Changing the Internal Audit Game: Citi Uses AI to Drive Innovation

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Introduction to Audit Innovation

Our Mission

Smarter Auditing – significantly improve the control environment and assurance through large population testing, anomaly detection, and new techniques

Smarter Testing

- Deeper testing through ***automation*** and ***full population testing***
- Use of multiple solutions to help ***identify thematic patterns across countries and entities***

Insightful Risk Assessment

- Identifying emerging risks and issues to ***drive insights*** and ***connect the dots***
- Using data and integrated platforms to uncover ***hidden patterns*** and develop new hypotheses

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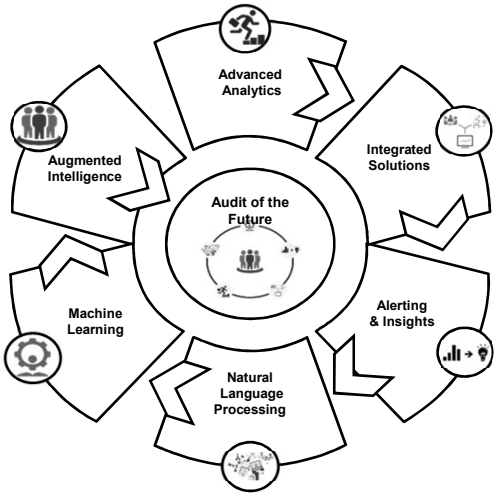
Improving the Auditor Journey

- Using technology and innovation to support the ***auditor of the future***
- Sharing ***subject matter expertise***, yielding insights and popularizing a ***data driven*** *mindset*



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Why Automation?

When auditors spend their time on highly repetitive and mundane tasks, it reduces the amount of time that they can dedicate to stakeholders or high value-add activities.

Benefits for the Auditor

- ❑Reduction of ***error rates*** and ***added assurance*** by testing full population
- ❑Auditors are more empowered from the utilization and ***exploration of data,*** augmenting their decision-making and creating the ***auditor of the future***
- ❑Auditors can identify emerging risks and issues to ***connect the dots*** and drive ***strategic conversations*** with stakeholders

Benefits for the Stakeholder

- ❑Real time ***escalation of thematic issues***
- ❑Widespread use of data helps gain an understanding ***and strengthening of entire control environment,*** providing thematic insight
- ❑Timely identification of issue themes and root causes enhances ***business controls***

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Degrees of Automation

Robotics Process Automation is any programmable device that can perform tasks and interact with its environment without the aid of human interaction or altering existing tech infrastructure.

Levels of RPA Sophistication

Task Automation

- ❑ Process of automating repetitive tasks
- ❑ Implementing rules and logic

Scripting of scripts

Linear task | **Orchestrated activities**

Read e-mail | Copy-paste | Enter data | Send confirmation

Machine Learning & Natural Language Processing

- ❑ Analysis of past and present data sources to make algorithmic predictions
- ❑ Using thematic analysis to identify emerging risks and regulatory policy matching

Process Dynamic

Inference

Non-standard | **Contextual**

Understand different process | Convert images to text | Understand and learns

Cognitive / AI

- ❑ Machine programmed to think, work, evolve and react like humans
- ❑ Helping humans become faster and smarter at the tasks they're performing

Systems Self Aware

Predictive | **Self Learning** | **Self Healing**

Predicts future behaviors | Virtual Assistants | Auto Feedback

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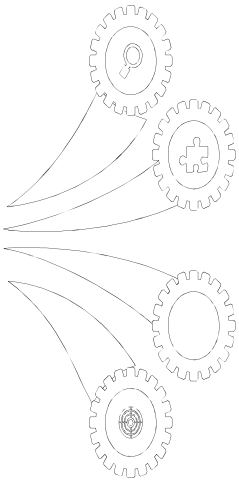
Robotics in Audit

Quality Assurance - Indicator Dashboard / Robot

Utilizing dashboards and robots to sharpen the QA process, reviewing the full population of audits applying indicators of quality issues and leveraging robots to automate manual data extractions



