Analytics in Action

SAS Analytics Insights Roadshow

7 June 2019 | Bangkok

Drive Business Evolution with Intelligent Risk Analytics

Sawadee Krup

Sheldon Goh

Regional Head of Risk Practice, SAS Risk Solutions, ASEAN

Nadharini Pinyosamosorn

Customer Advisory – Risk Solutions, SAS Thailand

Beyond BASEL III

BASEL IV

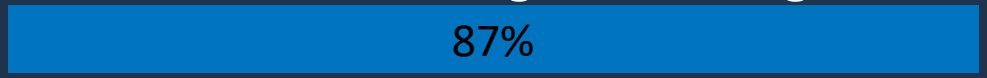
Credit Modelling with AI/ML

Stress Testing

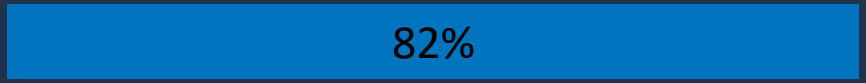
Model Risk?

ASEAN CRO Focus for 2019/20

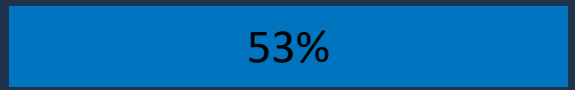
- Modernization for Digital Banking



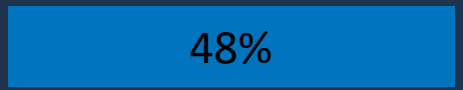
- Alternative Credit Models for the Unbanked



- BASEL IV



- Risk and Finance Integration



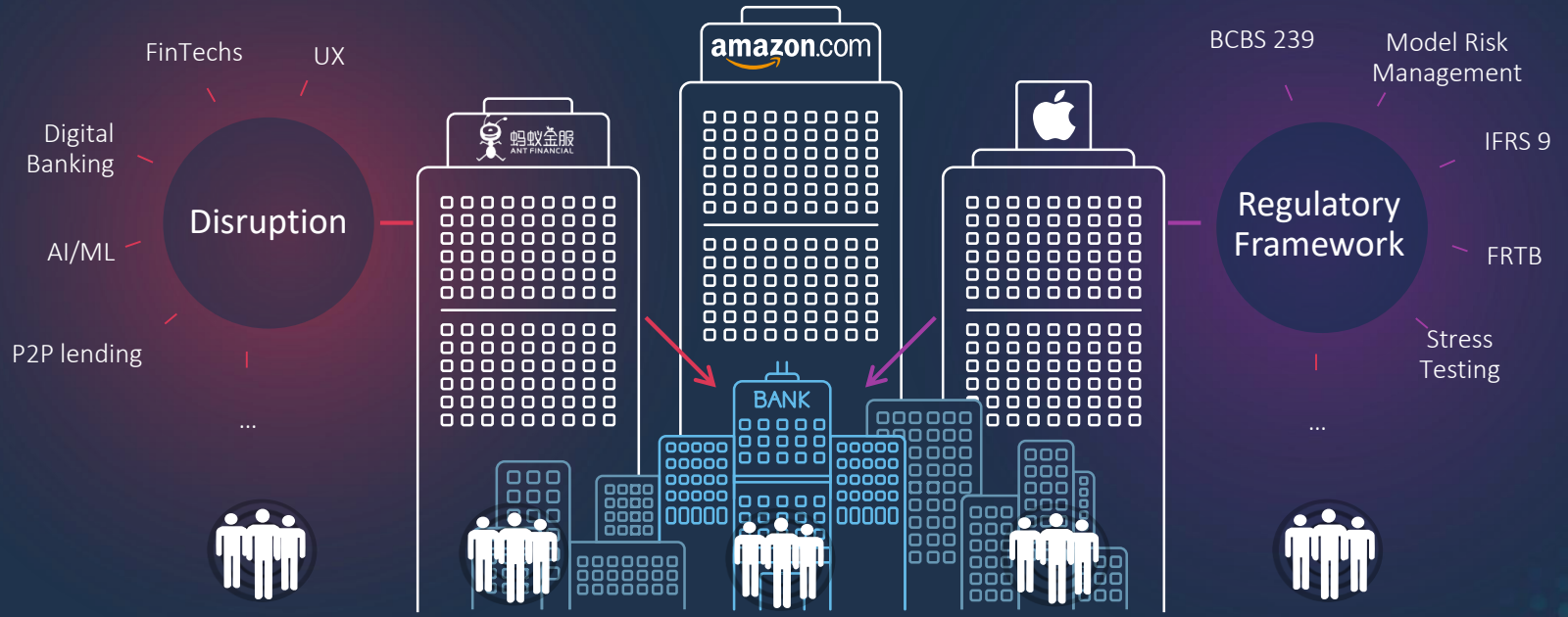
The New Age of Risk Analytics

The World is Changing...

