



# The Machine Learning Process: From Business Model to Machine Learning in Production

Constantin Gonzalez  
Principal Solutions Architect, Amazon Web Services

# What you'll get out of this session

- An overview of the Machine Learning (ML) process
  - From business model
  - To data collection and processing
  - To ML training and deployment
  - ... and all the way back
- A better understanding on how to apply ML to your business
- Examples from AWS customers and Amazon.com



# Introduction

# Long history of ML at Amazon



Personalized  
recommendations



Fulfillment  
automation and  
inventory  
management



Drones



Voice-driven  
interactions



Inventing  
entirely new  
customer  
experiences

# Machine Learning at AWS

**Our mission:**  
Put machine learning in the hands of every developer and  
data scientist

# The Amazon Machine Learning stack

Application Services

Platform Services

Frameworks & Infrastructure

# Bottom layer: frameworks & infrastructure



NVIDIA  
Tesla V100 GPUs

5,120 tensor cores

128 GB of memory

1 petaflop of compute

NVLink 2.0

~14X faster than P2



AWS Deep Learning AMI

Caffe2

Microsoft CNTK

mxnet

PYTORCH

TensorFlow

torch

Keras

GLUON

# The Amazon Machine Learning stack

Application Services

Platform Services

Frameworks & Interfaces

AWS Deep Learning AMIs

Caffe2

CNTK

Apache  
MXNet

PyTorch

TensorFlow

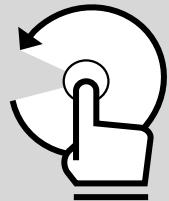
Torch

Keras

Gluon

# Amazon SageMaker

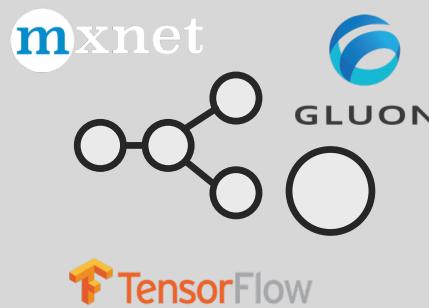
Build, train, and deploy machine learning models at scale



