


Algorithmic Transaction-Level Assessments (ATLAs): A Framework and A Set of Experiments

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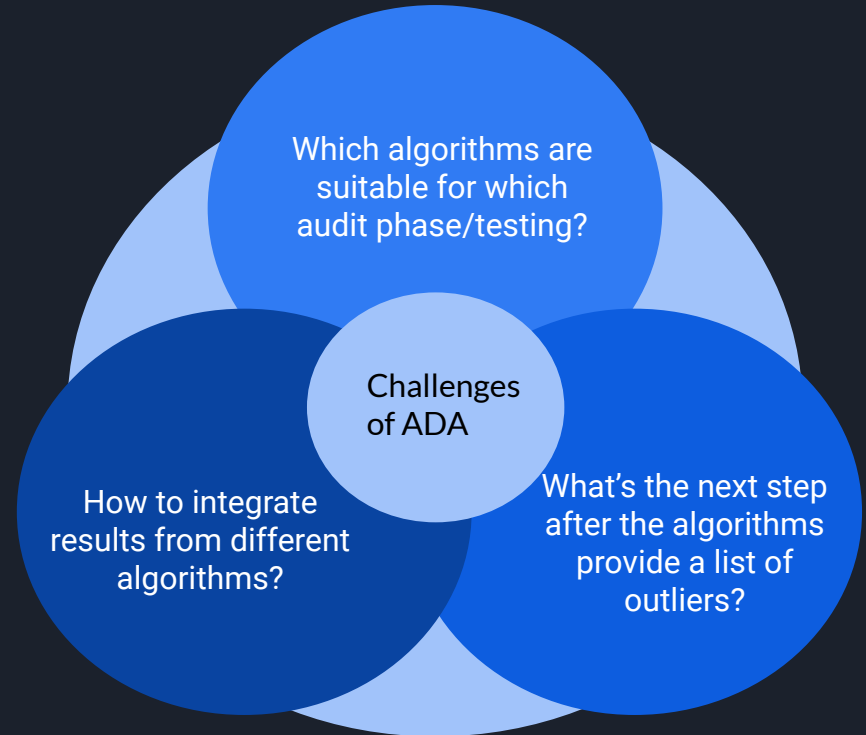
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- A decorative graphic on the right side of the slide, consisting of a series of dark gray, 3D-style rectangular blocks arranged in a descending staircase pattern from top-right to bottom-left. One block in the middle is highlighted in light green, and one block at the bottom is highlighted in blue.



Introduction

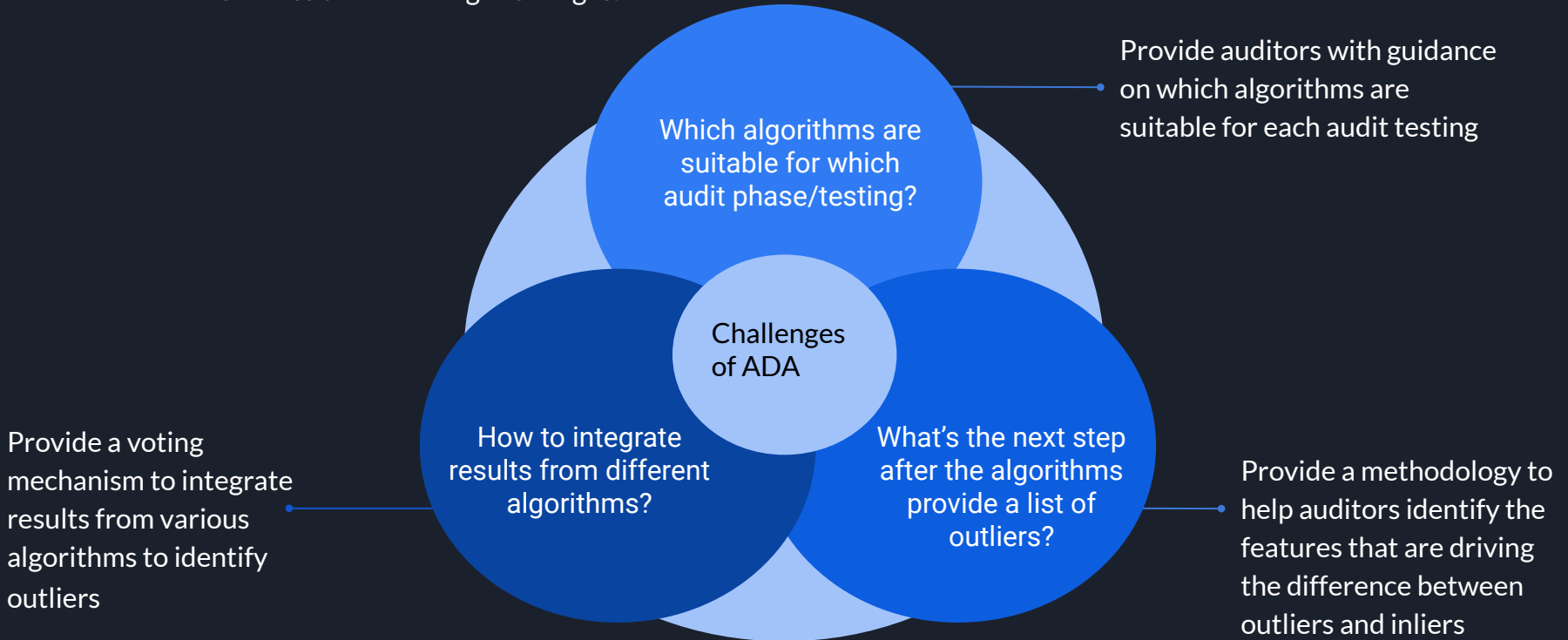
Audit Data Analytics (ADA) is an emerging field that receives increasing attention from practitioners, regulators, and academics.

