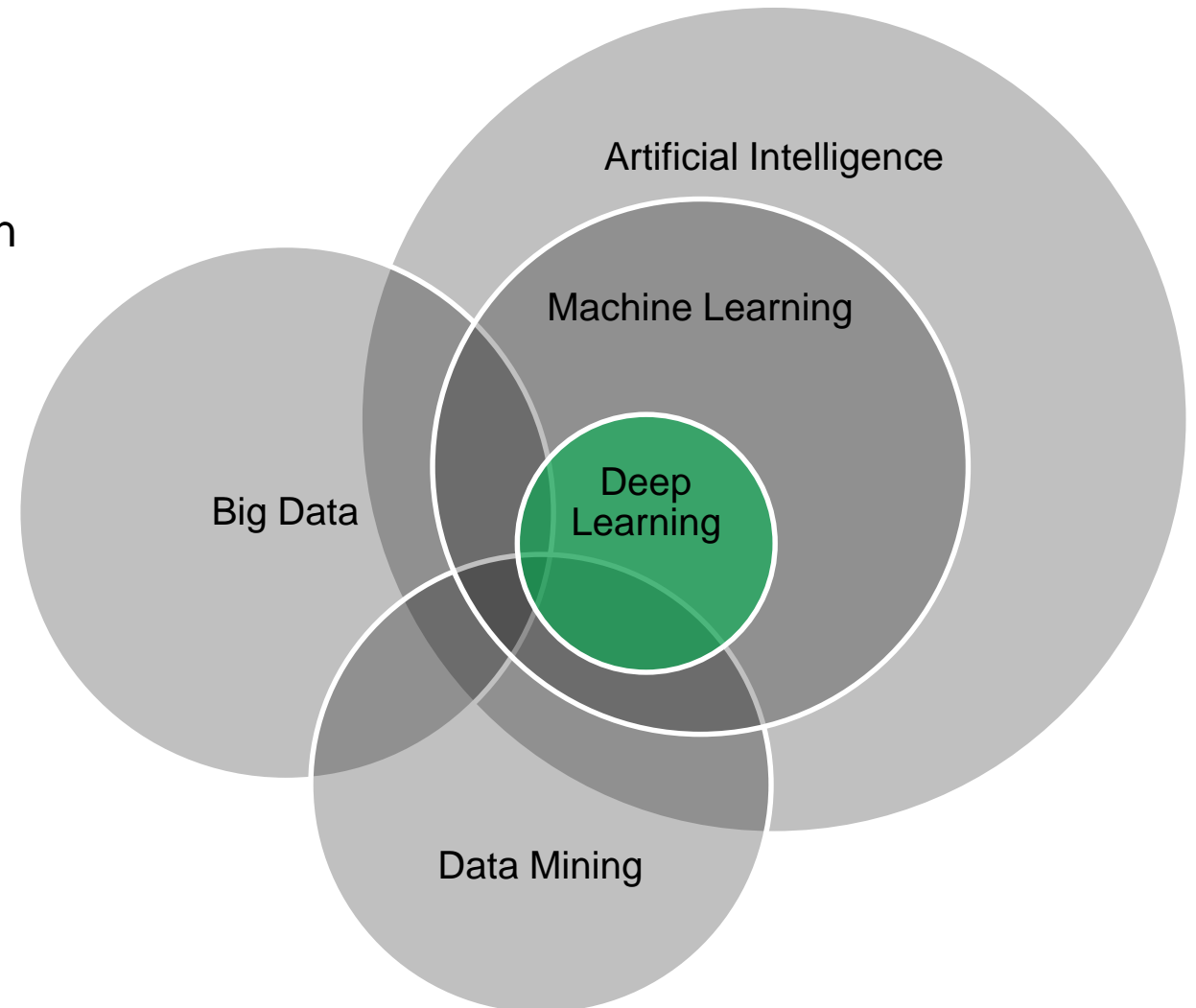
- Self-adaptive algorithms that a computer uses to identify patterns in data and use those patterns to make predictions
- Models programmed to perform a specific task
  - Customer segmentation
  - Estimate the probability of early repayment



# Buzzword definitions

## Deep Learning

- ML algorithms that attempt to mimic the human brain using hierarchical layers
- Performs well on tasks with large amounts of data such as image recognition and natural language processing



