



# ***Introduction to data analytics for internal auditors: leveraging technology for better insights***



# Did you know?

From 1 November 2023, ICAEW's revised Continuing Professional Development (CPD) Regulations bring in new CPD requirements, including a minimum number of hours and an ethics requirement.

This webinar could contribute to up to 1 hour of verifiable CPD, so long as you can demonstrate that the content is relevant to your role.

Find out more about how these changes affect you at [icaew.com/cpdchanges](https://www.icaew.com/cpdchanges).



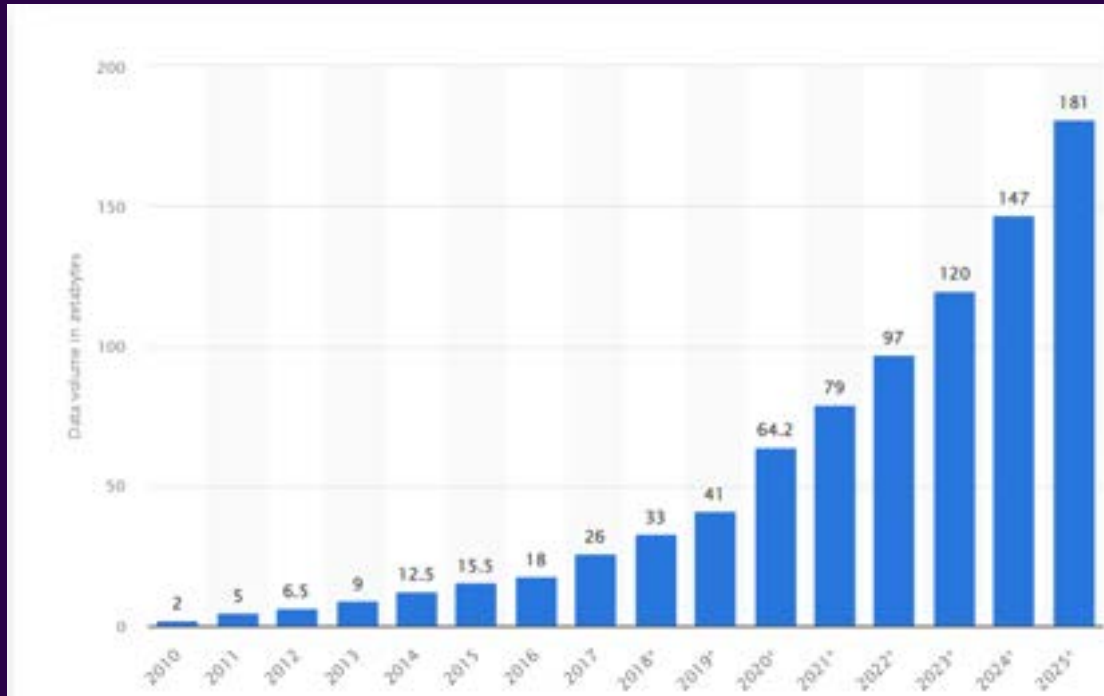
# DATA ANALYTICS IN INTERNAL AUDIT

June 2023



# USE OF DATA

*Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2020, with forecasts from 2021 to 2025 (in zettabytes)*

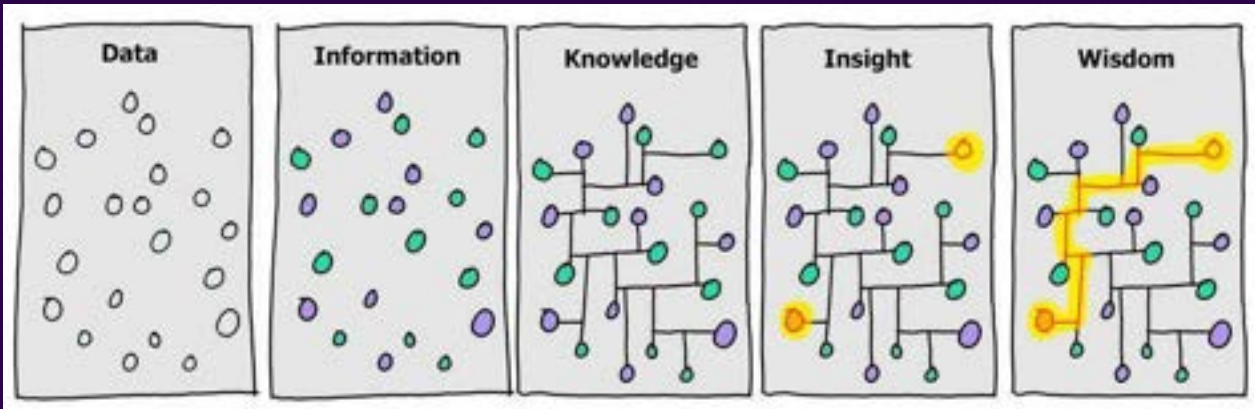


<https://www.statista.com/statistics/871513/worldwide-data-created/>

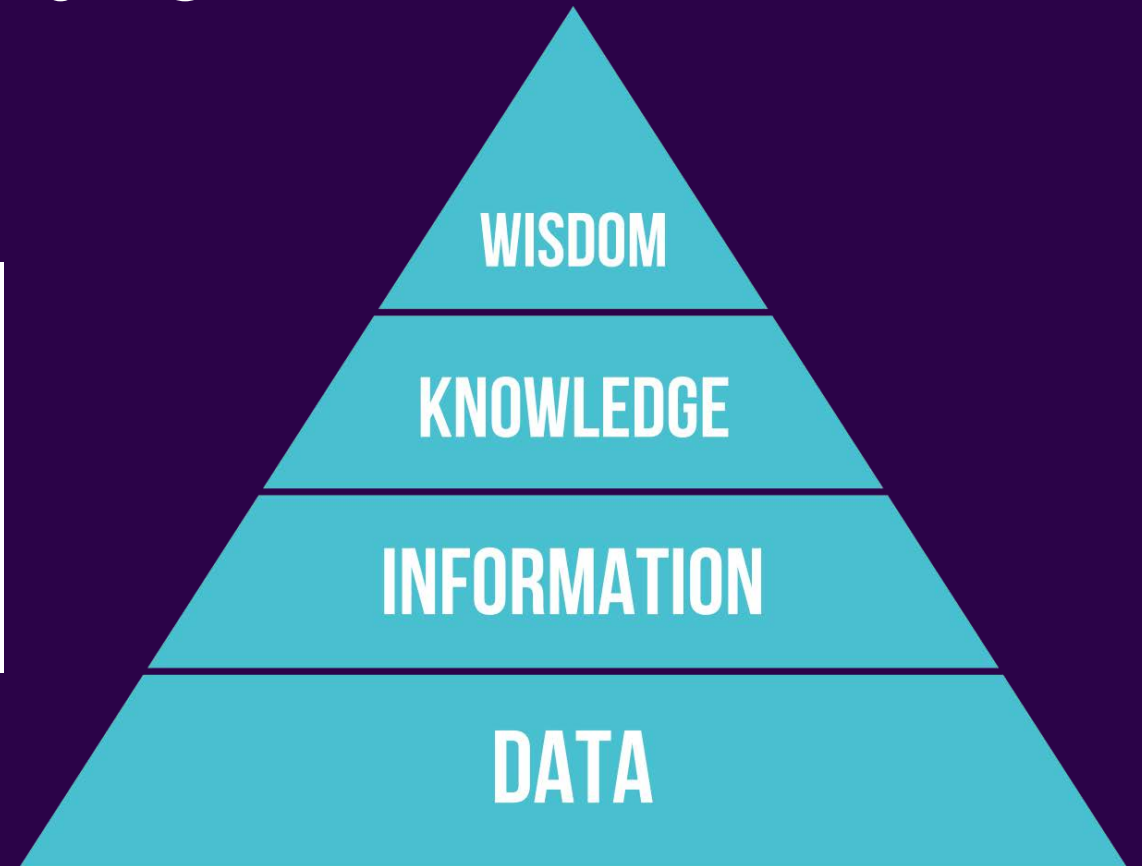
WHAT'S A ZETTABYTE?	
1 kilobyte	1,000 000,000,000,000,000
1 megabyte	1,000,000 000,000,000,000,000
1 gigabyte	1,000,000,000 000,000,000,000
1 terabyte	1,000,000,000,000 000,000,000
1 petabyte	1,000,000,000,000,000 000,000
1 exabyte	1,000,000,000,000,000,000 000
1 zettabyte	1,000,000,000,000,000,000,000

<https://energytoday.energysociety.org/blowing-past-the-zettabyte-era.html>

# FROM DATA TO WISDOM



<https://thefactory.com/news/gaining-wisdom-from-data/>



[https://en.wikipedia.org/wiki/DIKW\\_pyramid](https://en.wikipedia.org/wiki/DIKW_pyramid)



# PRESENTATION LAYOUT

- Importance of Data Analytics in Internal Audit
- Overview of Internal Audit Data Analytics Types
- Use of Analytics in all Phases of the Audit Cycle
- The Data Analytics Process
- Data Analytics Techniques & Approaches
- Data Analytics Tools
- Advanced Analytics
- Market Benchmark
- Challenges for the implementation of analytics
- Data Analytics Skills
- Future Trends

# WHY ARE ANALYTICS IMPORTANT IN INTERNAL AUDIT?

- *Audit efficiency, do more with less*
- *Greater assurance*
- *Satisfy regulatory requirements*
- *Cope with big data*
- *Innovation*
- *Understand business practices*
- *Ask the right questions*
- *Focus on high-risk areas*

