Data Analytics:
Continuous Controls Monitoring &
Predictive Analytics

Parm Lalli, CISA, ACDA
Matt Osbeck, CPA, CIA, ACDA

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Professional consultancy with core competency in:
- Internal Audit – IT Audit – Regulatory Compliance – PCI
- Finance & Accounting – Interim CFO/Controller – Training

We have offices across the United States and Canada.

Sunera is the nation’s largest independent provider of technology risk consulting.

PCI Qualified Security Assessor and Approved Scanning Vendor (QSA & ASV).

Certified SAP integration partner with specific expertise in SAP security, GRC and controls.

The only authorized reseller of ACL products in North America, solidifying our reputation as a market leader in Continuous Controls Monitoring.

Delivered thousands of projects for hundreds of organizations across all major industries and sectors, Sunera is adept in servicing the Fortune 1000 but very adaptable to smaller organizations and government entities.

We deploy trained and certified professionals with appropriate oversight utilizing proven, pragmatic methodologies to ensure our teams deliver quality results.

We are solution orientated. Each project is tailored to your specific needs and our client-centric approach enables us to deploy teams that complement our clients’ internal capabilities.

We are known for completing projects that achieve anticipated benefits, on-time and within budget. Our rigorous project management discipline combined with our finance and IT capabilities enables us to successfully deliver a wide-range of projects.

Registered with NASBA to offer CPEs for our external Internal Audit and ACL training courses.
About Our Speakers

**Parm Lalli, CISA, ACDA**

Parm is an ACL Certified Data Analyst (ACDA) and is the National Director for our Data Analytics Practice. Parm has over 10 years of Data Analytics experience, leading many Continuous Controls Monitoring implementations for organizations within many different industries. Parm has worked very closely traditionally with ACL and ACL products.

Prior to joining Sunera, Parm was employed with ACL and worked with audit departments, business unit managers, and end users to address their Data Analytics needs by using ACL. He worked on developing scripts across many different industries and applications.

**Matt Osbeck, CPA, CIA, ACDA**

Matt is a Senior Manager in the Los Angeles office of Sunera LLC and is an ACL Certified Data Analyst (ACDA). Matt has over 5 years experience leading data analytics projects. Matt provides 3-day ACL/Arbutus training courses and serves as a lead analytic developer. Matt has vast experience developing analytics for multiple ERP systems, including SAP to test a broad range of IT and operational/financial controls. His experience as has included data analysis of Order-to-Cash, Procure-to-Pay, FCPA / ABAC, IT, Manufacturing, Payroll/HR, Forensic/Fraud and other ad-hoc analysis for clients across many industries.

Prior to joining Sunera, Matt held Internal Audit roles at Wal-Mart, Inc. and Informa plc., a London-based multi-national performing financial, operational and compliance audits.
Continuous Controls Monitoring (CCM) describes the techniques of continuously monitoring and auditing an IT system. Typically, CCM solutions will be applied to Enterprise Resource Planning systems. A Continuous Controls Monitoring solution can help to reduce compliance costs (through decreased manual controls and manual testing of those controls), strengthen a company's internal control environment, and reduce the risk of unintentional or intentional errors and fraud.

- The key objective of CCM is:
  - To enable **near real-time and regular monitoring of controls effectiveness**.

- By monitoring the compliance with key controls, **your organization can obtain** ongoing assurance on the accuracy and validity of large volumes of data flowing through your systems, enabling the isolation and containment of control failures on a timely basis.
A number of tools are available. The right choice will depend on each company’s business requirements and will include how well the proposed tool will integrate with existing systems and tools.

- ACL
- SAP or Oracle GRC
- Approva
- Oversight
- Actuate BIRT
- Actuate e.Reports
- Cognos 8 BI Report Studio
- Crystal Reports
- InformationBuilders WebFOCUS
- JasperServer/iReport
- Microsoft SQL Server Reporting Services
- MicroStrategy Report Services
- SAS Web Report Studio

Gartner February 2009: Critical Capabilities for Business Intelligence Reporting
**Reports / Summaries / Process Improvement:**
Summarizes the data for planning, reconciliation or sample selection.
**Examples:** Vendor Spend, Accounts Payable by Business Unit.