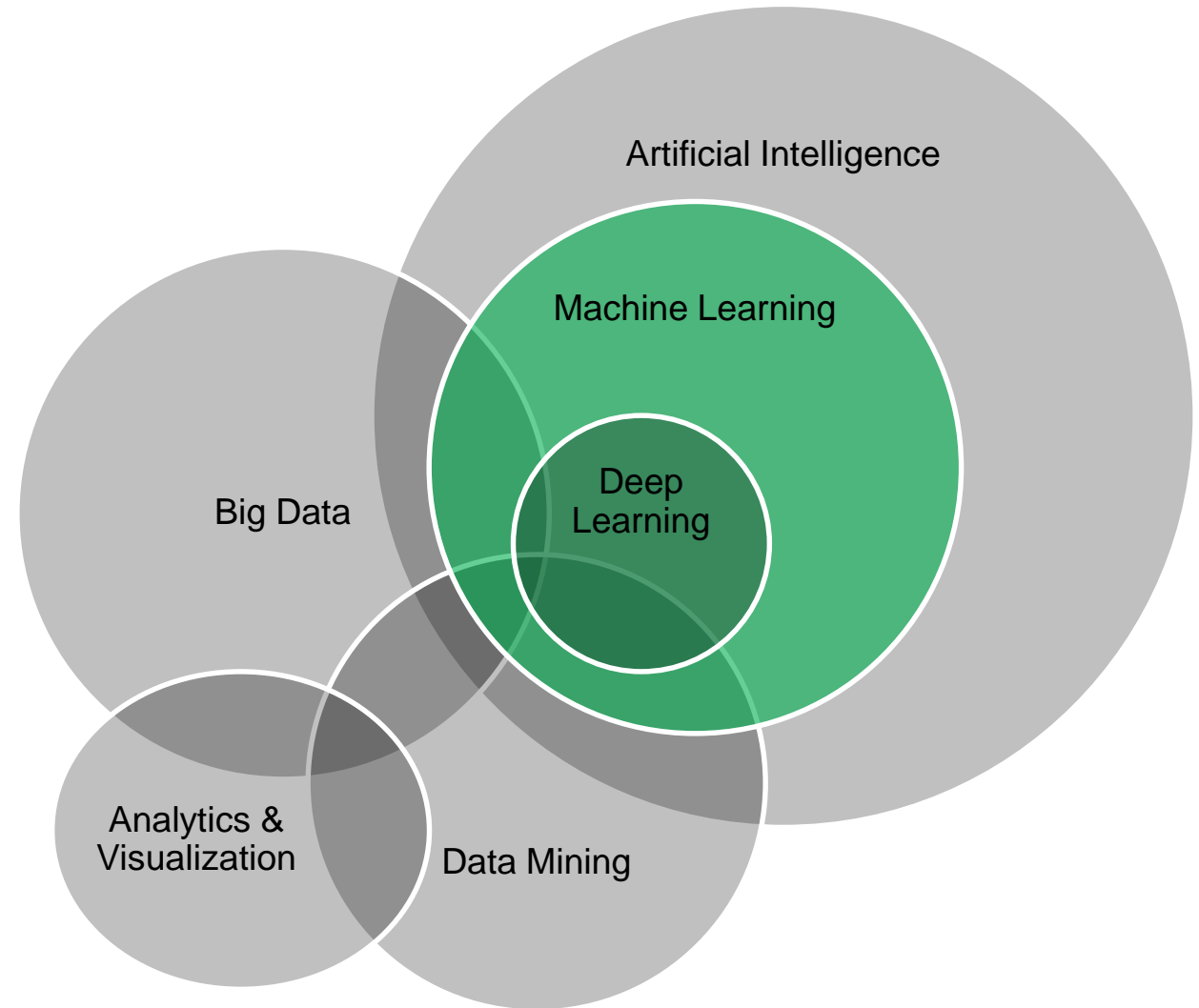


# What is AI/ML

- **Artificial Intelligence** is the broader concept of machines being able to carry out tasks in a way that we would consider “smart”.
- **Machine Learning** is a current application of AI based around the idea that we should really just be able to give machines access to data and let them learn for themselves.”

*“What Is The Difference Between Artificial Intelligence And Machine Learning?”*

Forbes, December 6, 2016



# What is AI/ML

- Early warning systems for automatic breaking
  - Simple system we can identify fundamental equations on what should happen

- Alert the user and break if:

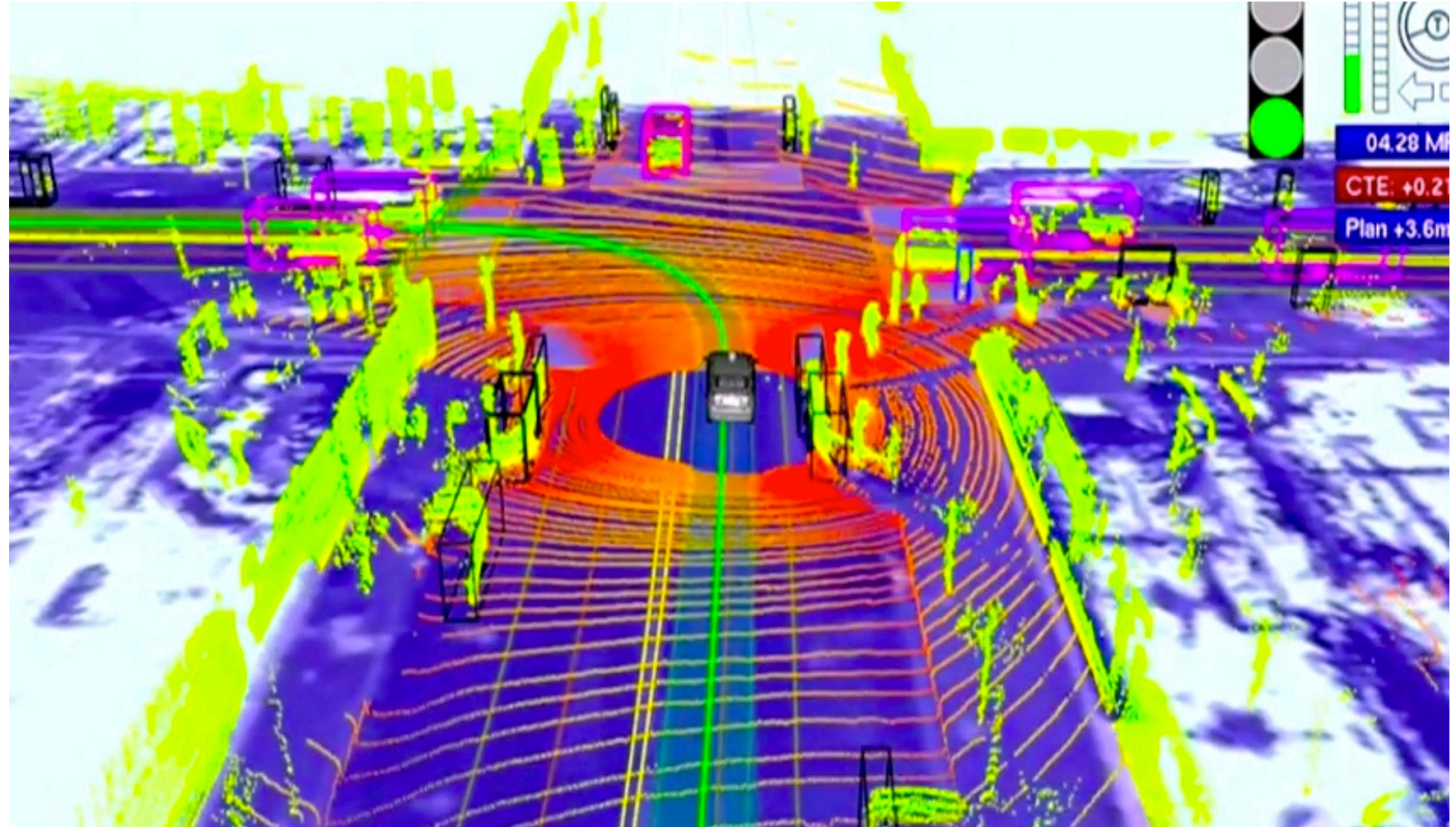
$\text{Distance} * \text{MaxBrakePower} < \text{Threshold} * (\text{Difference in car velocities})$

