

Case Complexity Analysis: Using Advanced Analytics to Understand Complex Problems

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Overview

The question of how hard a problem is to solve is something that scientists, researchers, computer scientists, governments and businesses have all thought about for a long time. The underlying need to categorize questions into categories is a need that unites them all.

This session shares knowledge and insight on how Guidehouse achieves the best performance possible when analyzing complex problems.



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Your
Speaker



Agenda

- What is Case Complexity Analysis?
- Benefits of a Case Complexity Approach
- Approaching a Case Complexity Problem
- Applications of a Case Complexity

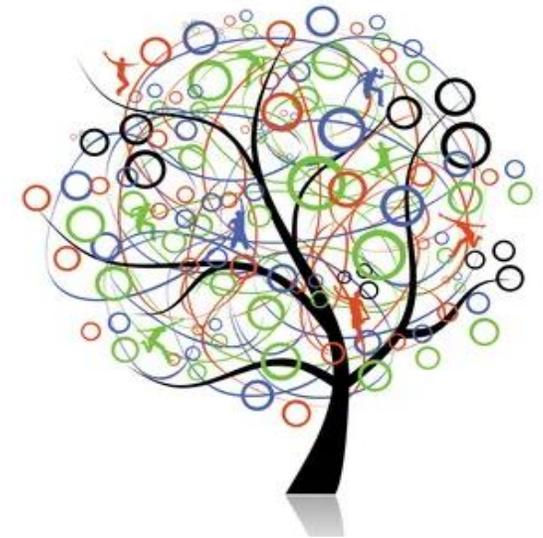
What is Case Complexity Analysis?

Case Complexity 101

- A task or case may be completed, or a problem may be solved in different ways, but some of these solutions may be preferable to others. Cases involve an ultimate decision or outcome as well as a process to arrive at that decision.
 - Cases on a docket
 - Applications in a que
 - Logins to a website.
- What do we mean when we say complexity?
 - Referring to a system with many interconnected parts, arranged in a variety of ways and that interact with one another
 - Mainly concerned with the idea of Social Complexity because we are dealing with problems where humans are involved

“There are three ways of doing things around here: the right way, the wrong way, and the way that I do it.”