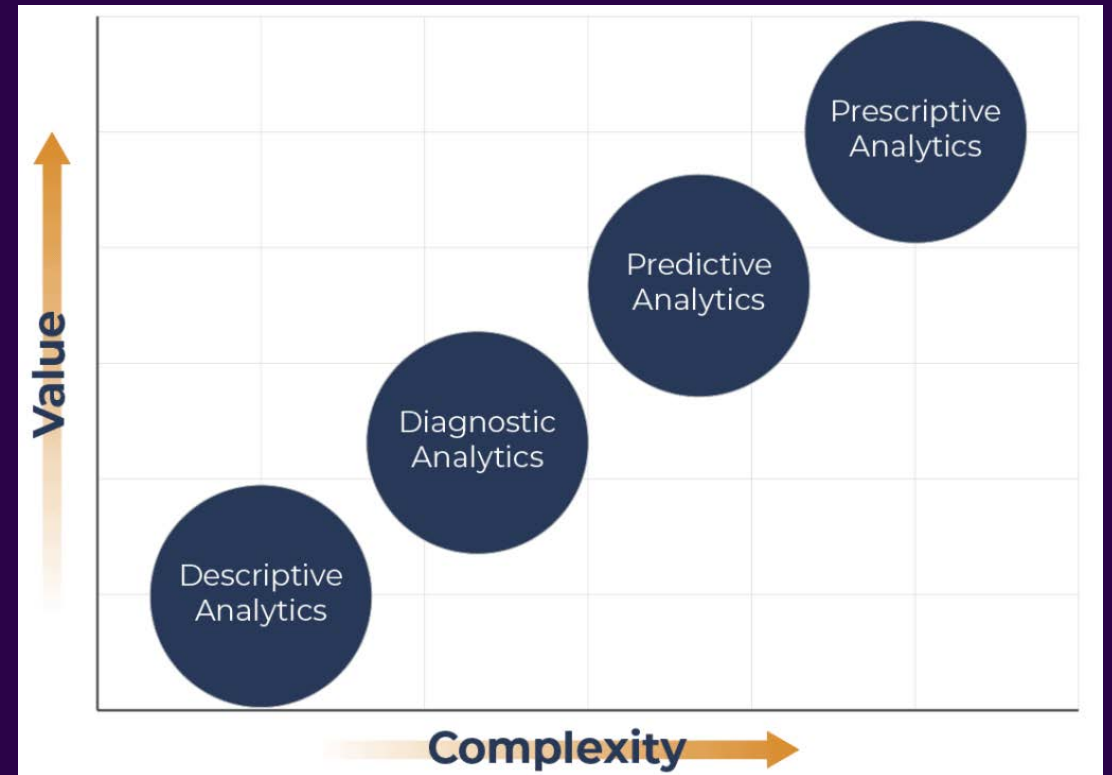


<https://soundcloud.com/djamandaeaven/daft-punk-harder-better-faster>

# DATA ANALYTICS TYPES



<https://www.impelsys.com/blog/how-data-analytics-is-upsurging-the-overall-efficiency-of-a-business/>



<https://iterationinsights.com/article/where-to-start-with-the-4-types-of-analytics/>



# ANALYTICS IN ALL THE PHASES OF THE AUDIT CYCLE



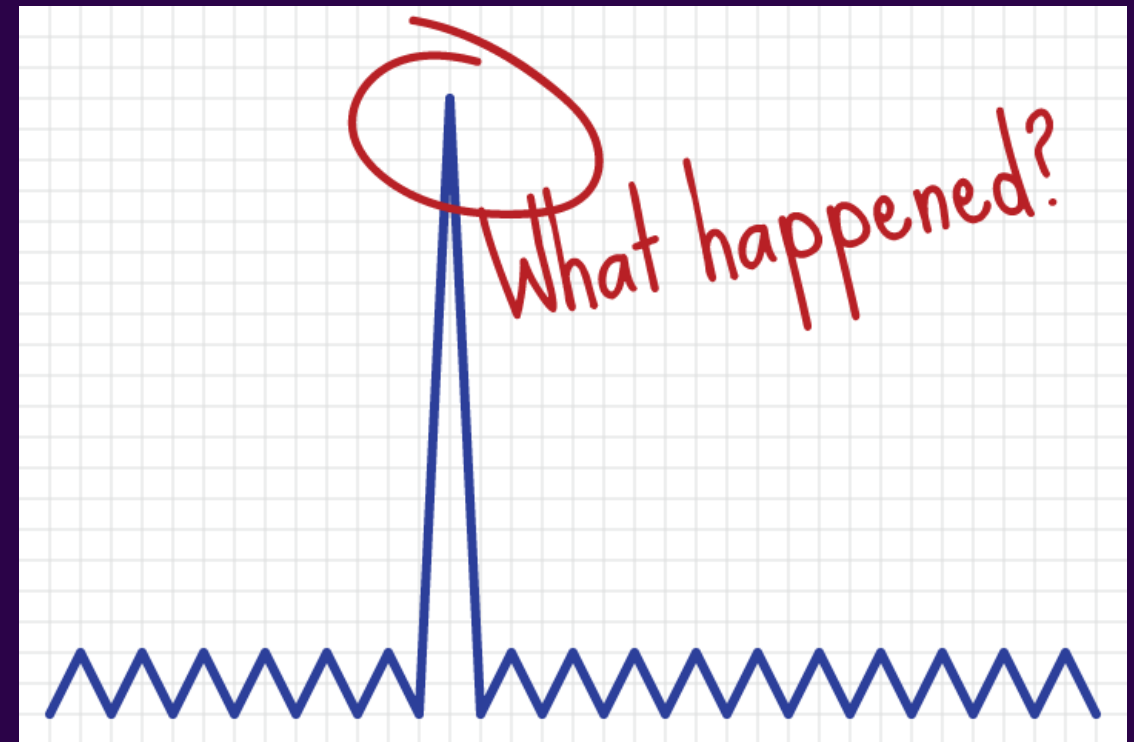
<https://www.compliancequest.com/audit-management/>

## Risk Assessment



[https://www.inetsoft.com/solutions/risk\\_management\\_reporting/](https://www.inetsoft.com/solutions/risk_management_reporting/)

## Planning & Scoping



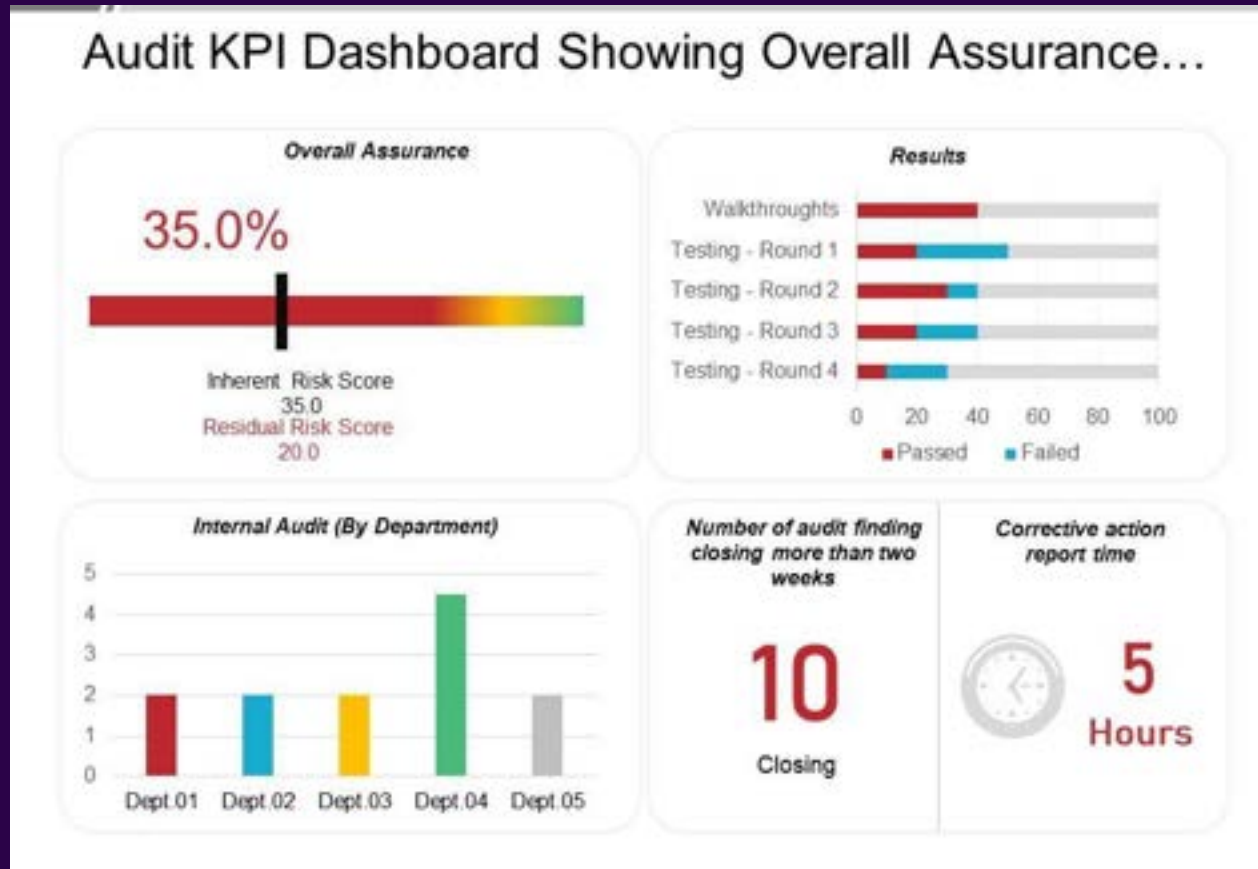
<https://www.logtag.com.au/logtag-spike-analysis/graph-spike/>