- Still an AI System

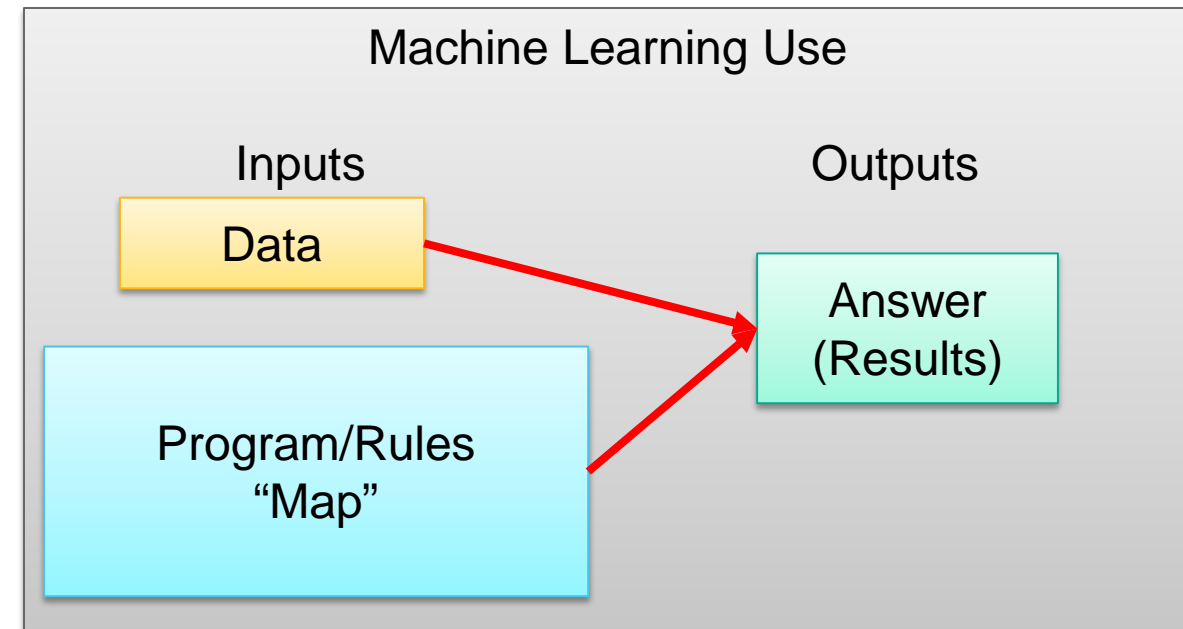
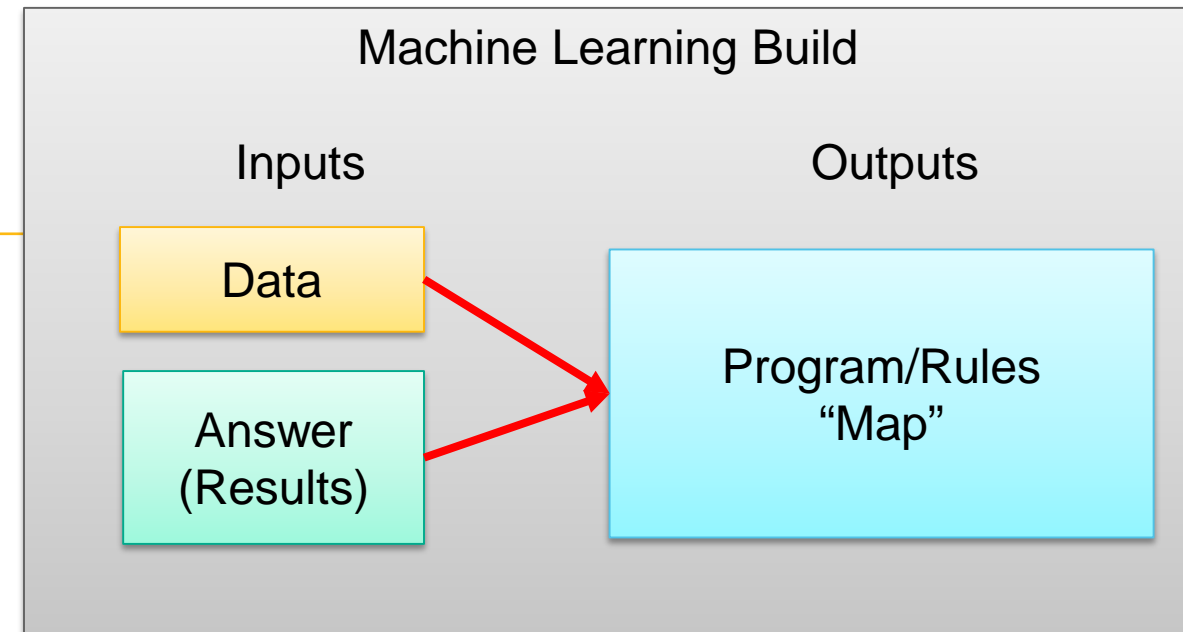
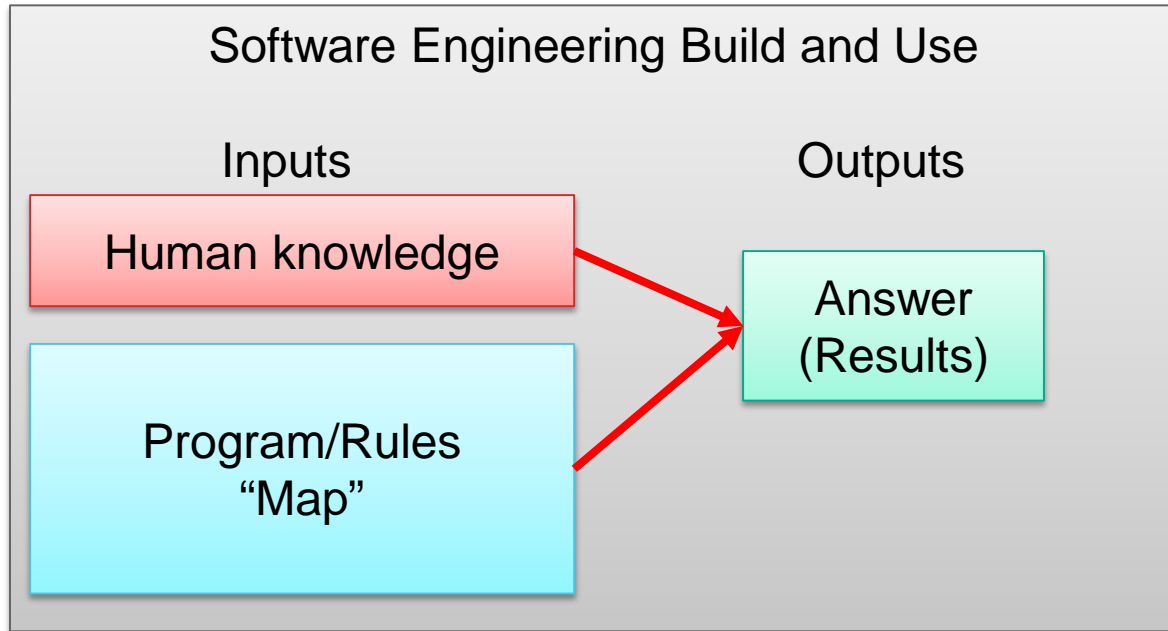