End-to-End  
Machine Learning  
Platform



Zero setup

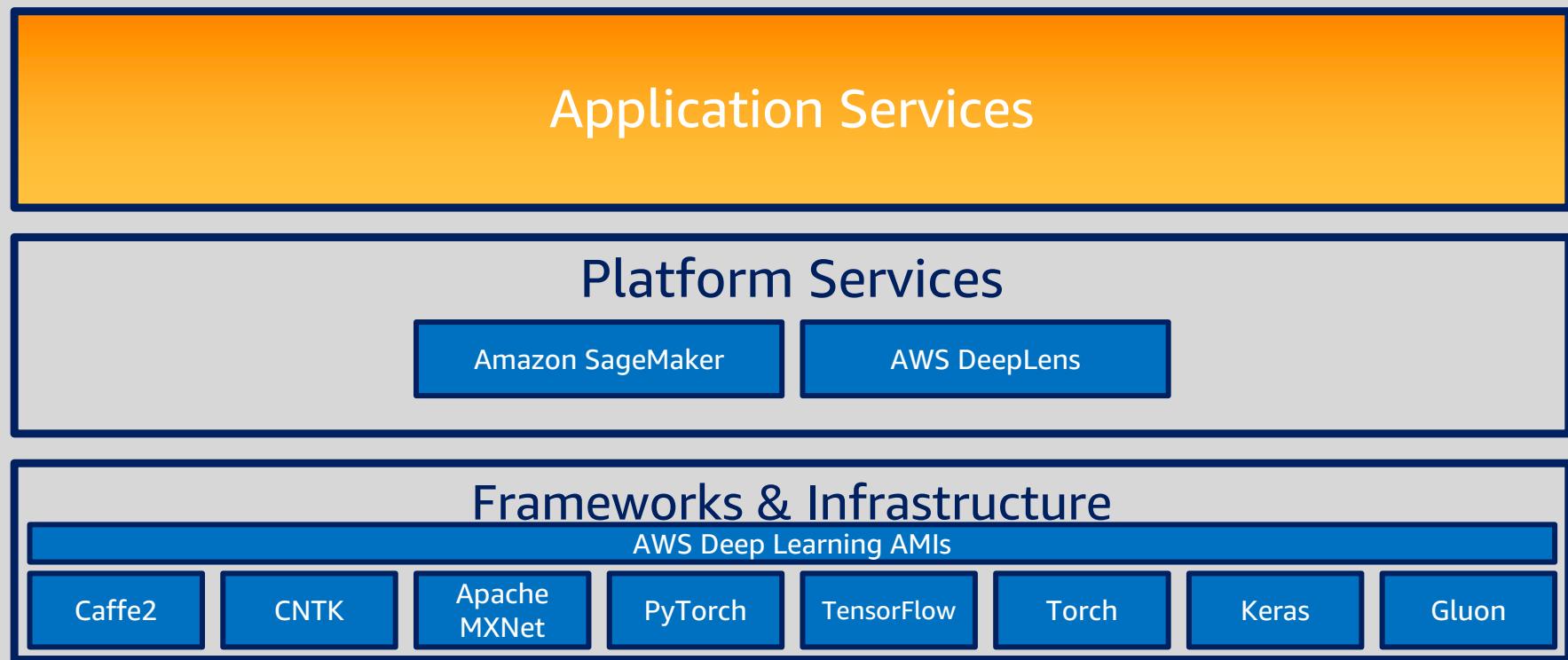


Flexible Model  
Training



Pay by the second

# The Amazon Machine Learning stack



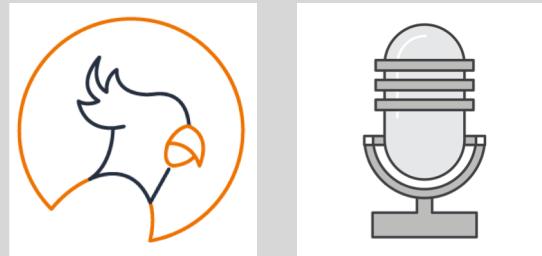
# Amazon ML application services

## Vision



Amazon Rekognition  
Amazon Rekognition  
Video

## Speech



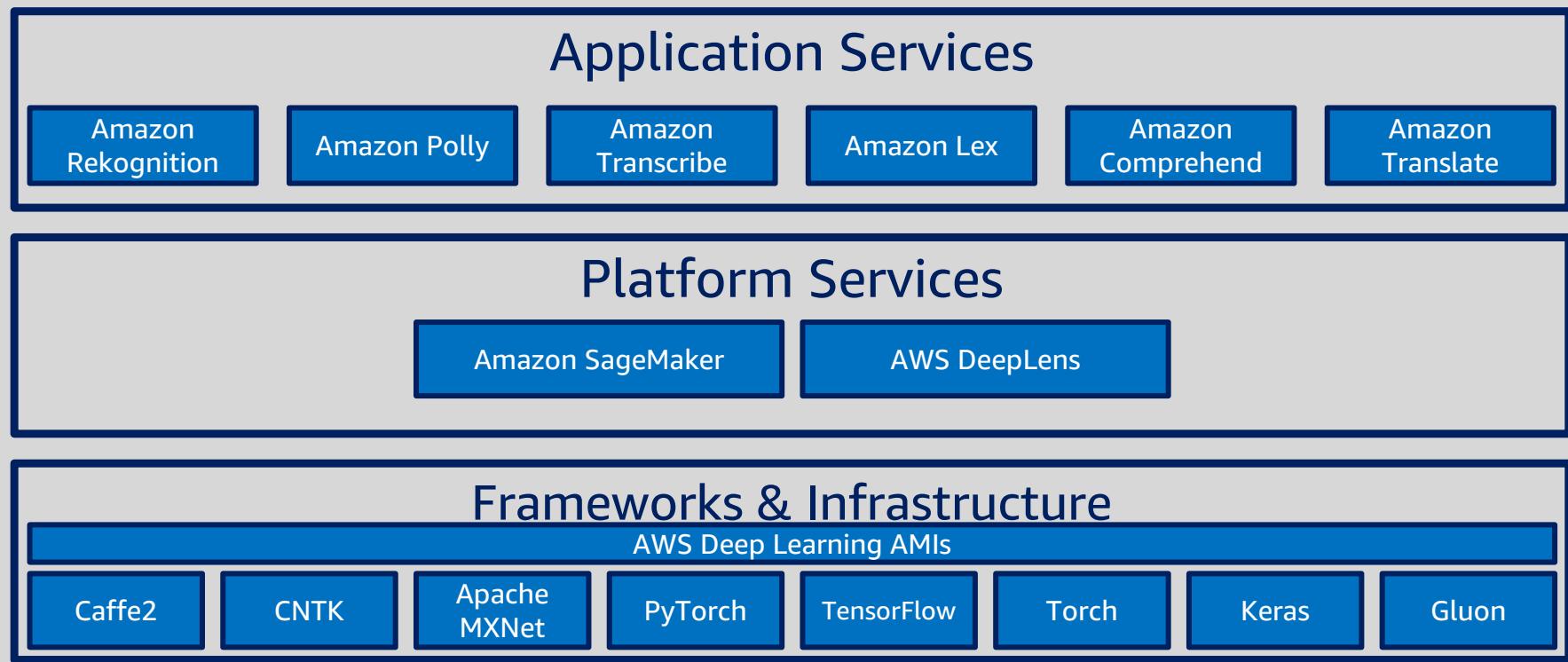
Amazon Polly  
Amazon Transcribe

## Language

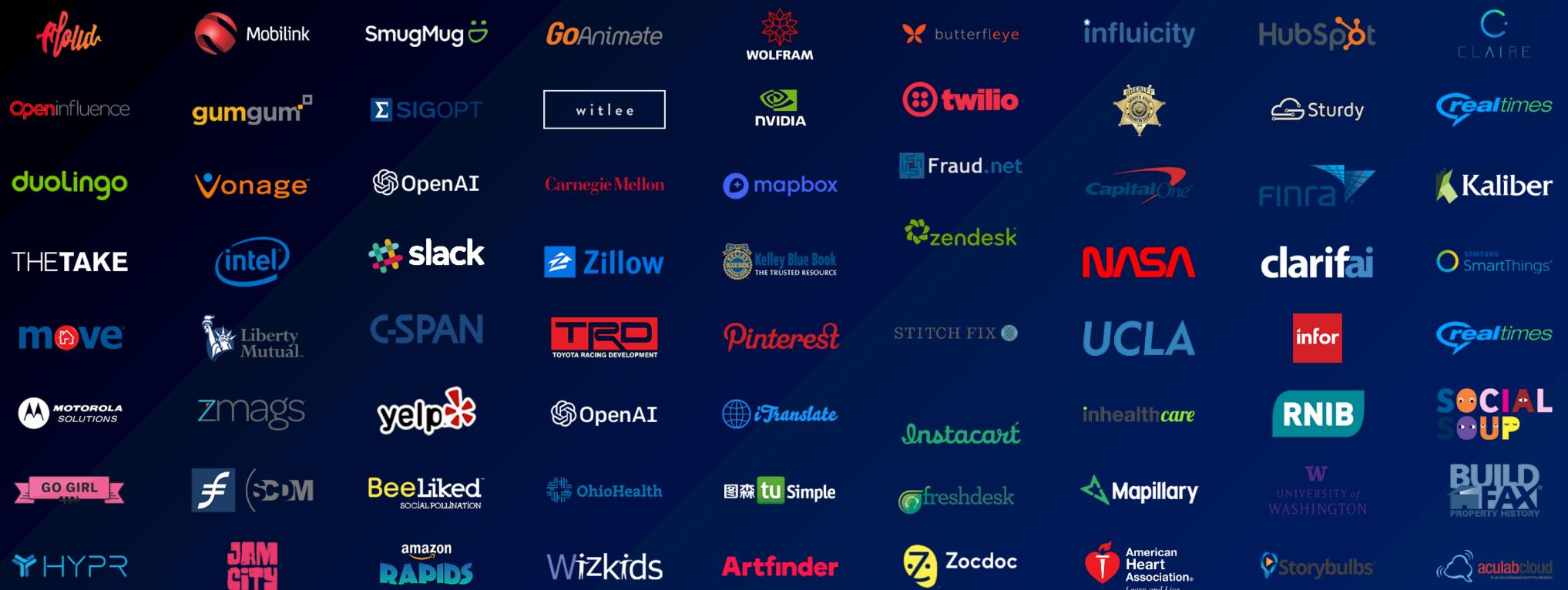


Amazon Lex  
Amazon Translate  
Amazon Comprehend

# The Amazon Machine Learning stack



# Customers running ML on AWS today



But how do I start?  
Where should I apply Machine Learning?  
What approach should I be taking?

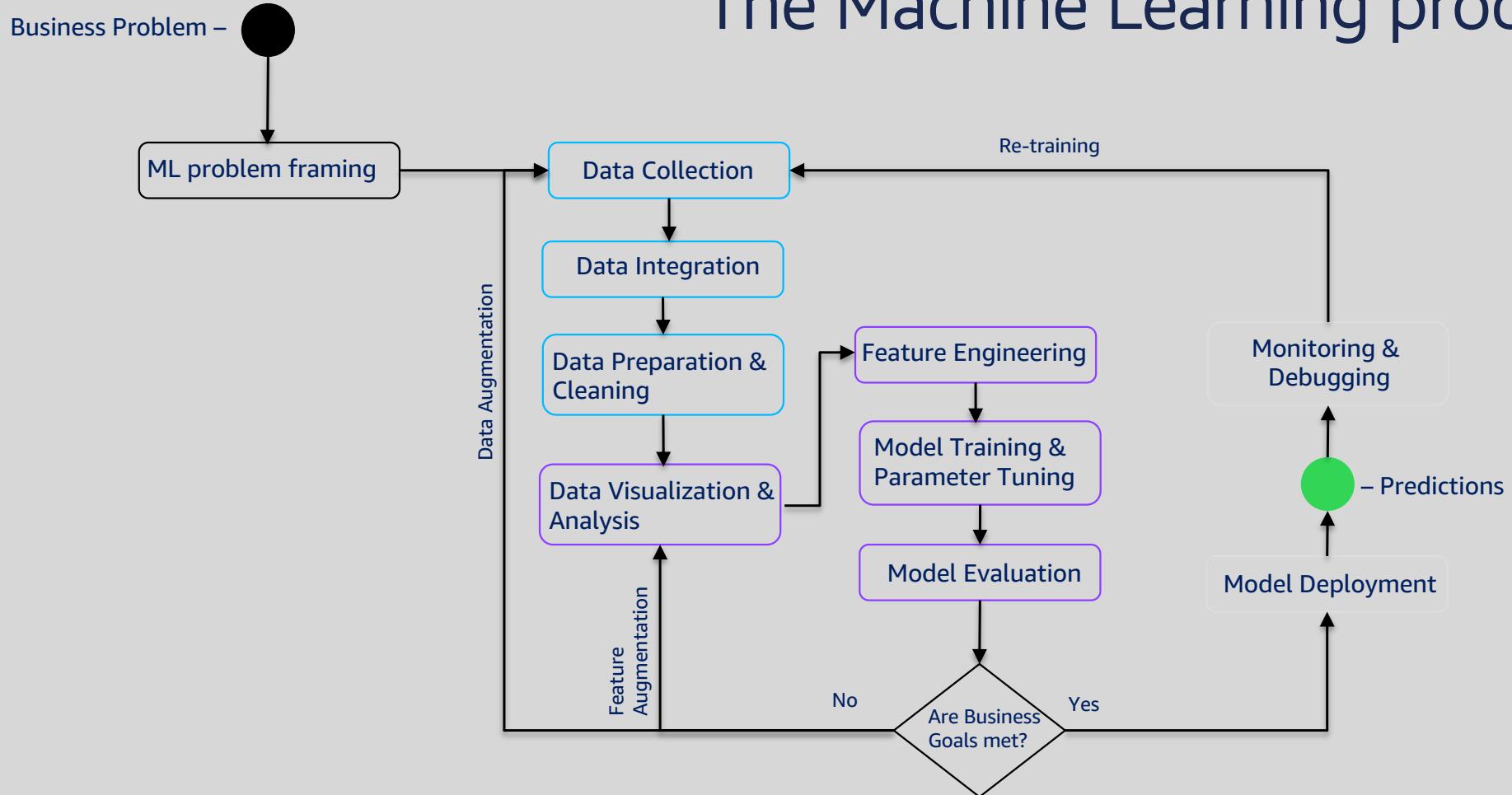
?