**Control Based:**
Clearly defined objectives that are more fact-based / black & white than the fraud & error based testing.
**Examples:** User Access, Employee Terminated in HR but Active in SAP, Authorization Limits

**Fraud / Error Based:**
Use fuzzy matching and advanced logic to identify potential fraud or errors or identify potential cash recoveries.
**Examples:** Duplicate Payments, Duplicate Expense Claims, T&E

**Predictive / Forecasting:**
Uses advanced algorithms to use inputs provided by the user to predict future events. Accounts for changes in weather and other special events that may have skewed comparative period results.
**Examples:** Sales Trends
10 Fortune 500 Organizations were involved
Identify Challenges faced by Organizations
Top Data Analytics tools used
- ACL
- Idea
- Arbutus
- Tableau
Group of 10 shared knowledge and agreed upon analytics
7 Recommendations made
CCM Documents Required

- **CCM Project Checklist**
  - This document is a complete Project Checklist of typical CCM project tasks and responsibilities

- **Data Analytic Tests**
  - This spreadsheet has standard analytics for many different business processes. Included are the purposes for each analytic

- **Requirements Document**
  - This is a document that outlines the requirements to carry out a CCM initiative for a specific business process. This document includes standard tests, the purpose of each test, frequency, parameters, and source data mapping.
CCM Documents Required

- **Application Guide**
  - This document is a guide on how to use this CCM application. It includes information on how to run tests manually and change parameters. It contains information about source data and how to re-run the process in case of failure.

- **Technical Guide**
  - This document is the technical guide required by IT to rebuild the server. It contains information on how to configure the server and its related components.
Types of Data Analytics

- **Ad Hoc Analysis**
  - Time consuming
  - Data typically supplied by IT
  - Up to 50% more budgeted time required
  - Difficult to repeat tests if not documented
  - Exploratory type analysis

- **Repeatable Analysis**
  - More skills required than Ad Hoc testing
  - Pre-defined scripts created to perform same tests over and over again
  - More consistent and can be run more frequently
  - Data may be supplied, but imports are automated
  - Good documentation for the scripts/analytics
Types of Data Analytics

- **Centralized Analysis**
  - Development, storing, and running of repeatable analytics is centralized
  - A single, powerful server is set up for the repeatable analytics
  - Data imports are all automated
  - Standards in place for developing tests and scripting
  - Source data and results are stored on server
  - Better security for data files and result files
  - Great deal of documentation on tests, scripts, data, and sample logic

- **Continuous Auditing**
  - Process of performing audit related tasks in a continuous manner
  - Continuous risk and control assessments types of testing
  - Compliance (SOX) control testing
  - Security even monitoring
Continuous Controls Monitoring (CCM)
- Very skilled and experienced individuals are able to script and implement
- All analytics and data imports are fully automated
- No interaction from end users required
- Allows for notifications to be sent to Business Unit Manager about identified exceptions
- May involve a web dashboard interface, workflow, remediation tracking, and heat maps
- Better role based security for reviewing results
- May provide management with areas for improvement with internal controls
- A better likelihood of identifying fraudulent activity
- Acts as a very good deterrent system
Benefits of Data Analytics

- Access data from many disparate sources
- Independent of the systems and people being audited
- 100% transaction coverage with unlimited file sizes
- Read-only data access to ensure the integrity of the data
- Audit trails are available to identify steps taken
- Scripting/batching capabilities to capture test logic (like macros)
- Very fast to run and produce results
- Easier to comply with the provisions of Section 404 of the Sarbanes-Oxley Act

- Close control loopholes before fraud escalates
- Quantifies the impact of fraud
- Cost-effective
- Acts as a deterrent
- Can be automated for continuous monitoring
- Provides focus based on risk and probability of fraud
- Direct pointers to critical evidence
- Support for regulatory compliance
- Logs for review and evidence
- Scalability – Build on what you need
- External Audit reliance
Validates effectiveness of internal controls
- Identifies occurrences of potential fraud
- Identifies transactional errors
- Identifies segregation of duties violations
- Identifies process deficiencies
- Utilizes a technology driven process
- Tests 100% of transactions as opposed to sampling
- Accesses data across disparate systems and geographies
- Provides prompt notification of control breakdowns
- Quantifies exposure of business risk
- Provides an auditable history of compliance tests and follow-up activities
- Enables better allocation of skilled audit/technical resources within the organization
What Are the Challenges