# What is AI/ML

- What if we have to turn?



# What is AI/ML



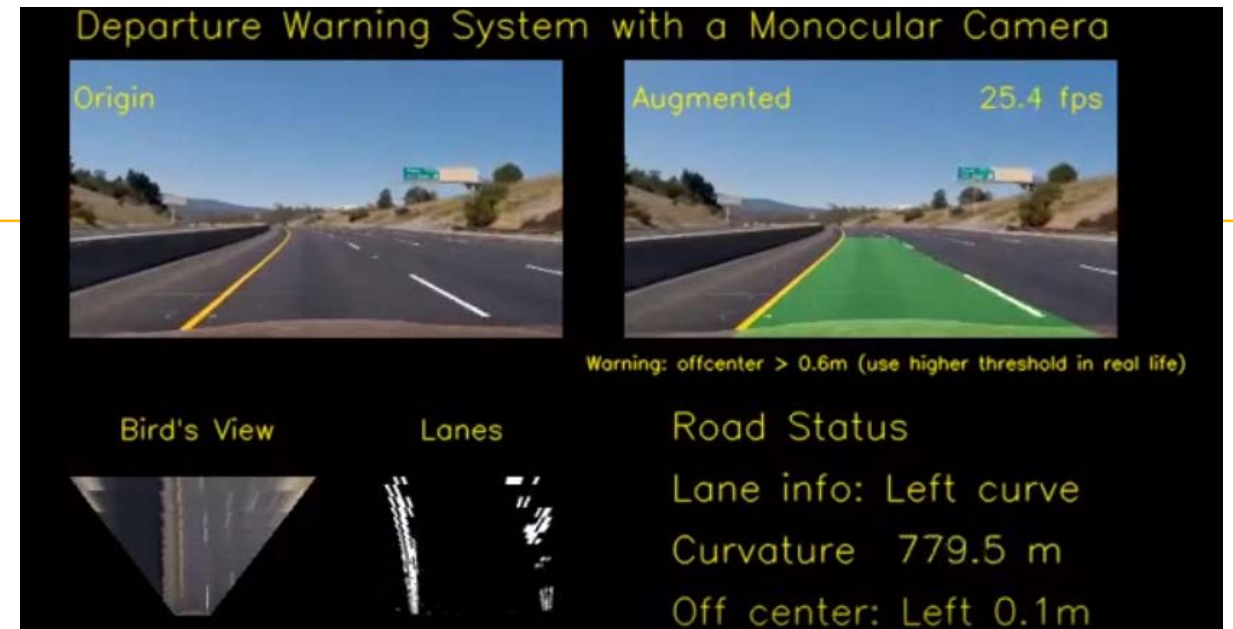


# What is AI/ML

- What if we have to turn?



CES 2016: NVIDIA DRIVENet Demo - Visualizing a Self-Driving Future (part 5)  
<https://www.youtube.com/watch?v=HJ58dbd5g8g>

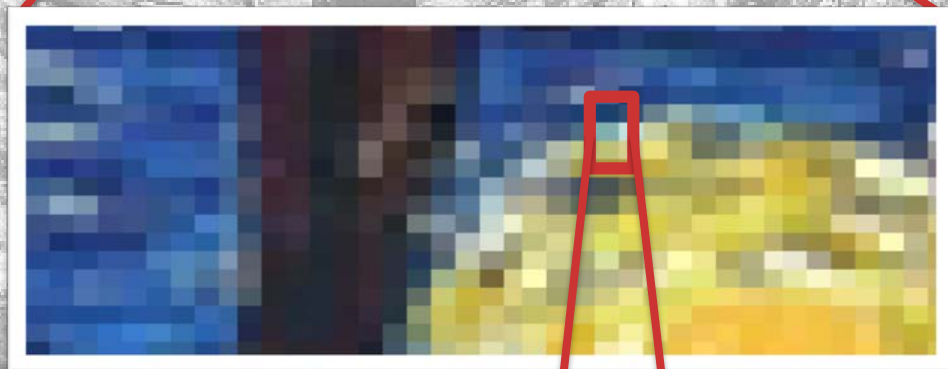


Lane Departure Warning System based on a Monocular Camera.  
<https://www.youtube.com/watch?v=fqQFVK4ZxoQ&feature=youtu.be>



