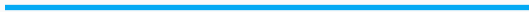




Doctor 360

With **EXACT
SCIENCES**



Today's speakers

**EXACT
SCIENCES**



Sharat Endapally

DATA ENGINEERING MANAGER
GRAPH & ANALYTICS

✉ sendapally@exactsciences.com

 **expero**



Scott Heath

GRAPH & ANALYTICS

✉ scott.heath@expero.com



Topics

Customer Focus :
Exact Sciences Doctor C360

EXACT SCIENCES & CHALLENGES

Why Change? Detail of Exact Sciences Use Case
(Sharat Endapally - 20 min)

GRAPH & ML - INCREASED VISIBILITY, & OPTIMIZATION

Demos Doctor C360 Application and Use Cases
Increase accuracy, real time graph algorithms for better outcomes
(Scott Heath - 20 min)

Q&A

(10 Min)



CANCER IS DETECTED TOO LATE

Exact Sciences is changing the way we think about detecting and treating cancer. As a leader in cancer testing, we are committed to providing earlier answers and life-changing treatment guidance.

→ [LEARN MORE](#)

PROVIDING EARLIER, SMARTER ANSWERS

We understand the role we play in the fight against cancer. From earlier cancer detection through treatment guidance and monitoring, we're working to enable patients and providers to take action sooner—when it matters most.

→ [LEARN MORE](#)



EXACT SCIENCES

Who is Exact Sciences?

A leading provider of cancer screening and diagnostic tests, Exact Sciences relentlessly pursues smarter solutions providing the clarity to take life-changing action, earlier. Building on the success of Cologuard and Oncotype DX, Exact Sciences is investing in its product pipeline to take on some of the deadliest cancers and improve patient care. Exact Sciences unites visionary collaborators to help advance the fight against cancer.



Customer 360 Use Case - Physician

Disclaimer :

The statements and opinions that I am going to share with you today are my own and do not necessarily represent the positions of my employer Exact Sciences or any of its affiliates.



Sharat Endapally

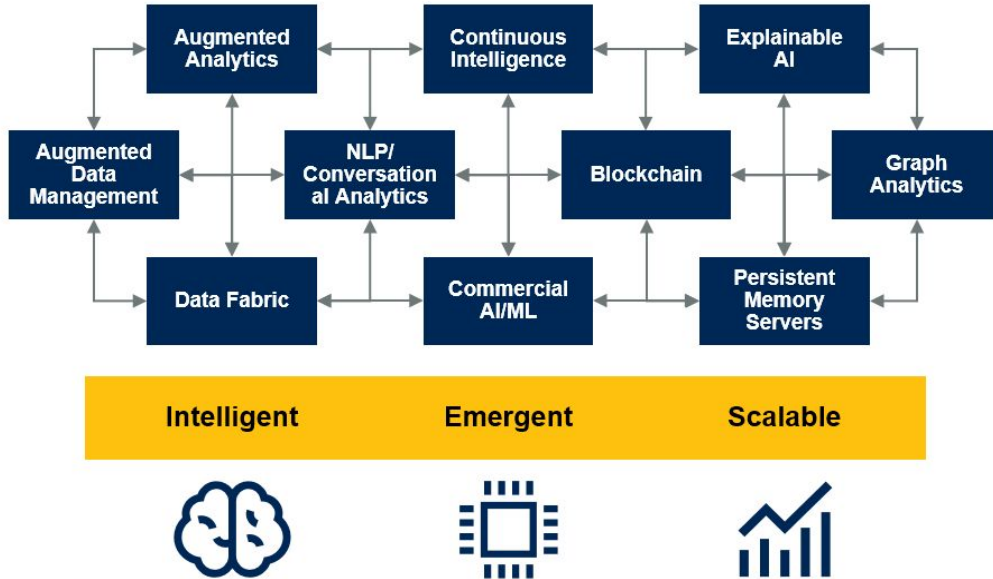
DATA ENGINEERING MANAGER
GRAPH & ANALYTICS

✉ sendapally@exactsciences.com



What Gartner Says about Graph

Top 10 Technology Trends



Source: Gartner
ID: 379563

Why Graph, Why now?

- Business want to ask business logic questions of their data
- Blending data from multiple sources, multiple business units, and increasingly external data
- Larger and more varied datasets mean more variables to analyze and connections to explore and test

C360 Use Cases

Use Cases Drive Outcomes



BUSINESS CASES

- Customer Journey | C360
- Churn Avoidance
- Segmentation & Recommendations
- Cross Sell | Upsell
- Prospect - Marketing & Analytics
- Risk & Predictive & Analytics
- 'Best Next Marketing Action'



SOLUTION NEEDS

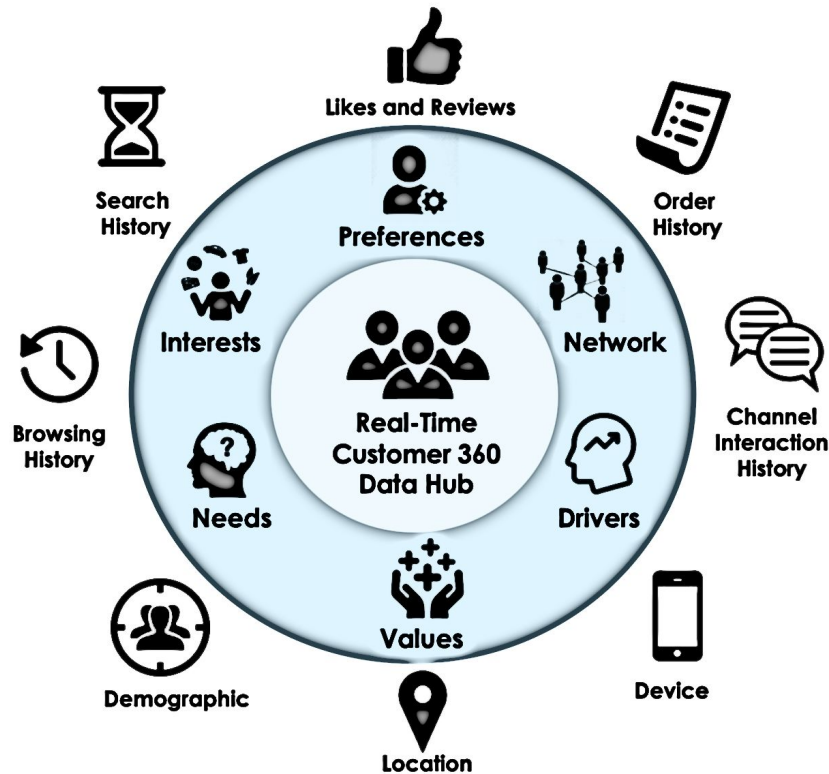
- Flexible Cloud Ready Solutions
- Visualization - Understand AI/ML
- Dependency | Network Pathing | Routing | Complex Visualization
- Data Science & ML Ops
- 'Network Mapping' Visualization
- Real Time Data - IoT Systems
- High Availability - Big Data



ML & ANALYTICS

- Patterns - Recommendations
- What If - Planning & Visibility
- Predictive & Analytics
- Scoring and Risk
- Audit & Compliance - Historical
- Targeting Similarities
- Decision Tree Analytics

Connected Data - Dr's and Products for Insights



Business Challenge

Identification of all aspects of input from products, marketing, interactions and buying patterns. Relationship connections and

Solution

- Build on top of current investments in existing data warehouse - Snowflake data lake and customer data repositories
- Find new relationships among data to drive better Dr product journeys, referral networks, key touchpoints, behaviors, medication adherence, outcomes, supply chain efficiencies and rev cycle.
- Analyze temporal (Time Series) and spatial data to find new patterns and insights
- Expand schema (attributes/fields, relationships) to accommodate new data sources & use cases

