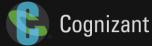
Machine Learning for Healthcare

Amber Marfatia,

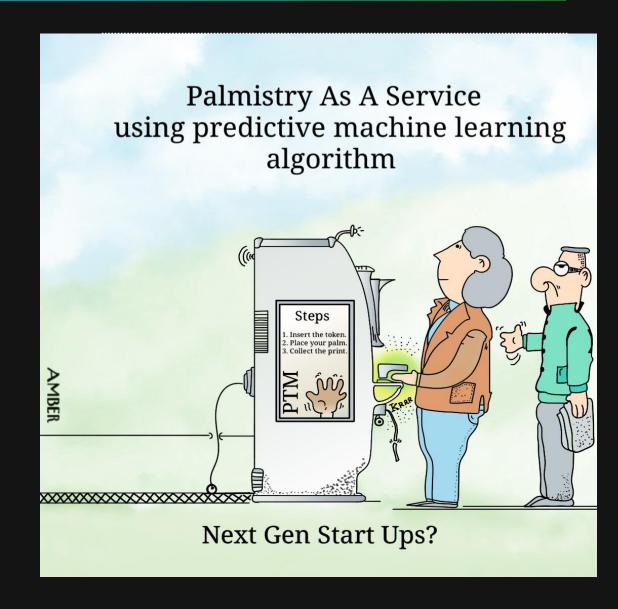
Ganesh Subramaniam

(June 2018)



Agenda

- What:
 - ML A brief introduction
 - ML Options & Type of models
- Why:
 - The focus on ML?
- Where:
 - Applications in HC (TZ and non-TZ examples)
- How:
 - Design ML Approach
 - To determine which algorithm is right (cheat sheet & approach)
 - Doing it with Azure ML
 - Current trend Machine Learning as a Service (MLaaS) platforms
 - Brief comparison of MLaaS platforms (1 or 2 slides)
 - Brief roundup of Cognizant's HC experience, platform
- Next steps
- Q&A

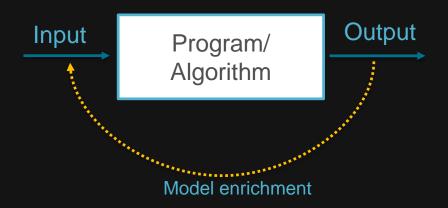




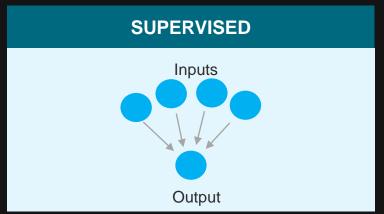
What?

Algorithms which **detect patterns** in very large data sets, and **progressively learn and refine predictions and recommendations** through incremental data and experiences, rather than via explicit programming instruction.

The algorithms **adapt in response to new data and experiences** to improve efficacy over time.



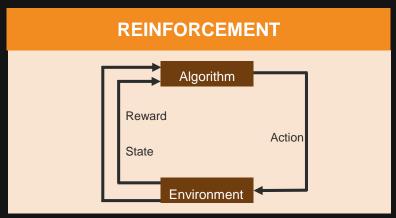
ML - Types



Algorithm uses training data and feedback from humans to learn the relationship of given inputs to a given output