NVIDIA Drive PX2 self-driving car platform visualized  
<https://www.youtube.com/watch?v=URmxzxYlmtg>





Sold	Demos	Parts
74	94	144
23	60	107
125	173	175
188	190	117
172	150	61





# What is AI/ML?

- Wide range of possibilities, but significant effort and specializations needed to create





# “Brains” to “Hands”...



## “Brains”

- Human knowledge
- Intellectual property
- Artificial intelligence

## “Hands”

- Humans
- Robotic process automation (RPA)
- Custom application developments

## AI/ML

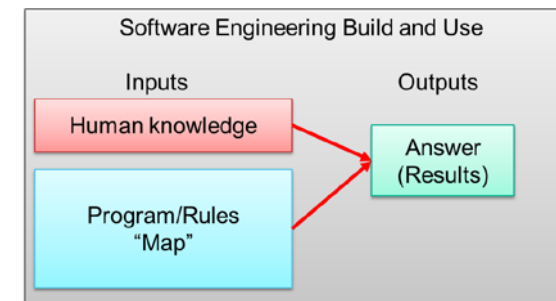
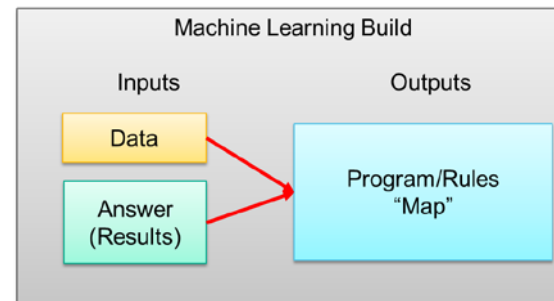
System based on **data**

- Learns from historical actions
- Doesn't need human understanding of system

## RPA

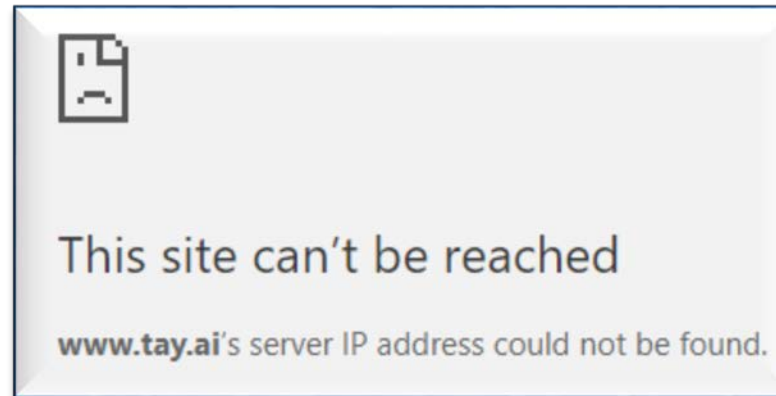
System based on **rules**

- Filling in web forms
- Copying data from one form to another
- Easily create a way to automate repetitive tasks



# Risks

Tay was an artificial intelligence chatter bot that was originally released by Microsoft Corporation via Twitter on March 23, 2016; it caused subsequent controversy when the bot began to post inflammatory and offensive tweets through its Twitter account, forcing Microsoft to shut down the service only 16 hours after its launch. – Wiki



## A few headlines:

Microsoft is deleting its AI chatbot's incredibly racist tweets – Business Insider

Facebook and YouTube should have learned from Microsoft's racist chatbot – CNBC

Tay: Microsoft issues apology over racist chatbot fiasco – BBC

Racist, Sexist AI Could Be A Bigger Problem Than Lost Jobs – Forbes

Microsoft's chatbot gone bad, Tay, makes MIT's annual list of biggest technology fails – Geekwire



# Case Study – Procurement



# Case Study – Original Project

Process	Duration	Results
Analyst defined rules, based on what was seen in the data, to help identify which contracts should be looked at	Team of 5 analysts working for 4 months	37 suspicious/fraudulent contracts found (0.22%)

Rule
All Open PO's with Award Amounts between \$19,500 and \$20,000
All Open PO's with Award Amounts between \$49,000 and \$50,000
All Open PO's with Award Amounts Over \$50,000
All Open PO's with Paid Amounts Over \$50,000
All Open PO's with Paid Amounts Over 1,000% of the Award Amounts
All Open PO's with Paid Amounts Over 100% of the Award Amounts
All Other PO's Awarded in Open Regions and Not to the Open Contractor



# Case Study – Anomaly Detection with ML

## Rules Approach

- One piece of information (univariate)



# Case Study – Anomaly Detection with ML

## With Machine Learning

Bid Amount	Total COs	Total Paid	Other
\$348,209.00	\$255,658.00	\$ 871,676.50	...
\$ 21,992.25	\$436,820.81	\$ 259,829.76	...
\$275,181.00	\$215,753.00	\$ 382,826.50	...
\$486,731.00	\$146,825.74	\$ 545,266.62	...