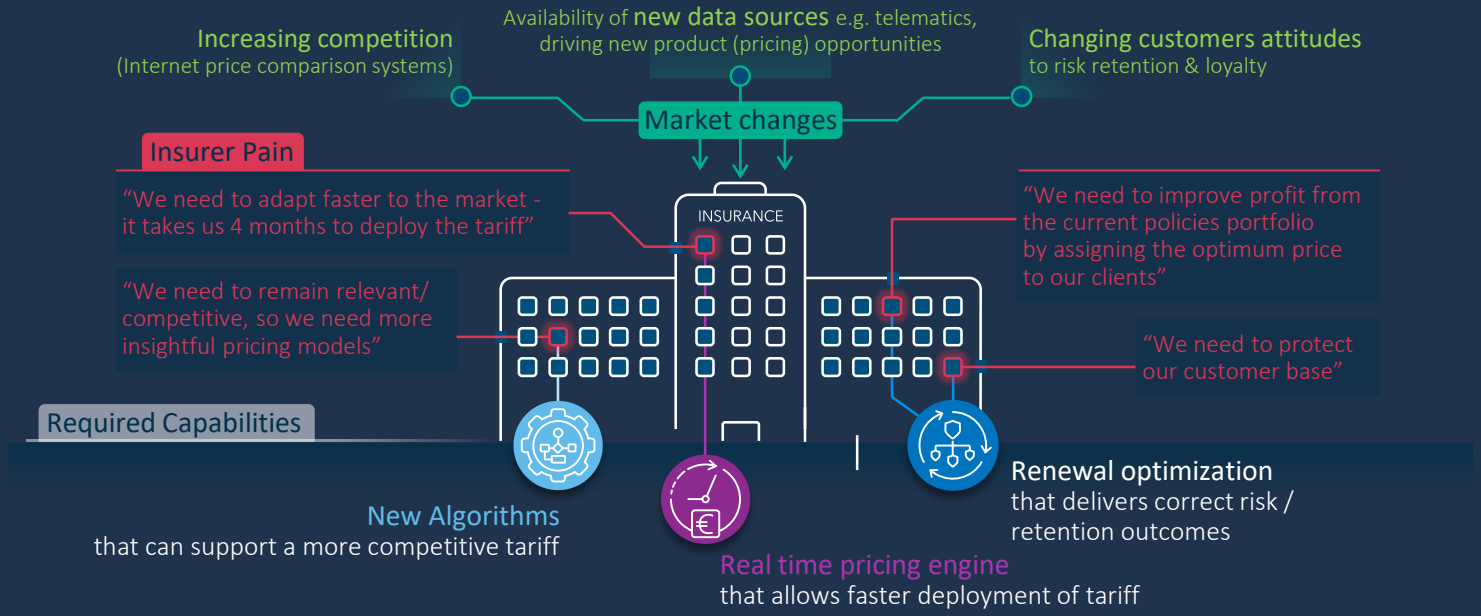
	2008	2018
INTERNET USERS	1,547m	3,578m
ACTIVE SOCIAL MEDIA USERS	< 900m	3,196m
UNIQUE MOBILE USERS	~ 600m	5,135m
CONSUMPTION DRIVING GENERATION	Baby Boomers & Generation X	Millennials & Generation Z

