



Whitepaper

SimulAIIt – Beyond Forecasting

Next Generation Predictive Analytics for *Decision Support*



SimulAIIt – From Forecasting to Decision Support

Over the last decade predictive analytics has played a vital role in supporting business strategy and Government policy. This technology is likely play a greater role in the future due to increasing digitization and availability of customer data; emerging analytical technologies; and the need for better decisions in a highly competitive, dynamic and complex national/global consumer environment.

The most predominant predictive analytics technologies that are currently used include mathematical and statistical approaches, e.g. linear regression which focused around the single task of producing demand forecasts. However, accurate *predictions* alone may not be sufficient to enable businesses to optimize strategic decisions. Businesses can obtain significant benefit from better understanding the impact that different strategies will have on customer behavior; the ability to test and forecast the effectiveness of different strategies (what-if scenarios) for a range of business problems (e.g. marketing, pricing, product uptake and retention, finance, capital planning, etc.); and determining how to best *influence* consumer/human decision making. By transitioning from *forecasting* tools to multi-purpose *decision support* tools, businesses can address a range of critical strategic problems, which enables greater control over future outcomes/demand, and ultimately leads to optimal strategic decisions and return on investment.

SimulAIIt (Simulait) is a new predictive analytics decision support tool that can assist business strategy and Government policy. This powerful tool emerged from the military sector and has been successfully applied to business and Government problems. SimulAIIt is based on *simulation and artificial intelligence* (agent-based modeling) technologies - hence the 'AI' in simulate. SimulAIIt is multi-purpose, and in addition to accurate forecasts, SimulAIIt can address a range of complex consumer business problems through what-if scenarios to test the impact and effectiveness of various strategic decisions.

In this whitepaper we provide an overview of why SimulAIIt is different to mathematical and statistical approaches, and how SimulAIIt's underlying micro-simulation technology provides a powerful multi-purpose decision support tool which has a demonstrated accuracy of over 95% in its forecasts.

Mathematical and Statistical Approaches: Forecasting

Mathematical and statistical approaches, such as linear regression, are top down approaches and work by using as inputs historical data (e.g. customer demand/sales data) and selected variables that are believed to impact on the data (e.g. weather). The algorithm then estimates the level of impact the variables have on the historical data to create a "model". The model can then be used to *extrapolate* the historical data to forecast the expected future outcomes based on variable assumptions (e.g. expected future weather).

There are various limitations of applying this approach to the complex (human-centric) consumer environment:

- Using the top down approach, aggregated variables are observed and reconstructed in a model – without consideration of how the behavior of individual consumers gives rise to the aggregated results.
- Similarly, limited context associated with the variables and observations may result in misleading variable relationships and inaccurate models.
- These approaches are not able to readily incorporate dynamic and non linear "human decision making factors and behaviors", that may be qualitative, obtained from a range of data sources such as market research or domain/expert knowledge. This limits the ability to analyze and address a range of business or policy problems (e.g. marketing, product uptake and retention) which require this level of representation in the model to run the what-if scenario.
- Creating a suitable model can be difficult when historical data may not a good predictor of future data.
- Similarly, a model may be unable to test new strategies, unique disruptive events, or new trends or factors that have not occurred in the past.
- Historical data is used to create the model - limiting the ability to validate the accuracy of the model using historical data.

SimulAIIt using agent-based modeling can address these limitations.

Agent-Based Modeling and SimulAIIt

The theory behind SimulAIIt and agent-based modeling can be described using ant behavior as an example. Ants exhibit what appears to be efficient, coordinated and adaptable behavior when collecting food to feed the colony. It would appear as though there were a central manager coordinating this complex task, however, this is not the case. The complex behavior of the ants is driven by each individual ant following three simple rules: i) when you see food pick it up; ii) then release a chemical trail for others to follow; and iii) follow any chemical trails you come across. Ants' individual behavior for collecting food therefore results in *emergent behavior* of the colony.