**Top 1% (~166)**

• 34/37 fraudulent contracts

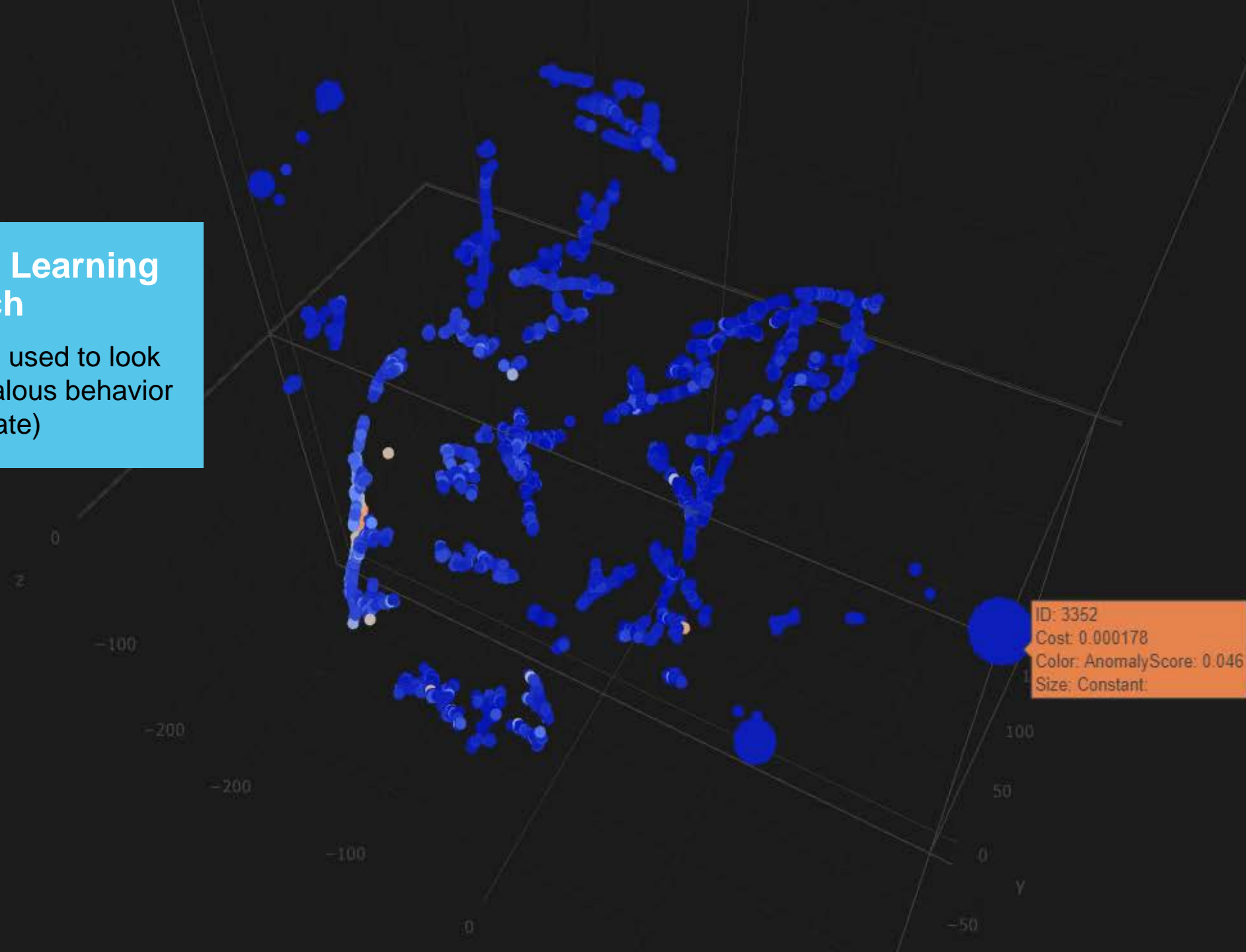
**Top 5% (~800)**

• 37/37 fraudulent contracts

**Only Underlying Data**  
(No human analyst rules)

## Machine Learning Approach

- All data is used to look for anomalous behavior (multivariate)