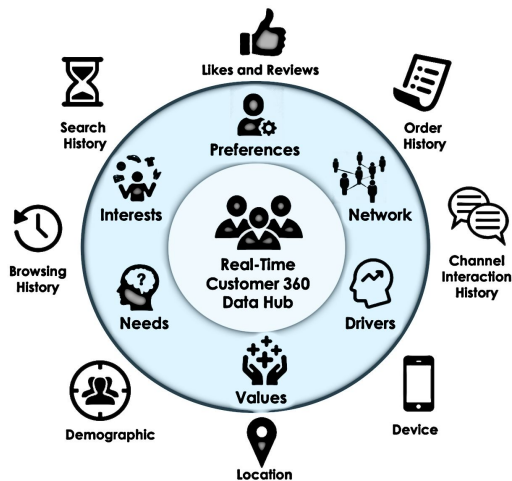
Business Benefits

Improve outcomes, increase satisfaction and lower costs

Physician 360 Touchpoints

KEY PAIN ITEMS

- **Dr & Customer Journey** - Where have they been and where are they going
- **Hidden Churn Data** - Lack of movement , feedback
- **CHURN Avoidance** - Customers who have left, quit product/service
- **Time** - History, Points, Marketing and locations
- **Positive Intervention** - Effort to avoid churn campaigns
- **Cross Sell New Product/Services** - Items and focus for cross selling
- **Geograph View** - Locations, Clinics and Doctors for regionality impact



COMMON RELATIONSHIPS - CONNECTED DATA ANALYTICS

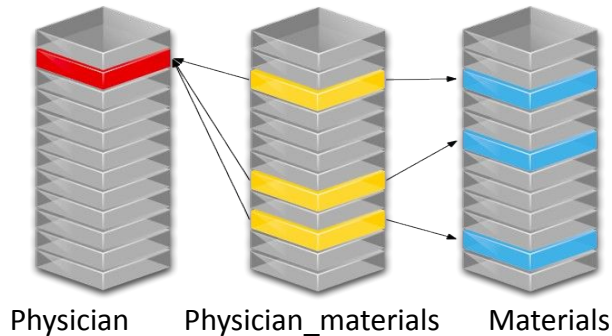
- **Product** : All interactions, products and relationships
- **Transactions**: Amounts, Locations, Types of Goods, Orders
- **Actors**: People, Customer service, relationships to Goods and Services
- **Locations**: Physical locations, corporate entities, zip codes
- **Marketing Devices** : Mac Addresses, IP, HW, IMEI, MEID, ESN and IMSI
- **Social**: Amplification of 'The Good, Bad and The Ugly'

SQL and Graph Are Very Different

Use SQL & Graph separately for what they are good at
Graph databases store data based on relationships, rather than transactions

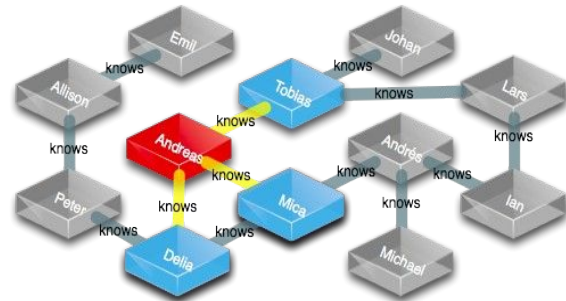
Traditional Database

Used For: Transactional systems with structured data



Graph Database

Used For: Data analytics systems connecting disparate structured or unstructured data

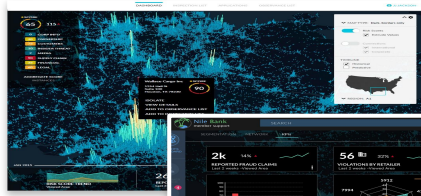


Graphs are suited for environments where the connections between data points are just as important as the data points themselves.

Graph Visualization - Who is Using System ?

ANALYST VIEW - TOOLKIT

TG STUDIO



EXECUTIVES

Dashboards & Reports

- Regional View
- Drill In Elements



LINE OF BUSINESS

Product Specific Dashboards & Reports

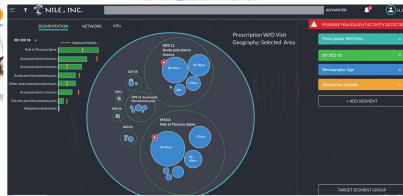
- Journey - Upsell | Cross Sell
- Good & Bad - Segmentation
- Marketing - Analytics



CUSTOMER INSIGHTS

C360 Interaction and Communication

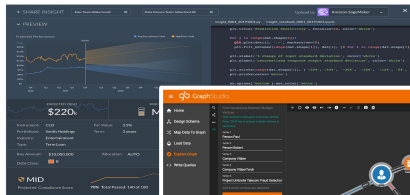
- Visual & Non Visual
- Alerts & Updates



MARKETING & SALES

Marketing & Sales Teams - Workbench

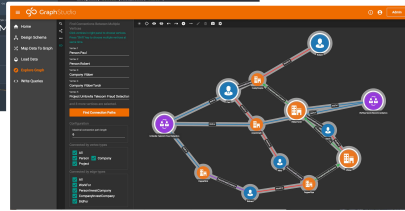
- Data Analysis & Insights
- Findings & Connectivity
- Exploration



ANALYTICS & ML

Analytics & ML Teams

- ML & Algorithms
- Complex analytics and 'scenarios'



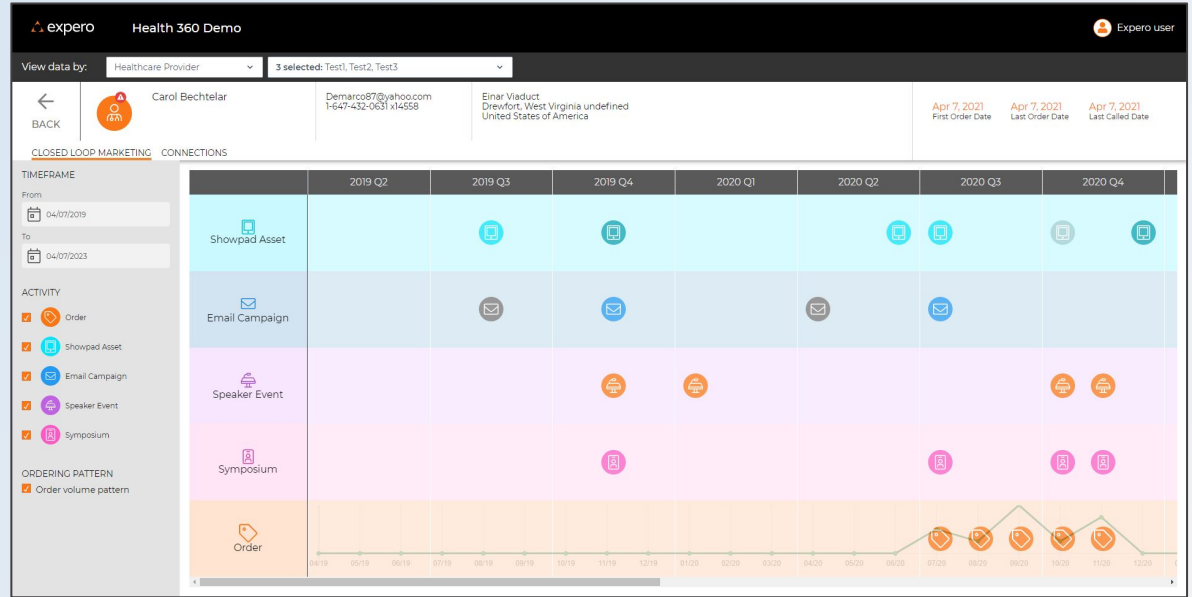
IT | PLATFORM

Graph & Management

- Data Models
- Graph Ops & Attributes

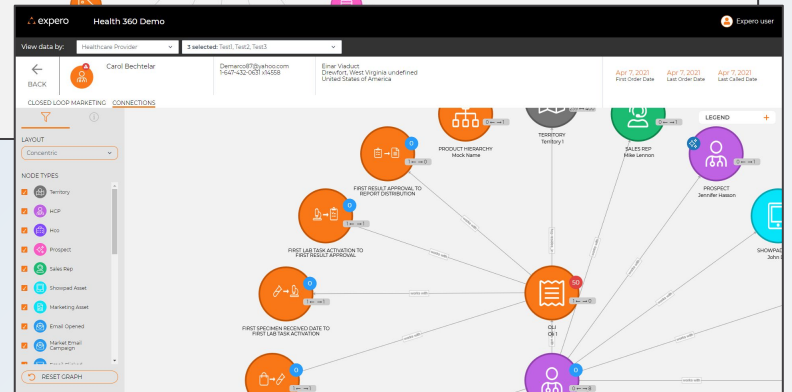
Data Connectivity & Visibility

- Journey analytics
- Pattern ID
- Good & Bad
- Product & Segments
 - Healthcare Provider
 - Closed Loop Marketing