# ANALYTICS IN ALL THE PHASES OF THE AUDIT CYCLE



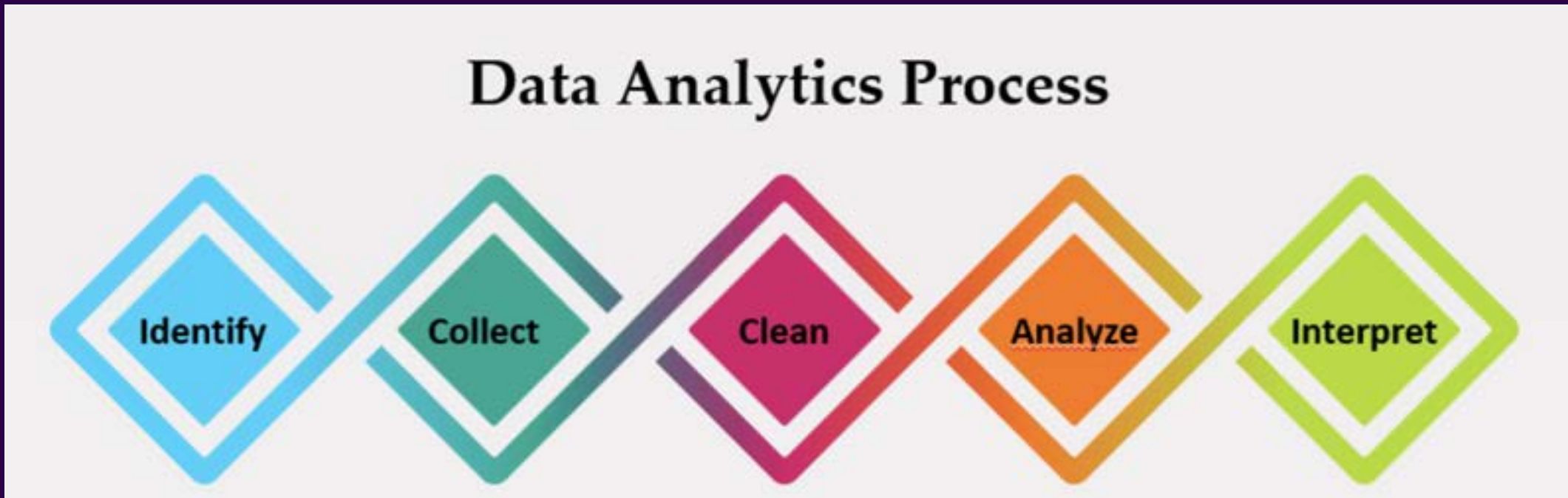
<https://www.compliancequest.com/audit-management/>

## Monitoring & Follow Up



<https://www.slideteam.net/audit-kpi-dashboard-showing-overall-assurance-internal-audit-and-results.html>

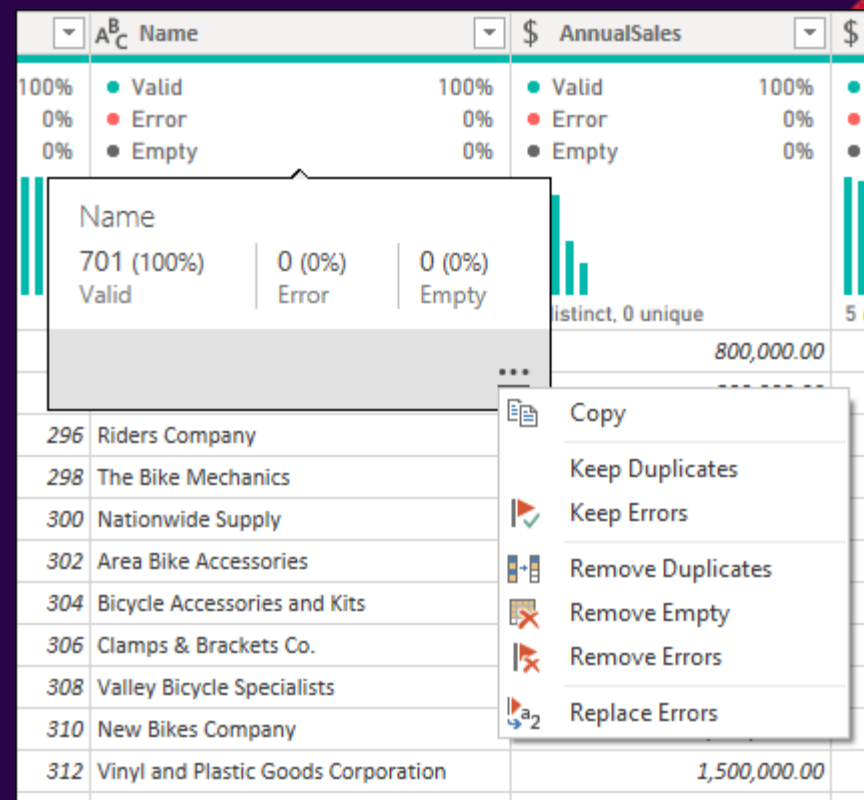
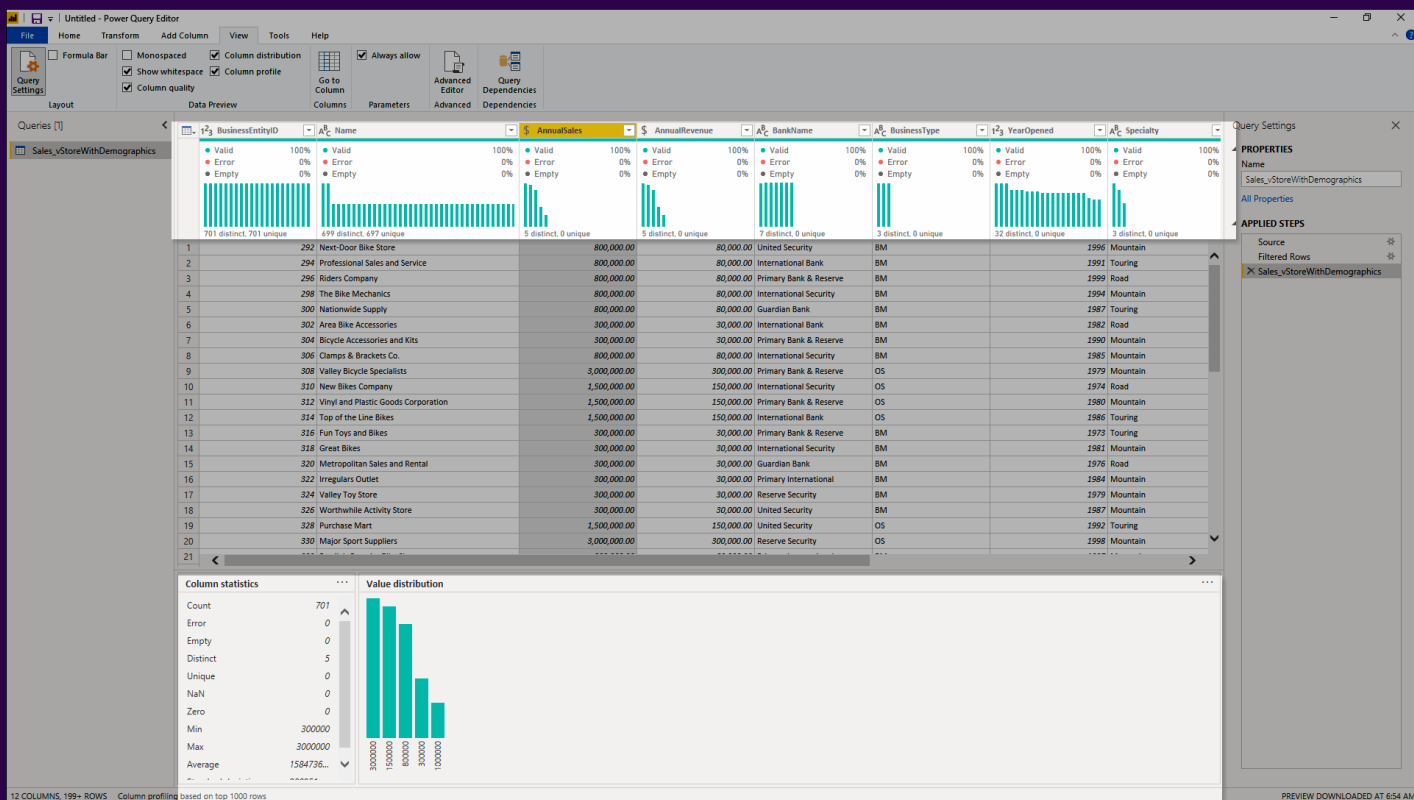
# THE DATA ANALYTICS PROCESS