Sources: World Bank, Statista, We Are Social, Morgan Stanley Research

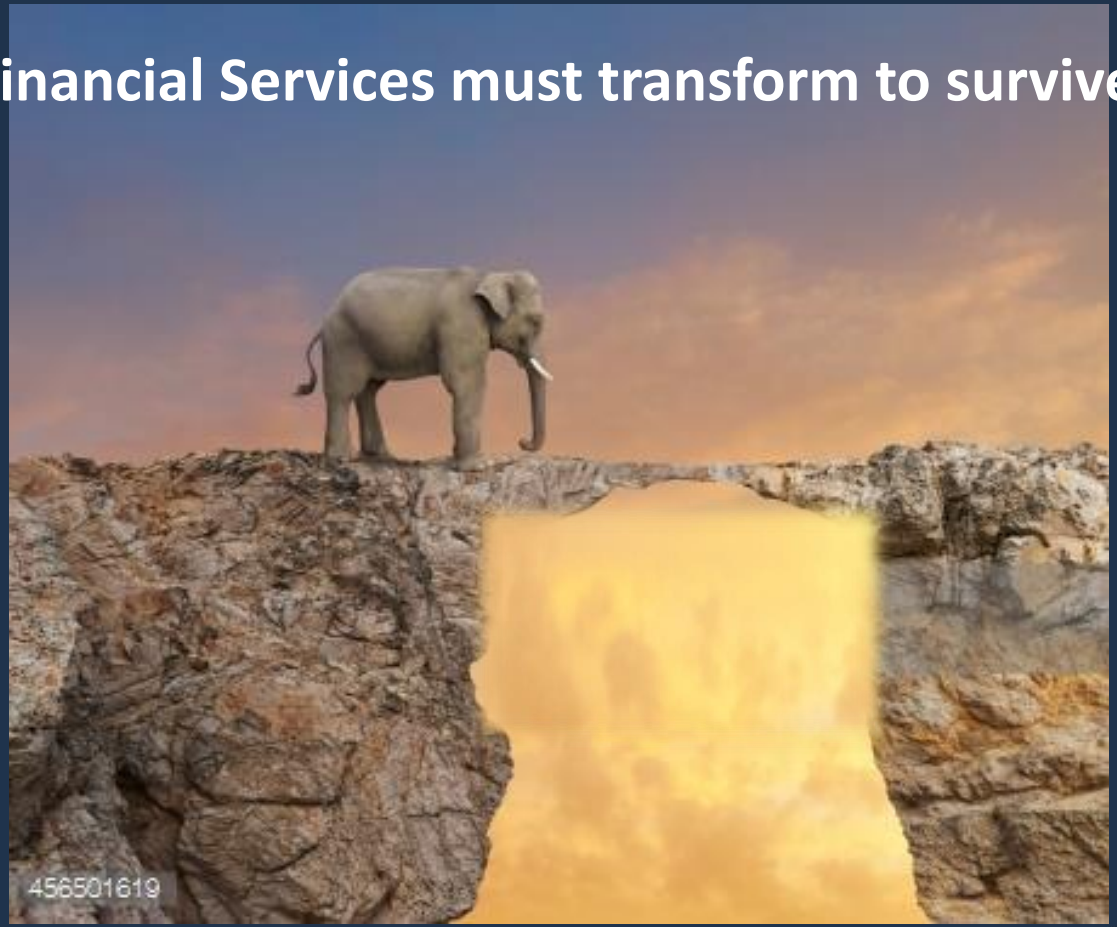
Financial Service are Affected



Challenges Insurers Face

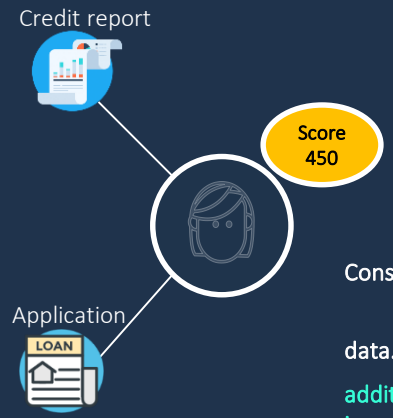


Financial Services must transform to survive



Behind Digital Transformation

Alternative data



Decisions are made on limited data.

3 in 5 [2]

Singaporeans **willing to share data** for cheaper banking products.

Consumers are open to sharing their credit data. **70%** [1] are willing to provide additional financial information to a lender if it increases their chance for approval or improves their interest rate for a mortgage or car loan.

Full picture of customer profile creates greater customer experience.

[1] – "The State of Alternative Credit Data" by Experian
[2] – https://asianbankingandfinance.net/banking-technology/news/3-in-5-singaporeans-willing-share-data-cheaper-banking-products

What is Artificial Intelligence?

- Artificial intelligence (AI) makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks.

- Using techniques such as machine learning and natural language processing, computers can be trained to accomplish specific tasks by processing large amounts of data and recognizing patterns in the data.

- AI has been an integral part of SAS software for years. Today we help customers in every industry capitalize on advancements in AI, and we'll continue embedding AI technologies in solutions across the SAS portfolio.

SAS and GARP Survey on AI in Risk Management

Over 2,000 risk and finance professionals from multiple regions, including United States, Canada, UK and EMEA, China, Hong Kong and Singapore, responded to the survey…

43.6 % of respondents said banking was their primary line of business.

27.4% of responses come from institutions that are $100 billion or greater.

35.7% of those surveyed identified as a team lead or management.

Can we add a bullet with institution size?

Source: SAS and GARP: The role of artificial intelligence in risk management survey

Analytics in Action

Current AI Adoption Strong and Growing

From data preparation to credit scoring, significant rates of AI adoption are evident

