

## **Data Complexity: The Opportunity and Challenge**

Financial services firms have the opportunity to fundamentally transform their clients' experiences, effectively capitalize on evolving market conditions, and mitigate risk using the vast amounts of customer, product, and market data at their disposal. However, as a firm's data grows exponentially in both volume and complexity, uncovering critical patterns and insights from the data becomes increasingly difficult.

Conventional approaches to data analysis struggle with highly complex data. These hypothesis-driven, iterative approaches are time-consuming, expensive, and heavily reliant on specialized individuals asking the right questions of the data. As these query-based approaches are typically limited to subsets of the data, they can miss critical insights.



Figure 1: Comparing conventional analytical approaches to the Ayasdi approach

## Introducing Ayasdi Machine Intelligence

Ayasdi's machine intelligence software provides a new approach to discovering insights from complex data, without requiring large teams of data scientists to write queries or code algorithms. It combines the power of topological data analysis (TDA) with machine learning to help firms extract critical intelligence from data, previously hidden or overlooked by conventional analytical approaches. It draws on the philosophy that all data has an underlying shape and that shape has meaning. The analysis creates a visual summary or compressed representation of all of the data to rapidly uncover clusters, progressions, anomalies, and cycles in complex or wide data, and explain the underlying reasons for these patterns. The uncovered insights can help inform more precise client retention, asset allocation, and risk mitigation strategies.







## **The Benefits**

Leaders in the financial services sector use Ayasdi's machine intelligence software to tackle some of the toughest data problems including: gaining a deeper understanding of their clients' behavior as well as the impact of evolving market conditions and risks.



Figure 3: How financial services firms benefit from Ayasdi's machine intelligence software

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### **DEEPER CUSTOMER INSIGHTS**

Relationship managers are increasingly challenged with achieving a trusted advisor status with their clients. There is a tremendous opportunity to gain a deeper understanding of what a client really values by correlating and analyzing the massive amounts of client, product, and market-related data at their disposal. However, conventional approaches that rely on business intuition and armies of analysts cannot

keep pace with evolving client behavior, products, market conditions, and regulations, as well as the growing complexity of the data. While these approaches can surface the macro-trends in client preferences, they fail to uncover the more subtle relationships that exist between a bank's clients and its products.

Machine intelligence software represents an innovative, new approach to helping banks create behavior-based client profiles to meet that goal. It brings together a broad range of machine learning, geometric, and statistical algorithms with TDA to rapidly correlate and analyze client, product, and market-related data. It uncovers subtle, precise client sub-segments from highly complex data. The underlying attributes that describe each segment inform the development of precise client profiles as well as predictive models that can be dynamically updated.

Using Ayasdi's software, banks can create models that help

"Credit Suisse intends to lead our industry in understanding complex datasets. We evaluate employing the world's most advanced analytic technologies, to gain the greatest possible advantage for our clients. At today's accelerated pace of business, rapidly uncovering subtle signals across our massive data sources, would help us to deliver superior results for our clients."

> - Marco Abele, Head of Digital Private Banking, Credit Suisse

precisely segment their clients and predict the likelihood of their transacting in specific products. Banks can also create models that inform the composition of optimal portfolios based on specific market conditions. They can also develop models that accurately predict asset churn to devise targeted retention strategies. Ayasdi's software can empower relationship managers with data-driven insights that help them personalize product recommendations to clients, thereby driving higher-value relationships and revenue.

#### **DEEPER MARKET INSIGHTS**

Price trends for publicly traded securities, as well as their relationship to macroeconomic indicators, often demonstrate stability over selected periods of time. However, these trends and relationships, referred to as regimes, can also shift quickly to form new patterns as the market enters new phases. Investors with a deep understanding of the characteristics of each regime, as well as the ability to recognize early indicators of the onset of new ones, can capitalize on the accompanying opportunities.

A precise understanding of market regimes aids the creation of better asset allocation strategies and more accurate liquidity forecasts. However, this requires the ability to analyze highly complex market and economic data to uncover and capture the key characteristics of each regime. Conventional statistical tools and machine learning techniques limit analyses to small sets of explanatory variables, and require analysts to hypothesize relevant partitions and analytical forms prior to analysis. As a result, uncovering



regimes, their explanatory variables, and the implications for the future can be difficult and timeconsuming.

Ayasdi's machine intelligence software helps portfolio managers uncover subtle, valid combinations of features that characterize different market regimes. It then rapidly pinpoints similarities to past regimes to help them more accurately assess the performance of various asset classes. The software can also surface the complex relationships between market regimes and liquidity proxies to aid the creation of more precise liquidity forecasting models.