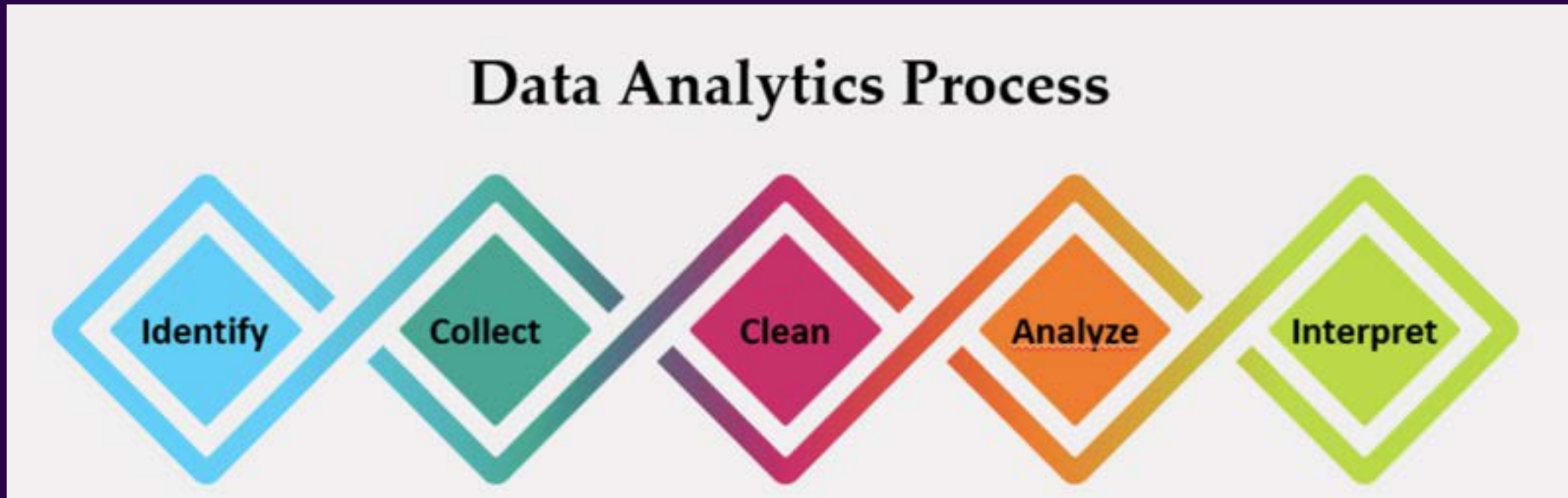
<https://www.impelsys.com/blog/how-data-analytics-is-upsurging-the-overall-efficiency-of-a-business/>

# THE DATA ANALYTICS PROCESS

## Data Cleansing



# THE DATA ANALYTICS PROCESS



<https://www.impelsys.com/blog/how-data-analytics-is-upsurging-the-overall-efficiency-of-a-business/>

# DATA ANALYTICS TECHNIQUES AND APPROACHES



<https://www.endlessmeats.com/5-ways-to-detect-outliers-that-every-data-science-should-know-outlier-catch-7003110871>

## Outlier Detection

### Data visualization - Plotting

### Sorting

Example: Sorting method

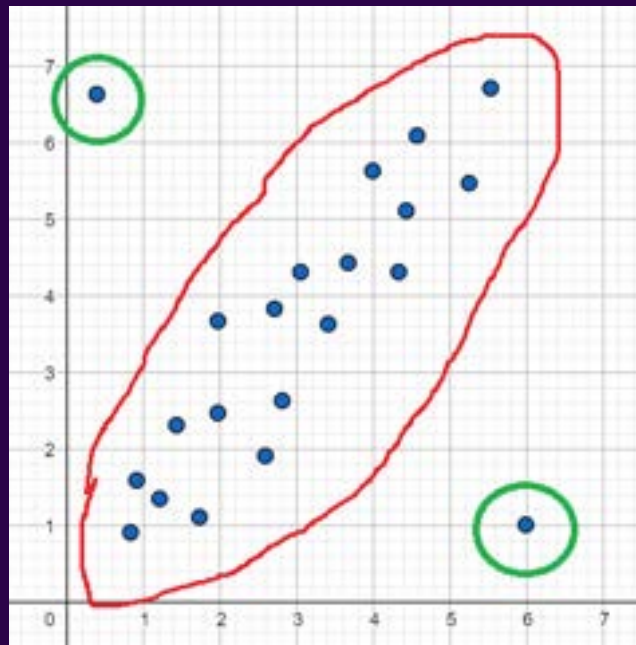
Your dataset for a pilot experiment consists of 8 values:

180 156 9 176 163 1827 166 171

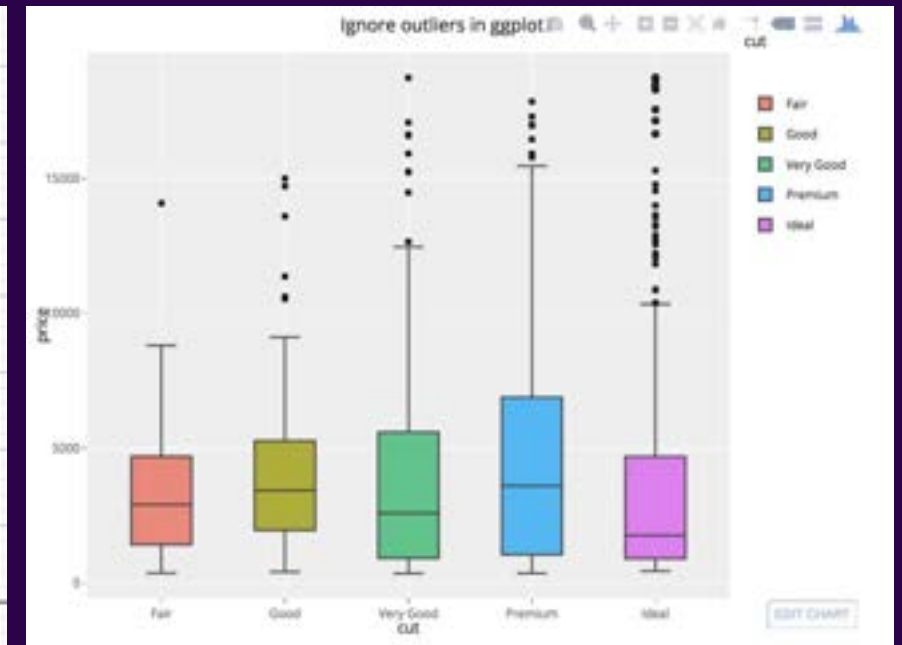
You sort the values from low to high and scan for extreme values.

9 156 163 166 171 176 180 1872

<https://www.scribbr.com/statistics/outliers/>



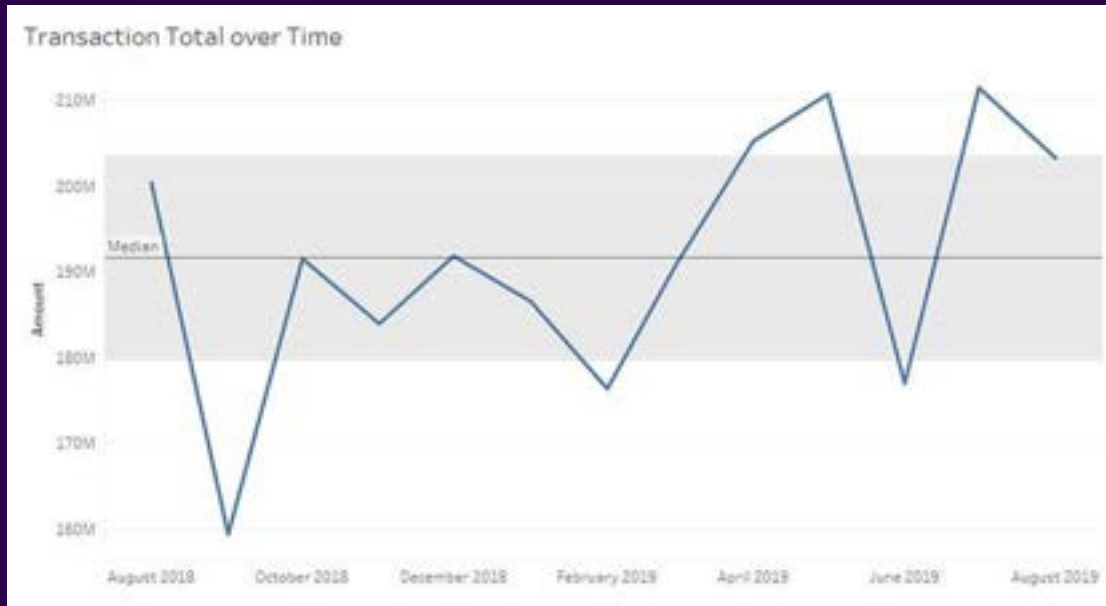
<https://study.com/skill/learn/how-to-identify-outliers-clustering-in-scatter-plots-explanation.html>



<https://github.com/plotly/plotly.R/issues/1114>

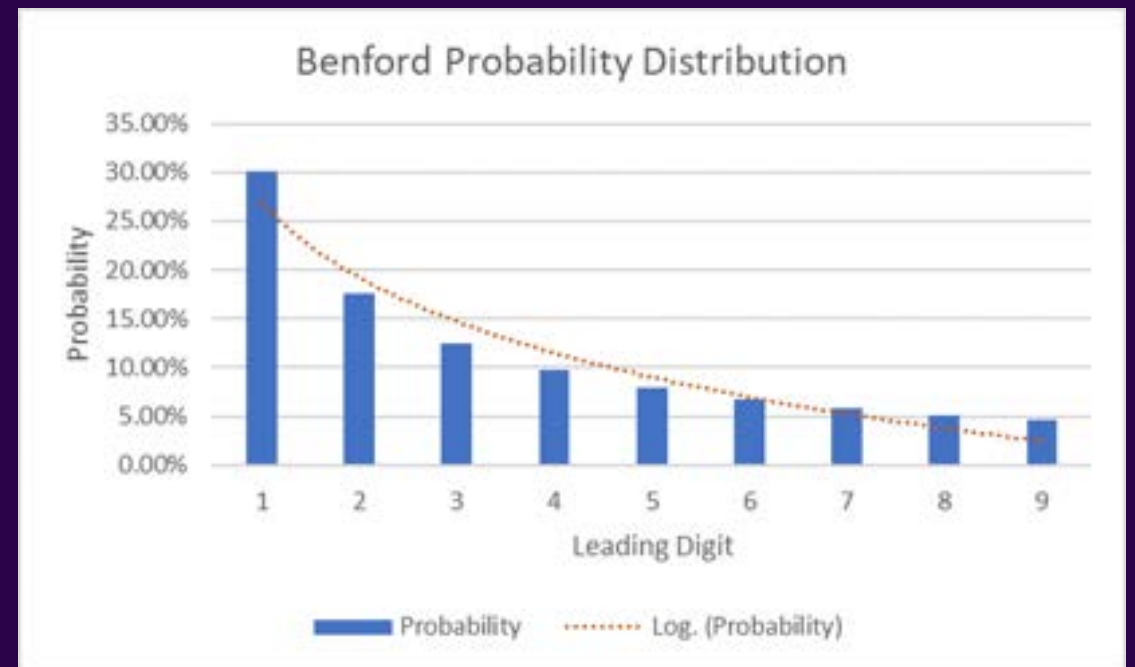
# DATA ANALYTICS TECHNIQUES AND APPROACHES