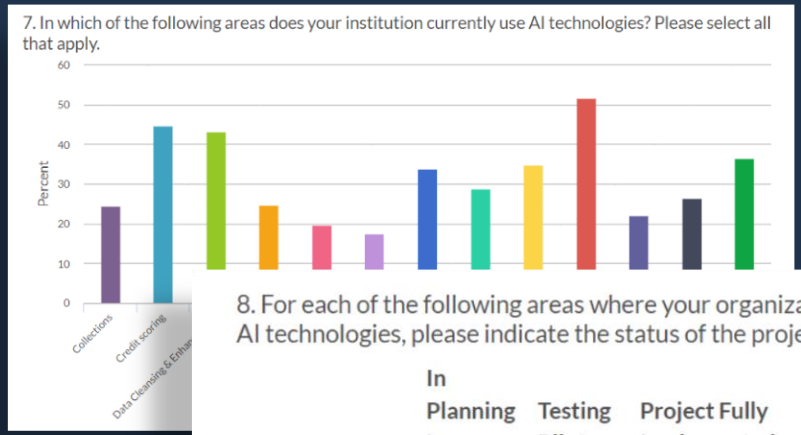
30 - 50% current use rate of AI in areas like credit scoring, data preparation, model calibration, model validation, and risk grading.

Widespread use of process automation - over **50%** of respondents.

55 - 75% are likely to adopt AI in broad range of risk areas within next three years, adding to the above list: regulatory reporting, loan approvals, collections, and loss provisioning.

Source: SAS and GARP: The role of artificial intelligence in risk management survey

Embedding AI in Business Problems



8. For each of the following areas where your organization is currently using AI technologies, please indicate the status of the project.

	In Planning In	Testing Pilot	Project Fully Implemented	Don't Know	Responses
Collections					
Count	77	90	121	56	344
Row %	22.4%	26.2%	35.2%	16.3%	
Credit scoring					
Count	131	187	254	62	634
Row %	20.7%	29.5%	40.1%	9.8%	

*The report shows that **44.6%** of risk organizations already use AI for credit scoring.*

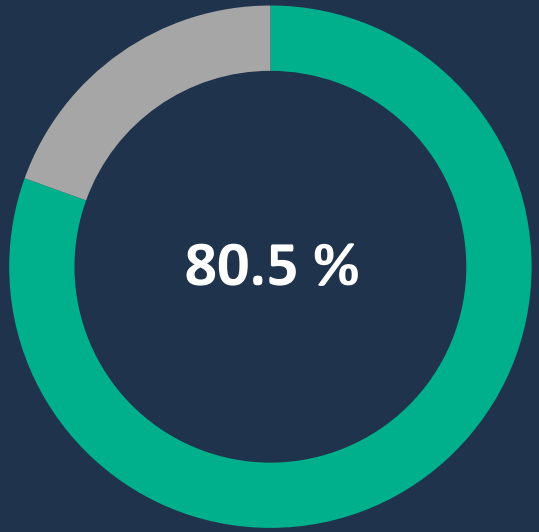
***40.1%** of respondents have said that the project is fully implemented, which constitutes the highest implementation rate among the areas surveyed.*

Realizing the Benefits of AI

Two key benefits have been identified:

- Process automation
  - Efficiency
  - Cost savings
  - Reduced human error

- Analytics advantage
  - Data access: new volumes and velocity, unstructured data, text, image, audio
  - Improved model accuracy
  - Faster model execution, model portability



Current adopters are seeing the benefits of AI.

Source: SAS and GARP: The role of artificial intelligence in risk management survey

The future of banking

Summary of McKinsey report:

Bank risk management will likely look dramatically different by 2025, when it has become a core part of banks' strategic planning, a close collaborator with business heads, and a center of excellence in analytics and de-biased decision making. Its ability to manage multiple risk types while preparing for new regulations and complying with current ones is expected to make it even more invaluable to financial institutions, and its role in creating fulfilling customer experiences will most probably transform it into a key contributor to banks' bottom lines. The risk function is also expected to become increasingly a differentiating factor among banks, helping to determine which ones succeed. However, the only risk functions that are likely to achieve this state are those that undertake a wholesale, ambitious transformation—and that start to do so now. For those that do, a wealth of potential value awaits.

Banking Industry Transformation – Key Drivers

Market

- Geopolitical changes (Brexit, Catalunya..)
- Macroeconomics (exceptionally low interest rates)
- Emerging technologies (Fintechs, Bigdata, IOT…)

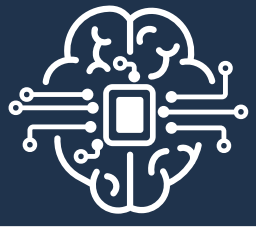
Regulatory

- Accounting standards (IFRS 9, CECL)
- Stress Testing (CCAR, DFAST, EBA, ICAAP, SREP)
- EBA Regulatory Reporting
- Basel Standards (Basel 3, Basel 4)
- Capital requirements for the trading book (FRTB)
- Model Governance & TRIM
- Anacredit

Business

- Cost reduction, efficiency, repeatability (industrialization)
- Digitization
- Leveraging risk investments for business

SAS Active Research: Artificial Intelligence and Machine Learning



The Approach

Applying artificial intelligence and machine learning to real-world business problems.