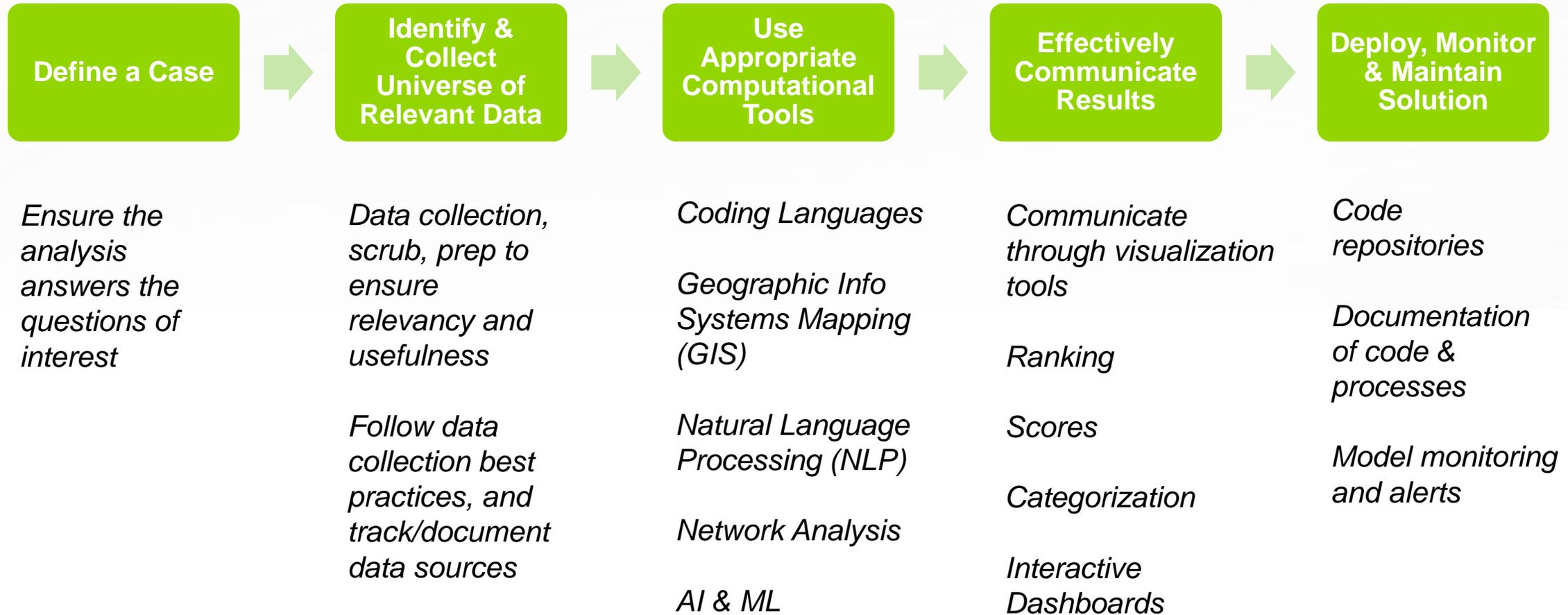
Robert De Niro ~ Casino



Case Complexity 101

- A technique to complete a complex task **using computational tools to understand the resources** (manpower, time, computation, money, etc.) required (i.e. a case) as well as the outcome of a given case.
- Using computational tools and methods to
 - Understand big questions and analyze the issues that **require complex and large amounts of data**
 - **Manage resources and allocate them efficiently.**
- Take the form of scores or categorizations that can help
 - Provide **visibility and clarity** into information and process
 - Enable and accelerate **informed decision making.**
 - **Manage resources** and allocate them efficiently.

Approaching a Case Complexity Problem



Applications of Case Complexity

Applications of Case Complexity

1

Computation

Hard problems to solve in computer science range from the almost esoteric (ex: P vs NP) to the seemingly mundane (ex. sorting algorithms)



2

Intellectual Property & Patents

Standardize patent classification data to match patterns and phrases based on context



3

Judicial Court Caseload & Child Welfare Cases

Understanding the type, complexity and depth of case being dealt with is important for timely and appropriate completion of the case.



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Audit and Recommendation Completion Analysis

Challenge

Have a better understanding of different types of audits and resulting recommendations

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- Used survival analysis techniques determine the curve of recommendation closure times for publicly available government audits.
- Used Cox proportional-hazards model to identify attributes that are significant in predicting of the overall timeliness to closure.
- Determined significant features, estimated a survival curve to better understand the model and view the curve by the given attribute and the percentage of recommendations closed at any number of days.
- Leveraged text analysis to create a list of predefined objectives to categorize reports into specific topics and sub-topics.
- Provided a view of the conversation going on among reports using Network analysis.

Impact

- The findings allows clients to categorically select cut points to place recommendations into buckets of slowly or quickly closing by the given attribute threshold.
- Each recommendation is coded as slow or quick, using text analysis to determine patterns of the recommendations types, allowing efficient use of client resources.
- The final report text is converted from raw text to a test object suitable for analysis, and was analyzed with respect to a custom dictionary to score each report based on the frequency and proportion of dictionary words in each report. The custom dictionary allows for time sensitive urgent analysis to be prioritized as the need arises
- Combining the information to view create a more holistic view of the audit landscape provide enhanced understanding of audits for better decision making





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Clearance Investigation & Adjudication

Challenge

- A government client needs to streamline their workflow when conducting the new hire and existing employee and contractor security processing. They want an automatic scoring system which can read the standard intake forms and rank the complexity of the case to enable them to assign the case to the correct resources depending on experience level.