- Implementing change
- Changing culture for the organization
- Defining what CCM can accomplish
- Gathering large volumes of data in multiple applications
- Understanding data and processes
- Monitoring of manual controls
- Relying on reporting
- Implementing costs
- Integrating with multiple compliance frameworks and into the existing IT environments

HOW DO YOU MAXIMIZE YOUR INVESTMENT IN CCM?
Where to Apply Data Analytics

What controls are eligible for automated testing?

- Electronic data is available and accessible.
- Access to data through an automated process is possible.
- Rules can be documented or captured within test logic.
- Internal controls and Compliance controls are eligible.

What are the ideal conditions for automated testing?

- Large number of controls are in place.
- Large volumes of data are available.
- Multiple systems and data sources are available.
- Data is at multiple locations
- Fraudulent activities are caught prior to a transaction reaching the end of a process.
Data Analytics Steps for Mature Rollout

- **Steps for Implementing Continuous Controls Monitoring/Auditing**
  1. Vendor selection and product evaluation
  2. Assess controls
  3. Scope and design system requirements
  4. Data warehouse implementation
  5. Data access requirements definition
  6. Analytics script development
  7. Results verification and review
  8. Adjusting logic, parameters, and thresholds
  9. Rollout
Data Analytics Project Team

- **Project Team Skills**
  - Project Manager – Managers who organize and manage all resources to complete the implementation project within the defined scope, time, and cost
  - Business – Key owners of each business process to be monitored
  - Audit – Process and control experts to identify areas of risk and test design
  - IT – Key owners of the data and primary systems related to each of the processes
  - Technical – Specialized experts to build, configure, and implement the monitoring tools
Data Analytics — Sunera Approach

• **Step 1**
  – Review existing business process risk documentation
  – Review existing analytics for efficiency and effectiveness
  – Update existing analytics for full automation

• **Step 2**
  – Conduct additional reviews of business processes and identify risk areas
  – Identify opportunities for improving process through Data Analytics
  – Identify analytics opportunities within specific business processes
  – Identify and verify all compensating controls
Data Analytics — Sunera Approach

- **Step 3**
  - Add risk rating for identified analytics across business units
    - High, Medium, Low
  - Quantify risk areas based on business units ($$)
  - Obtain management agreement on ratings and quantitative measures

- **Step 4**
  - Create requirements documentation
    - Data requirements from all available sources
    - Confirm test logic
    - Confirm required parameters
    - Confirm reporting fields
  - Obtain agreement and sign off on requirements document
Data Analytics — Sunera Approach

- **Step 5**
  - Obtain sample data from all required sources
    - Directly or data dump
  - Verify data based on requirements document
    - All fields present
    - No corruption of data
  - Perform data preparation

- **Step 6**
  - Create scripts for tests
  - Create Excel result sets
  - Have end user and/or business unit manager verify results
  - Tweak any tests to remove false positives
Step 7
- Create scheduling for all tests
  - Daily, weekly, monthly, quarterly
- Move all pieces into production environment
- Verify data connections/feeds

Step 8
- Create documentation for handoff
- Provide training to CCM stakeholders
A Mature Data Analytics Overview

- Self-contained on dedicated server
- Fully automated and scheduled
- Alerts to business unit managers or stakeholders of results
- Clear and concise documentation
  - For all scripted analytics
  - For setup and configuration
- Training provided to any and all individuals involved, including new hires
- Ongoing review of existing analytics and possible new analytics based on new business processes
- Maintain a change log for any addition or removal of scripts or changes to configuration
Data Analytics Examples

Reports / Summaries
- Major Casino –
  - Pit Boss Comps
  - Credit Card Reporting Reconciliations
  - System vs Direct Report Comparison
- Global Shared Service Center – Top 10 Vendors
- CRM Data Migration – Detailed Exception Reports