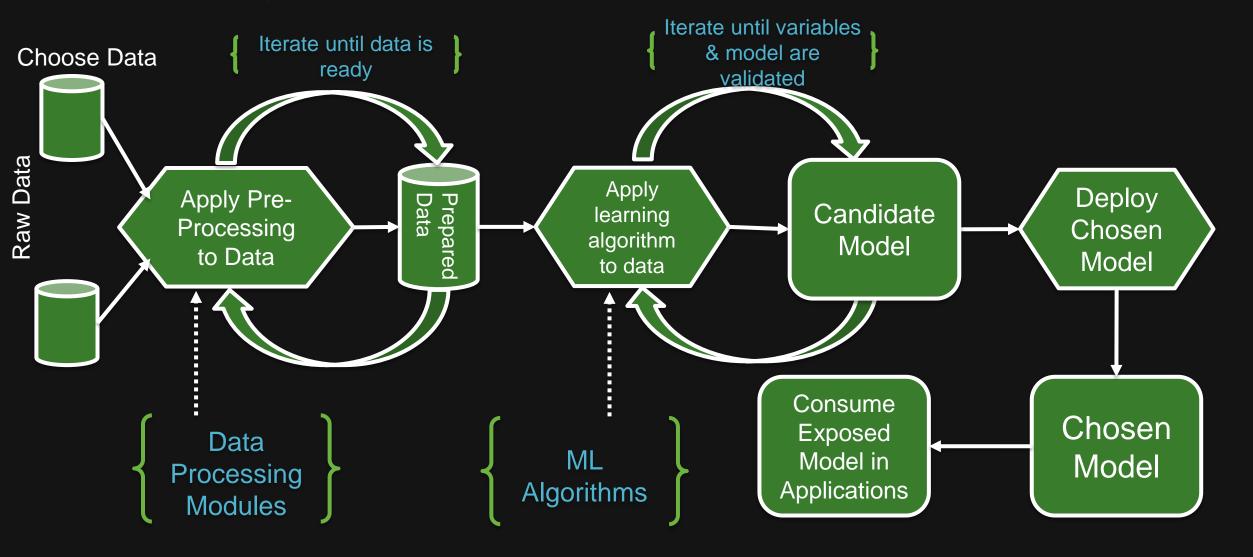
UNSUPERVISED

Algorithm explores input data without being given an explicit output variable



Algorithm learns to perform a task simply by trying to maximize rewards it receives for its actions







Member/Patient assistance

- Education (symptom checker, drug contra-indications, etc)
- · Benefit, eligibility, claims inquiry
- · Locating urgent care/emergency care facilities

Care Mgmt./PHM

- Predicting therapy adherence
- Personalized care interventions
- Disease propensity
- · Re-admission propensity
- · Predicting enrollment to CM/DM programs

Utilization/Rev. Leakage

- Predicting utilization (IP, ER, Rx,...)
- Predicting drug abuse behavior
- Predicting member churn
- Maximizing subrogation \$\$ recovery
- Detecting coding gaps (HCC)



Payer Operations

- Optimizing outreach channel (self-serve propensity)
- Sentiment analysis from call logs, web 2.0, etc.
- Risk coding/adjustment
- Fraud & abuse detection

Clinical Operations

- Diagnostic aid (diabetic retinopathy, tumor malignancy, etc.)
- Optimizing treatment regimes (DTRs)
- Patient triaging
- Patient education (chatbot)
- Prior Auth requests
- Benefit, eligibility, claims inquiry

IT Operations

- Predicting ticket volume (e.g., OE
- Predicting server/network downtime



Human Intel.

Cognitive Layer

Innovative Design Thinking

People-centered methods | Design thinking tools

Human Intelligence

Anthropology study | Phenomenon-based

Cognitive APIs

Cognitive Enabled Apps | Chatbots | Chatbot builder

Machine Learning

Artificial Neural Networks| Deep learning | Fuzzy Logic

Natural Language Processing

Lexical Analysis | Syntactic Analysis | Semantic Analytics | Pragmatic Analysis | Machine Translation

Big Data and Analytics

Fast data |Data lake | Data Governance | Data Quality

Hybrid Compute Layer

Distributed Server | Distributed Storage | Cloud



Design Thinking & Human Intelligence

80+ Consultants

Skilled in understanding Human Experience from the intersection of anthropology & Design Thinking

ML, NLP Capabilities

3000+ Skilled Resources

Skilled in extracting Contextual Information from Unstructured Data using NLP. Also, Integrating the outcome from Personalized interactions into ML Models



14+ Engagements 32+ Clients

Implemented Multi-disciplinary approach to UX by including anthropologists, Human Factor specialists, Psychologists

48+ Engagements 38+ Clients

Implemented Behavior Prediction Models using Advanced ML algorithms



>>

Working at the intersection of anthropology and design thinking, Cognizant's multidisciplinary approach places a rigorous understanding of human experience to power up innovation

- Big Decisions 4.0 Cognizant's proprietary Al Platform
- Cognizant's Bot/Virtual Assistant Builder
- Cognizant's Cognitive Solution
 Gallery with 30 APIs



Foundatio nal Layer

Cognizant - Representative experience

Drug seeking behavior for an integrated managed care consortium

65% prediction accuracy. \$12 MN per 1000 correctly identified drug seekers





Likelihood of claim denial for a leading PBM

82% prediction accuracy, leading to reduction in denial

volumes, worth \$2.85M

Identifying claims having high propensity for subrogation recovery at leading Payer