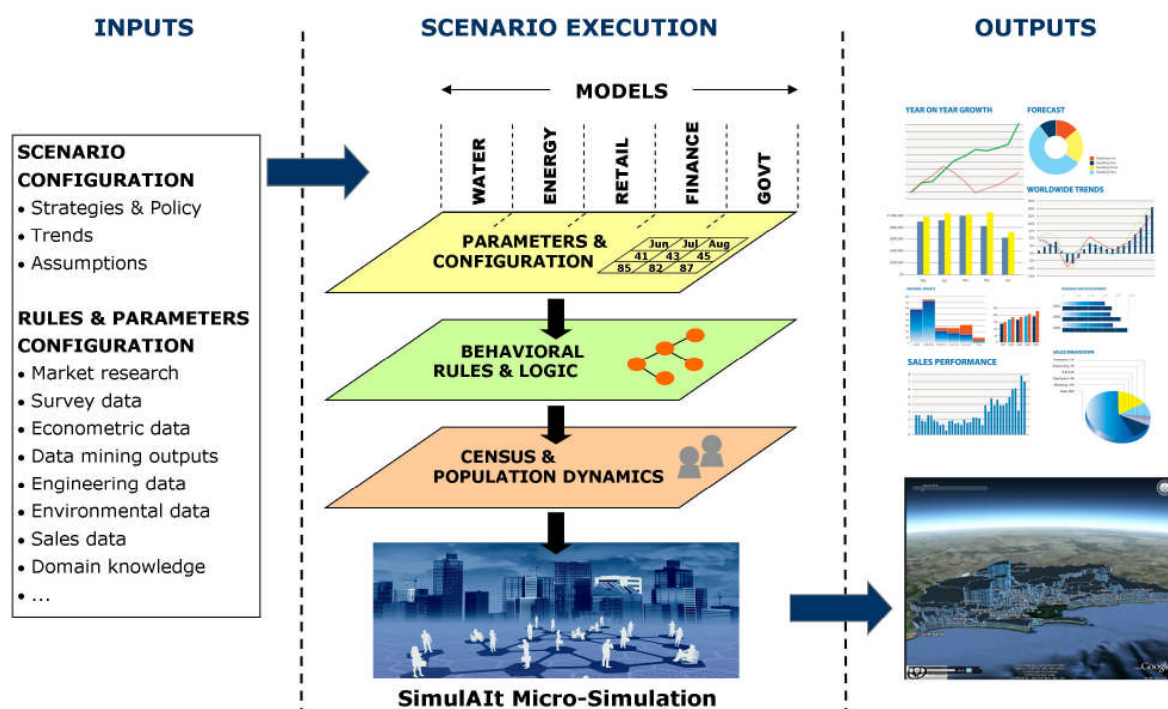
Not dissimilar to ants, consumers can also be considered as rule based, although the rules that describe consumers are unsurprisingly more complex. For example, if the weather is hot, most consumers will respond by turning on their air-conditioner, or go somewhere cool like the beach. These rules are largely driven by a consumer's demographic characteristics, situation, and preferences. Mass-consumer behavior can thus be described by the *emergent behavior* of millions of individual consumers making different decisions in response to different cues.

Agent-based modeling is a type of micro-simulation that provides a practical approach to model consumers. Agents are software components within a simulation environment that can represent consumers and their prescribed rules to mimic the decisions and behaviors of different consumers. Many agents can then be used to simulate millions of consumers in order to predict (emergent) mass-consumer behavior.

SimulAIIt is an agent-based micro-simulation platform developed by Intelligent Software Development. SimulAIIt uses a bottom up approach to developing models - where you *start with your customers*. SimulAIIt allows you to implement the rules that describe your customer's behavior: e.g. how they make decisions in different circumstances given different choices; how they interact or are exposed to communications; and how they respond to different strategies including policies, marketing, pricing, and competition. Different types of qualitative and quantitative data can be utilized to define the rules. This includes

market research and social data, demand and sales data, economic data, environmental and policy data, and more importantly expertise and domain knowledge that you may have of your customers. SimulAIIt comprises a human cognition reasoning engine and dynamic multi-dimensional database that enables the easy translation of complex and dynamic human decision making and system behavior from the real world into the SimulAIIt agents (which would be difficult, for example, with "two-dimensional" spreadsheets). Past experience shows that sufficient data is usually available from clients and in the public domain, and powerful models can be configured in a timely and cost-effective manner - requiring only weeks or months of effort for most business problems.

Once the high-level behaviors have been defined, SimulAIIt's integrated Census data and population dynamics allow the rules and behaviors to be extrapolated across varying population sizes. SimulAIIt can then simulate millions of individual consumers and their behaviors, and provide forecasts of different regions and over various timeframes.



SimulAIIt: Forecasting + Decision Support

SimulAIIt forecasts (*predictions*) have demonstrated a high level of accuracy. Modeling the underlying details and context behind consumer demographic characteristics and behavioral attributes empowers you with the ability to derive not only which variables are important contributors to (individual and collective) consumer outcomes, but *why* they are important. For example, saying that 10 of 15 consumers within a region are forecast to purchase a television next year is different to saying that 4 consumers will replace broken down televisions, 3 high income consumers will replace their existing television due to the release of a new television model, and 3 lower income consumers will replace their "aging" television due to a price reduction marketing campaign. This enables greater insight into which strategies impact on which decision variables and their significance, allowing you to better isolate and forecast the impact that different strategies have on consumers.

A unique feature of SimulAIIt is the ability to validate the models it generates. Validation can be conducted by "predicting forward from the past" and comparing simulated outputs to actual historical data. This is because the models are built from the bottom-up with detailed information about demographics and behavior, and do not explicitly use historical data. In this way, the accuracy of the model and the confidence in forecasts can be assessed.

The accuracy of SimulAIIt and the ability to rigorously validate models should not, however, be considered as the most important feature of the tool. Rather, the power of SimulAIIt is in its ability to address a broad range of business problems. The way the SimulAIIt model is constructed by representing the underlying factors, variables and rules that impact on consumers, enables the testing of strategies to *influence* consumer decisions and behavior through what-if scenarios. Allowing a greater number of strategies and variables to be tested, enables a greater range of business problems to be analyzed (e.g. marketing, pricing, product features and uptake, retention, etc.). Additionally, the detail and modeling the *why* of consumer decision making also enables the testing of new strategies, disruptive factors, or emerging trends that have not occurred in the past. Hence SimulAIIt provides a powerful accurate and multi-purpose *decision support* tool, rather than a just *forecasting* tool.

Want More Information?

Looking for case studies of what SimulAIIt has achieved for our clients?

Have some specific questions?

Want to know about SimulAIIt Online self-service web portal into SimulAIIt?

Want further information?

Email: info@IntelligentSoftware.com.au

Phone: +61 (0)8 8343 8455

Web: www.IntelligentSoftware.com.au