Control Based
- SOX Controls – IT GCs
  - Leavers, Access Rights, System Settings
  - Segregation of Duties
- Compliance (AML, HIPAA, FCPA)
- Policy & Procedures
  - Black Car Ride Example
  - Large Fast Food Corp – T&E Audit

Fraud / Error Based
- Major Corporation - Waste & Abuse
  - Adult Entertainment – MCC Analysis
  - Double Dip – Mileage + Gas
  - Split Requisitions to circumvent appr. Limits
  - Dupe Expense (Cash + Credit)
  - Payroll to diff EE’s (same bank/ address)

Predictive / Forecasting (NEW)
- NEW Hot Topic
- Rebate Estimation
- Executive Dashboard Estimates
- Recent Algorithm Developed by Sunera
Data Analytics Examples

- Purchasing
  - Purchase splitting
- Purchase cards
  - Inappropriate, unauthorized purchases
- Travel & Entertainment Expenses
  - Duplicate claims, inappropriate activity
  - Adult bars using MCC and description
- Payroll
  - Phantom employees
  - SSN Test
Accounts Payable

- Questionable invoices
  - Invoices without a valid P.O.
  - Sequential invoices
  - Vendor Invoice Formats

- Duplicate invoices
  - Multiple invoices for same item description
  - Invoices for same amount on the same date
  - Multiple invoices for same P.O. and date

- Vendors
  - Phantom vendors
    - PO BOX Test
  - Vendor/Employee collusion
  - One time Vendors or Vendors not used in over a year
Purchasing

- Questionable purchases
  - P.O./invoices with amount paid > amount received
  - Purchases of consumer items
- Split purchases
  - Similar transactions for same vendor within specific timeframe
- Inflated prices
  - Compare prices to standard price lists or to historical prices
Purchase Cards

- Split purchases to avoid purchasing card limits
  - Purchases processed as two or more separate transactions
  - Identified by isolating purchases from specific vendors within short periods of time

- Favored vendors for kickbacks
  - Trend analysis to compare current transaction volumes to previous time period

- Suspicious purchases
  - Transactions that occur on weekends, holidays, or vacations
  - Travel related charges not on travel expenditure reports
Time and Expense

- Duplicate claims
  - Submitting claims twice
- Tracking “no receipt” claims
  - Isolate expenses without receipts and identify underlying trends through profiling techniques
- Threshold reviews
  - Track personnel exceeding thresholds
- Inappropriate activity
  - Compare expenses to travel records to ensure expenses claimed for valid trips
- Trends by employee compared to peers
- Fuel vs Mileage claims
  - Fuel purchase location vs Branch location
Data Analytics Sample Logic

- **Duplicates**
  - Exact Duplicate – All fields identical within investigation period
  - Almost Duplicate Variance, Same-Different Duplicates
    - Purchase Order: Same Vendor and Similar Amount
    - Payments: Different Vendor Same Bank Account
    - Payments: Same Vendor Different Invoice Number Similar Amount
    - Payments: Same Vendor Same Invoice, Same Amount, Different Date
    - Payments: Same Vendor Name, Same Amount, Same Date, Different Vendor ID
Authorization Limits
- Single and multiple accumulated values exceeding limits
- Transaction amounts that exceed or are just below the authorization limit
  - Requisitions, Purchase Orders, Invoices, Payments
- Accumulated transaction amounts that exceed the authorization limit
  - Split Requisitions, Split Purchase Orders, Split Invoices, Split Payments

Aging
- Single Record Age
  - Days difference between Create Date and Approval Date
  - Stale Requisitions, Stale Purchase Orders, Stale Invoices
- Multiple Files Aging
  - Retroactive PO vs. Invoice (Invoice Create Date prior to PO Create Date)
Data Analytics Sample Logic

- **Data Quality**
  - Identifying fields where critical data elements deviate from expected values and formats
    - Invalid ID formats, missing key values, invalid characters, invalid values
    - Requisitions, Purchase Orders, Invoices, Received Goods, Payments