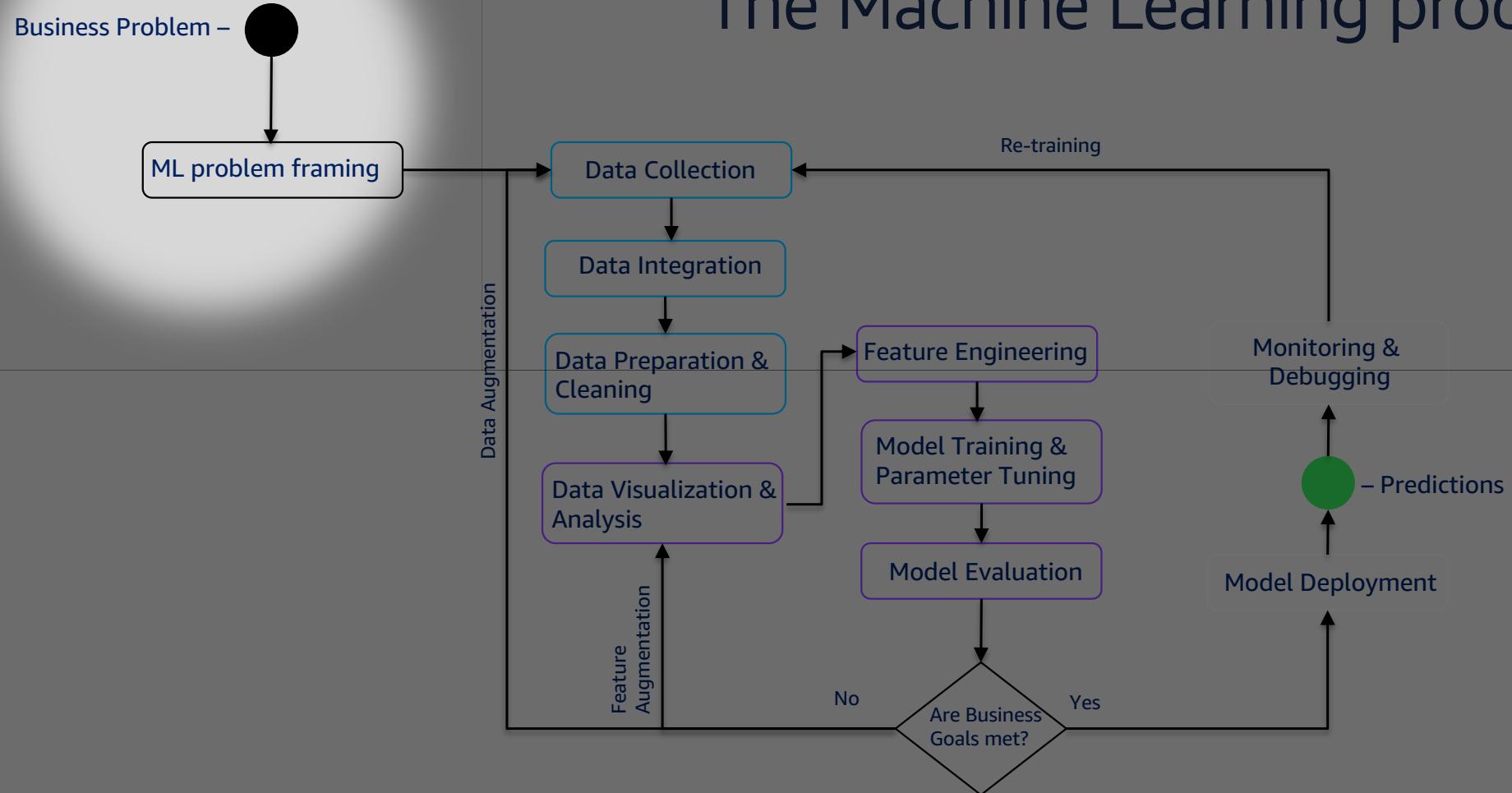


# The Machine Learning process

# The Machine Learning process

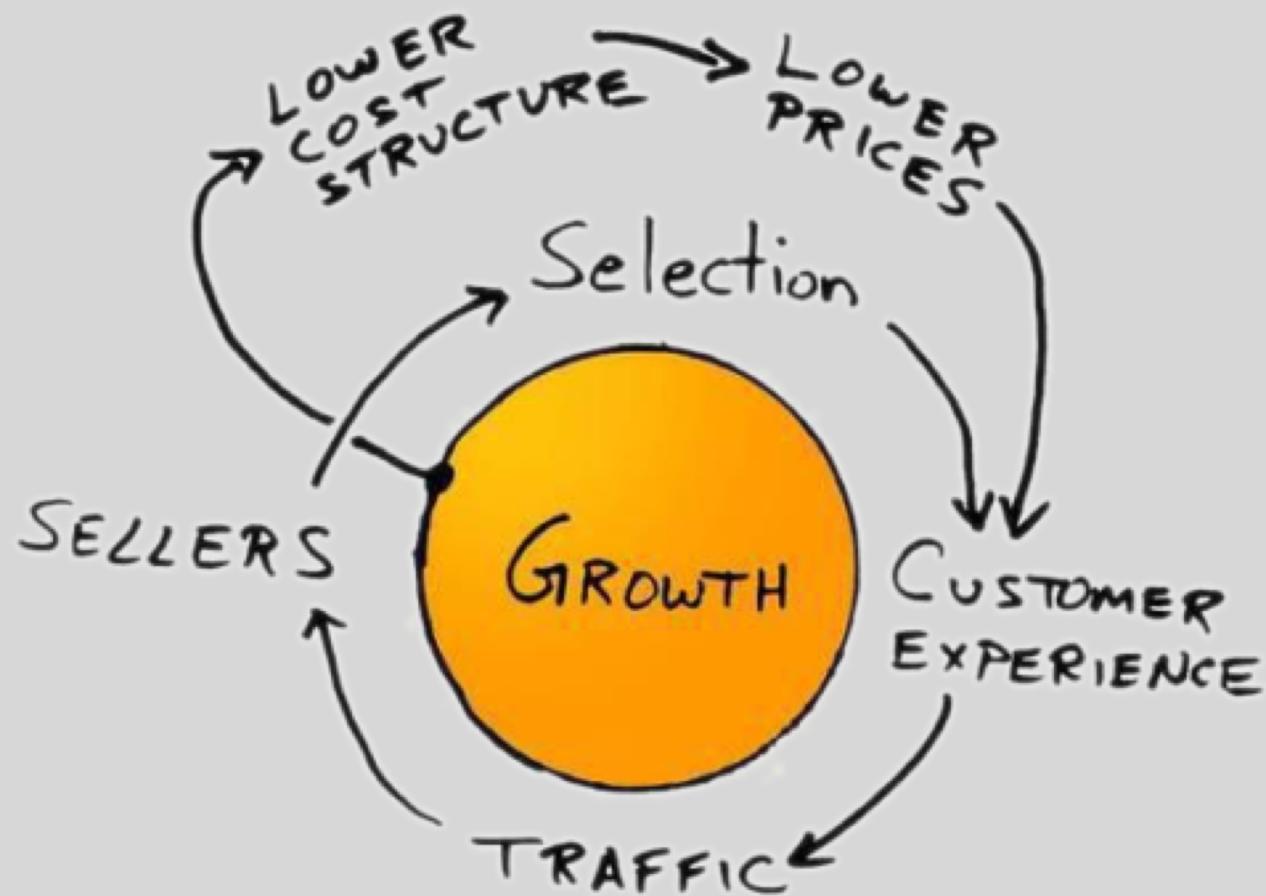


# The Machine Learning process



# Finding the right ML problem

# The Amazon Flywheel



Amazon PartnerNet  
SiteStripe Link erstellen : Text Bild Text+Bild Teilen: [f](#) [t](#) Der "Amazon Associates Link Builder" – das erste offizielle Amazon WordPress Plug-In für Amazon-Partner. [Mehr dazu.](#) Verdienst Hilfe [G](#)

smileamazon.de prime Alle ▾ [Suche](#) amazonfresh Und der Einkauf ist gemacht.

Lieferung an Constantin 81827 München fresh Alle Kategorien Ausgewählt: CORRECTIV Recherchen fuer die Gesellschaft gGmbH ▾ DE Hallo, Consta... Mein Konto Mein Prime Meine Listen 0 Einkaufswagen

Wir stellen vor  
**echo spot**  
129,99€



Verwerfen < >

**PRIME**  
Hallo, Constantin  
KUNDE SEIT 1999  
BESTELLUNGEN  
12 kürzliche Bestellungen  
IHRE TOP-KATEGORIEN  
Lebensmittel & Getränke  
Drogerie & Körperpflege  
Prime Video

Gratis Premiumversand:  
Schnell, kostenlos & bequem



**FRESH**  
ERNEUT KAUFEN



**VIDEO**  
Weiter ansehen:  
You Are Wanted - Staffel 2



**MUSIK**  
Empfehlungen für Sie:  
Love Death Immortality (Re...)



**ALEXA**  
„Alexa, fü...  
hirzu“ >



Julien Simon [Follow](#)

Hacker. Headbanger. Harley rider. Hunter. <https://aws.amazon.com/evangelists/julien-simon/>

Jan 29 · 8 min read

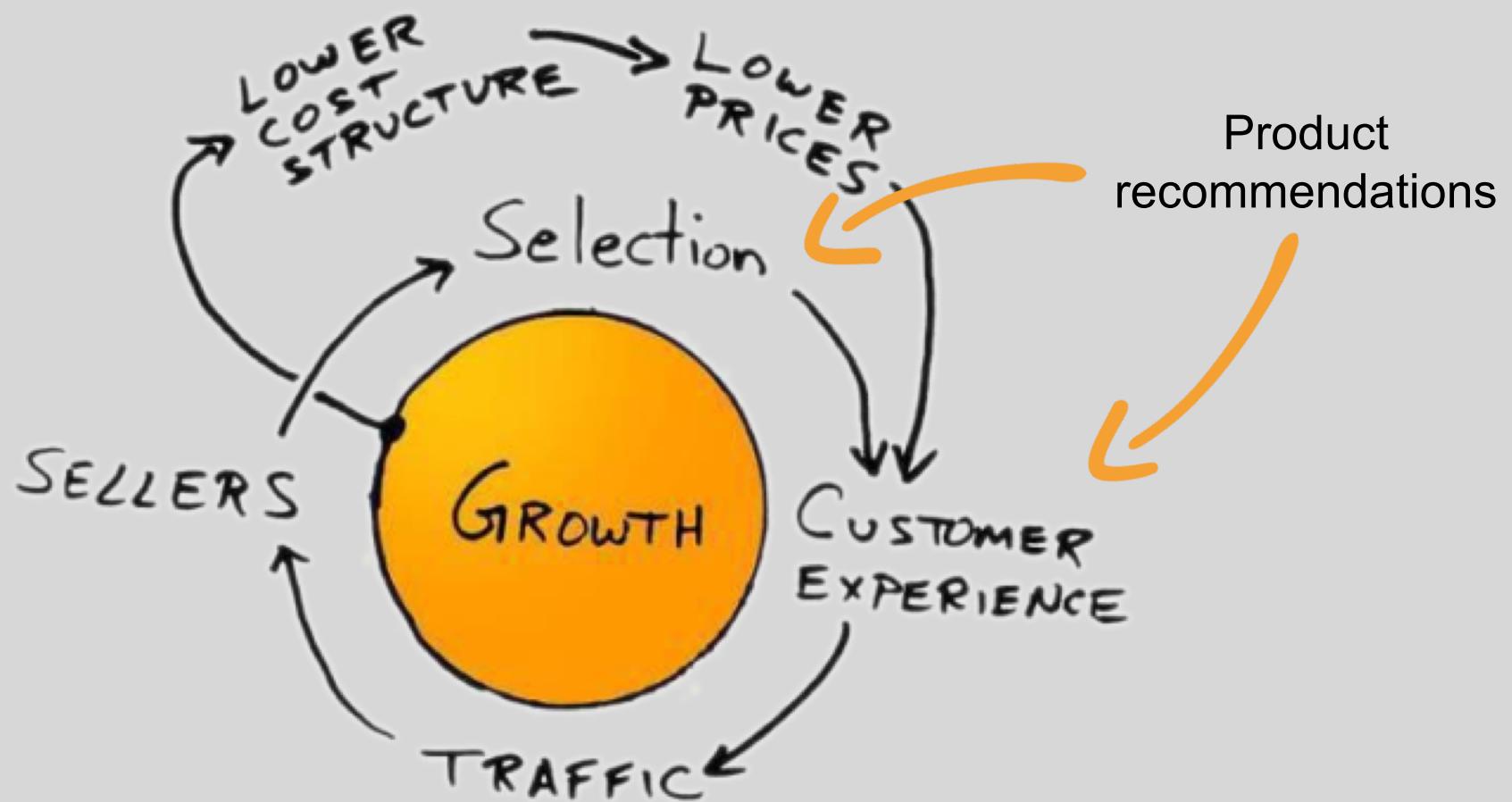
## Building a movie recommender with Factorization Machines on Amazon SageMaker

Recommendation is one of the most popular applications in Machine Learning. In this post, you will learn how to build a movie recommendation model based on Factorization Machines—one of the built-in algorithms of Amazon SageMaker—and the popular MovieLens dataset.