Robotics

- ❑Visually display how 100% of completed audit files and audit teams perform against select attributes through an ***indicator dashboard***
- ❑ Samples selected for review are ***intelligently targeted*** towards audit files and audit teams with indicators for potential lower quality

Traditional Approach

- ❑Labor-intensive: ***16 hours*** to review one Audit
- ❑ ***Sample sizes*** leads to smaller percentage reviewed – # of Audits subject to QA review

Innovative Approach

- ❑Robot performs extraction, leaving auditor with more time to perform quality review
- ❑Robot reduces review time from ***16 hours to 12 hours***
- ❑***Increased penetration rate***
- ❑Robot usage allows for a ***significant increase*** in audit review per year

Impact

- ❑***100%*** of completed audit files and audit teams screened
- ❑Time saved now dedicated to increased and qualitative review

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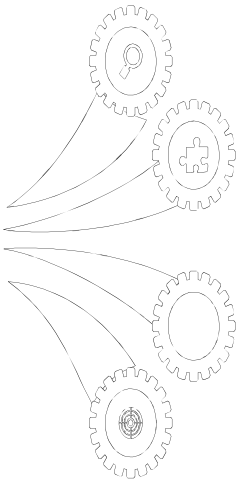
Robotics in Audit

FINRA License Testing Bot

Advanced robotic techniques automate manually intensive tests which are repeatable to increase efficiency while enhancing audit assurance



Robotics

- ❑Programmable device that can perform tasks and interact with its environment, ***without the aid of human interaction***
- ❑Implementation ***without altering existing tech infrastructure***
- ❑Utilizes automation, machine learning, and cognitive / artificial intelligence

Traditional Approach

- ❑***15 minutes*** to manually check one broker would take ***1 year*** to test 5500 brokers
- ❑ ***5% error rate*** and sample size **of 25**

Innovative Approach

- ❑***1 minute*** to check one broker
- ❑**0 Hours** used by auditor for testing, allowing auditor to focus on exceptions
- ❑***100%*** population testing

Impact

- ❑***Enhanced*** assurance through increased sample size
- ❑***100%*** of broker populations tested in 3 business areas
- ❑***Time Savings*** through the automation of repetitive manual tasks

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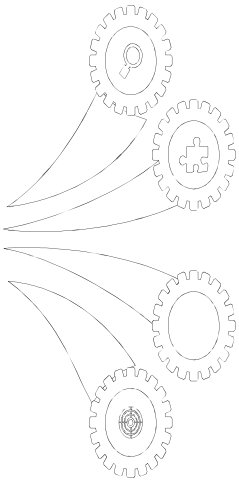
Machine Learning and Natural Language Processing in Audit
Customer Complaints

Monitoring of complaints and social media data to identify trends and emerging themes to improve risk assessment and predictive risk capabilities



Machine Learning & Natural Language Processing

- ❑**Sourcing Complaints** from social media to enable **early risk identification and intervention**
- ❑Differentiate between ***comments and complaints***
- ❑***Categorize*** complaints into appropriate category
- ❑Visualize data to identify ***outlier activity and emerging risks***

Traditional Approach

- ❑***Limited to sampling*** of internal complaints
- ❑***Reactive vs predictive*** – utilizing social media as a leading indicator
- ❑Requires ***time consuming manual reading*** and categorization of applicable complaints

Innovative Approach

- ❑***Millions of messages*** analyzed in < 3 hours
- ❑Consistency in categorization ***without individual bias***
- ❑Potential ***leading indicator*** of formal complaints and other risk factors

Impact

- ❑Leveraging solution to ***identify areas of increased risk*** based on customer experience
- ❑New data points to identify emerging risks and ***hidden patterns***
- ❑Lending insight that can be used for ***audit scoping and business monitoring***