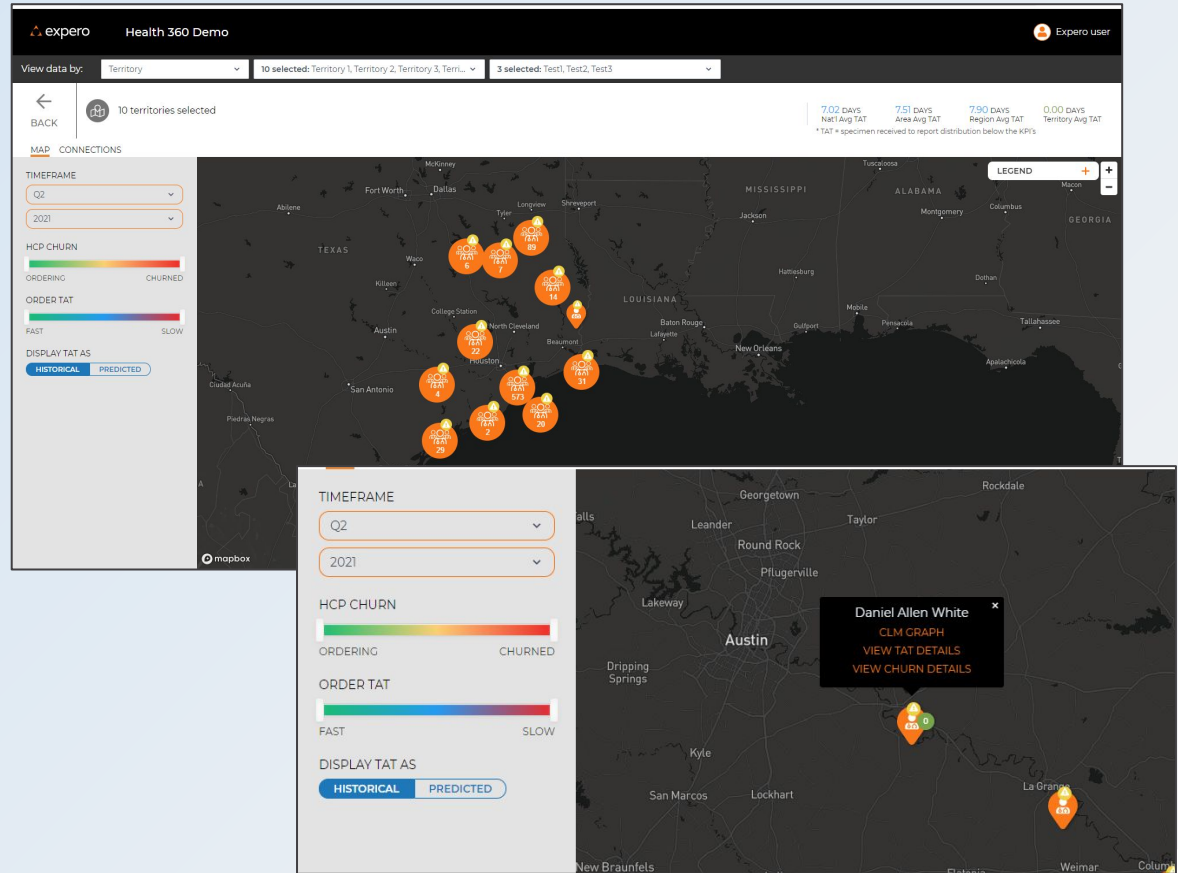
Data Connectivity & Visibility

- Person Connections
- Connection View
 - Dr Info
 - Patient
 - Time - Specimen
 - Event
- Product & Segments



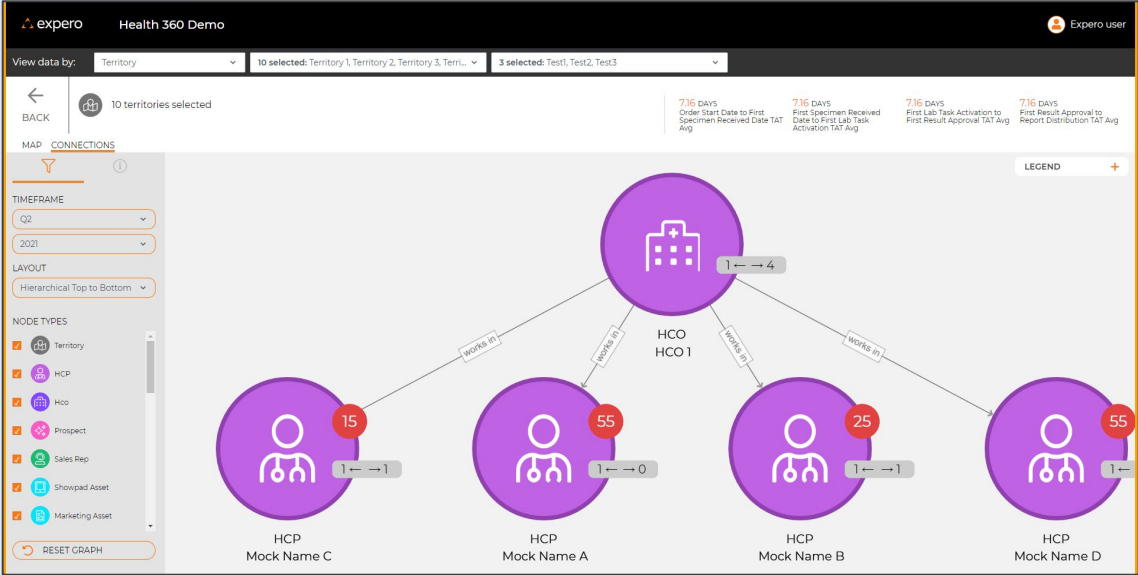
Data Connectivity & Visibility

- Geo View
- Regional - Territory
- Key Data Attributes
 - TAT
 - Churn Details
 - CLM Graph
- Product & Segments



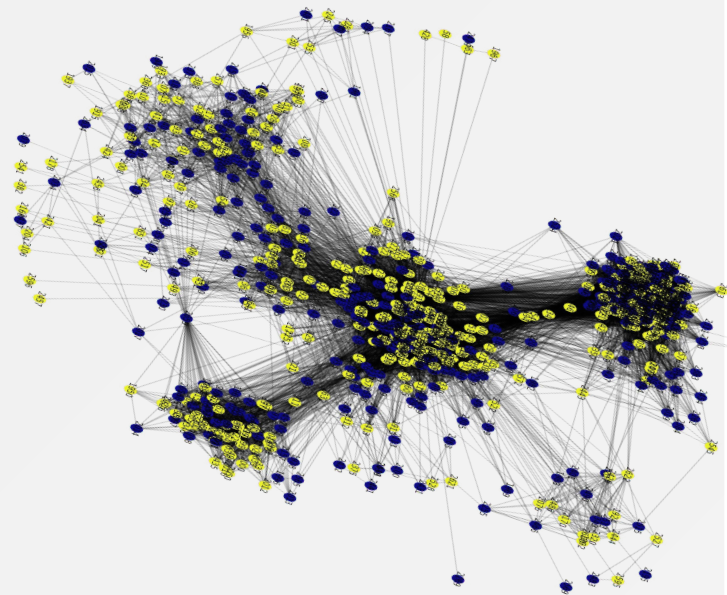
Data Connectivity & Visibility

- Churn View
- Regional - Territory
- Clinic & Related reasons
- Time of Specimen