## Trend Analysis



<https://insights.crosscountry-consulting.com/internal-audit-delivering-greater-value-through-data-analytics>

## Benford's law



<https://insights.sei.cmu.edu/blog/benfords-law-potential-applications-insider-threat-detection/>

# DATA ANALYTICS TECHNIQUES AND APPROACHES

## Sampling

Attribute Sampling

Planning (Beta Risk Control) | **Planning (Beta and Alpha Risk Control)** | Sample Evaluation

Population size:       % Expected deviation rate:

% Tolerable deviation rate:       Confidence level (to control Beta Risk):

Sample size: 50      Critical number of deviations in sample: 2

Deviations	% Deviations	Achieved Confidence (Beta Risk Control)
0	0.00	99.62
1	2.00	97.26
<b>2</b>	<b>4.00</b>	<b>90.28</b>
3	6.00	77.04
4	8.00	58.58
5	10.00	39.70
6	12.00	23.47
7	14.00	12.15
8	16.00	5.52

**Conclusion:** If no more than 2 deviations are observed in a sample of size 50, you can be at least 90.00% confident that the population deviation rate is not more than 10.00%.

Print   Close   Compute   Help

## Ageing Analysis

A/R aging schedule

Customers	Total	Outstanding	Amount due			
			1-30 days	31-60 days	61-90 days	90+ days
ABC Inc	\$100,000	\$10,000		\$10,000		
XYZ Ltd	\$200,000	\$50,000	\$25,000	\$25,000		
MNO Pvt	\$300,000	\$60,000			\$60,000	
FLP Ltd	\$400,000	\$100,000				\$100,000
<b>Total</b>	<b>\$10,00,000</b>	<b>\$220,000</b>	<b>\$25,000</b>	<b>\$35,000</b>	<b>\$60,000</b>	<b>\$100,000</b>

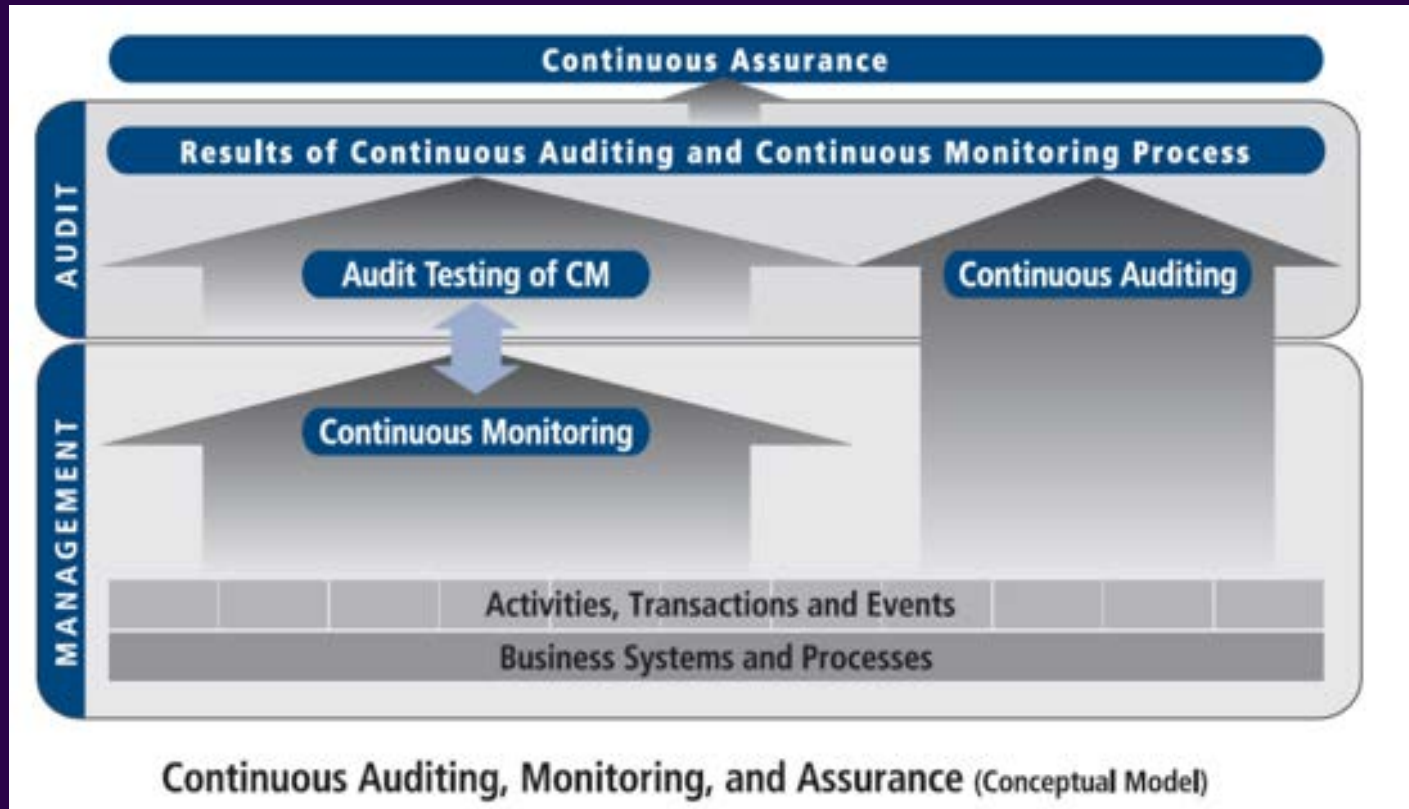
<https://blog.caseware.co.uk/blog/new-sampling-method-added-to-idea-11>

<https://www.chargebee.com/resources/glossaries/account-receivables-aging-report/>