Example SAS Machine Learning Models and Algorithms

- Forest, Gradient Boosting
- Factorization Machine
- Support Vector Machine
- Robust PCA
- Support Vector Data Description
- Streaming Text Tokenization and Text Vectorization
- Streaming Receiver Operating Characteristic Information
- Streaming Image Processing
- Streaming K-Means
- Streaming DBSCAN
- Streaming Linear Regression

Potential Use Cases:

1. **Credit Lifecycle** – using ML/AI techniques in the credit lifecycle
2. **Model Calibration/Benchmark Models** – Using advanced analytics to update/calibrate models, especially large systems of models
3. **Automating Complex Processes** – Macro economic Forecasting, Automating CCAR , IFRS 9 processes
4. **Model Risk Management** – Incorporating advanced analytical models into traditional MRM frameworks.
5. **Model Transparency** – Interpreting advanced analytical models
6. **Risk Data Quality** – Improving data quality by employing advanced analytics beyond simple rule-based cleaning methods – detection and remediation

Operationalizing AI in Risk

Quick tips for using AI:

- Use tools that make AI models easy and encourage correct usage
- Build data science skills in existing risk talent
- Mitigate data science talent turn-over
- Develop processes for governance

- Where explain-ability issues persist, consider AI/ML models for challenger models or to assist the process rather than replace the production model

- Start with well-defined problems
- Make sure you have good quality data available

Credit Scoring & Modelling for Digital Banking

Key Challenges

Data

- Data availability
- Data quality
- Data regulations, such as the General Data Protection Regulation in EU (GDPR)

Model Interpretability

- The internal calculations of modern machine learning models often do not lend to human intuition
- Transparency of the model for compliance

Cost

- Cost to implement
- Time required before benefits are achieved

People

- Talent needed for AI
- Lack of understanding among key stakeholders
- Lack of commitment from business leaders

Technology

- Rapid pace of change in AI technology

Source: SAS and GARP: The role of artificial intelligence in risk management survey

Data Management

Addressing key data challenges is imperative for successful AI deployment:

- Data availability and quality
- Data security & privacy
- Bias in training data

Data Ingestion & Management

Automation & standardization of data generation & processing

Data Governance & Lineage

Flexibility in source, structure & frequency

Model Output

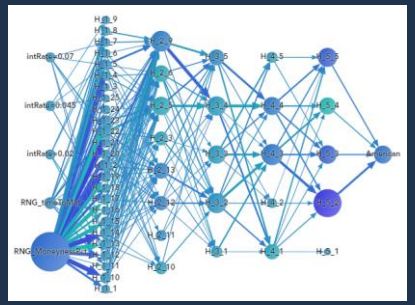
Validation, Benchmarking and Testing for unintended consequences

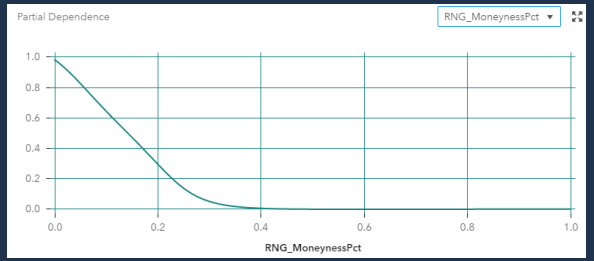
Feedback loop: potential to amplify bias

Model Interpretability

Understanding modern machine learning models:

- The internal calculations of modern machine learning models often do not lend to human intuition
- Common techniques to understand the models are:
  - Examining model outputs versus inputs (partial dependency, ICE)
  - Approximating model outputs with an easier model (LIME)
  - Additive variable importance (SHAP)





1. Credit Lifecycle

Score Card Development – using alternative data, feature engineering and AI/ML techniques to improve the lift in credit models.

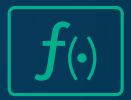
- Explainable AI/ML: provide explanations for decisions
- Better binning algorithms: use ML techniques to classify and bin variables.
- Use of deep learning/natural language processing with alternative data.

Collections Scoring – using supervised learning to predict the likelihood of moving further into delinquency, predict recovery amounts and personalize strategies.

Automated Decisioning and Strategies – auto-training and deploying of models used in decision strategies, helping to identify new ways to engage with customers.

2. Model Calibration and Acceleration/ Benchmark Models

Model Calibration – Calibrating complex modeling systems. Using ML techniques to re-calibrate individual atomic models used in a complex modeling framework like a Monte Carlo simulation model and testing impact on decisions.



Approximate Complex Non-Linear Functions & Stochastic Processes - Fit functions for hard-to-model assumptions like customer behavior. Approximate functions to replace computation intensive calculations, for example, a stochastic simulation.

Calibrate overrides to tune existing models – auto-adjustment of overrides of models.