Core TigerGraph Project Goals

- **Increase Insight** - Identify complex data relationships for sales and marketing in order to create better outcomes
- **Increase Speed & Efficiency** - Offer faster data results (over SQL) for more accurate and trusted outcomes (both automated & human)
- **Visualize 'Know Your Customer's & Their Customer (KYC-C)** - Easily see Customer (Doctor & Clinic) and their customer (patient) connections for insights into better outcomes
- **Continuous improvement on Retention & Acquisition** - A system that can learn, adapt & get better over time for assisting Sales & Marketing
- **Utilize My Current Tech** - Utilize Snowflake and current SQL systems and Bolt on and make better



Topics

Customer Focus : Exact Sciences Doctor C360

EXACT SCIENCES & CHALLENGES

Why Change? Detail of Exact Science Use Case

(Sharat Endapally - 20 min)

GRAPH & ML - INCREASED VISIBILITY, & OPTIMIZATION

Demos Doctor C360 Application and Use Cases

Increase accuracy, real time graph algorithms for better outcomes

(Scott Heath - 20 min)

Q&A

(10 Min)



Life Science Data IS about Deep Data Relationships & Connected Data

Core concepts in this domain are deeply linked data -- Complex Data Linkage

Patient - Products

Nodes

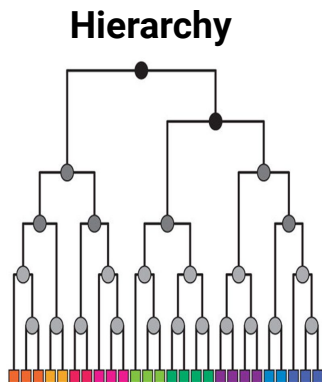
Patient - Test and time
Test - Specimen Information
History of events
Doctor Event data

Relationships

Lineage Consists
Patient relation
Connected To

Analytics

Test Information
Prediction of Need
Cost Optimization



Clinic - Dr - Patients

Nodes

Customer - Dependants
Doctor - Products
Clinics - Hospital Networks
Risk Factors

Relationships

Owns
Related to
Sold by

Analytics

Cross Sell
Regionality view
Positive Link Analytics
Inventory Tests



Event Analysis - History

Nodes

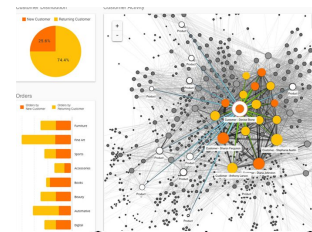
Sales Rep, Patient, Doctor
Locations, Payouts, Disputes
Risk Calculations - Options
Amounts, Transaction details

Relationships

Good - Bad
Relationships
Outcome status

Analytics

Profit Predictions
Demand - Outcomes
Intervention - Bad outcomes
Cost Optimization



Tree of Pain - C360 Use Cases

Key Drivers

Strategic Objectives

Example Use Cases

Business Value

Increase Revenue (make money)
\$↑

Digital Transformation

Decrease Costs (save money)
\$↓

Mitigate Risk (protect money)
\$↔

Core Business Platform

Customer Experience (CX)

Increase Operational Efficiency

Data Analytics

Material Fraud Detection

Audit, Regulatory

Prospecting & Marketing | C360

Customer | Doctor Journey

Cross Sell | Upsell

Churn Avoidance

Risk & Segmentation

Outcome Predictive & Recommendations

Data Insights - Digital Innovation

New Product Launches

Audit & Governance - Data Providence

Compliance Process & Regulatory

Roles / Persona Types

Execs & Mgt

C360

ML & Data Science

Audit | Compliance

Technical Teams

Often, **failures in C360 Data Science** aren't due to lack of model training data or ML quality - rather scale and delivering repeatable outcomes.

Data Science PROJECTS (e.g, ML, RL, NLP, etc.)

Often data science outcomes are one off solutions generated as experiments - "It works in my Jupyter notebook."



Not Scalable



Unpredictable

VS.



Data PRODUCTS

Repeatable & scalable version of Data Science outcomes ready for business use - embeddable ML, RL, NLP, etc.



Scalable



Measurable



Consistent



CI/CD

Machine Learning and Algorithm Support

Use Both to Increase % Accuracy

GRAPH

Clustering

Betweenness

Similarity

Degree

Page Rank

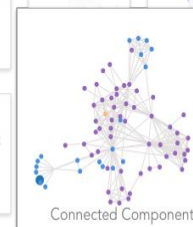
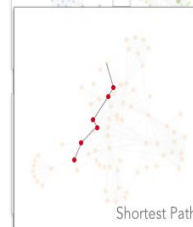
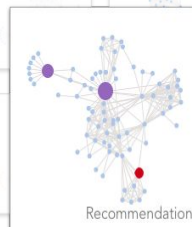
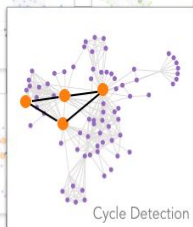
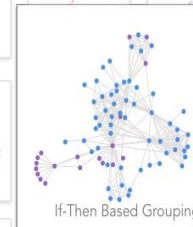
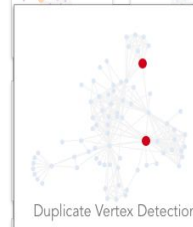
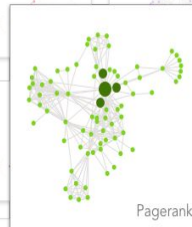
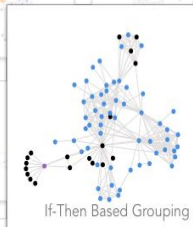
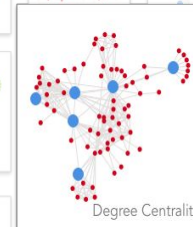
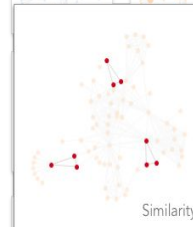
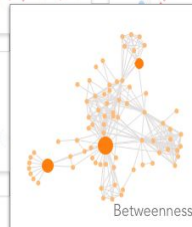
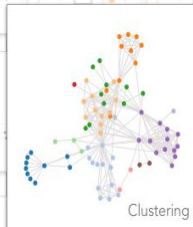
Recommend

Shortest Path

Connected

Centrality

Detection



ML

Graph Convolutional Networks (GCN)

Temporal Pattern Detect

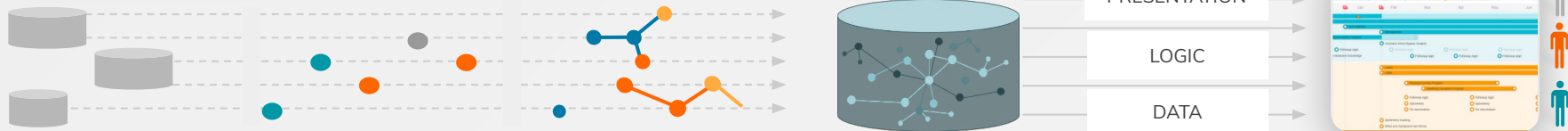
Louvain

Dependency Networks (RPN)

Markov Networks (RDN)

Probabilistic Models (PRM)

LOGICAL FLOW



EXPERO SOLUTION

Source Data

Structured and unstructured data (e.g. social media, raid data)
SQL, Triple Store, Hadoop, etc



Dr INFORMATION
 Name / DOB / Products

KEY INFLUENCERS
 Name / DOB / Address

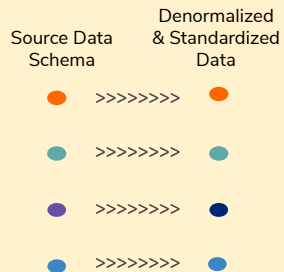
CLINICS
 Shipper / Phone Number

LOCATIONS
 Shipper / Address

Data Mapping - Source Map

Extract & transform or Create 'Map' of data - **Data Mapped**

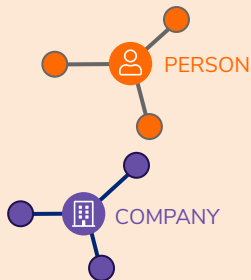
MAP TO SOURCE



Entity Resolution (ER) Master Data Mgt

Resolve and persist entities within and across datasets - Use ML or Custom Algorithms