<https://medium.com/@julsimon/building-a-movie-recommender-with-factorization-machines-on-amazon-sagemaker-cedbfc8c93d8>

# The Amazon Flywheel



 This product page was automatically translated.  
Was this translation helpful? [Yes](#) or [No](#)

## 1432 Girali (Grasping toy) - Selecta Wooden Toys>Selecta Spielzeug

by [Selecta Spielzeug](#)

 3 customer reviews

Price: **£12.03** & **FREE Delivery** in the UK. [Details](#)

**Only 7 left in stock.**

Sold by [Alle-Spielwaren](#) and [Fulfilled by Amazon](#). Gift-wrap available.

Want it delivered to [Germany](#) ▾ by tomorrow, 18 March? Order within **5 hrs 41 mins** and choose [One-Day Delivery to Germany](#) at checkout. [Details](#)

[18 new from £7.11](#)

- 10 cm / 4 in.
  - This classic series of grasping toys has been perfected by Selecta for over 30 years.
- [See more product details](#)





Services ▾

Resource Groups ▾



PowerUser/cli-session @ glez ▾

Ireland ▾

Support ▾

## Amazon Translate



Dashboard

[Try Amazon Translate](#)[Amazon Translate](#) > Try Amazon Translate

### Try Amazon Translate Info

#### Translate text

[Swap languages](#)[Translate](#)

Source language

Auto (auto)

Engel  
klein  
mit Geige  
Wendt & Kühn  
Neuheiten 2017

49 characters, 50 of 5000 bytes used

Detected language: German (de)

Is this translation what you expected? Please leave us [feedback](#)

Target language

English (en)

Angel small with violin Wendt &amp; Kühn New Arrivals 2017

English is the only supported target language for the detected source language.



Services ▾

Resource Groups ▾



PowerUser/cli-session @ glez ▾

Ireland ▾

Support ▾

## Amazon Translate



Dashboard

[Try Amazon Translate](#)[Amazon Translate](#) > Try Amazon Translate

### Try Amazon Translate Info

#### Translate text

[Swap languages](#)[Translate](#)

Source language

Auto (auto)

Engel  
klein  
mit Geige  
Wendt & Kühn  
Neuheiten 2017

49 characters, 50 of 5000 bytes used

Detected language: German (de)

Is this translation what you expected? Please leave us [feedback](#)

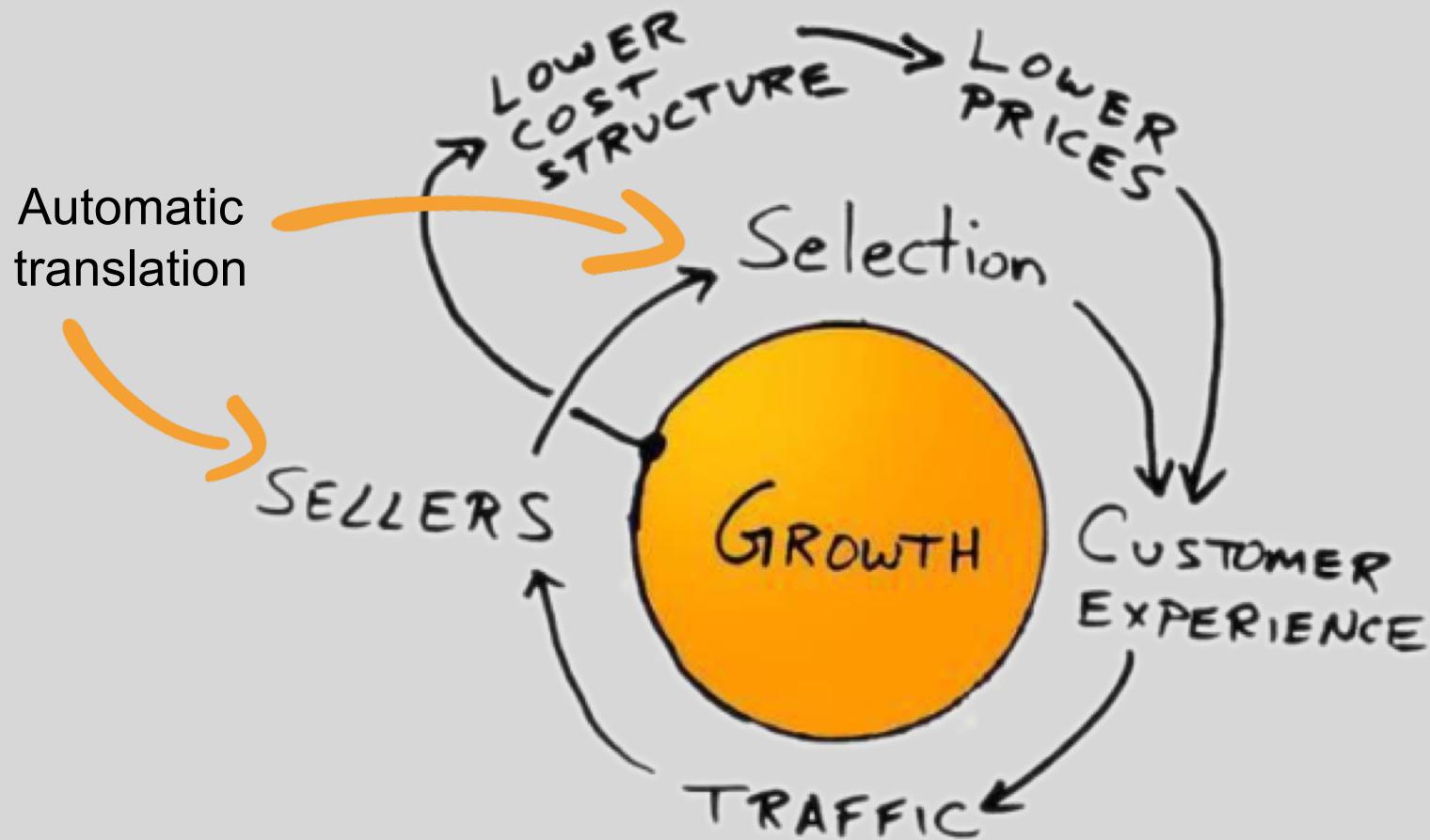
Target language

English (en)

Angel small with violin Wendt &amp; Kühn New Arrivals 2017

English is the only supported target language for the detected source language.

# The Amazon Flywheel





- + K-Means Algorithm
- + Principal Component Analysis (PCA)
- + Latent Dirichlet Allocation (LDA)
- + Neural Topic Model (NTM)
- DeepAR Forecasting**
  - Hyperparameters
  - Inference Formats
- + BlazingText
- + Random Cut Forest
- + Using Your Own Algorithms
- + Automatically Scaling Amazon SageMaker Models
- + Using TensorFlow
- + Using Apache MXNet

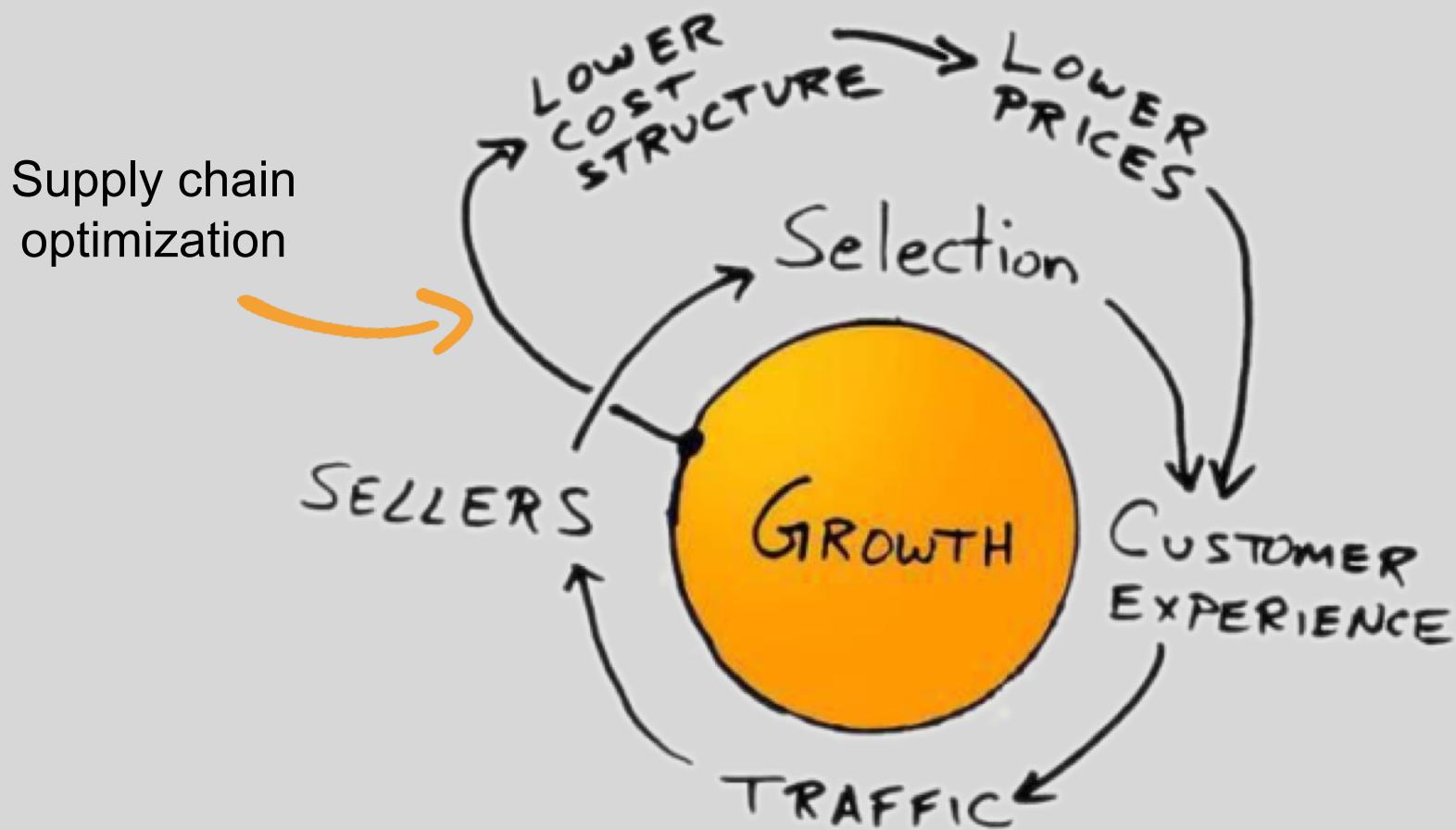
[AWS Documentation](#) » [Amazon SageMaker](#) » [Developer Guide](#) » [Using Built-in Algorithms with Amazon SageMaker](#) » DeepAR Forecasting