Potential recovery rate increase of 34% leading to plug

in revenue leakage of USD \$4.3M





Log analysis-based device Failure Prediction model for a pharmaceutical provider

~55% reduction in turnaround time. ~25% reduction in device recall

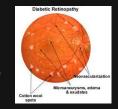


Therapy adherence prediction for leading PBM

66% prediction accuracy. Revenue improvement due to increased refills

Diabetic retinopathy detection for a leading India-based ophthalmology institute

80%+ prediction accuracy; reduction in diagnosis time



from 4 hrs to 45 mins



Customer churn prediction model for a leading health plan

Member attrition down to 16% from 21%

Ticket analysis prediction model for a leading managed care organization

35% time saving in ticket alignment





Emerging trend: MLaaS platforms

Cloud-based systems that provide machine learning as a service for building, training, deploying and integrating ML models

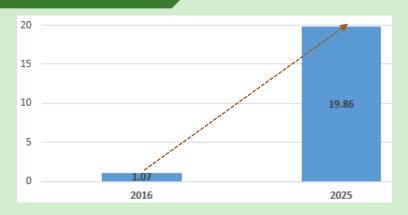
MLaaS Platform – Why?

To ease the development, training and deployment of machine learning models for solving business-specific problems in any domain, along with scalable computational and storage infrastructure (faster GTM)

Influencing trends & drivers

- Increased adoption of cloud-based technologies (private over public as of 2016)
- Use case explosion across verticals, especially HC and LS
- Proliferation of structured & unstructured data (incl. IoT streams, from increased connectivity)
- Consumerism need to recognize & predict consumer behavior,
 and personalize intervention
- Technology decrease in computational and storage costs

Market Size* (\$Bn)

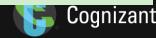


- US market size \$497Mn (2017)
- Bulk of the market share prof. services to manage infra scaling and security
- HC & LS leading verticals key growth contributors, from increased digitalization

Major Players



> 70% of market share (2016)



MLaaS platforms – Typical capabilities, services offered



E2E services for ML as part of cloud computing services

- Ingestion, transformation, analytics and visualization of structured and unstructured data (including IoT streams)
- Development, training, testing, validation, tuning and deployment of analytical models
- Library of time-saving sample experiments, **pre-trained models**, R and Python packages, SDKs, and **best-in-class** algorithms
- In-built Natural language processing, predictive analytics and deep learning models and frameworks.
- Integration aids to mesh models with current application infrastructure.



Cloud Machine Learning Services for Predictive Analytics - Comparison

	Amazon SageMaker	Azure ML Studio	Google ML Engine
Classification	✓	✓	✓
Regression	✓	✓	✓
Clustering	✓	✓	✓
Anomaly detection	✓	✓	✓
Recommendation	✓	✓	✓
Algorithms	10 built-in + custom available	100+ algorithms and modules	Tensor-Flow-based
Graphical interface	×	✓	×
Configuration level*	medium	high	low

^{*}Refers to extent of customization (feature engg., classifier selection, etc.,) versus a black box



Leveraging Cognitive

Making the platform support itself – totally hands-off

Insights for All

Enabling analytical democracy across the organization.
For business users, analysts and data scientists.

Leverage Universal Data

From structured data to complex, fast digital data.

Robust Information Architecture to support all analytics needs.

Scalability & FlexibilityHarness the power of Cloud.
Or deploy on premise.

Speech & Audio **Computer Vision** Natural Language Processing & Generation **Processing** Al Capabilities Knowledge Graphs | Analytical Pipeline Using ML Framework Inference Engine Deep Learning Studio & Interactive Analytics Workbench Deep Learning Framework Sandbox | Statistical Algorithms | Machine Learning & Al Al Engines Tensorflow | Keras | Theano | DL4J| Caffe | CNTK | Darknet Data Discovery and Exploration Workbench **ITorch** Self-service | Unified View | Search | Ad hoc **Smart Connectors Data Integration Data Storage** Knowledge Graph Data Workbench Information Models **Industry Specific Architecture Cross-Industry** Custom Alert & Monitoring | System Telematics | Metadata Workbench

Analytics Infrastructure Infrastructure Provisioning Workbench (MLOPS\DEVOPS)
Provision | Deploy | Schedule | Monitor