MACHINE LEARNING



Data, Search & Analytics Platform

A comprehensive data storage, search, and analytics platform - massively scalable

GRAPH



Application Programming Interfaces (API)

Set of methods, tools, and protocols to build software applications

MICROSERVICE MACHINE LEARNING

User Interface (UI)

Visualization tool enabling mission users to perform self-service data analysis

OPEN SOURCE & CUSTOM



DEMO

- User Roles
- C360 Process

At Risk
Fran Farmington
Member Since: 1 Jan,2015
Member ID: 11324567
60 yrs
MALE
DOB: 11/11/1958
512.328.1212
fran@experioc.com
1550 W 45th St Unit 2002
New York, NY 10036

OVERVIEW CLAIMS PROVIDERS CARE PLANS **CONNECTIONS** BACKGROUND JOURNEY

Provider Quality Metrics: LOW to HIGH

At Risk
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FLAGGED POSSIBLE FRAUD

OVERVIEW CLAIMS PROVIDERS **CARE PLANS** CONNECTIONS BACKGROUND JOURNEY

Treatment Type: Disease

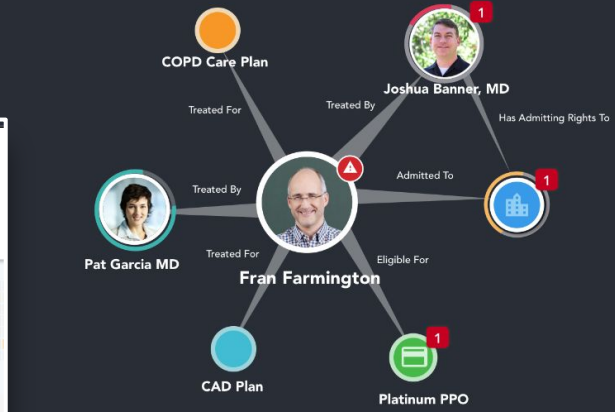
- Pharmacological
- Non-pharmacological
- Monitoring
- Patient Resources

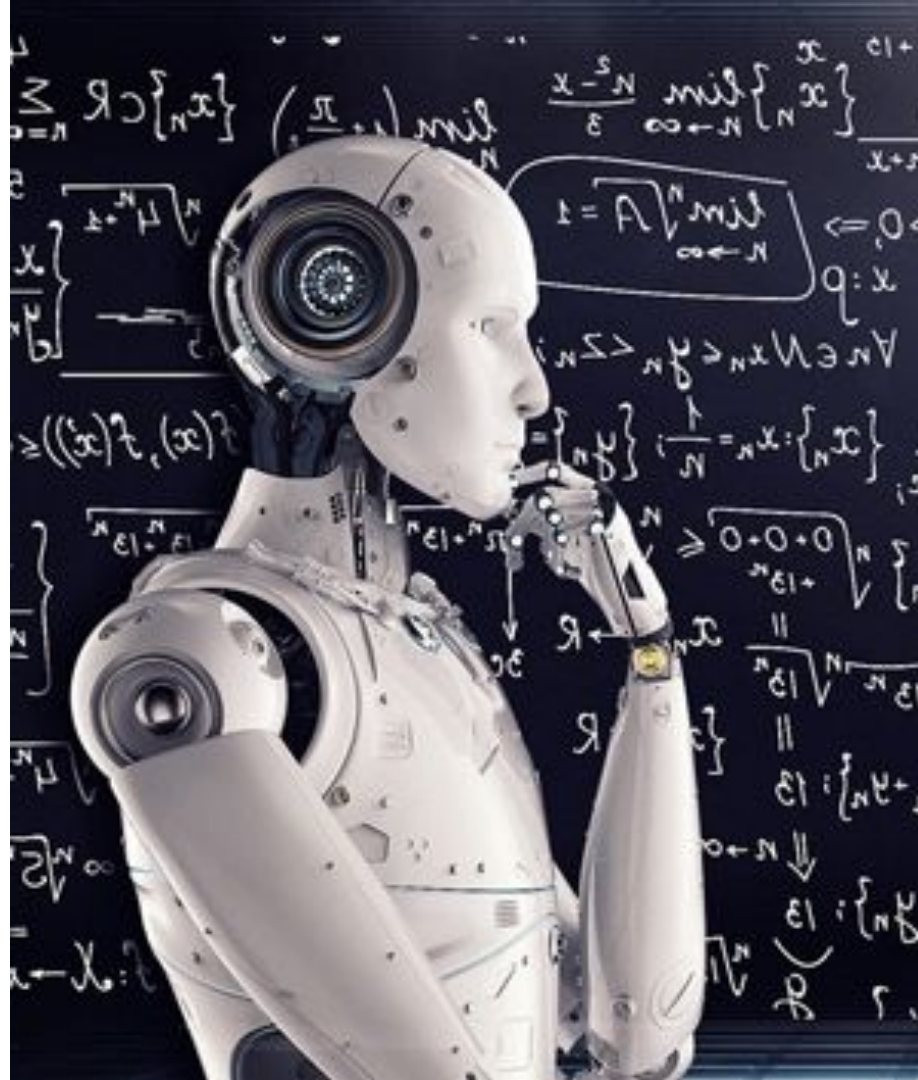
CAD (75.3)

- Statins
- Aspirin
- ACE Inhibitor
- Physical Activity Program
- Coronary Artery Bypass Surgery
- Followup Appt
- Alternative Medicine Knowledge

COPD (44.9)

- LABA
- LABA
- Physical Activity Program
- Smoking Cessation Program
- Followup Appt
- Spirometry
- Flu Vaccination





Data Science & Graph Customer 360

why is data science + ML interesting in
this domain?

Resources:

[ML Blog Posts](#)

[ML Gallery](#)

Recommendation Engine - Product/Service

We build systems like Netflix and Amazon to cross sell and upsell your customers on other products or services.

According to Forbes, Amazon attributes 29% of their sales to cross sells driven by their recommender system.

“If you liked X, you might also like Y.”

Customers who bought this item also bought

Page 1 of 11



0.5mm Replaceable Rollerball Ink Refills Specially for IDEAPOOL Rosewood and Bamboo...
★★★★☆ 12
\$7.60 ✓prime



Bamboo Ballpoint Pen Writing Set, IDEAPOOL Premium Gel Ink RollerBall Pens for Signature...
★★★★☆ 68
\$10.99 ✓prime



LEATHER JOURNAL Writing Notebook - Antique Handmade Leather Bound Daily...
★★★★☆ 910
\$26.00 ✓prime



Lined Refillable Vintage Writing Journal for Women, Retro Tree of Life Faux Leather Cover...
★★★★☆ 264
\$22.99 ✓prime



Handcrafted Rosewood Ballpoint Pen, Smooth and Easy Writing for Signature Calligraphy Executive...
★★★★☆ 55
\$10.99 ✓prime



LEATHER JOURNAL Tree of Life - Writing Notebook Handmade Leather Bound Daily Notepads For Men...
★★★★☆ 32
\$29.95 ✓prime