However, there are several main challenges in ADA adoption.

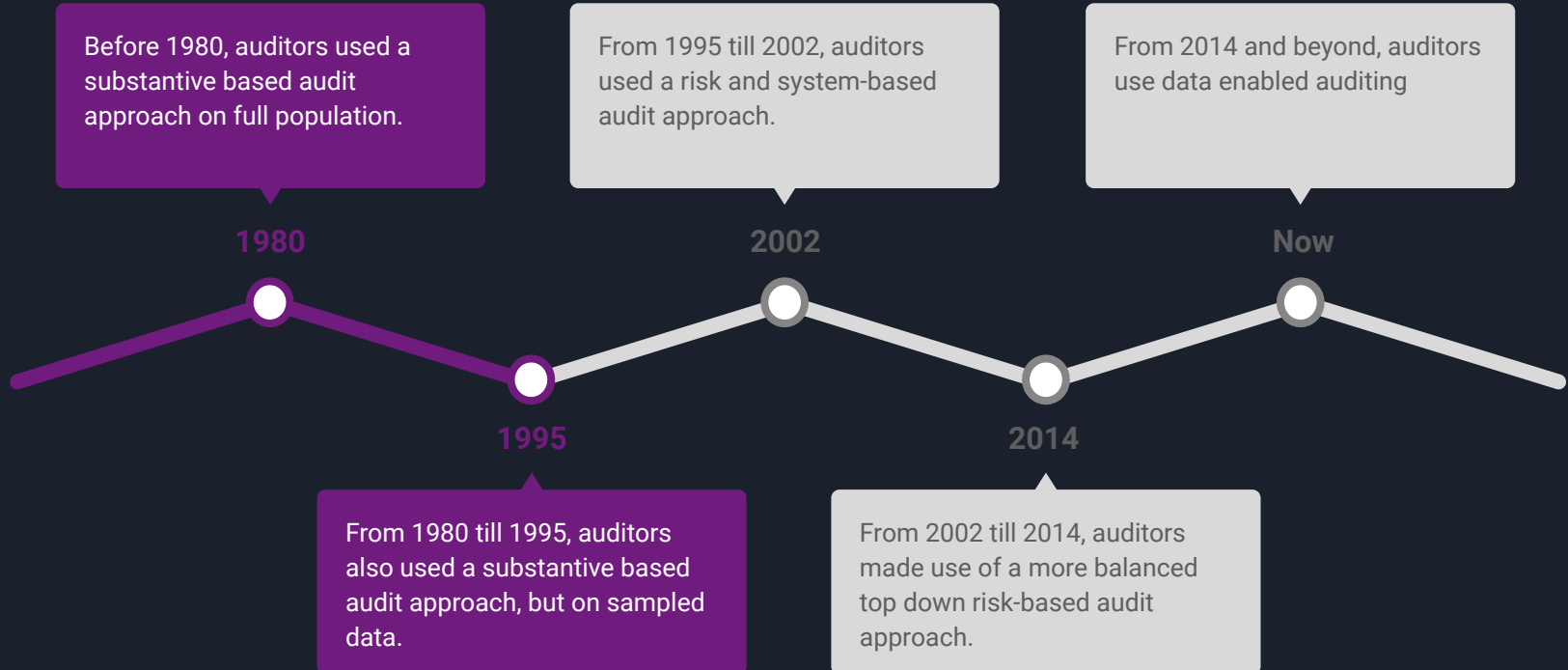


Contribution

We provide an Algorithmic Transaction-Level Assessments (ATLAs) Framework that can address the following challenges.