Public Cloud

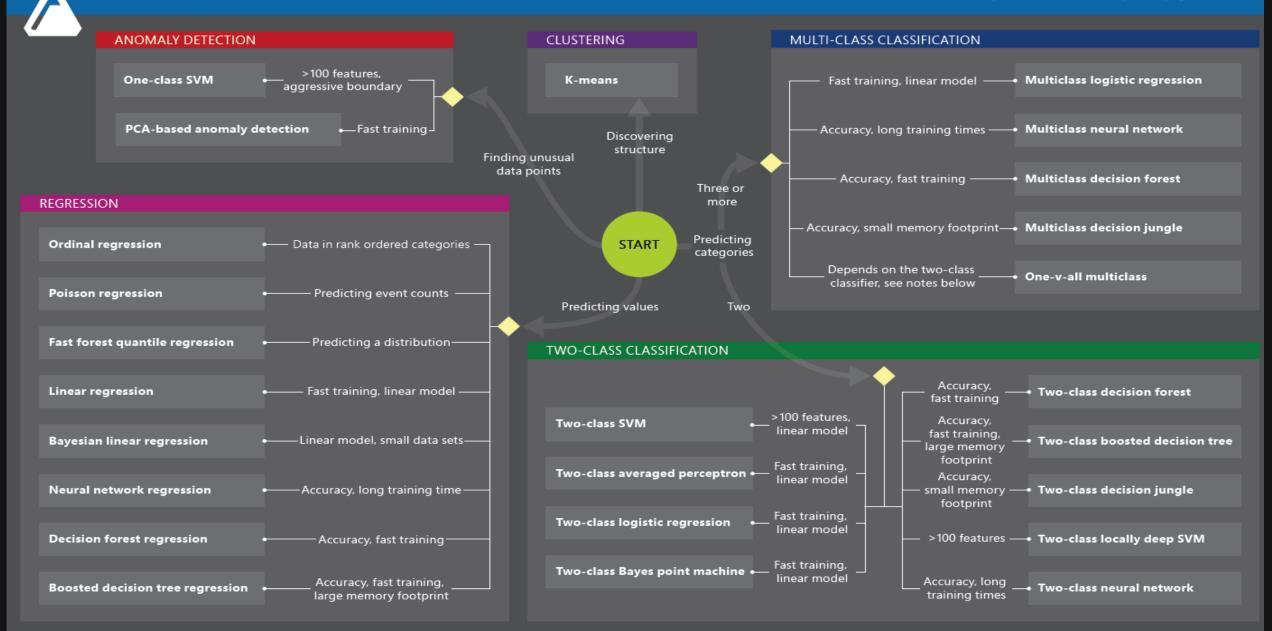
Multi-tenant Hosted

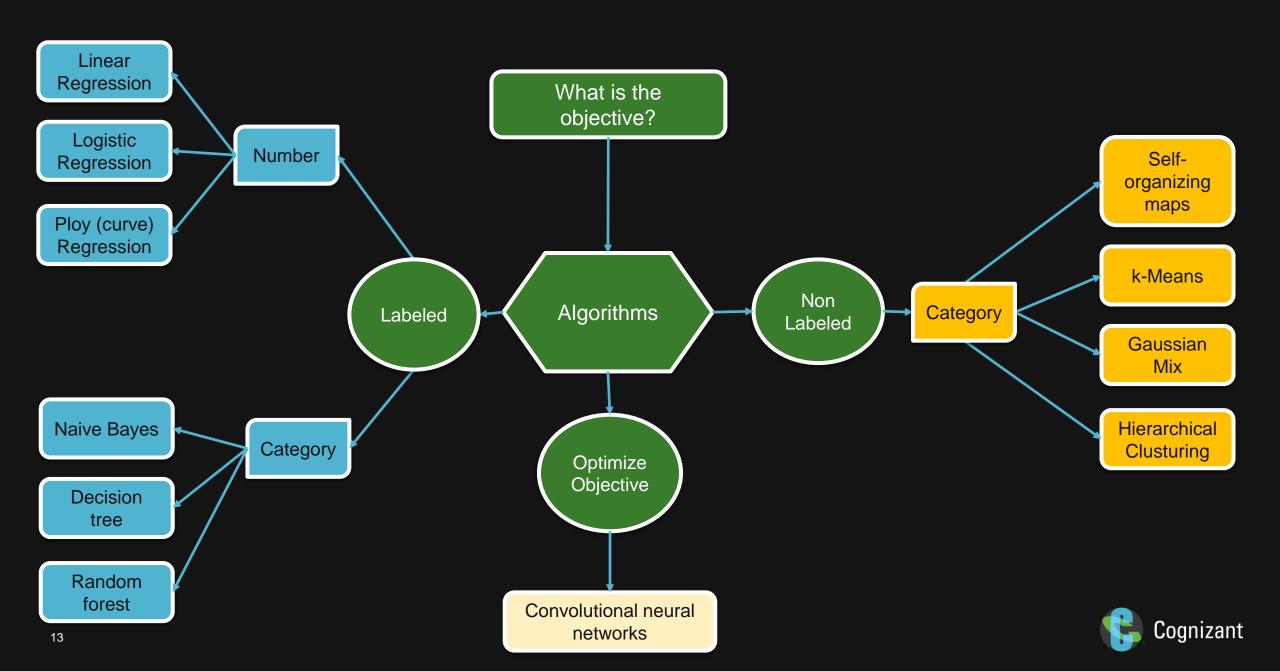
On Premise

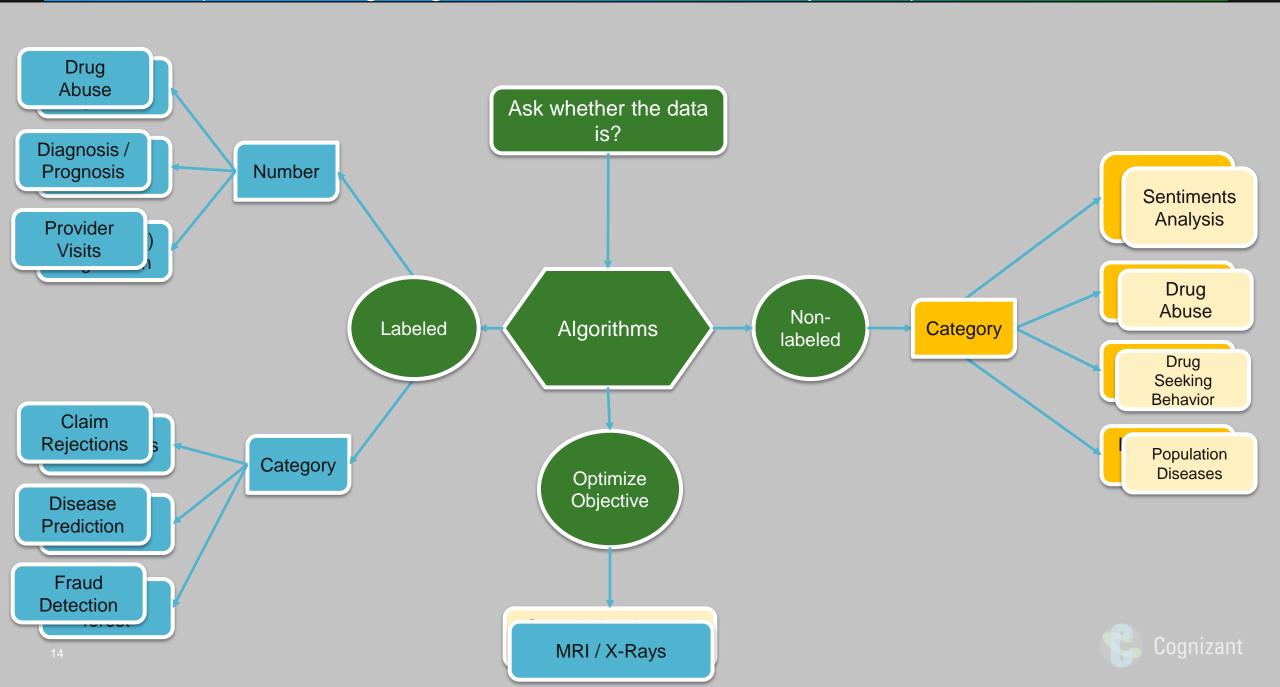


Microsoft Azure Machine Learning: Algorithm Cheat Sheet

This cheat sheet helps you choose the best Azure Machine Learning Studio algorithm for your predictive analytics solution. Your decision is driven by both the nature of your data and the question you're trying to answer.







Demo



Questions?



Thank you

Healthcare Technology Office.

Email us at: healthcareTechnology@cognizant.com