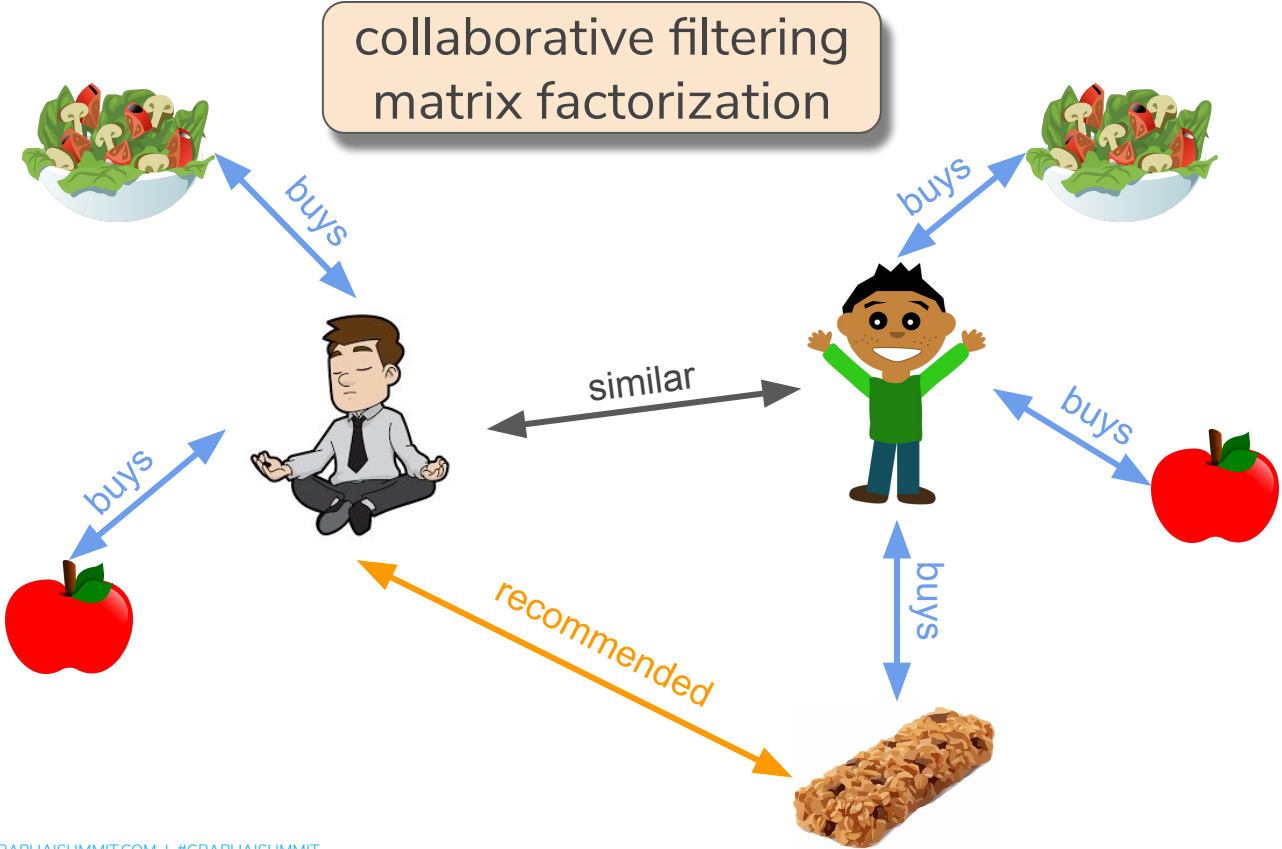
Markings by C.R. Gibson MJS-4792 Genuine Bonded Leather Journal, By Markings, Smyth...
★★★★☆ 541
\$12.49 ✓prime



Handmade Large 8" Embossed Leather Journal Celtic two latches blue stone blank personal...
★★★★☆ 78
\$23.00 ✓prime