Create benchmark models - using AI/ML techniques to challenge existing production models built with traditional techniques**.**

3. Automating Complex Processes

Robotic Process Automation – Potential for automating complex processes like CCAR using a combination of techniques from RPA. Perform anomaly detection on outputs produced by the CCAR process to detect issues.

Macro Economic Forecasting - Using AI/ML to generate macroeconomic scenarios that are AI generated and human validated.

- Use Random Forest Regression or other Machine Learning techniques for an alternative forecasting tool when little is known about the data.
- Generate scenarios automatically.

Using a combination of scenario generator and financial simulator to provide a planning toolkit that automates scenario generation and identify correlations with financial and risk metrics**.**

4. Model Risk Management

Using AI/ML to test model performance – use AI/ML algorithms to investigate standard performance metrics (Gini, KS, etc.) to predict model viability.

Building AI/ML governance best practices within the SAS MRM solution - using out of the box best practices to govern AI and ML models.

Applying AI/ML to MRM data points and external sources to auto score and auto document key performance metrics

- Use AI/ML to interrogate MRM data points and score key risk indicators. The same indicators would be scored by human validators. Differences would be feed back into the ML algorithm with intent to improve its ability to match human validator ratings.
- Generating regulatory documentation about models.

5. Model Transparency

Robust reporting and analysis with reason codes – Providing better transparency on outputs and decisions made by black box models.

Developing surrogate models – providing insights in significant variables used in black box models and for benchmarking purposes.

6. Risk Data Quality

Cognitive Data quality – Leveraging Cognitive Data Quality approaches to perform anomaly detection on model inputs and outputs, and perform auto adjustments.

Alternative data – Creating a data strategy in the risk solutions to make it easier for clients to use alternative data as a source for risk analysis/model development.

- Support for alternative data in Data Integration, and addition of alternative data to data models.

7. Risk Optimization

Auto-tuning risk parameters – Using Machine Learning algorithms to determine optimal parameters for complex calculations.

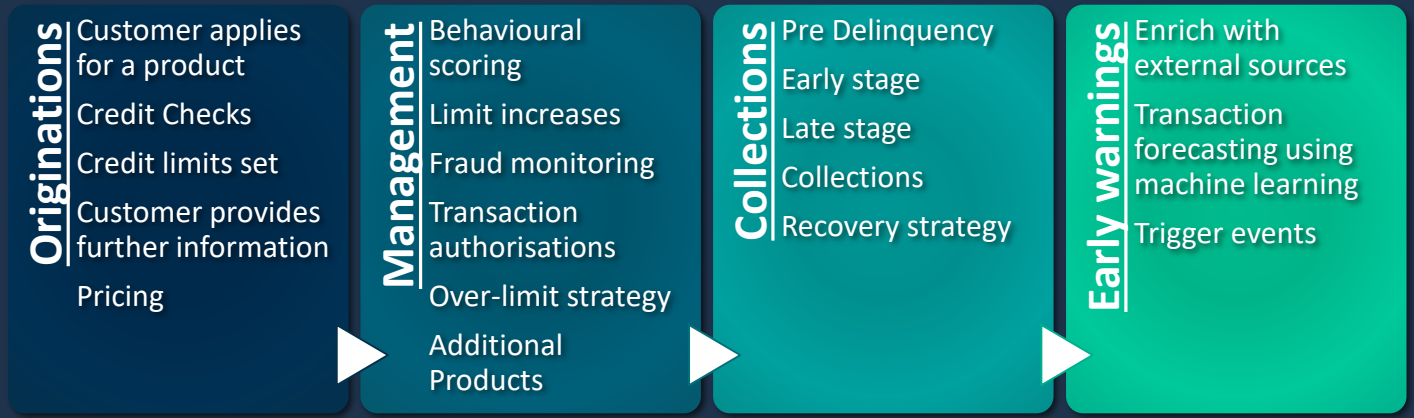
Liquidity optimization - Identifying drivers of liquidity components and improve expert-based forecasts using Machine Learning models.

Commodities Risk Analytics - Optimizing hedge positions for a given horizon and production expectation.