## DeepAR Forecasting

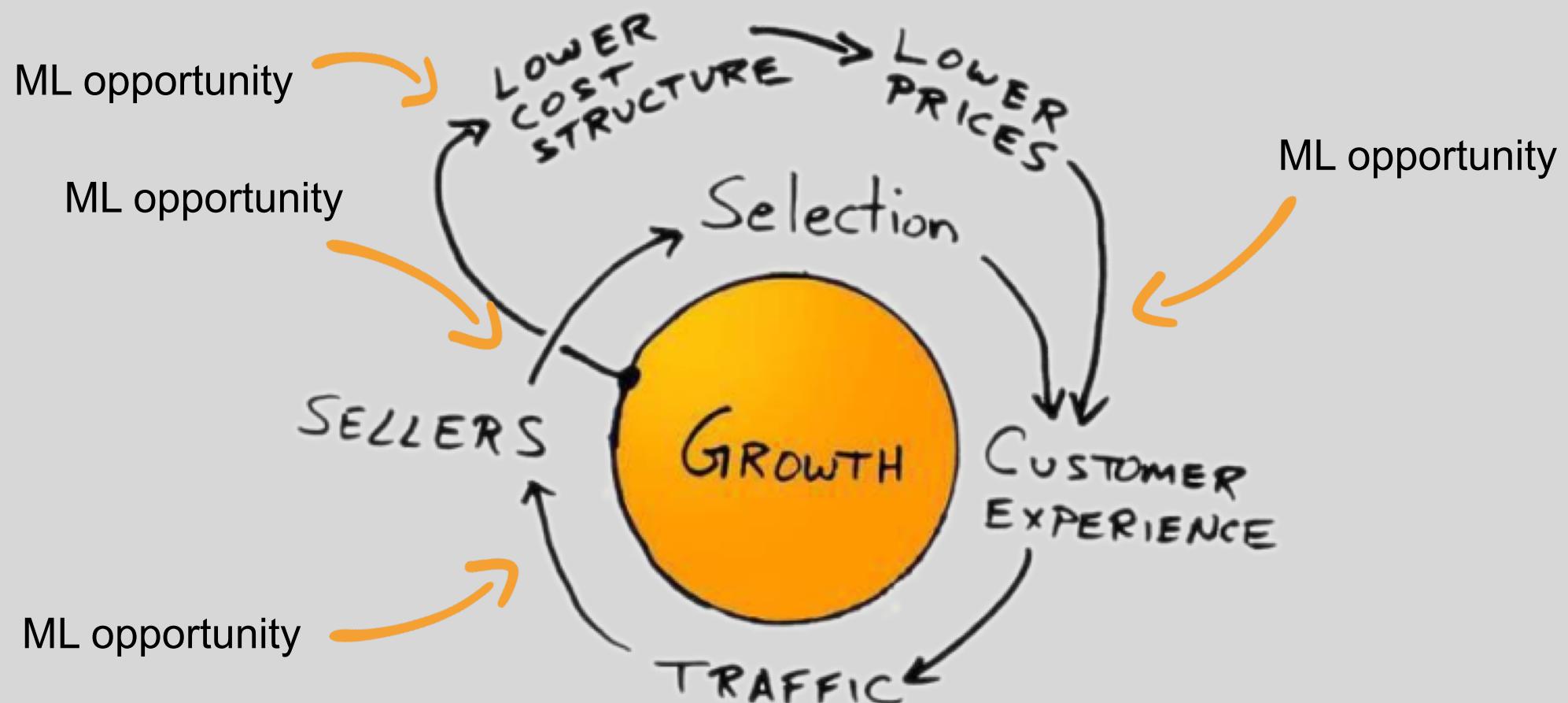
Amazon SageMaker DeepAR is a supervised learning algorithm for forecasting **scalar** time series using recurrent neural networks (RNN). Classical forecasting methods, such as Autoregressive Integrated Moving Average (ARIMA) or Exponential Smoothing (ETS), fit one model to each individual time series, and then use that model to extrapolate the time series into the future. In many applications, however, you might have many similar time series across a set of cross-sectional units (for example, demand for different products, load of servers, requests for web pages, and so on). In this case, it can be beneficial to train a single model jointly over all of these time series. DeepAR takes this approach, training a model for predicting a time series over a large set of (related) time series.

For the training phase, the dataset consists of one or preferably more than one time series, and an optional categorical grouping variable of which the time series is a member. The model learns entirely from these values. The DeepAR algorithm currently accepts no other external features. The model is then trained by randomly selecting time points from the provided time series and using them as training examples.

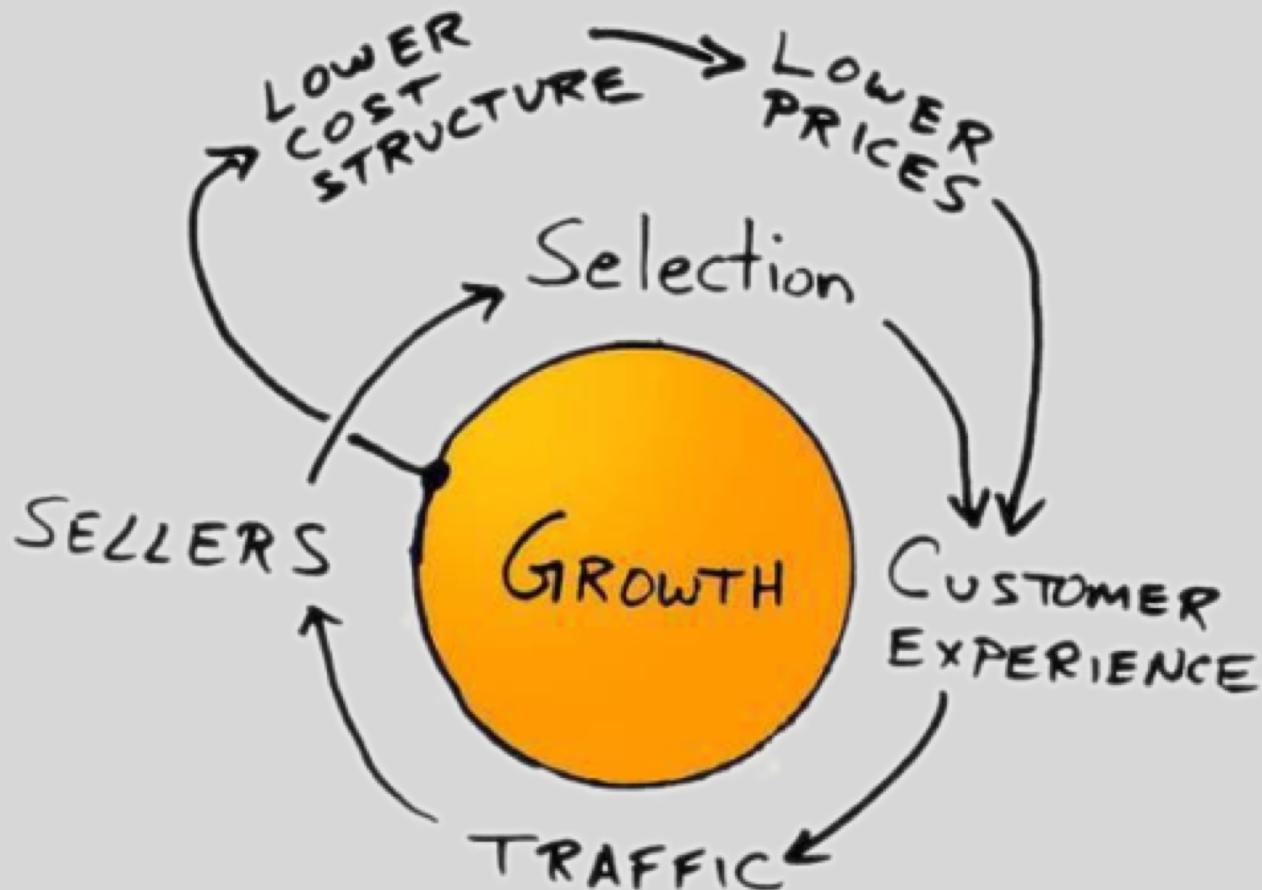
# The Amazon Flywheel



# The Amazon Flywheel



# Build your own Flywheel



# Build your own Flywheel

The screenshot shows the product page for "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" (English) Taschenbuch – 20. August 2010. The page includes the book cover, author information, customer reviews, and purchase options. A sidebar on the right provides additional details like delivery information and a 'prime' badge.