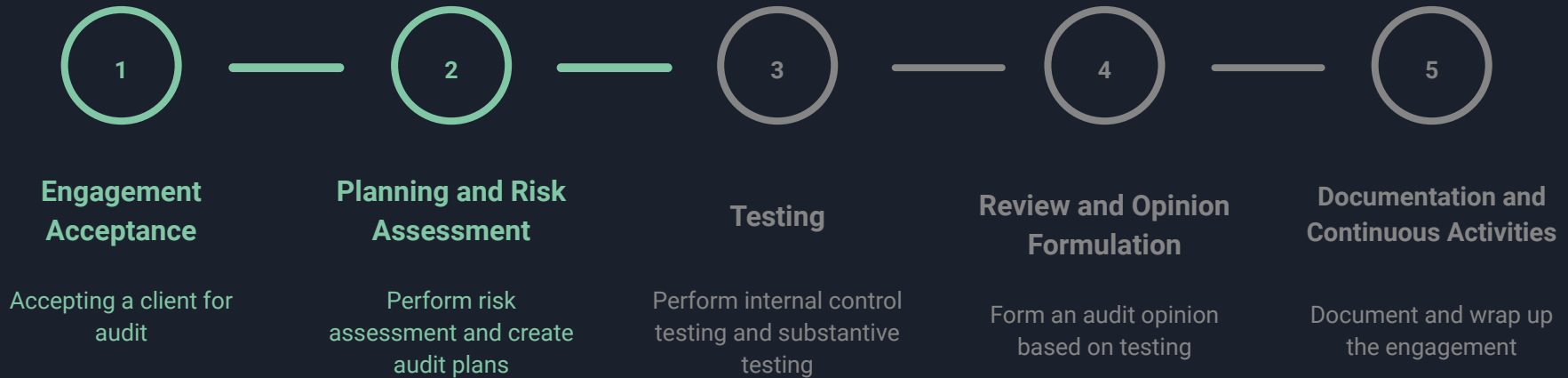


Background: Development of Audit Methods





Background: Current Audit Procedures