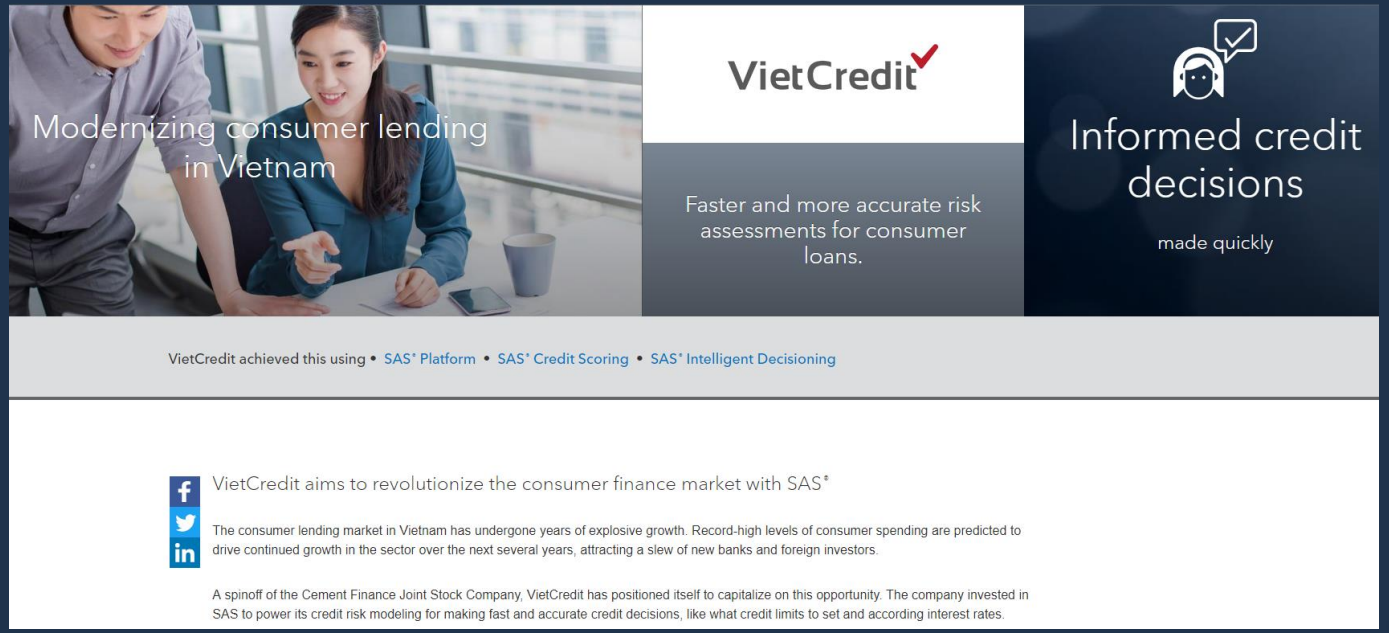
DECISIONS DECISIONS

Risk Decisioning

Types of Decisions



Building Right from Day 1



SAS Risk Analytics & Case Studies

The SAS Platform

Integrated data management, analytics and reporting

DATA QUALITY

DATA PREPARATION

Powerful, robust infrastructure

MODEL MANAGEMENT

INTILLIGENT DECISIONING

Open, sustainable and expandable technology

ARTIFICIAL INTELLIGENCE

MACHINE LEARNING

TEXT ANALYTICS

FORECASTING

REPORTING

VISUALIZATION

Best of 2 worlds: UI and Programming

	Data	Pre-Modeling	Modeling	Post-Modeling	Portfolio Optimisation	Real-time Decisioning
SAS Software	SAS Data Preparation	SAS Analytical Data Builder	SAS Visual Data Mining and Machine Learning	SAS Model Manager	SAS Optimization	SAS Intelligent Decisioning
Visual GUI 	✓	✓	✓	✓	✓	✓
Code 	✓	✓	✓	✓	✓	✓
sas Java python {REST} Lua R	CAS Actions & PROCS					CAS Actions & PROCS Macro-Facility

Transforming The World of Risk Analytics

SAS Risk Platform powered by AI/ML

Integrated data, AI/ML models, and reporting

Open, sustainable and expandable technology

Powerful, robust infrastructure

Flexibility and repeatability

Expected Credit Loss (IFRS 9/CECL)

Enterprise Stress Testing

Regulatory Risk Management

Model Risk Management

Risk Modelling & Decisioning

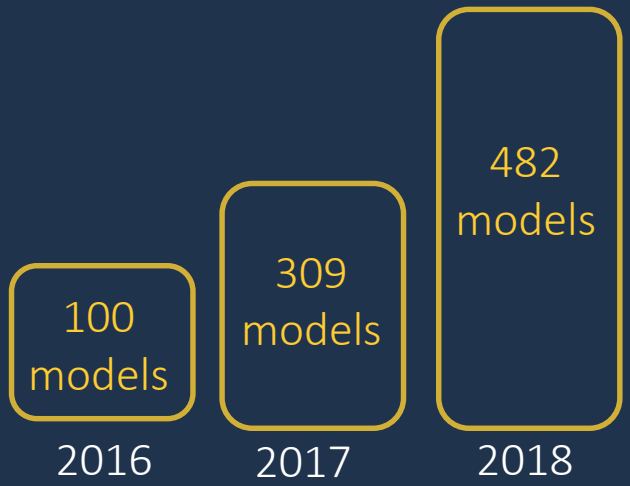
Insurance (Solvency/IFRS 17)

Case Study: Self Learning and Auto-Deployment of Models

The Approach

Efficiency improvements in the model development and deployment lifecycle

A large Brazilian bank with over $400 billion total assets.