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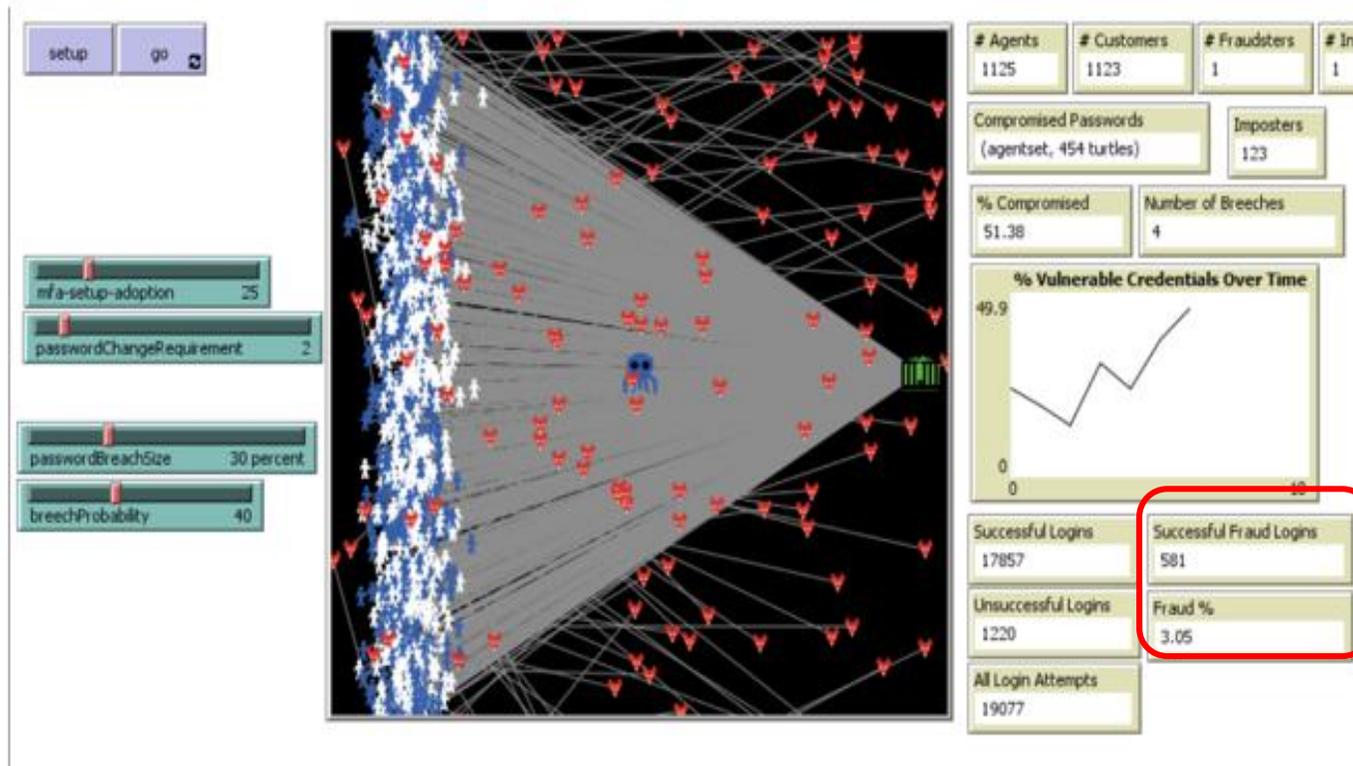
- Automated case complexity scoring process allowed for the improvement in the time to close cases in the program
- Expanded technological capabilities by leveraging Machine Learning (ML) and Artificial Intelligence (AI) to predict background investigation case complexity, likelihood of approval, and processing time to improve the end-to-end case adjudication process and enhance overall operational efficiencies.

Impact

- A streamlined process for the background investigation adjudication process
- A consistent adjudication methodology
- Better insights into the population of security clearance applications to more effectively manage resources.

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Fraud & Cybersecurity



 Red highlight shows fraud metrics resulting from a single run of an ABM simulation

Challenge

- Fraud, in a myriad of forms, costs billions every year.
- Data about fraud is very hard to come by and is not available for study and analysis because of a variety of privacy issues.
- These concerns, while valid, do not remove the need for data in order to understand fraud better and to ultimately prevent it.

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- Used Agent Based Modeling (ABM) simulation to provide bottom-up method to generate realistic synthetic data sets of transactions that represent “normal customer behavior and patterns of fraudulent behavior.
- Allow exploration of model to generate results under a variety of different conditions and security configurations.