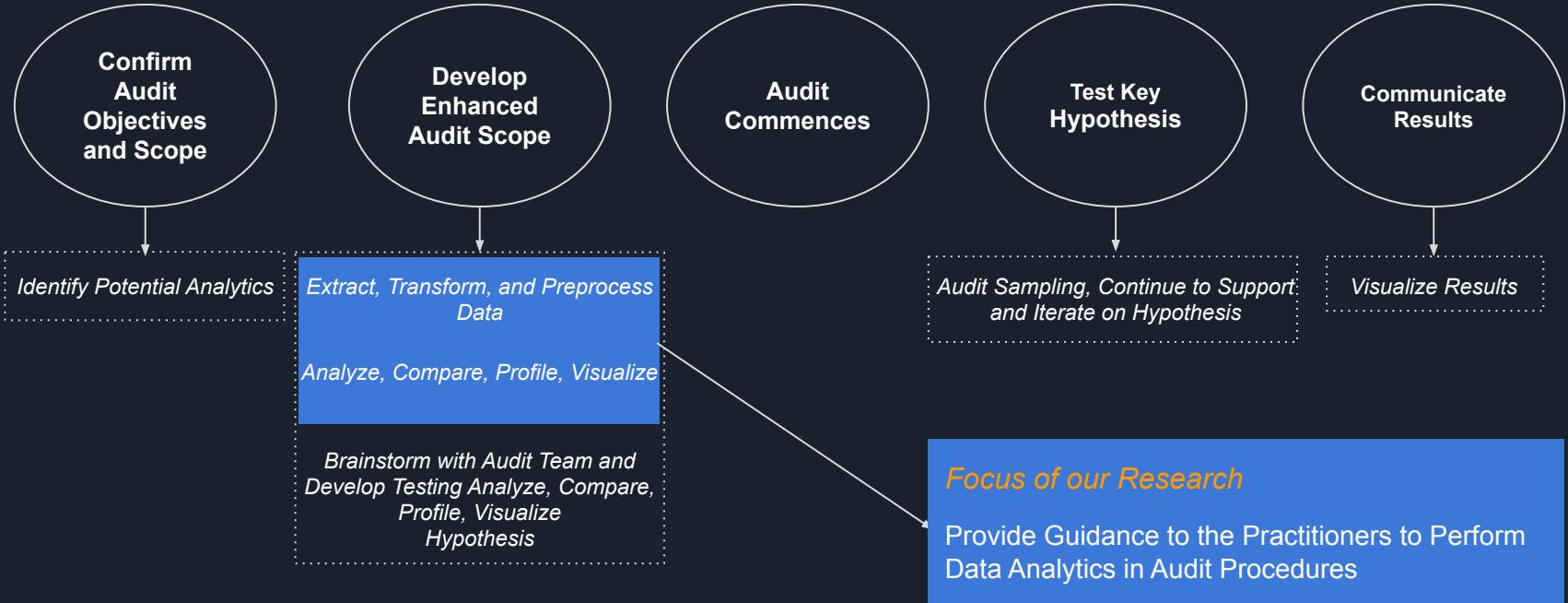


Background: Audit Data Analytics

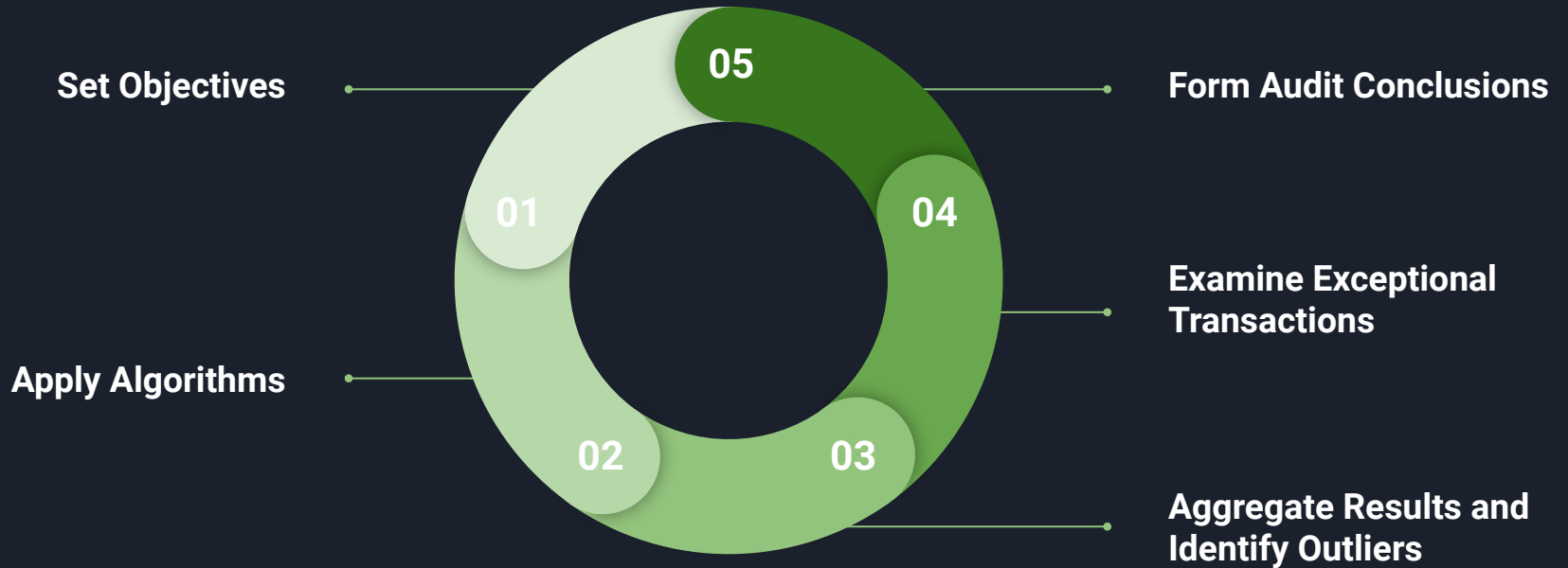
Why Data Analytics?