- **Segregation of Duties**
  - SOD Security Table Level
    - Comparing roles within ERP security tables to a conflict matrix
  - SOD at Transaction Level
    - Single Record Create/Modify vs. Approve
      - Requisitions, Purchase Orders, Invoices, Payments
    - Multiple files
      - Create/Modify PO vs. Create/Modify/Approve Vendor Master Update
      - Create/Modify PO vs. Receiver ID for Goods Received
      - Create/Modify PO vs. Create/Modify Invoice
**Numeric Pattern Matching**

- Benford digital analysis: exceptions which reveal themselves as digital anomalies.
  - Higher than expected PO amount of $49,000, bypassing controls on amounts over $50,000.
- Numeric Sequence or Gaps: exceptions which reveal themselves in a numeric sequence or gap.
  - Invoice Number Sequences (suspect invoices)
- Transactions with even dollar amounts based on a divisor number, minimum transaction count, and threshold value.
  - Expense Report Amounts with even dollar values
String Pattern Matching

- Name Match (% word match)
  - Word exclusion lists to remove common words like: The, company, and, etc.
  - Invoice: Employee Vendor Name Match – (Phantom Vendor)
  - Invoice: Prohibited Vendors

- Address Match (Numeric or Alpha Numeric match)
  - Match on zip/postal code plus numeric digits from address field.
  - Match on alpha-numeric values from the address field (no spaces or special characters)
  - Invoice: Employee Vendor Address Match – (Phantom Vendor)

- Soundslike Match (phonetic match)
  - SOUNDEX algorithm
  - SOUNDSLIKE algorithm
  - Payroll: similar employee names
  - T&E: Different expense cards assigned to employees with similar names
Transition CCM into Predictive Analytics
**Reports / Summaries / Process Improvement:**
Summarizes the data for planning, reconciliation or sample selection.
**Examples:** Vendor Spend, Accounts Payable by Business Unit.

**Control Based:**
Clearly defined objectives that are more fact-based / black & white than the fraud & error based testing.
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**Predictive / Forecasting:**
Uses advanced algorithms to use inputs provided by the user to predict future events. Accounts for changes in weather and other special events that may have skewed comparative period results.
**Examples:** Sales Trends, Risk Indicators, Rebate Estimation
Predictive Analytics Defined

Predictive Analytics…

“…is business intelligence technology that produces a predictive score for each customer or other organizational element. Assigning these predictive scores is the job of a predictive model which has, in turn, been trained over your data, learning from the experience of your organization.”

Source: Predictive Analytics World

“..encompasses a variety of techniques from statistics, modeling, machine learning, and data mining that analyze current and historical facts to make predictions about future or otherwise unknown events.

In business, predictive models exploit patterns found in historical and transactional data to identify risks and opportunities. Models capture relationships among many factors to allow assessment of risk or potential associated with a particular set of conditions guiding decision making for candidate transactions.

Predictive analytics is used in actuarial science, marketing, financial services, insurance, telecommunications, retail, travel, healthcare, pharmaceuticals and other fields.”

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Why is Predictive Analytics Important?

- Enable forecasting by allowing organizations to learn from data based on historical trends
- Provide insight of what’s expected to happen based on data populations
- Allow management determine growth potential
- Gain a competitive advantage
There are a wide variety of tools that specialize in or offer the ability to develop predictive analytics, including but not limited to:
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### Predictive Analytic Uses

<table>
<thead>
<tr>
<th>Area</th>
<th>Prediction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit Scores</td>
<td>Based on many criteria, several agencies have an entire business based on predicting how much risk you present to others in defaulting on your debt.</td>
</tr>
<tr>
<td>Fraud</td>
<td>Identify control weaknesses that may lead to fraud or estimate the amount of theft (shrink) in retail stores around given demographics.</td>
</tr>
<tr>
<td>Marketing &amp; Sales</td>
<td>Predicting sales based on varied pricing and product models.</td>
</tr>
<tr>
<td>Security Risk Indicators</td>
<td>Predicting vulnerability to external threats that may impact the organization</td>
</tr>
<tr>
<td>(KRIs)</td>
<td></td>
</tr>
<tr>
<td>Customer Retention &amp;</td>
<td>Use demographic / socio-economic information about customers to determine their likelihood to remain a customer and how much they will spend over their lifetime (Large Retailer).</td>
</tr>
<tr>
<td>Turnover Rates</td>
<td></td>
</tr>
<tr>
<td>Inventory / Production</td>
<td>Forecast the timing of orders and production at the customer level and seasonality level (not just sales).</td>
</tr>
</tbody>
</table>
## Real world uses of Predictive Analytics