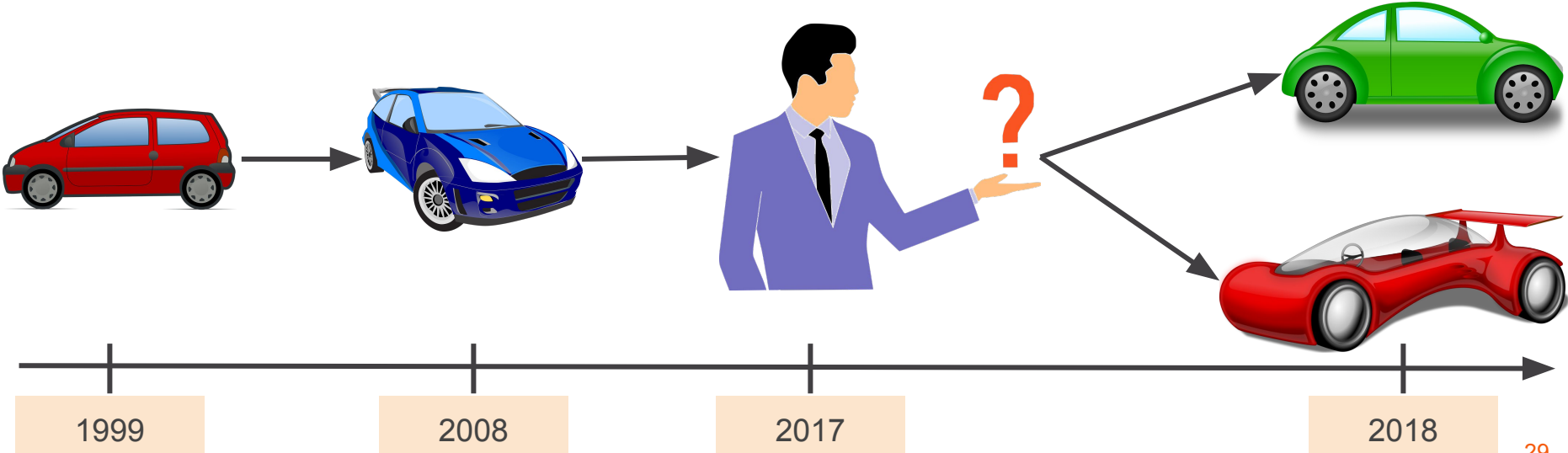


Recommendation Engine - Product/Service

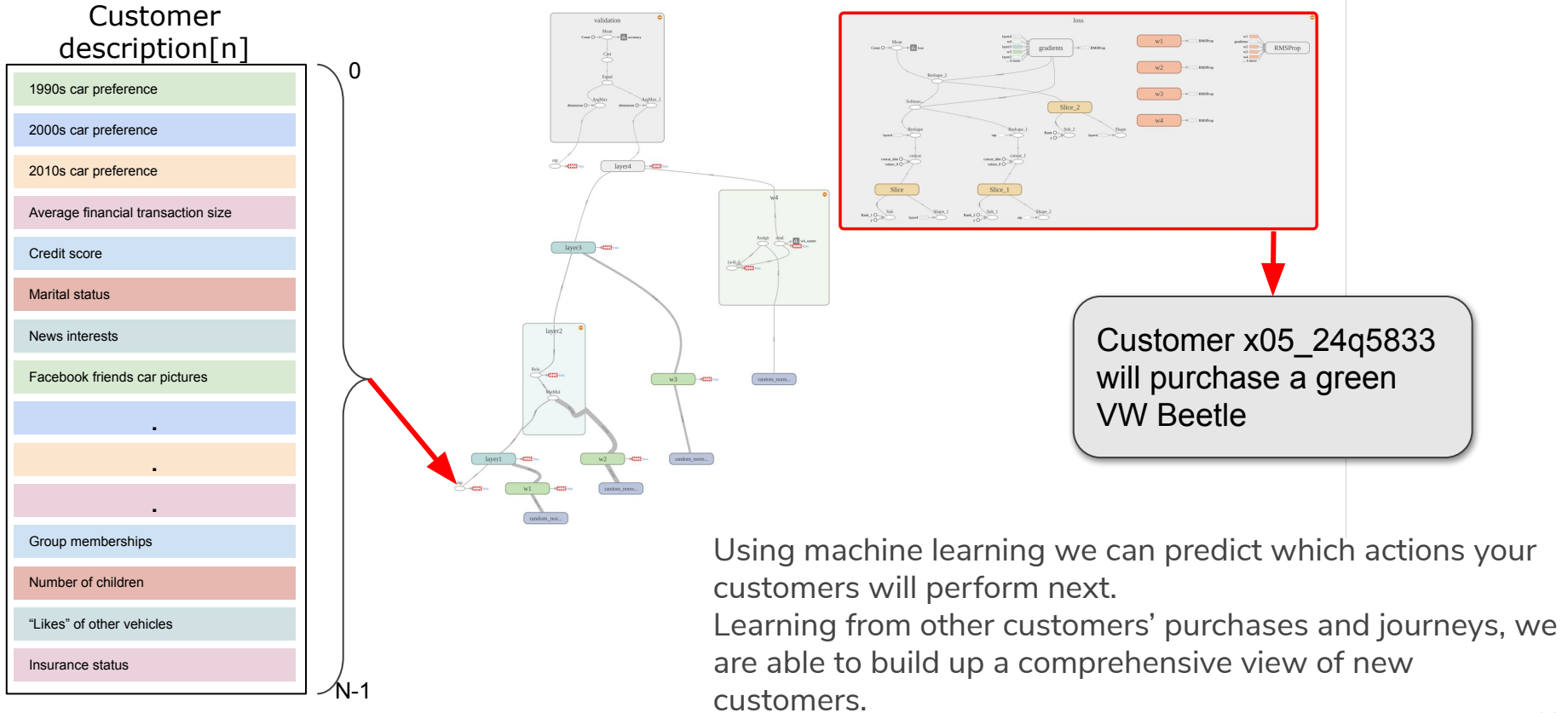


Predictive Customer Journey - What Will Customer X Do Next?

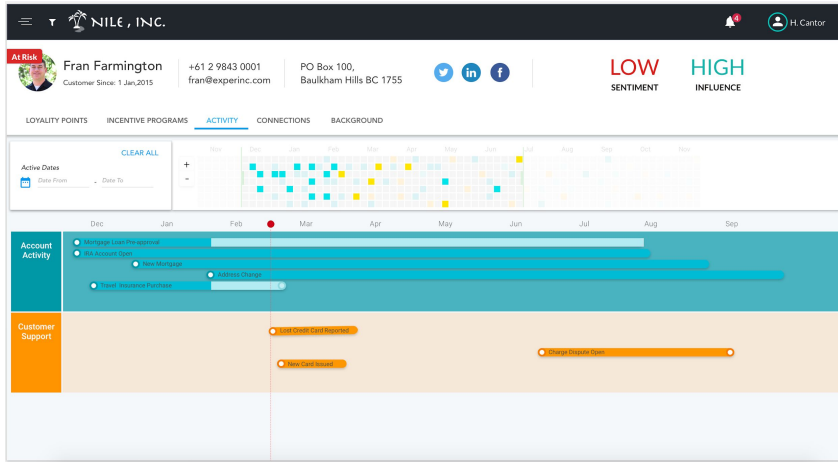
Upsell your customers by predicting their next product interests.
Offer discounts to customers considering leaving.
Grant free consulting to customers at a decision fork.



Predictive Customer Journey - What Will Customer X Do Next?



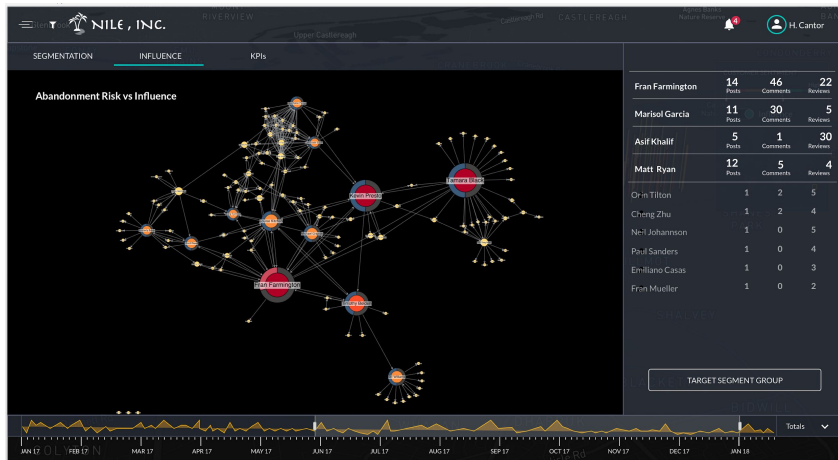
Customer Journey Course Corrections



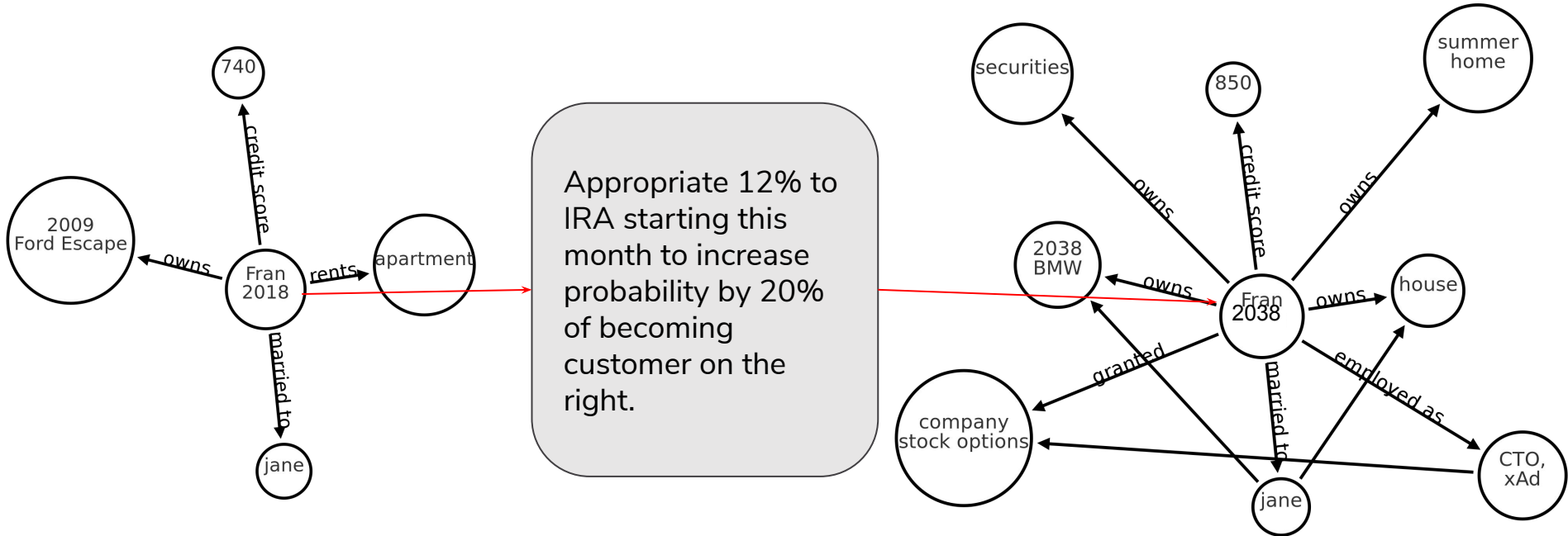
Fran recently finished grad school in computer science, he owns a 2009 Ford Escape, he rents his home, he's married, and his credit score is 740. If Fran wants to be a CTO by the time he's 50, what should he be investing in today?

More importantly, how can your bank be the driver for that change, recouping interest for the next 20 years of Fran's financial transactions?

Using pattern recognition, **we can analyze customer bank data to calculate probabilities of customer journey trajectories** and course correct along these journeys as they unfold.