As opposed to making global assumptions regarding all the underlying data, TDA effectively constructs an ensemble of models, each representing different market regimes and responsible for a different segment of the data. An ensemble of asset allocation or liquidity forecasting models can be much more accurate as they are each optimized for different segments of the data, thus reducing the possibility of systematic errors in the model output.

The insights derived from Ayasdi's machine intelligence software can supplement portfolio managers' professional experiences, helping them create effective regime-based asset allocation strategies and more precise liquidity forecasting models.

### **DEEPER RISK INSIGHTS**

Accurately assessing a bank's risk exposure requires a deep understanding of the complex and dynamic interplay of a large number of market and macroeconomic variables and the ability to continuously incorporate these findings into models. Ayasdi's machine intelligence software draws on the power of

machine learning and TDA to rapidly analyze highly complex data sets and uncover relationships that drive more accurate and defensible risk models. The key to defining effective risk models involves identifying and incorporating the right combinations of variables that can serve as indicators of risk.

Ayasdi's software draws on innovations in topological data analysis (TDA) and machine learning to analyze thousands of variables simultaneously. It uses the shape of the data to reveal subtle patterns and relationships in highly complex data that signal risk. The software provides a simple visual way of finding and explaining the variables that characterize these uncovered patterns and relationships. For instance, it rapidly identifies combinations of factors that impact revenue streams. By incorporating these variables, firms can create more accurate operational risk models. "Citi's unmatched multinational business footprint creates a complex data analytics landscape. Ayasdi's big data technology simplifies and accelerates the analysis of thousands of discrete variables and delivers insights that enable Citi to tailor services to specific client needs, operate more efficiently, and mitigate risk."

Deborah Hopkins, Chief Innovation Officer, Citi

For example, following the 2008-09 financial collapse, the major banks are required to demonstrate each year to the Federal Reserve that they have adequate capital in reserve to withstand stressed economic and financial conditions. Referred to as the Comprehensive Capital Analysis and Review (CCAR) process, these tests put immense pressure on banks to create models that can accurately forecast revenues and

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the reserve required to absorb losses, for all their lines of business. Failure to pass has led to banks to restructure. Passing the test has put others on the road to doubling their share price.

Using conventional approaches machine learning techniques and spreadsheets to identify the key variables that impact revenue streams can be a highly iterative, time-consuming, and manually intensive process. As it is often a "black box" approach, it leaves business unit leads with little room and time to weigh in on the logic behind the choice of the variables selected for inclusion in the models – before they run out the clock on the stress tests. They cannot confidently defend the models that are included in the filings presented to the Federal Reserve.

Ayasdi's machine intelligence software can supplement a bank's capital planning process. The software is adept at correlating and analyzing thousands of market and macroeconomic variables to understand their impact on a business unit's revenue performance.



### Figure 4: Ayasdi Machine Intelligence surfaces variables that are highly correlated with revenue forecasts

It provides business leads with the ability to screen the identified variables prior to their inclusion in models that represent a particular business unit. The software also automatically conducts exhaustive statistical tests (including stationarity and multicollinearity tests) to validate the generated models' ability to predict revenues for the business units. It winnows down the numbers of models to a set of statistically valid models that best represent a particular unit. This new approach to identifying, validating, and selecting the variables and models ensures that business logic is built into the process and that a bank has accurate and defensible revenue forecast models that will stand up to the Federal Reserve's scrutiny.

### Summary

There is a tremendous opportunity for financial services firms to tap in to the massive amounts of client, product, and market-related data at their disposal and uncover previously hidden insights. This information can drive stronger customer relationships, improve asset allocation strategies, and mitigate risk.



Ayasdi's machine intelligence software combines innovations in machine learning and TDA to help firms analyze thousands of variables simultaneously. It leverages the shape of the data to surface subtle relationships in highly complex data, often hard to uncover using conventional analytical tools. Using Ayasdi's software, financial institutions can speed the development local, higher fidelity models that aid with client segmentation, asset allocation, and risk mitigation.

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## **ABOUT AYASDI**

Ayasdi is on a mission to make the world's complex data useful by automating and accelerating insight discovery. The company's Machine Intelligence software leverages Topological Data Analysis (TDA), to simplify the extraction of knowledge from even the most complex data sets confronting organizations today. Developed by Stanford computational mathematicians, Ayasdi's approach combines machine learning algorithms, abundant compute power and topological summaries to revolutionize the process for converting data into business impact. Ayasdi is funded by leading venture capitalists including Kleiner Perkins, Khosla Ventures, Institutional Venture Partners, Citi Ventures, and FLOODGATE. The company counts many of the Fortune 500 as clients.

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