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>DESCRIPTION</th>
<th>EXEMPLARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply chain</td>
<td>Simulate and optimize supply chain flows; reduce inventory and stock-outs.</td>
<td>Dell, Wal-Mart, Amazon</td>
</tr>
<tr>
<td>Customer selection, loyalty,</td>
<td>Identify customers with the greatest profit potential; increase likelihood</td>
<td>Harrah’s, Capital One, Barclays</td>
</tr>
<tr>
<td>and service</td>
<td>that they will want the product or service offering; retain their loyalty.</td>
<td></td>
</tr>
<tr>
<td>Pricing</td>
<td>Identify the price that will maximize yield, or profit.</td>
<td>Progressive, Marriott</td>
</tr>
<tr>
<td>Human capital</td>
<td>Select the best employees for particular tasks or jobs, at particular</td>
<td>New England Patriots,</td>
</tr>
<tr>
<td></td>
<td>compensation levels.</td>
<td>Oakland A’s, Boston Red Sox</td>
</tr>
<tr>
<td>Product and service quality</td>
<td>Detect quality problems early and minimize them.</td>
<td>Honda, Intel</td>
</tr>
<tr>
<td>Financial performance</td>
<td>Better understand the drivers of financial performance and the effects of</td>
<td>MCI, Verizon</td>
</tr>
<tr>
<td></td>
<td>nonfinancial factors.</td>
<td></td>
</tr>
<tr>
<td>Research and development</td>
<td>Improve quality, efficacy, and, where applicable, safety of products and</td>
<td>Novartis, Amazon, Yahoo</td>
</tr>
<tr>
<td></td>
<td>services.</td>
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Fact based on your search

Predictions based on Others

Amazon Example of Predictive Analytics
Kayak Example of Predictive Analytics

- Recommendations on historic trends
Target knows when you are pregnant!

- Target assigns each customer an ID based on credit card number and other details.
- Then compares purchases made by that person and with a purchasing pattern of pregnant women.
- **Example:** One high school girl was purchasing products that indicated she was pregnant (high pregnancy score based on the Target fact pattern). Target sent coupons to her house (which happened to be her parents) for diapers, etc. The dad was appalled that someone would send diaper coupons to a high school girl. Dad then drove to target and demanded to speak with a manager. Later he apologized to the manager after speaking with his daughter, and found out there are some things going on in his house that Target knew but he did not.
1. Identify the **Objective**
   - Web search example would be to find the actual page you want to read based on the query submitted

2. Figure out what **Levers** you have to pull
   - Levers would be things that you can change yourself. Lever Google pulled is the ordering of sites

3. What **Data** we have and can connect that hooks up those levers with the outcome we want
   - Data on website tells us people that like website X will also like Y

4. **Hook** together the Levers to the objectives using the data.

   ➢ This is how Google was built
Other Examples

- **Pandora**
  - Automatically plays music based on music you like / select

- **Netflix**
  - Selects movies/TV Shows you might like based on what you recently watched.

- **Internet Ad Placements**
  - These are now highly targeted based on things you have searched for.

- **Apple**
  - Calculate production numbers of their products based on past sales
Predictive Analytics Models

- **Predictive Models**
  - models of the relation between the specific performance of a unit in a sample and one or more known attributes or features of the unit.
  - objective of the model is to assess the likelihood that a similar unit in a different sample will exhibit the specific performance

- **Descriptive Models**
  - models quantify relationships in data in a way that is often used to classify customers or prospects into groups
  - models identify many different relationships between customers or products

- **Decision Models**
  - Models describe the relationship between all the elements of a decision
  - generally used to develop decision logic or a set of business rules that will produce the desired action for every customer or circumstance.
Regression

- The difference between regression and descriptive is that regression deals with numerical/continuous target attributes, whereas descriptive deals with discrete/categorical target attributes.