- Problem Statement
  - Model development to deployment lifecycle took more than 1 year
- Bottom line
  - Machine Learning (>100 algorithms) at scale
  - Considers >80,000 input variables
  - Enabled the self-learning and self-deployment of models

Case Study: Advanced Machine Learning and Regulatory Compliance

The Approach

Differentiate with multisource data assets and machine learning, while conforming to FCRA & Reg B

A large organization providing data and services to banks in United States wanted to improve ultimate accuracy of income models and risk scores.

820,000,000 consumers
91,000,000 businesses

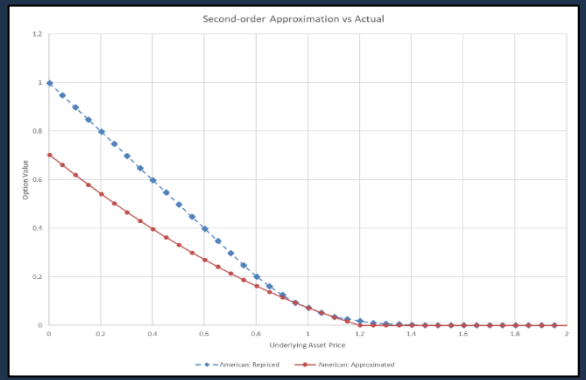
- The Methodology
  - Exclusive patent pending machine learning technology producing regulatory compliant neural networks for risk decisioning applications. Optimally constrained neural networks:
    - Improved performance and accuracy
    - Returns a risk score and reason codes
    - Interpretable to customers and regulators
    - Enables deeper learning of consumer behavior through complex non-linear attribute interactions
- Bottom line
  - For a portfolio bad rate of 9.5%, 1.3% more consumers are approved
  - Captures 3.3% more bad consumers in the bottom 20% of the population
  - Over 30% accuracy lift, scorable rate around 95% for income models

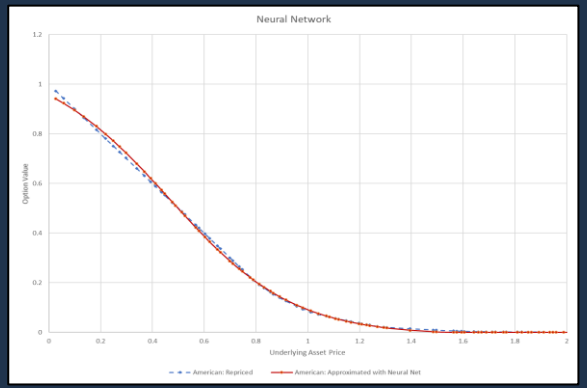
Case Study: Model Approximation

The Approach

Model approximation for on-demand stress testing and real-time risk calculations

- Problem Statement
  - Traditional methods often under-fit true valuation functions
- Bottom Line
  - Using good quality data and proxy models give superior results in terms of performance and accuracy





Case Study: Digitization of compliance processes

The Approach

Digitization of manual compliance checks of trade transactions

A large global bank digitizes over 25MM trade-related pages annually with optical character recognition (OCR).

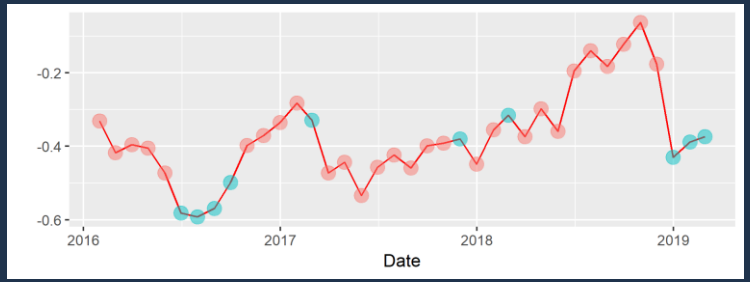
- Problem Statement
  - The bank had highly manual, resource and cost intensive processes for trade transaction compliance
- Bottom Line
  - By utilizing advanced analytics and natural language processing, they were able to better understand networks of related parties, unstructured data and customer activity over time
  - Processes that combine analytic results and trade related bank policies were automated to help focus on trade transactions activities that may need further investigation in accordance with the bank's escalation processes

Case Study: Liquidity Forecasting

The Approach

LCR & NSFR Component Forecasting & Variance Analysis

A large regional bank.



- Problem Statement
  - Identify drivers of liquidity components and improve expert-based forecasts using Machine Learning
- Bottom line
  - LCR & NSFR forecast with alerts
  - Funding required for the forecasted LCR & NSFR
  - Sensitivity test on forecasted LCR & NSFR
  - Back testing of forecasted results with actual and BAU forecasted results
  - Benchmark of forecasted results with competitor's results