# DATA ANALYTICS TECHNIQUES AND APPROACHES

## Continuous Auditing



IIA – IPPF Practice Guide

# DATA ANALYTICS TOOLS

## Quick Poll

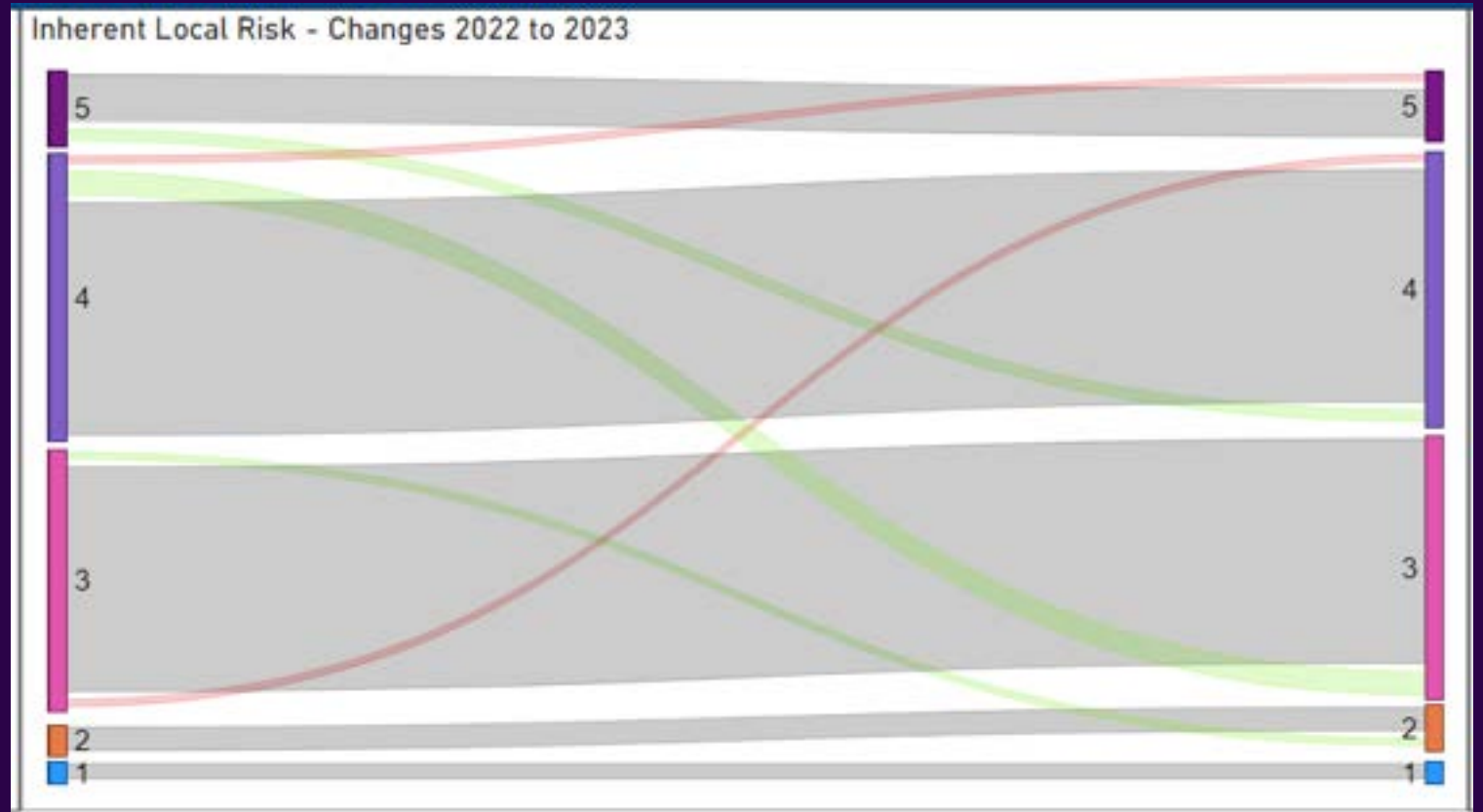


# DATA ANALYTICS TOOLS

Software	Programming Skills	Data management	Statistical Analysis	Machine Learning	Visualization	Capacity	Security	Cost
Excel	✗	✓✓	✓✓	✗	✓✓✓	Max 1m lines & 16k columns	🔒🔒	\$
SAS	🏋️	✓✓	✓✓✓	✓	✓	✓✓✓	🔒🔒🔒	\$\$\$
Power BI	✗	✓✓	✗	✗	✓✓✓	2GB	🔒🔒🔒	\$\$
GAS	✗	✓✓✓	✓	✓	✓	2BL lines	🔒🔒🔒	\$\$\$
SQL	🏋️	✓✓✓	✗	✗	✗	✓✓✓	🔒🔒🔒	\$\$
R	🏋️🏋️🏋️	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	🔒🔒	\$
Python	🏋️🏋️🏋️	✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	🔒🔒	\$

# DATA ANALYTICS TOOLS

## Visualisations

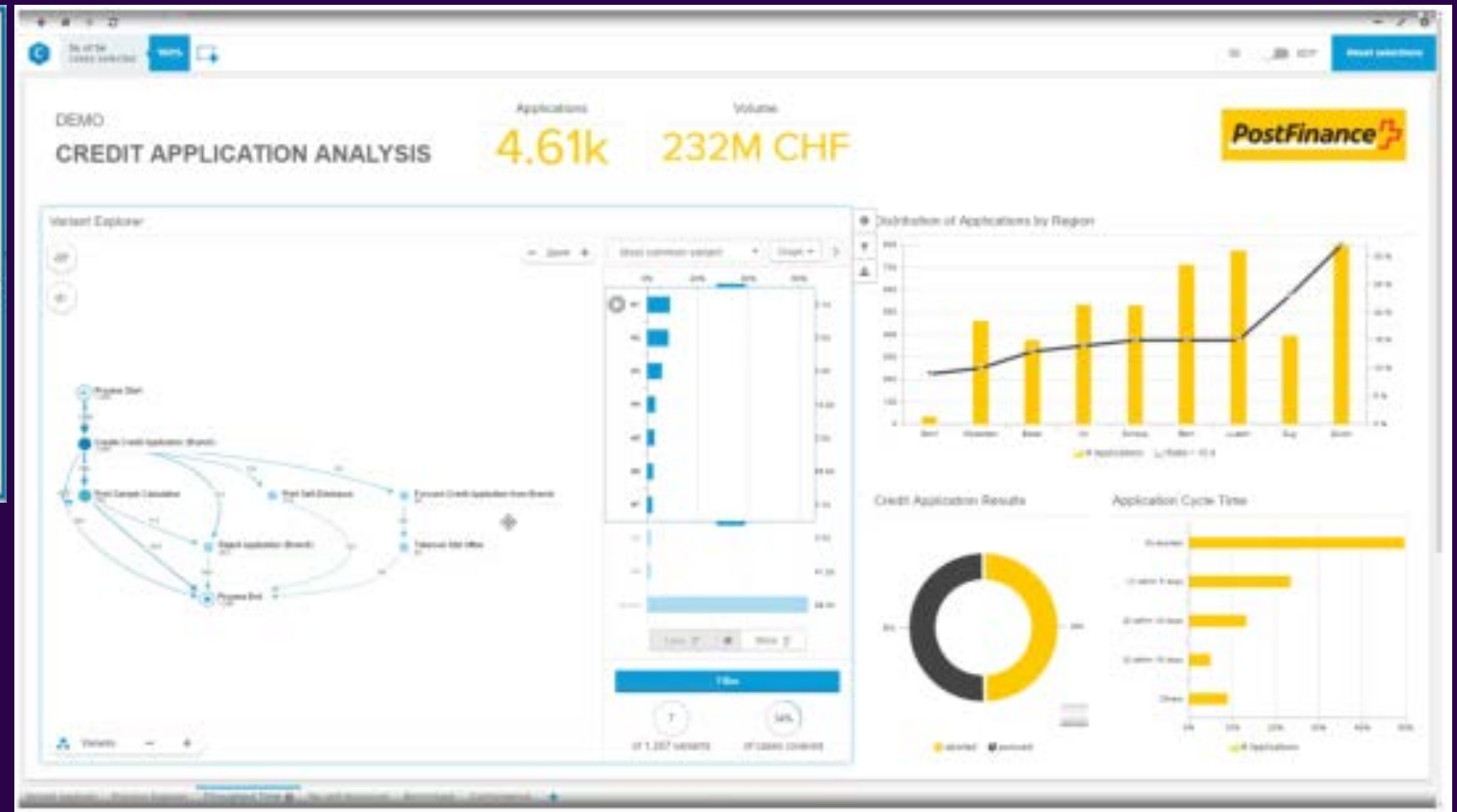


# DATA ANALYTICS TOOLS

## Process Mining Tools



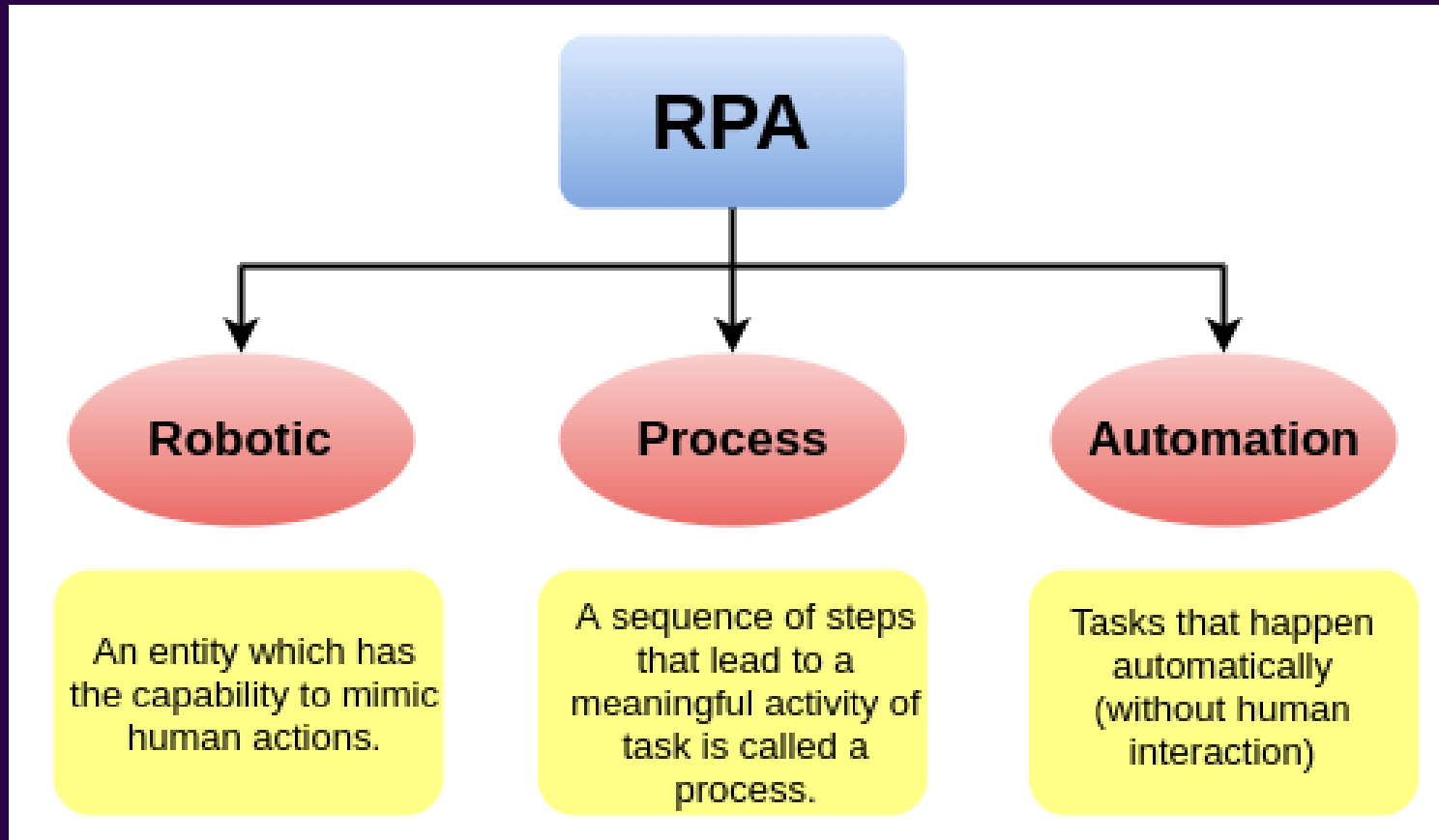
<https://financebuddha.com/blog/4-stages-of-personal-loan-processing-in-india/>