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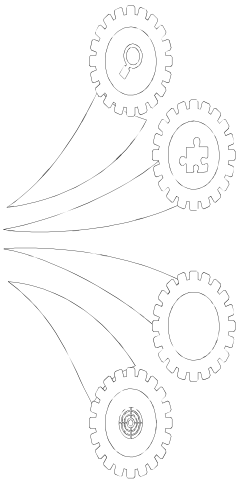
Machine Learning and Natural Language Processing in Audit
Root Cause Analysis

Gain insights into Issues and Corrective Action Plans through a root cause analysis that uses Natural Language Processing and Machine Learning techniques



Machine Learning & Natural Language Processing

- ❑Analyze Issues and Corrective Action Plans from a root cause perspective, enabling more ***depth and breadth*** in understanding of risks
- ❑Enable better, more ***risk-based approach*** to issue management
- ❑Pre-empt occurrence of problems through ***focus on root causes***

Traditional Approach

- ❑Standard analysis
- ❑Manual approach to root cause
- ❑Symptomatic and siloed approach
- ❑Limited ability to “connect the dots”

Innovative Approach

- ❑Machine Learning and Natural Language Processing techniques
- ❑***Broader and deeper understanding*** of issues based on root causes
- ❑Risk-based approach to addressing problems ***across lines of business***

Impact

- ❑Large percentage of the issue population categorized into ***17 root causes***
- ❑ ***Horizontal analysis*** of root causes leading to ***deeper insights***
- ❑***Improve control environment*** more strategically and substantively
- ❑ Tool for enhanced ***audit scoping and business monitoring***

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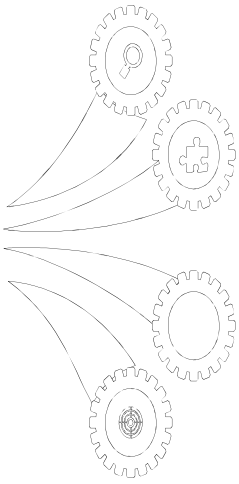
Robotics, Machine Learning and Natural Language Processing

Enterprise Platform

Web-based solution execution platform which centralizes Innovation tools for every phase of the audit life cycle, enabling consistent & globally accessible monitoring, testing, & reporting



Enterprise Platform

- ❑Web based solution execution enables ***global on-demand testing and monitoring***
- ❑***One stop shop*** for all Innovation offerings including Online Solutions, Packaged Solution and Robotics requests
- ❑Allows the audit team to leverage analytics and innovation throughout ***all phases of the audit life cycle***

Traditional Approach

- ❑Use of Analytics limited to auditor skillset
- ❑Analytics ***performed in siloes***
- ❑Solution execution performed on ***an ad-hoc basis***

Innovative Approach

- ❑Solutions & Bots at the ***click of a button***
- ❑***Customized*** threshold monitoring & alerting
- ❑Consistent use of control tests

Impact

- ❑***Cross-functional*** *and* ***utilized*** by auditors and business leaders
- ❑***Empowers*** auditors to embrace data driven mindset
- ❑Reduction of manual documentation and mobile compatibility, facilitating ***auditor of the future***

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Innovation in all Organizations

Audit Innovation can take many forms

Organizations of all sizes can use innovation

Forms of Innovation

- Advanced Analytics
- Integrated Solutions
- Alerting and Insights
- Natural Language Processing
- Machine Learning
- Augmented Intelligence

Benefits

Small Organizations

- Solutions can apply to processes firm-wide (dependent on level of specialization)
- Fewer disparate data sources
- Less complexity
- Intra-firm rules and guidelines can be easier to navigate

Large Organizations

- Larger, leverage-able infrastructure
- More data for advanced modeling
- Greater resources

Impact

- Complementing and augmenting traditional processes to drive **insight**
- Leveraging Technology and Big Data to increase **assurance**
- Developing **Fail-Fast** and **Agile** strategies to rapidly launch innovative solutions

Invest in the power of innovation to drive efficiency and effectiveness throughout your audit process

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Thank You!

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