- Perform the Same Audit Faster
- Perform the Same Audit Cheaper
- Perform Better Audits.

Steps to Enhance, Automate, and Continuously Improve the Audit Process



The ATLAs Framework



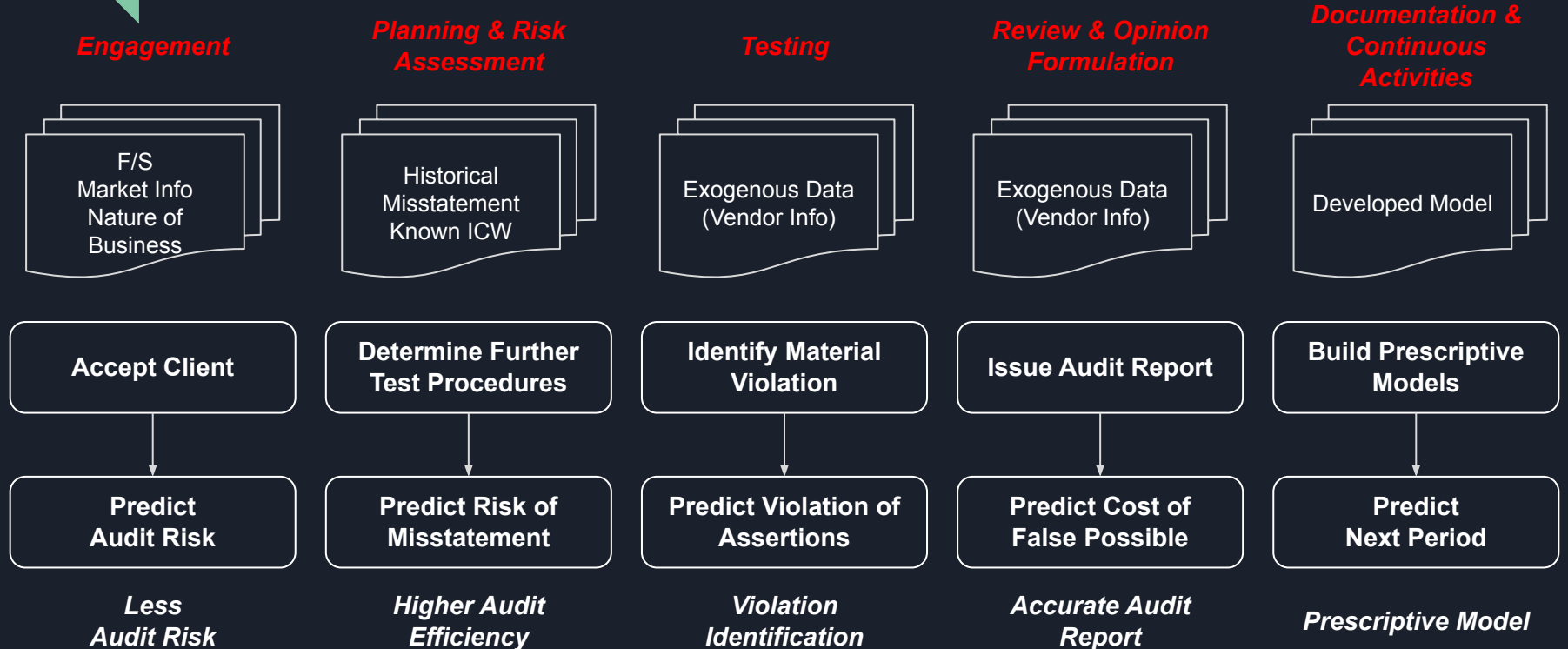


Stage 1: Set Objective

Set the objectives for the transaction-level audit testing. For example,

- testing the completeness and accuracy of the transactions
- or, simply identifying abnormal transactions