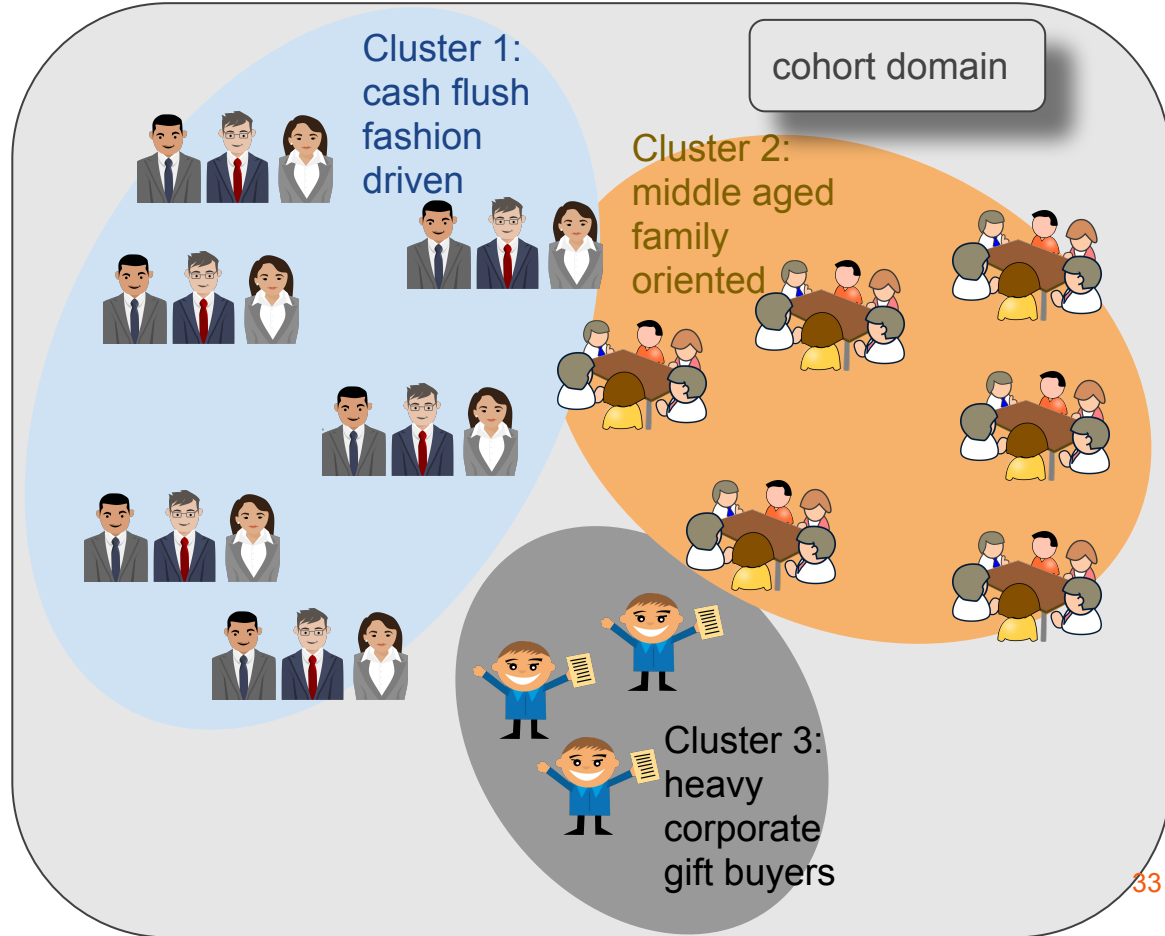
Customer Journey Course Corrections



Prescriptive Analytics - Customer Cohort Patterns

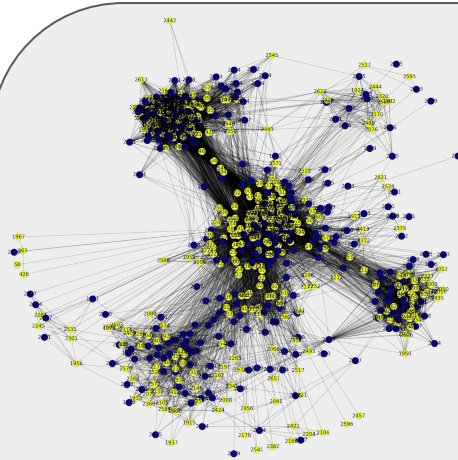
Deriving high level insights about customer cohorts enables your company to reach higher levels of customer satisfaction, and thus redouble engagement and drive recurring revenue.

We use data science to analyze the similarities and differences between cohorts to build effective marketing, sales, and engagement strategies for your existing customers.



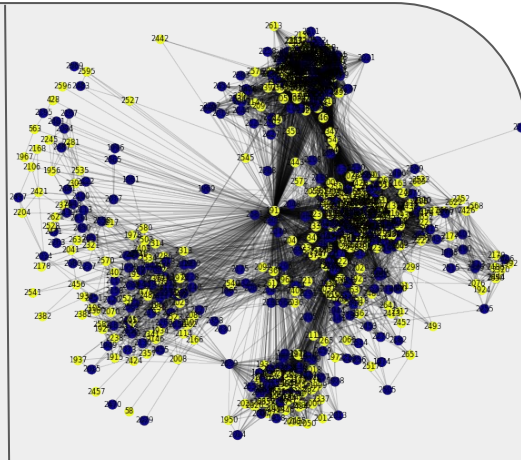
Prescriptive Analytics - Customer Cohort Patterns

In which ways to customer cohorts relate?
Also, how are they unrelated?



Cohort 20180101:

Connectedness - .32
Degree - 297
Clique size - 9
Diameter - 55
Centrality - .701

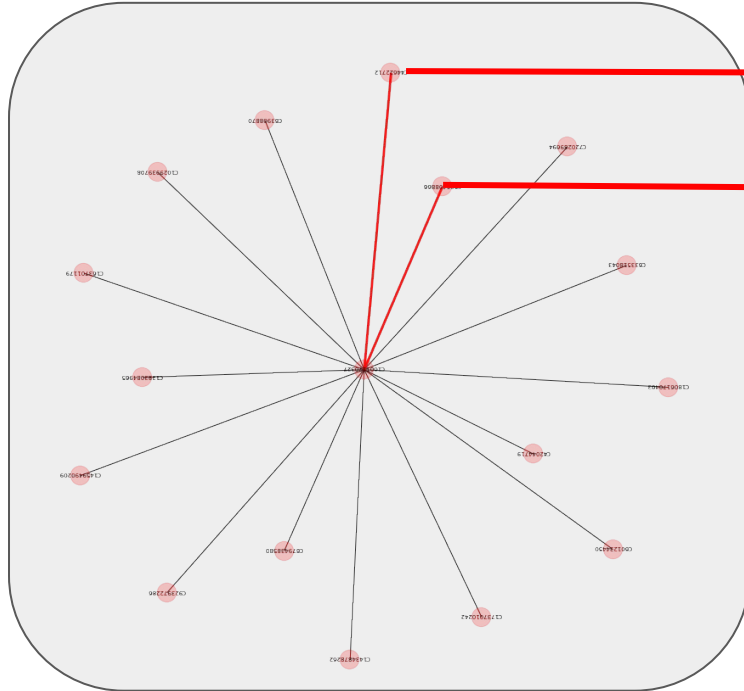


Cohort 20180201:

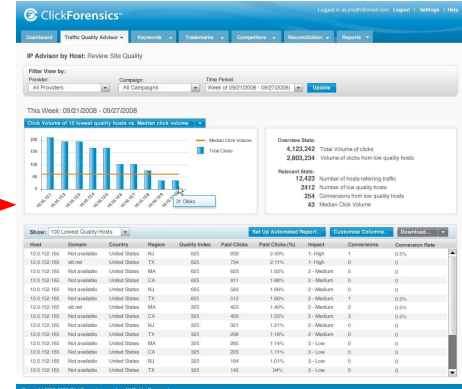
Connectedness - .4
Degree - 312
Clique size - 9
Diameter - 55
Centrality - .765

Predictive Analytics - Marketing Campaign Effectiveness

Which marketing strategies work the best? And to which demographics?



Campaign 1



Campaign 2

Customer Intervention Suggestions

Intervening because a customer is dissatisfied is an unfortunate last resort we'd prefer not to have to take. But when it is time to do so, an automated machine learning solution can quantitatively evaluate your options and suggest optimal action, graded by it's chances of success and it's cost to the company.

Retain more customers. Use data science.



Expero Graph + ML system

Offer gift card Customer churn risk down 50% and will cost \$25	Do nothing Customer churn risk down 0% and will cost \$0	Schedule phone call Customer churn risk down 18% and will cost \$1.50
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Questions?

**EXACT
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