Bücher (Fremdsprachig) ▾ business model generation

Ausgewählt: CORRECTIV Recherchen fuer die Gesellschaft gGmbH ▾

DE Hallo, Constantine Mein Prime Meine Listen Einkaufswagen

Lieferung an Constantin 81827 München

fresh Alle Kategorien Constantins Amazon Angebote Gutscheine Verkaufen Hilfe

Fremdsprachige Bücher Erweiterte Suche Bestseller Neuheiten & Vorbesteller Angebote Englische Bücher Französische Bücher Spanische Bücher Italienische Bücher Niederländische Bücher

Business Model Generation und tausende andere Lehrbücher sind für den sofortigen Download auf Ihr Kindle Fire-Tablet oder auf die kostenfreien Kindle-Apps für iPad, Android tablets, PC oder Mac verfügbar. Erfahren Sie mehr

« Zurück zu den Suchergebnissen für "business model generation"

**Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers** (Englisch) Taschenbuch – 20. August 2010

von Alexander Osterwalder (Autor), Yves Pigneur (Autor)

★★★★★ 44 Kundenrezensionen

Alle 4 Formate und Ausgaben anzeigen

Kindle Edition EUR 20,94 Taschenbuch EUR 24,64 prime

Lesen Sie mit unserer kostenfreien App

Lieferung Mittwoch, 30. Mai: Bestellen Sie innerhalb 4 Stunden und 34 Minuten per Premiumversand an der Kasse. Siehe Details.

62 neu ab EUR 20,03 | 16 gebraucht ab EUR 15,06

Hinweis: Dieser Artikel ist zu einem günstigeren Preis bei anderen Verkäufern erhältlich, die nicht Amazon Prime anbieten.

Business Model Generation is a handbook for visionaries, game changers, and challengers striving to defy outmoded business models and design tomorrow's enterprises. If your organization needs to adapt to harsh new realities, but you don't yet have a strategy that will get you out in front of your competitors, you need Business Model Generation.

Mehr lesen

Alle 4 Bilder anzeigen

Neu kaufen EUR 24,64 Alle Preisangaben inkl. deutscher USt. Weitere Informationen.

prime Auf Lager. Verkauf und Versand durch Amazon. Qualifiziert für smile.amazon.de.

Menge: 1 In den Einkaufswagen Loggen Sie sich ein, um 1-Click® einzuschalten.

Liefern an Constantin - 81827 München Gebraucht kaufen EUR 15,06

# Build your own Flywheel

**The Business Model Canvas**

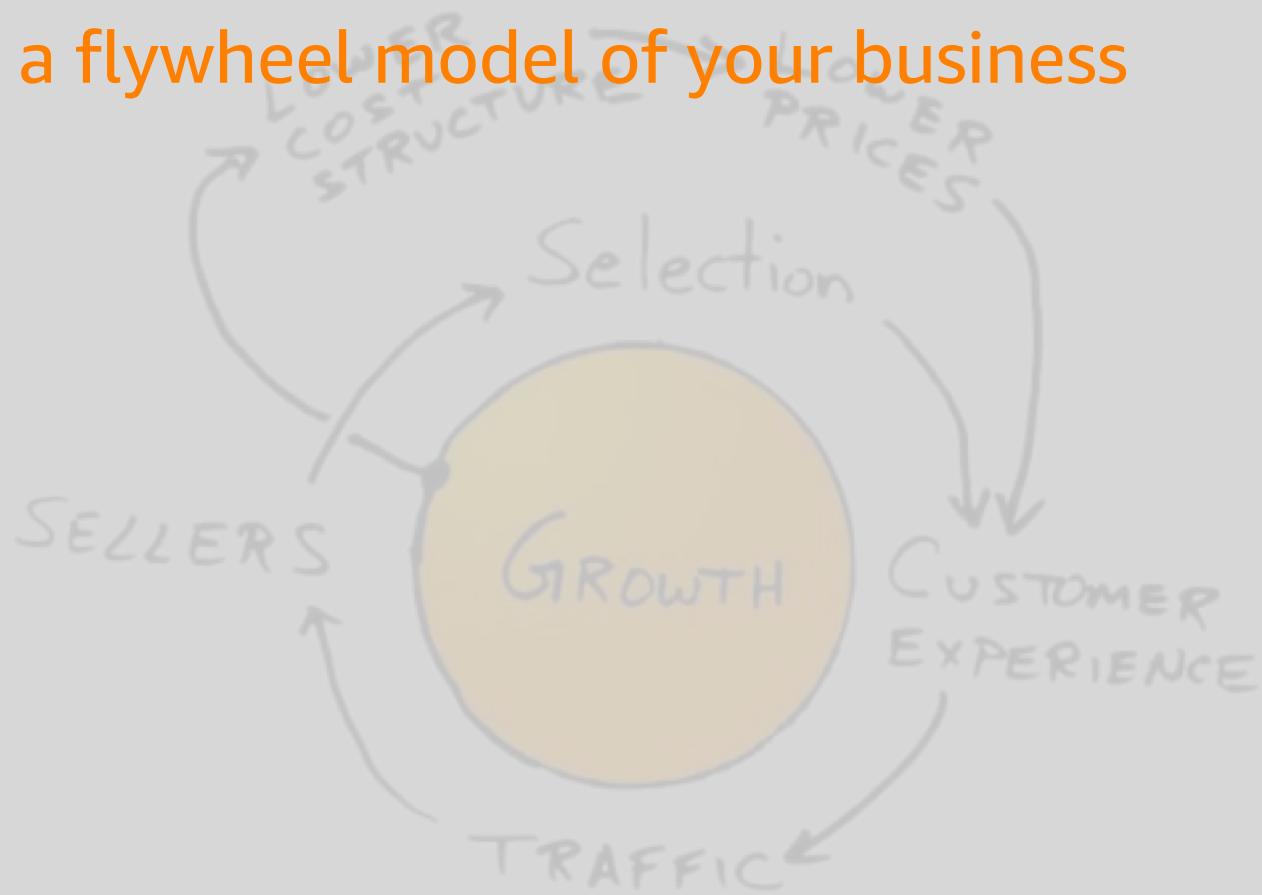
		Designed for:	Designed by:	Date:	Version:
<b>Key Partners</b> 	<b>Key Activities</b> 	<b>Value Propositions</b> <p>What value do we deliver to the customer? Which one of our customer's problems are we helping to solve? What kind of products and services are we offering to each Customer Segment? Who are the most important needs are we satisfying?</p> <p><b>EXPERIENCES</b> Productive Efficient Reliable Customized Design Personal Price Fast delivery Accesible Convenient Quality</p> <p><b>REQUIREMENTS</b> Partners Optimization and economy Acquisition of resources Acquisition of particular resources and activities</p>			
		<b>Customer Relationships</b> <p>What type of relationship does each of our Customer Segments expect us to establish with them? Which ones have we established? How are they integrated with the rest of our business? How do we manage them? How costly are they?</p> <p><b>EXAMPLES</b> Exclusive Delicated Person Assistance Personalized Automated Services Price Fast delivery Accesible Convenient Quality</p> <p><b>MORE MARKET</b> Niche Market Generalized Diversified Multi-sided Platform</p>			
<b>Key Resources</b> 	<b>Channels</b> 	<b>Customer Segments</b> <p>For whom are we creating value? Who are our most important customers?</p> <p><b>MORE MARKET</b> Niche Market Generalized Diversified Multi-sided Platform</p>			
		<b>Channels</b> <p>Through which Channels do our Customer Segments want to be reached? How do we reach them? How are our Channels integrated? Which ones work best? How can we make them more cost-efficient? How are we integrating them with customer routines?</p> <p><b>CHANNEL PAGES</b> How do we raise awareness about our company's products and services? How do we help customers evaluate our organization's value Proposition? How do we allow customers to purchase specific products and services? How do we deliver a value Proposition to customers? How do we provide post-purchase customer support?</p>			
<b>Cost Structure</b> 	<b>Revenue Streams</b> 	<p><b>Cost Structure</b> What are the most important costs inherent in our business model? Which costs are variable? Which are fixed? Which Key Activities are most expensive?</p> <p><b>IN YOUR BUSINESS MODELS</b> Cost Driven Model cost structure, low price value proposition, minimum automation, extensive outsourcing Value Based Model value proposition, minimum cost structure, high price value proposition</p> <p><b>AMPLE CHARACTERISTICS</b> Centralized, decentralized, unified Variable costs Dynamic costs Economies of scale</p> <p><b>Revenue Streams</b> For what value are our customers really willing to pay? How much do they currently pay? How are they currently paying? How would they prefer to pay? How much does each Revenue Stream contribute to overall revenue?</p> <p><b>TYPE OF USE</b> Asset use Subscription Licensing Sharing Advertising</p> <p><b>PASS PRICE</b> Low High Customer future dependent Customer segment Volume dependent</p> <p><b>VERAGE PRICE</b> Registration Charging Customer Volume market</p>			

| **DESIGNED BY:** Business Model Foundry AG  
The makers of Business Model Generation and Strategyzer  
This work is licensed under the Creative Commons Attribution-ShareAlike 3.0 Unported License. To view a copy of this license, visit:  
<http://creativecommons.org/licenses/by-sa/3.0/> or send a letter to Creative Commons, 171 Second Street, Suite 300, San Francisco, California, 94105, USA.