Stage 2: Apply Predictive Algorithms

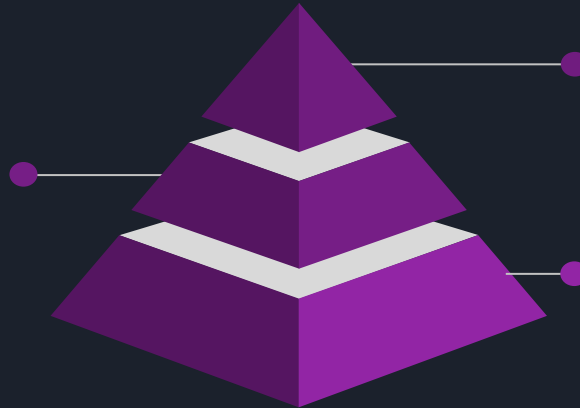


Stage 3: Aggregate Results and Identify Outliers

For the same audit testing, different algorithms usually output different set of outliers. We propose the following two-step method to obtain outliers that deserves auditors' attention.

- Step 1: create a voting mechanism to collect "votes" of outlier from algorithms examined
- Step 2: based on "votes", classify transactions into three types:

Pseudo Outliers (examine a sample)
Transactions that are deemed as outliers by at least one but not all of the tested algorithms



Outliers (examine all)
Transactions that are deemed as outliers by all of the tested algorithms

Inliers (no need to examine)
Transactions that are deemed as inliers by the all of the tested algorithms



Stage 4: Examine Exceptional Transactions

Based on the outliers, pseudo outliers, and inliers identified in Stage 3, we propose the following three-step approach to examine the exceptional transactions (i.e., outliers and part of the pseudo outliers)

1

Perform a stand-alone feature extraction analysis

2

Provide visualization for each identified feature

3

Investigate the exceptional transactions based on Step 2



Stage 5: Form Audit Conclusions

At this stage, auditors transform the data analysis outcomes into audit conclusions



Illustrations of ATLAs - Set Objectives

General Ledger data from a real audit engagement

Extract revenue transactions

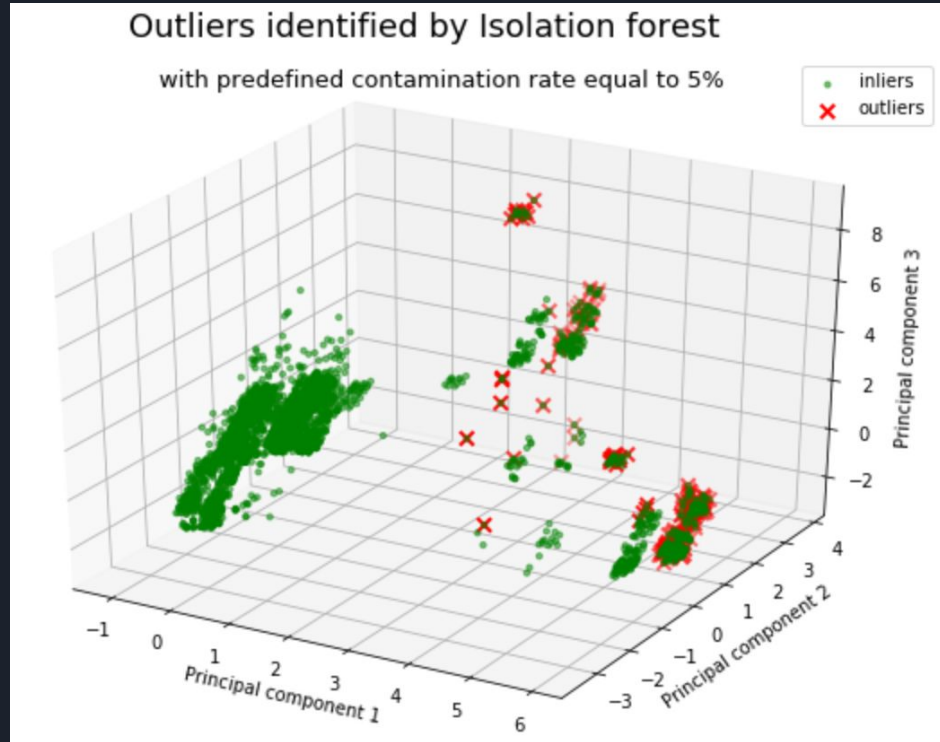
Generate features for data analysis

- Period
- Main counterparty
- Main ledger
- Transaction amount
- Etc.