- I.e. if the target attribute contains continuous (floating-point) values, a regression technique is required. If the target attribute contains categorical (string or discrete integer) values, a classification technique is called for.
Predictive Analytic Techniques

- **Regression**
  - Most commonly used for Predictive Analytics
  - Uses mathematical equation as a model to represent the interactions between the different variables in consideration

- **Machine Learning**
  - originally employed to develop techniques to enable computers to learn (Artificial Intelligence)
  - techniques emulate human cognition and learn from training examples to predict future events
## Types of Regression Analysis

<table>
<thead>
<tr>
<th>Regression Types and Their Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear</strong></td>
</tr>
<tr>
<td><strong>Partial and Stepwise</strong></td>
</tr>
<tr>
<td><strong>Logit or Probit</strong></td>
</tr>
<tr>
<td><strong>Regression Splines</strong></td>
</tr>
</tbody>
</table>
Regression Basics

- Explain relationships between variables by examining the entire populations. However, you are only drawing data from your segment of the population (i.e. your population of customers is not the entire population across the industry/product segment). To ensure the best results:
  - Build the best model of the “TRUE” relationships between variables.
  - Analyze confidence in the model (mathematical description of its accuracy)
Regression (con’t)

• The most common form of regression is **linear regression**, in which a line that best fits the data is calculated, that is, the line that minimizes the average distance of all the points from the line.

• This line becomes a predictive model when the value of the dependent variable is not known; its value is predicted by the point on the line that corresponds to the values of the independent variables for that record.
Regression (con’t)

- **Time Series** - models are used for predicting or forecasting the future behavior of variables.

- Account for the fact that data points taken over time may have an internal structure that should be accounted for ie. Trends
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Phase 1: Identify Internal & External Variables

Phase 2: Determine Data Sources

Phase 3: Develop & Run Analytics

Phase 4: Remove False Positives

Phase 5: Implement Analytics

Phase 6: Monitor Progress
Gift Card Case Study

- Developed at global multi-billion dollar restaurant company with many different brands
- Goal: Calculate Breakage (Unredeemed Gift Cards) Revenue & Revenue flows to the organization.
- Factors Impacting Gift Card Sales /Redemptions:
  - External Variable(s):
    - Economy
  - Internal Variable(s):
    - Seasonal Sales and Promotions
    - Brand Selling the Card
    - Sales Channel vs In-Store
- Results:
  - Level of cross-redemption of branded cards
  - GAAP based rationale for Breakage Revenue
  - FP&A Forecast of Gift Card Sales, Redemptions, Breakage under multiple scenarios (Automated)
This image is a poll’s place holder. Enter slide show mode (F5) to view your live poll.

You can resize this image to resize where your poll will load in slide show mode.

Make sure you’ve installed the PollEv Presenter app (pollev.com/app) and are connected to the internet!

If you need to duplicate this poll make sure to copy/paste the entire slide (not just the place holder image).
Data Analytics Rollout Options

- **Insource**
  - Internal resources plan and deploy all CCM initiatives

- **Outsource**
  - Sunera resources (or other provider) perform all the activities required for CCM rollout
  - Provide documentation and training to client staff for maintenance of the program

- **Co-source**
  - Sunera (or other provider) provides the knowledge and expertise and works with client staff
  - Shares the work of developing and creating tests
  - Provides guidance
  - Performs reviews of client work conducted and provide feedback/insight
  - Conducts coaching sessions
  - Provides ongoing support and advice
Sunera Training Offers:

- **2 or 3 day training classes**
  - Training is hands-on and classes are tailored to meets your participants’ skill levels (beginner, intermediate, advanced).
  - We customize the training by integrating your company’s data into the seminar, so your employees get to work with realistic company scenarios.
  - Sunera is registered with the National Association of State Boards of Accountancy (NASB) as a sponsor of continuing professional education on the National Registry of CPE sponsors and offers CPE credits to those who attend and completed the training.
  - Training is provided by a Sunera Director or Principal Level Associate with multiple years and project experience using ACL.
  - We are planning on offering a training course in Calgary in October pending sufficient interest.
  - Training (classroom instruction) can be provided to organizations directly.
For additional information on Sunera’s services, visit our website at www.sunera.com or contact:

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