**Strategyzer**  
strategyzer.com

# Checklist

## 1. Create a flywheel model of your business



# Checklist

1. Create a flywheel model of your business
2. Find opportunities to add value through ML
  1. Save cost through better planning
  2. Save cost through automating human work
  3. Increase revenue through delivering a better product/service
  4. Increase revenue through better customer experience

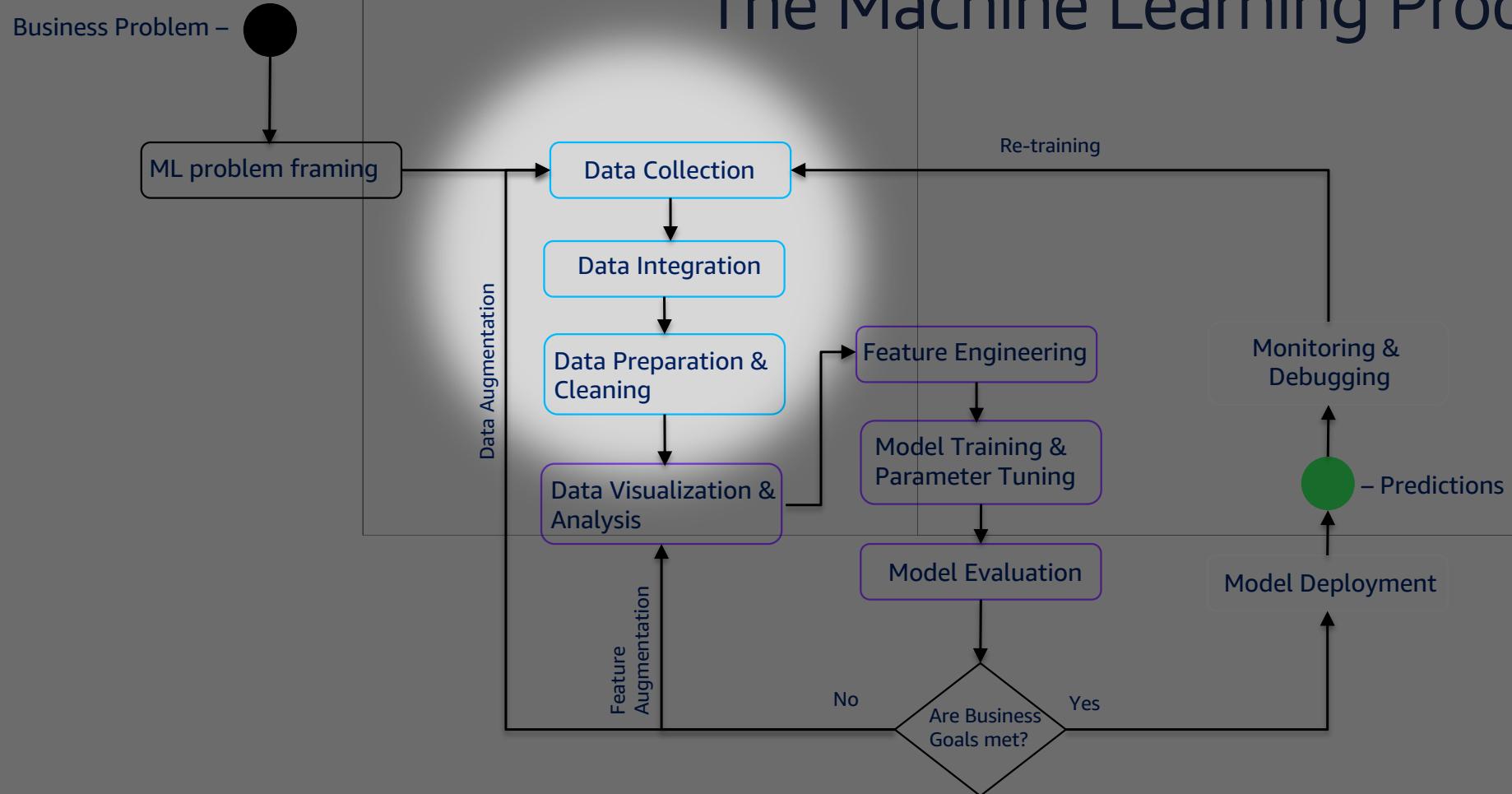
# Common ML use cases for some verticals

- Retail: Supply chain and demand forecasting
- Financial services: Credit default prediction for customer behavior
- Manufacturing: Real-time predictions for industrial IoT
- Advertising: Predict click-through rate for targeted ads
- Media and branding: Prediction of language content quality
- Automotive innovation: Self-driving vehicles and simulation
- Health and wellness: Track disease progression