Objective: identify outlier transactions

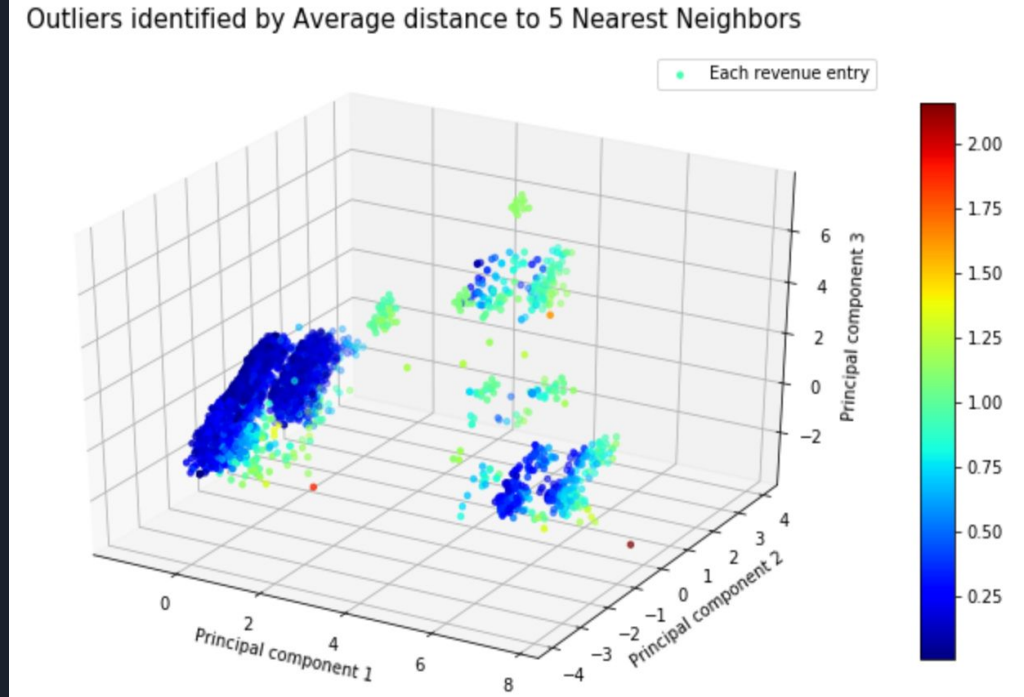
Illustrations of ATLAS - Apply Algorithms

Algorithm 1: Isolation Forest



Illustrations of ATLASs - Apply Algorithms

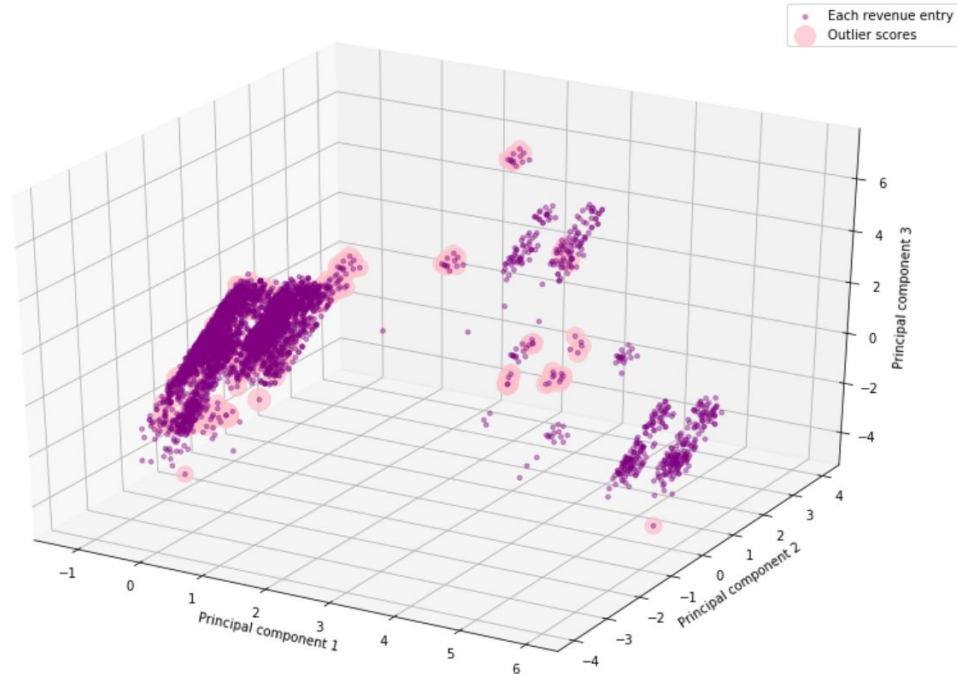
Algorithm 2: K-Nearest
Neighbors (KNN)