# Case Study – Anomaly Detection with ML

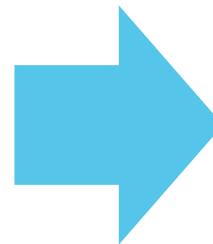
## Filter Out the Noise



## Zero Human Rules



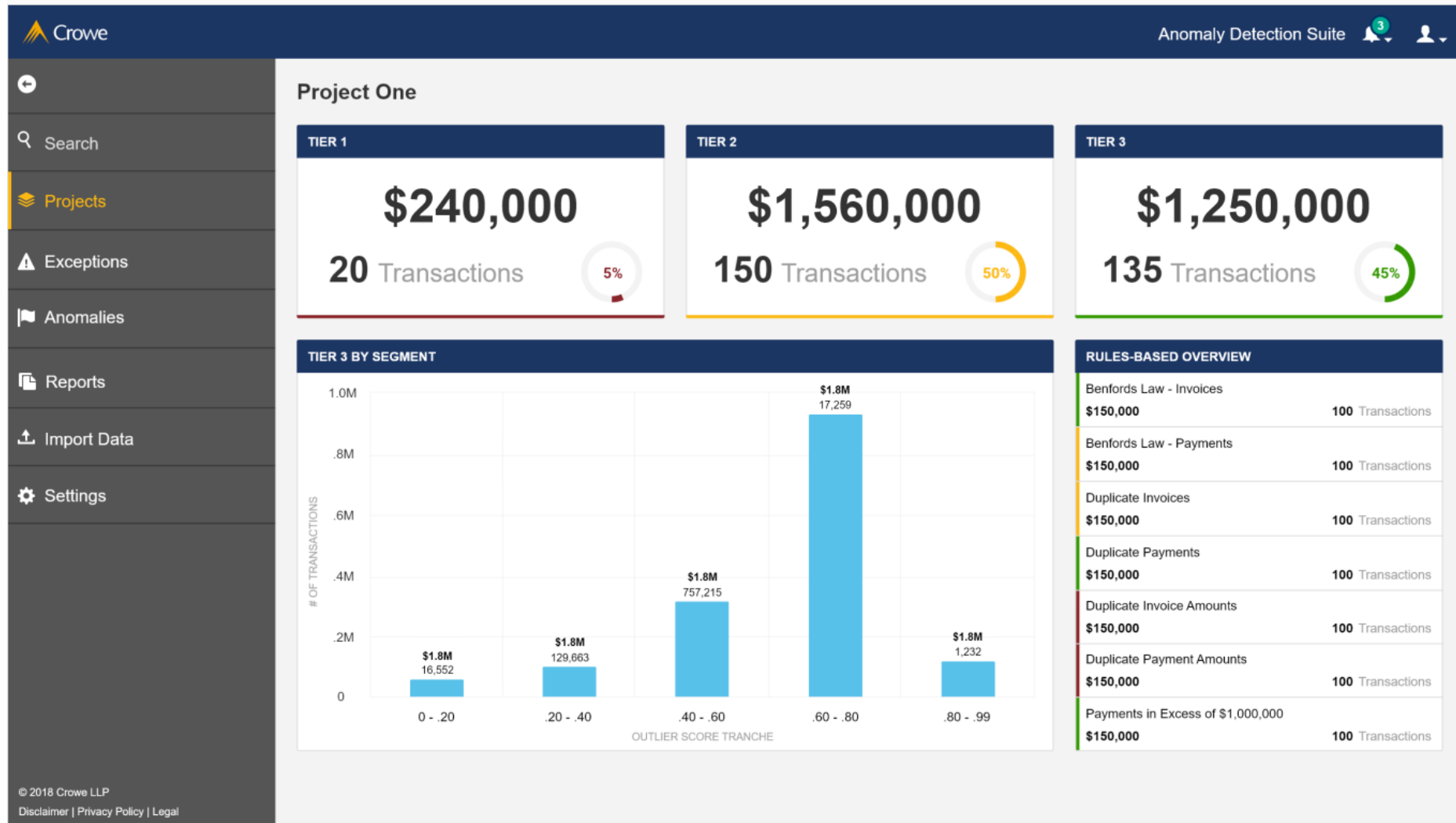
**5** People  
**4** Months




**1** Person  
**1** Month













# Crowe Anomaly Detection Suite



# Crowe Anomaly Detection Suite

 Crowe

Anomaly Detection Suite  

  Search  Projects  Exceptions  Anomalies  Reports  Import Data  Settings

Anomalies 

Project One

FILTER

Tiers 

0 1 5

Price Range 

-2,000,000 -1,000,000 - 1,500,000 2,000,000





























Date 

Between

12/31/1990 - 05/31/2018

Update

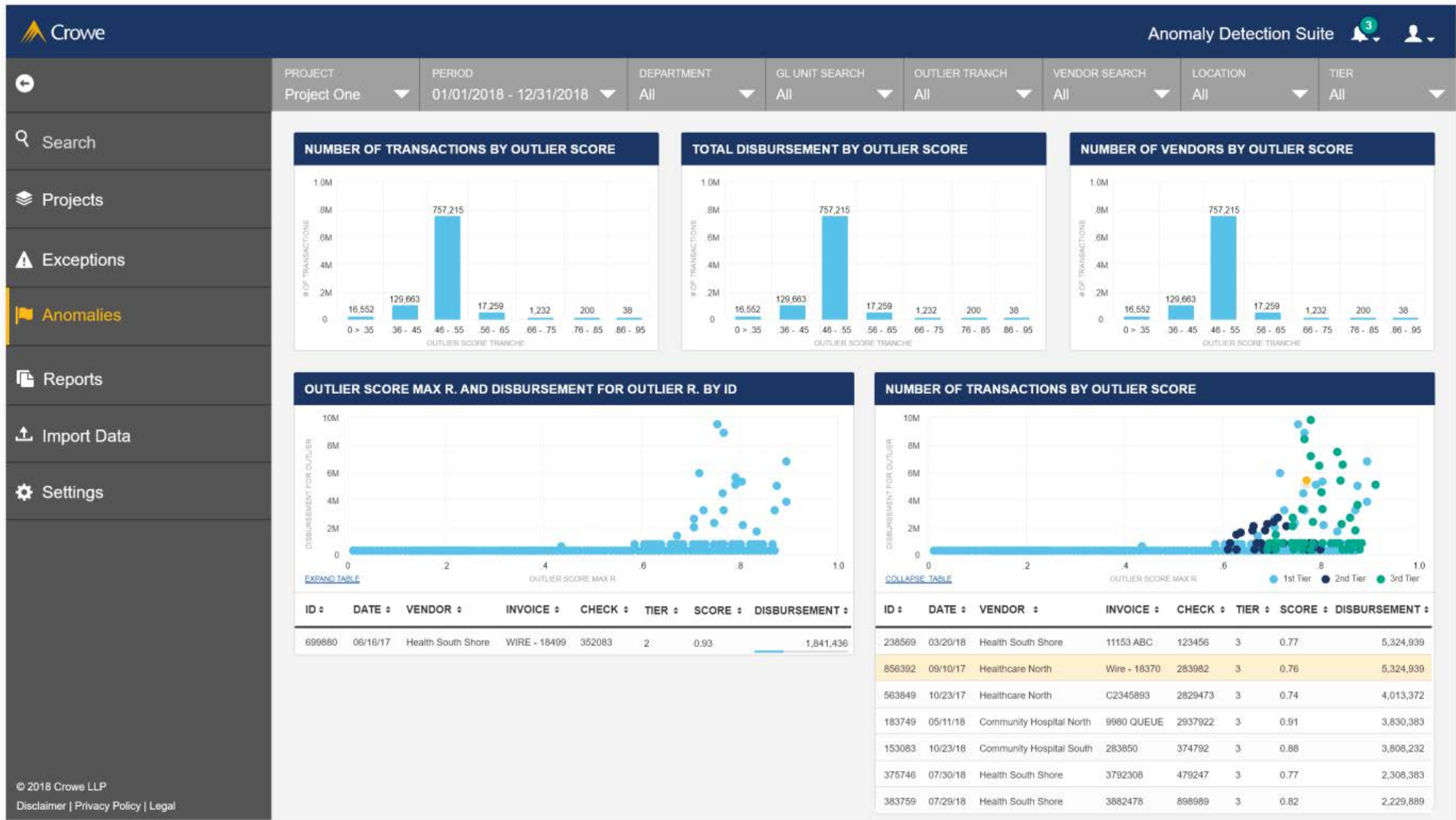
(14) ANOMALIES

SCORE :	CONTRACT # :	LOCATION :	PRICE :	DATE :	ANOMALY?
1.985709342	04345	West	\$ 1,303,247.40	12/10/09	 
1.932053782	02872	North	\$ 1,097,358.23	02/22/15	 
1.24267526	07110	South	\$ 1,062,930.60	09/22/14	 
1.779306357	08566	East	\$ 1,025,934.80	04/22/12	 
1.584519757	00368	West	\$ 1,020,460.54	09/06/95	 
1.016880124	04341	Northwest	\$ 977,350.13	06/15/91	 
1.563616736	02470	Southeast	\$ 872,233.95	12/27/09	 
1.697050198	04301	East	\$ -	01/31/07	 
1.726290761	09105	North	\$ -	07/25/96	 
1.764045416	02302	Southwest	\$ (528,000.00)	06/16/04	 
1.027004967	00484	West	\$ (590,517.00)	01/23/10	 
1.357761662	07167	Northeast	\$ (699,812.78)	05/26/03	 