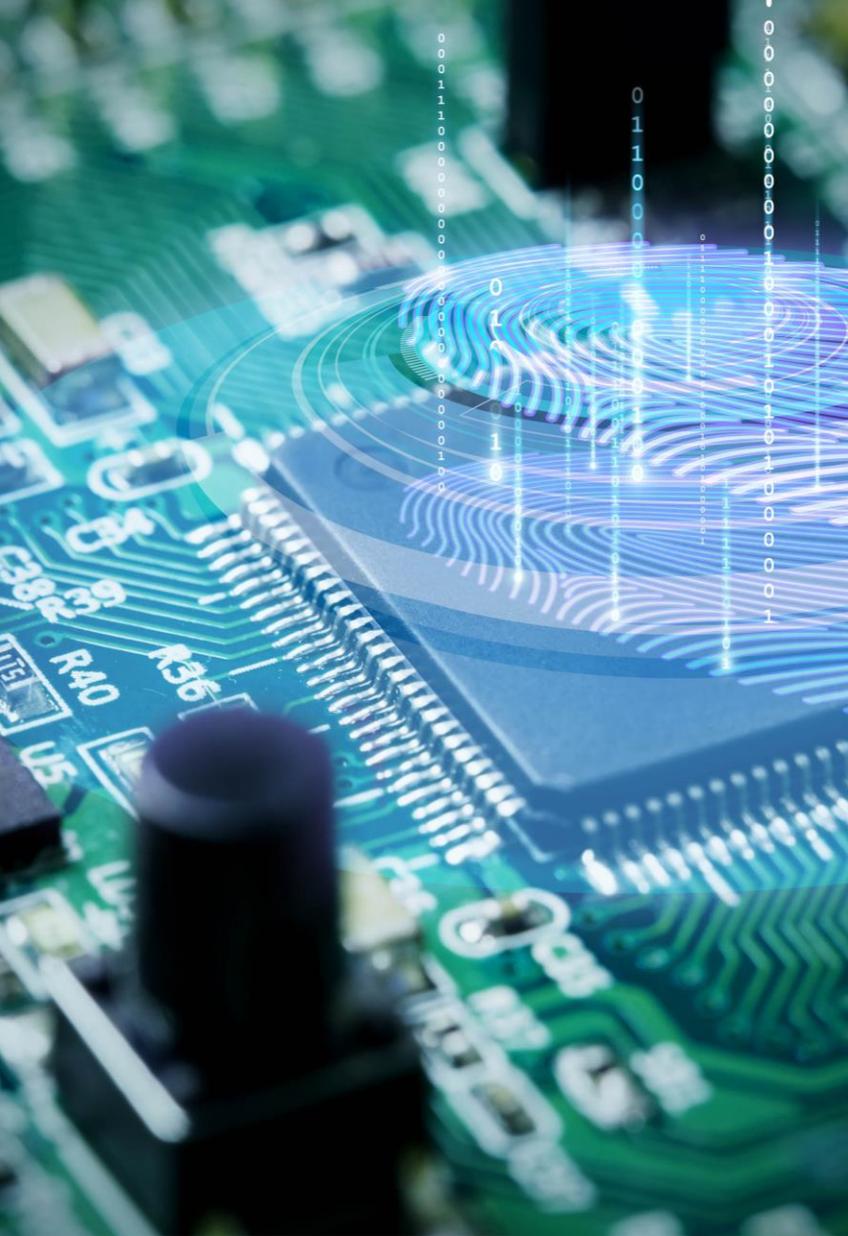
Impact

- These data represents a useful tool for researches to analyze and identify fraud and the patterns surrounding it.
- The agent-based modeling provides a uniquely bottom-up way of generating synthetic fraud datasets for use in building tools to help identify fraud and the patterns surrounding it.



Closing Thoughts

- Computational tools allow us to better understand difficult and complex problems
 - Better management and allocation of resources
 - More informed decision making
- Responsibly implementing computational tools
 - **Fairness:** You've probably seen news about negative outcomes from AI or automated systems. AI is often perceived as being objective, but it's generating predictions off patterns in data, which sometimes encodes human biases
 - **Privacy:** These problems frequently includes highly sensitive information. Guidehouse leverages the best data privacy and compliance tools to ensure security.
 - **Transparency:** Follow data collection best practices and track/document data sources. Understand input data well and understand underlying distributions of the data. Monitor and evaluate models and document code and algorithms thoroughly.



References

- **Website**

- [Guidehouse Advanced Analytics and Intelligent Automation Capabilities](#)
- [Guidehouse Technology Advisory](#)

- **Thought Leadership**

- [AI-powered Framework: Powered Case Complexity Frameworks Can Help Streamline the Review Process to Decrease Backlogs and Reduce Workloads](#)
- [An AI-Powered Framework for Case Complexity](#)
- [Moving to a DevSecOps Framework: How to Make the Cultural Shift](#)
- [Creating a Data Advantage](#)
- [A Data-Centric Culture is Critical to an Organization's Success](#)

- **LinkedIn and Twitter**

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Thank You!