Illustrations of ATLAS - Apply Algorithms

Algorithm 3: Local Outlier Factor (LOF)

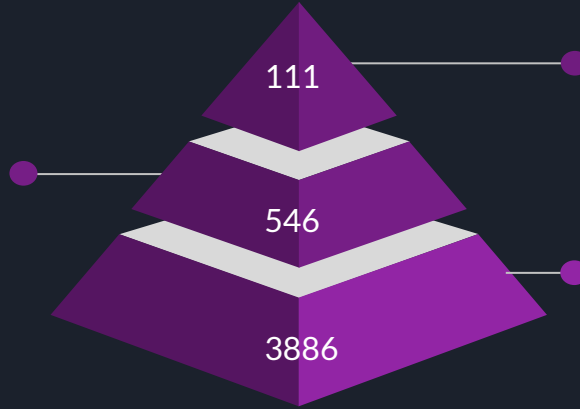
Outliers identified by Local outlier factor when threshold is equal to 1.50



Identifying Outliers

Pseudo Outliers (examine a sample)

Transactions that are deemed as outliers by at least one but not the majority of the tested algorithms



Outliers (examine all)

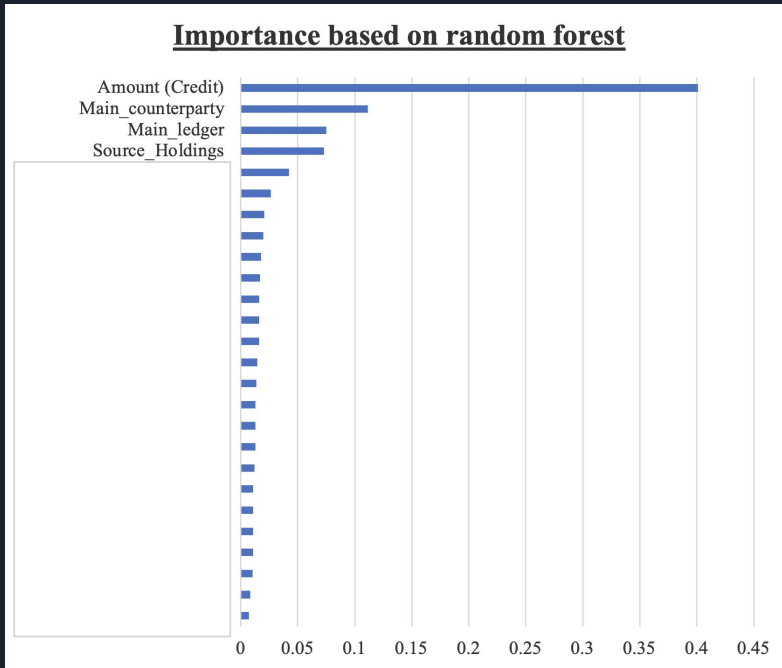
Transactions that are deemed as outliers by the majority of the tested algorithms

Inliers (no need to examine)

Transactions that are deemed as inliers by the all of the tested algorithms

Examine Transactions

Step 1: Perform a stand-alone feature extraction analysis



Ongoing work for other steps in examining transactions and forming audit conclusions



Implications

1. Predictive Audit

- Can we perform predictive audit by utilizing data analytics?
- Can we audit before looking on the ledgers?

2. Rethinking Reasonable Assurance

- Limitation of Binary Opinion
- Data Analytics and Materiality

3. The Usage of Unsupervised Learning Models

- How can we validate?



Futuristic Outlook

ADA As A Service (AAAS) (Dai and Vasarhelyi 2020)

Recommender systems to suggest appropriate algorithms

Cognitive assistants to aggregate and “explain” ADA results, and translate them into auditing language and conclusion.



Conclusions

We propose an ATLAS Framework that can

- Provide auditors with guidance on which algorithms are suitable for each audit testing
- Provide a mechanism to integrate results from various algorithms to identify outliers
- Provide a methodology to explain the outcome of “black box” algorithms

THANK YOU!

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