1.223193327	02172	South	\$ (805,656.31)	03/01/92	 
1.237845119	08059	East	\$ (959,230.66)	04/04/09	 

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# Crowe Anomaly Detection Suite



# Implementation Observations





**“IF IT AIN’T  
BROKE...  
”**

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**“IF IT AIN’T  
BROKE...  
~~DON’T FIX IT.”~~”**



**‘IF IT AIN’T BROKE, DON’T FIX IT’  
IS THE SLOGAN OF THE  
COMPLACENT,  
THE ARROGANT  
OR THE SCARED.**

**IT’S AN EXCUSE FOR INACTION.**



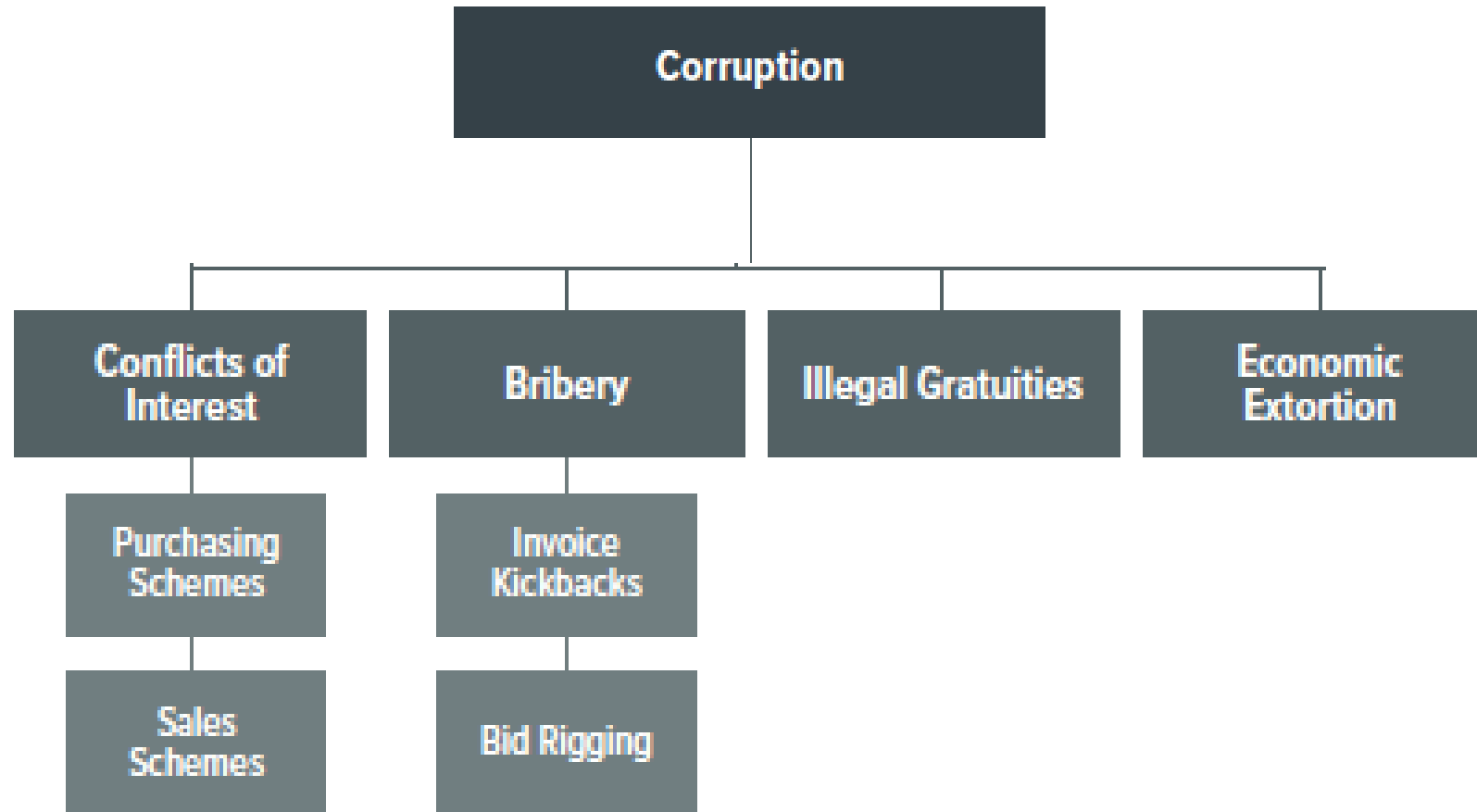
– Colin Powell

# ACFE Report to the Nations: Most Common Government Fraud Schemes

INDUSTRY	Cases	Billing	Cash larceny	Cash on hand	Check and payment tampering	Corruption	Expense reimbursements	Financial statement fraud	Noncash	Payroll	Register disbursements	Skimming
Government and public administration	184	15%	11%	11%	9%	50%	11%	5%	22%	7%	2%	11%



# ACFE Report to the Nations: Corruption



# Case Study – Anomaly Detection with ML

## With Machine Learning

Bid Amount	Total COs	Total Paid	Other
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**Top 1% (~166)**  
• 34/37 fraudulent contracts

**Top 5% (~800)**  
• 37/37 fraudulent contracts

**Only Underlying Data**  
(No human analyst rules)



# Thank You

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