<https://www.adesso.ch/en/industries/banking/process-mining-celonis.jsp>

# DATA ANALYTICS TOOLS

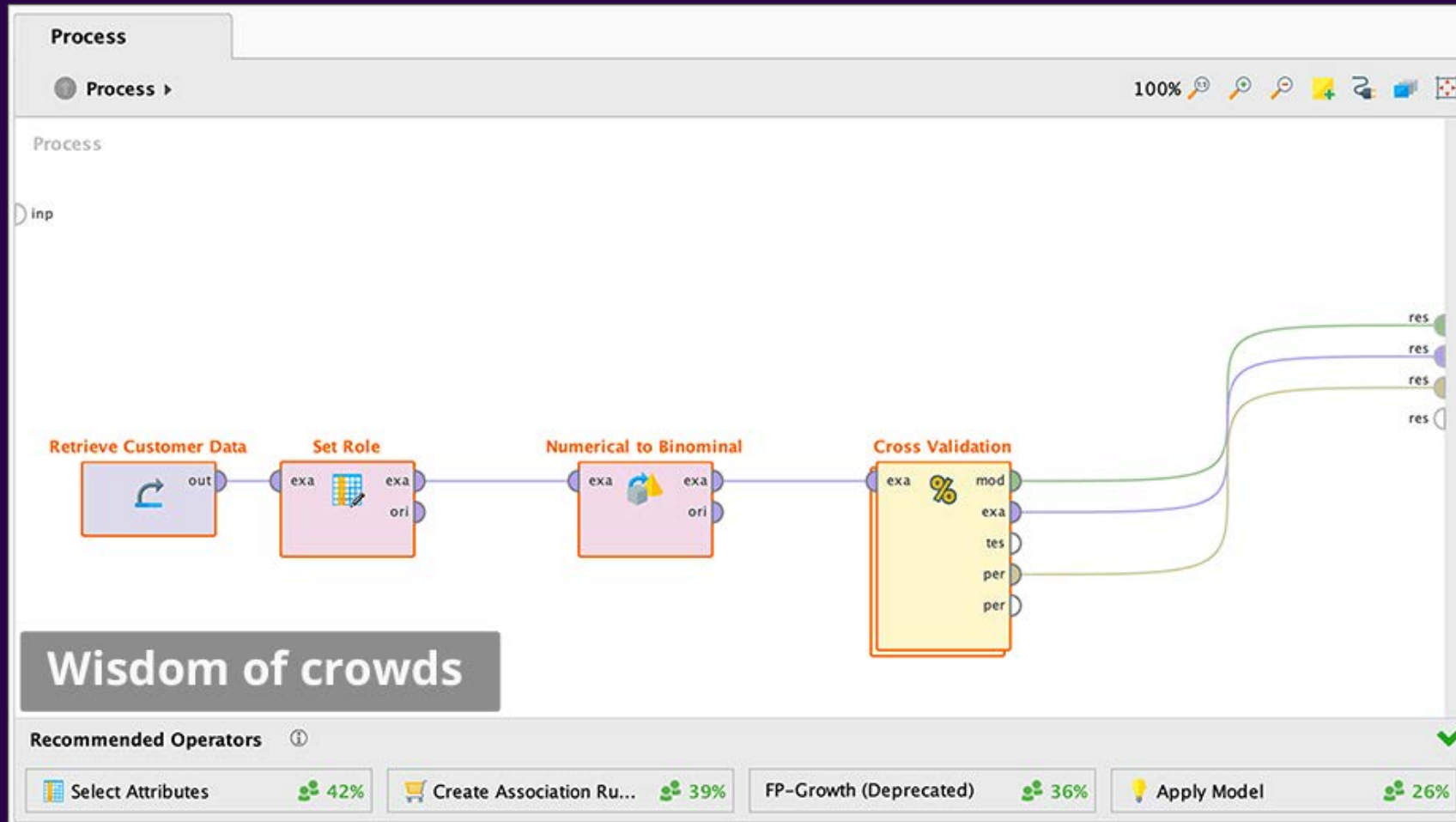
## Robotic Process Automation



<https://www.javatpoint.com/rpa>

# DATA ANALYTICS TOOLS

## Low Code Tools

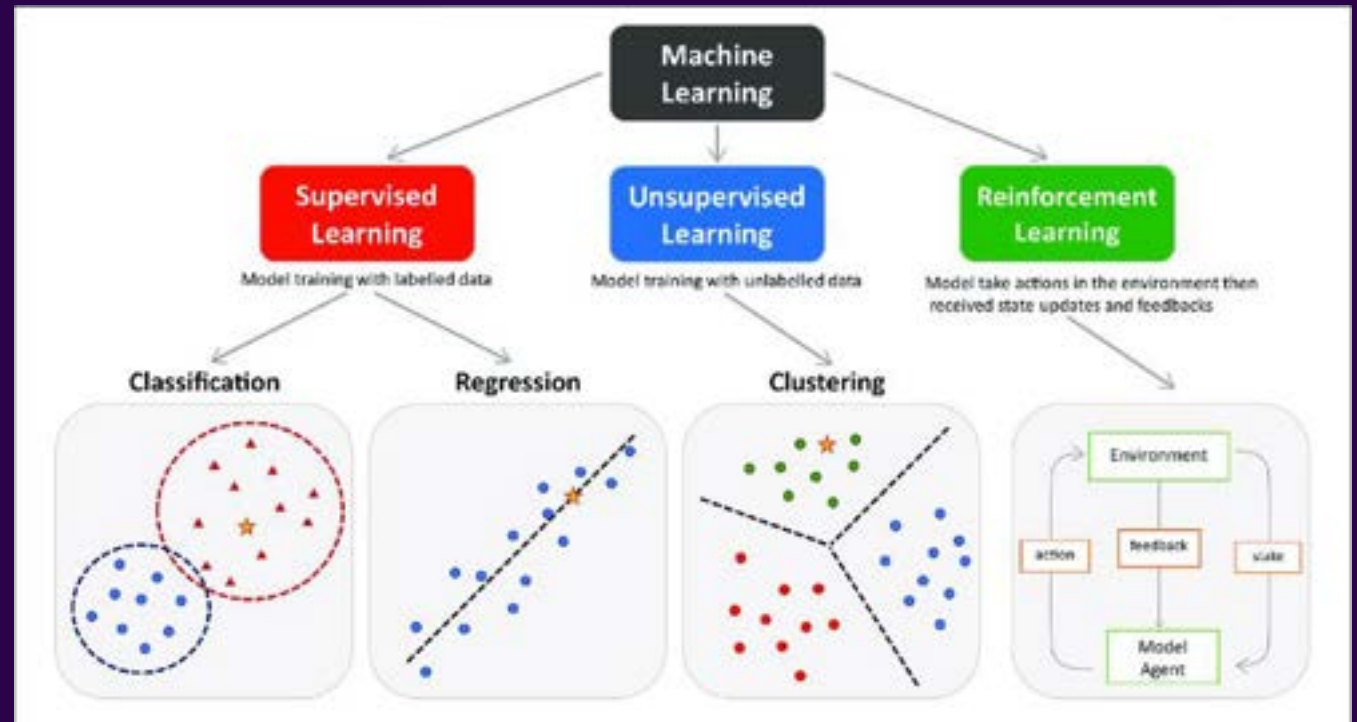


<https://solutionmetrics.com.au/rapidminer-studio/>

# ADVANCED ANALYTICS

**Advanced Analytics** is the autonomous or semi-autonomous examination of data or content using sophisticated techniques and tools, typically beyond those of traditional business intelligence (BI), to discover deeper insights, make predictions, or generate recommendations. Advanced analytic techniques include those such as data/text mining, machine learning, pattern matching, forecasting, visualization, semantic analysis, sentiment analysis, network and cluster analysis, multivariate statistics, graph analysis, simulation, complex event processing, neural networks.

<https://www.gartner.com/en/information-technology/glossary/advanced-analytics>



[https://www.researchgate.net/figure/The-main-types-of-machine-learning-Main-approaches-include-classification-and\\_fig1\\_354960266](https://www.researchgate.net/figure/The-main-types-of-machine-learning-Main-approaches-include-classification-and_fig1_354960266)



# ADVANCED ANALYTICS

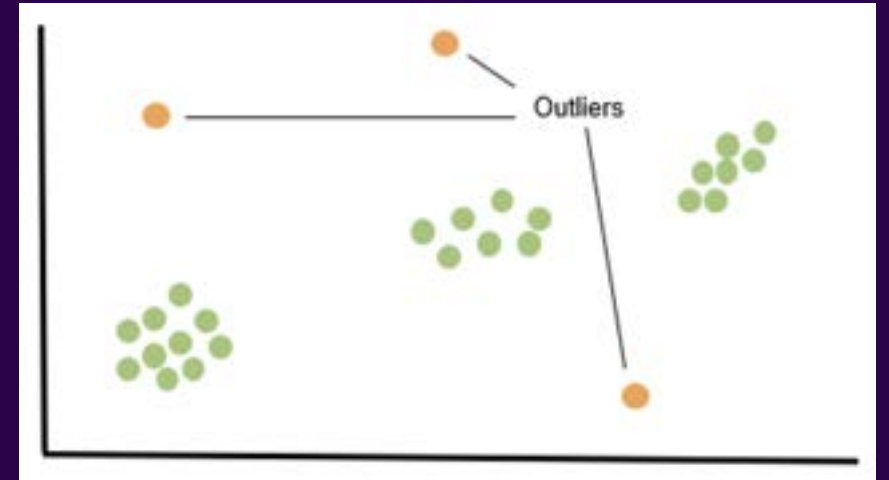
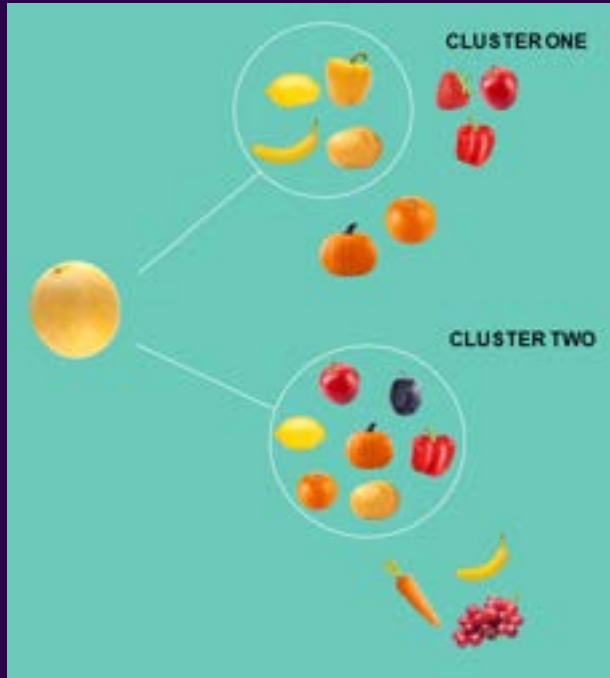
## ML – Supervised Learning



<https://www.chaew.com/groups-and-networks/communities/data-analytics-community/community-insights-and-announcements/ml-what-is-it-really>

# ADVANCED ANALYTICS

## ML – Unsupervised Learning



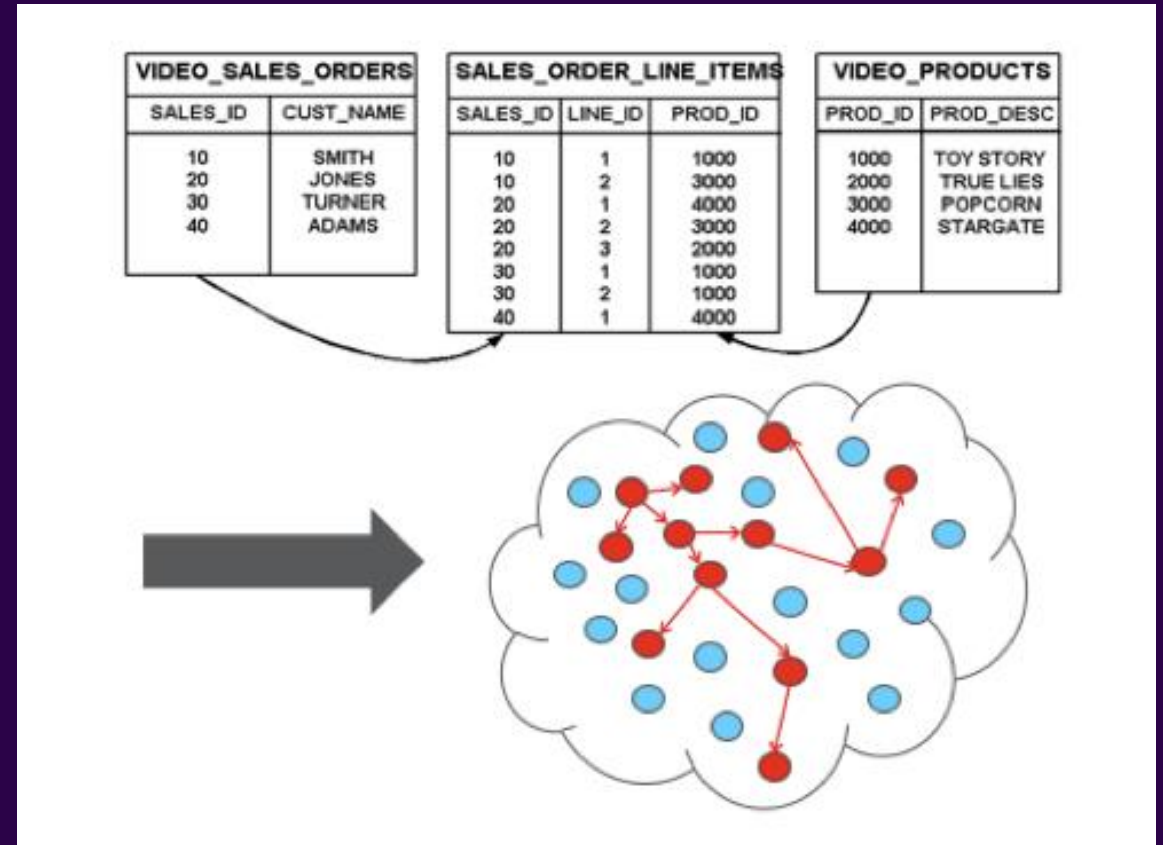
<https://www.icaew.com/groups-and-networks/communities/data-analytics-community/community-insights-and-announcements/ml-what-is-it-really>

# ADVANCED ANALYTICS

## Graph Analytics



<https://research.aimultiple.com/graph-analytics/>



<https://medium.com/swlh/what-is-graph-analytics-9223d71c26d8>

# DATA ANALYTICS MATURITY – USE OF ADVANCE ANALYTICS

Quick Poll



# MARKET BENCHMARK

Research from Protiviti (February 21)  
370 IA Departments in North America

Level of Maturity: Next-Generation Internal Audit Capabilities – Organizations That Are Digital Leaders vs. All Others (North America)\*

	Digital Leaders – Organizations	All Others
<b>Governance</b>		
Internal Audit Strategic Vision	7.6	5.7
Organizational Structure	7.5	5.5
Aligned Assurance	7.2	5.4
Resource & Talent Management	7.0	5.3
<b>Methodology</b>		
High-Impact Reporting	7.3	5.2
Dynamic Risk Assessment	6.9	4.7
Continuous Monitoring	7.2	4.4
Agile Audit Approach	6.2	4.3
<b>Enabling Technology</b>		
Advanced Analytics	6.8	3.9
Automation	6.1	3.7
Process Mining	5.7	3.1
Machine Learning (ML) & Artificial Intelligence (AI)	6.0	2.6

<https://www.protiviti.com/us-en/survey/next-generation-internal-audit-journey-needs-begin-now>

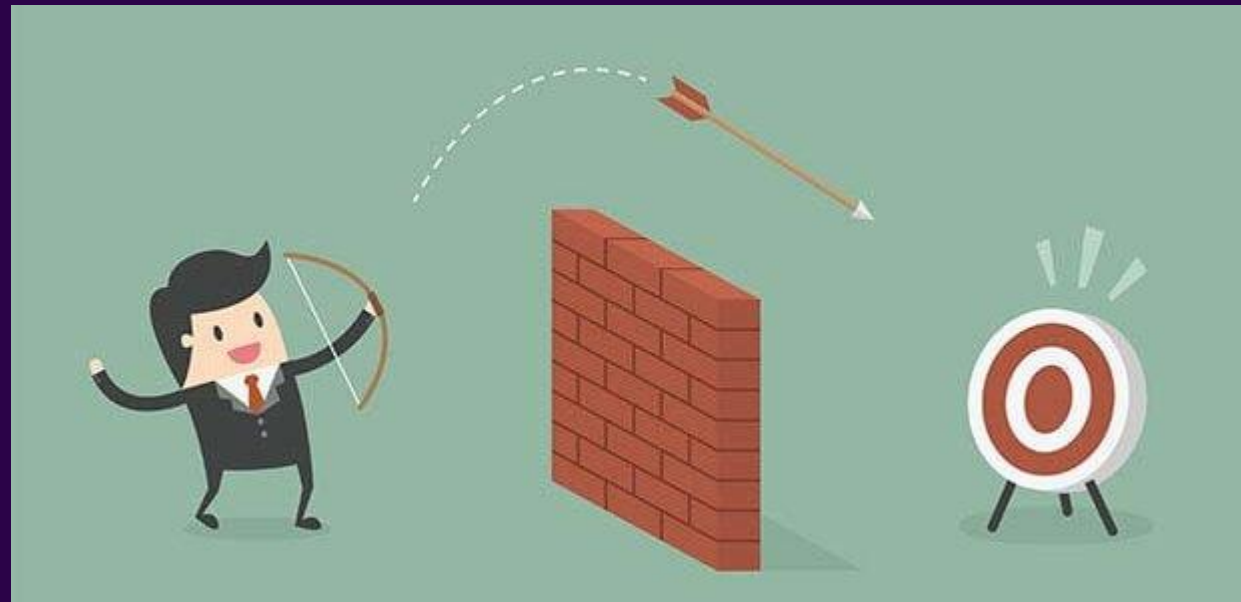
# CHALLENGES IN IMPLEMENTING DATA ANALYTICS STRATEGY

## Common Challenges

- Funds
- Management support
- Develop Skills
- Attract talent

## Ways to overcome

- Clear vision
- Present a strong case
- Grow from within



<https://optinmonster.com/ecommerce-business-challenges-solutions/>

# FUTURE TRENDS



<https://investingnews.com/invest-in-openai-chatgpt/>



<https://www.businessinsider.com/quantum-computing-investing-computers-enterprise-2021-3>

# DATA ANALYTICS SKILLS

From Zero to Hero



<https://www.growthspace.com/future-of-work-upskilling-and-reskilling>



# TAKE AWAYS



**KEEP  
CALM  
AND  
KEEP YOUR EYES  
AND EARS OPEN**

# THANK YOU

Dimitris Kaskantanis

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<https://www.linkedin.com/in/dimitris-kaskadanis>