# Collecting training data

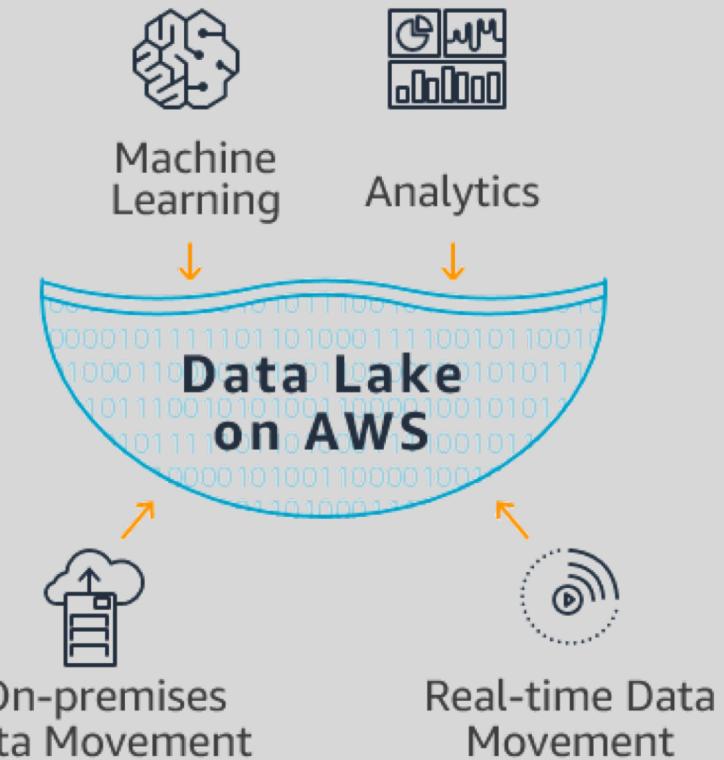
# The Machine Learning Process



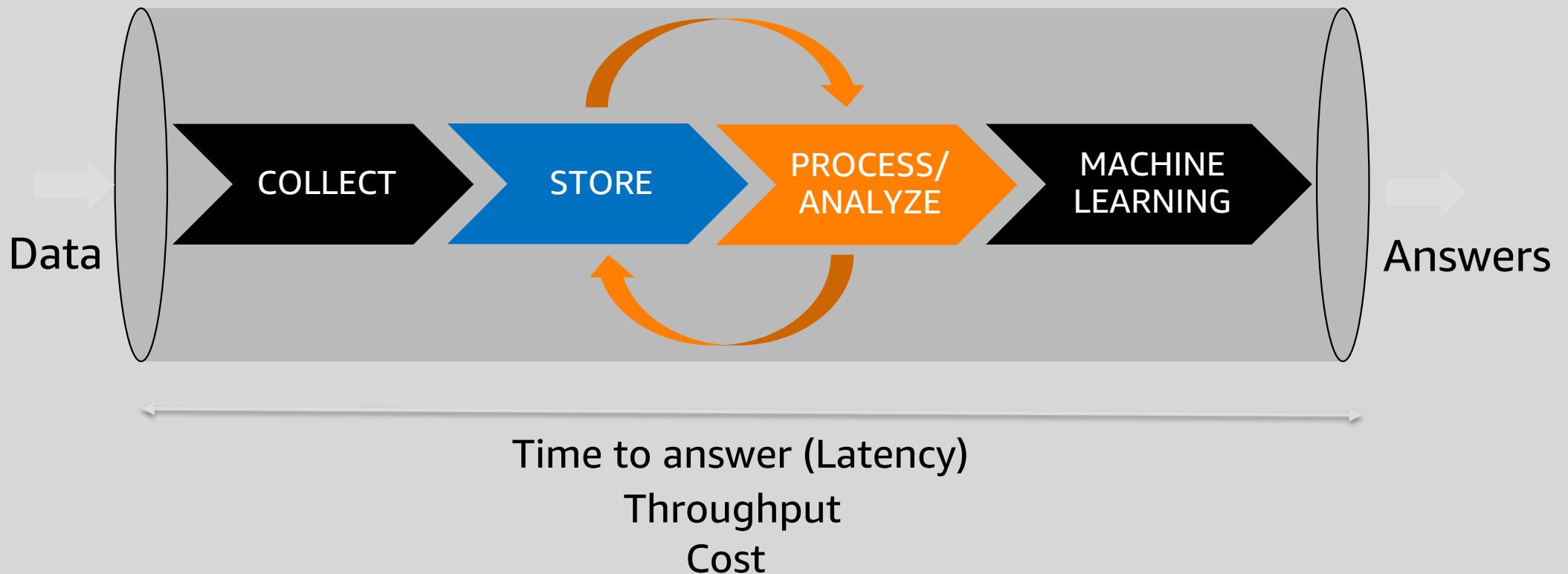
# Build your Data Lake first

## Data Sources:

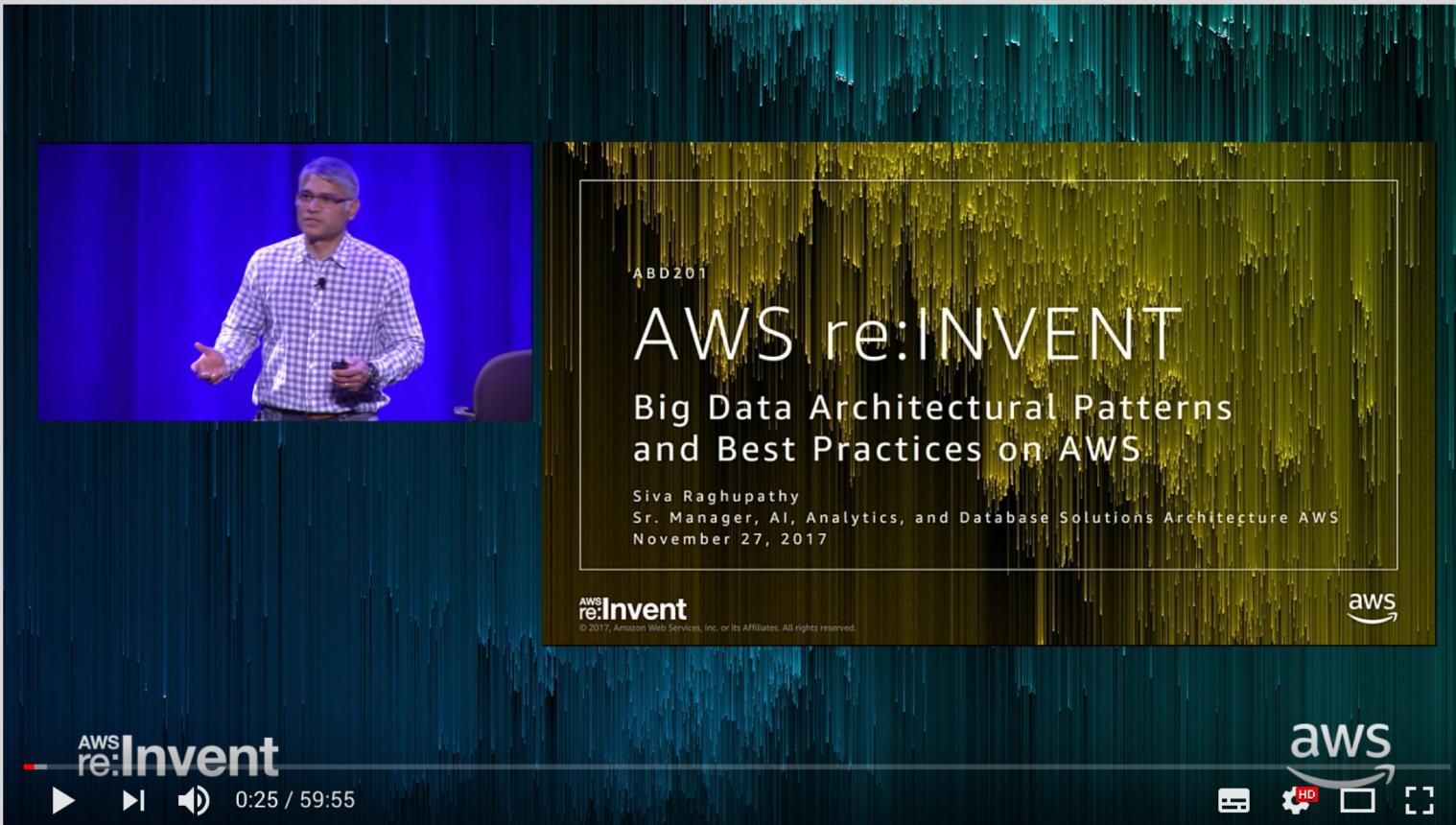
- Legacy
- Web
- Mobile
- IoT



# Data Processing overview



# All about Big Data on AWS in under one hour!



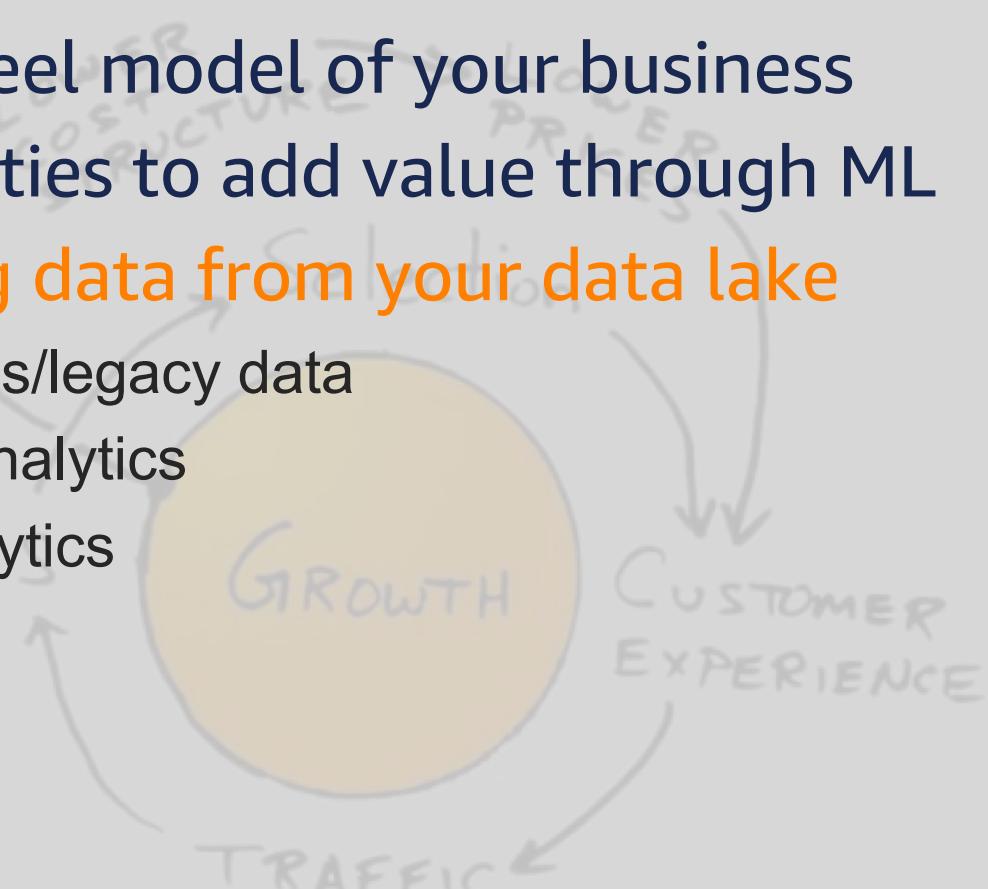
<https://www.youtube.com/watch?v=a3713oGB6Zk>

© 2018, Amazon Web Services, Inc. or its affiliates. All rights reserved.

aws SUMMIT

# Checklist

1. Create a flywheel model of your business
2. Find opportunities to add value through ML
3. **Collect training data from your data lake**
  1. On-premises/legacy data
  2. Web logs/analytics
  3. Mobile analytics
  4. IoT data



# Here.com uses Amazon Rekognition to enrich their mapping content



*“We use Amazon Rekognition to enrich our mapping content. Rekognition’s Text in Image allows us to continually update signage information so our customers have the latest information at their fingertips. We look forward to continuing our partnership with AWS and implementing their computer vision solutions in more of our products.”*

—Rajkumar Jain  
Director of Engineering at HERE Technologies

# Supervised Learning



# Supervised Learning



Data



Labels

# Supervised Learning



# Supervised Learning



Data



Labels



Images: Unsplash.com

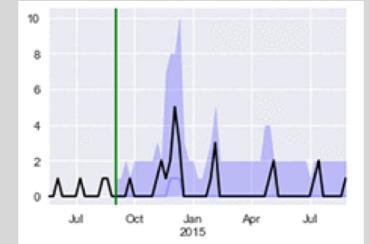
# Supervised Learning



Data



Labels



# Supervised Learning



Cheap!

# Supervised Learning



# Supervised Learning



- Historical data
  - Log files
  - Transactions
  - Data Warehouse

# Supervised Learning



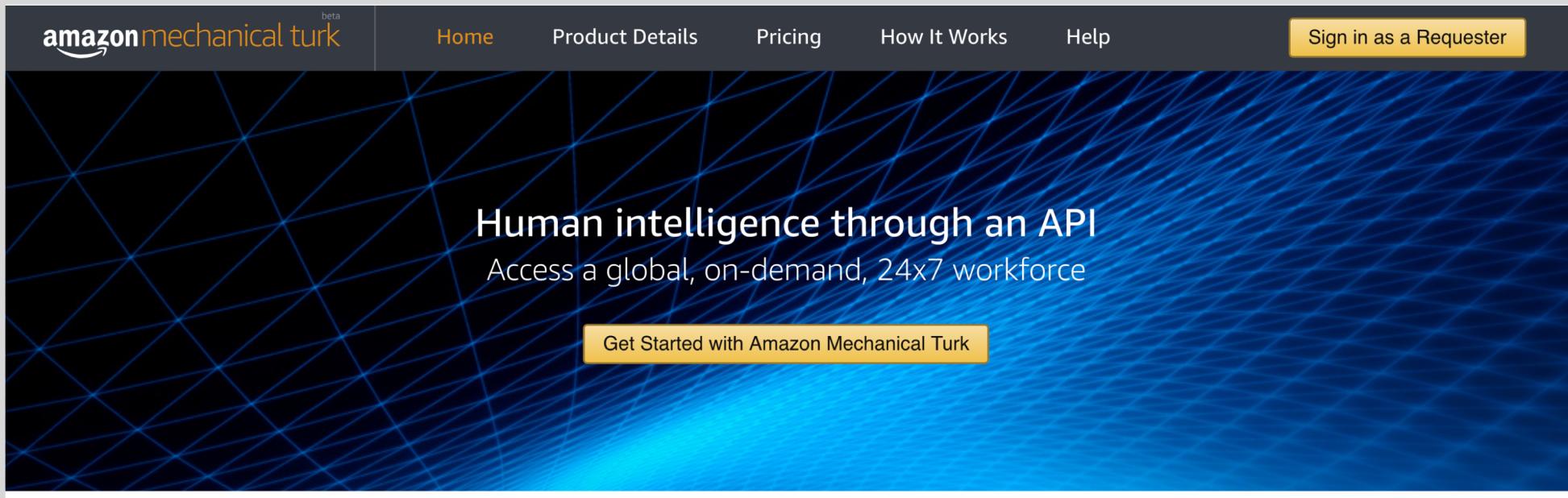
- Operational data
  - Streaming
  - IoT sensors

# Supervised Learning



- Real humans
  - Experts
  - User feedback
  - Hired “eyes and ears”

# Amazon Mechanical Turk (MTurk)



Amazon Mechanical Turk (MTurk) operates a marketplace for work that requires human intelligence. The MTurk web service enables companies to programmatically access this marketplace and a diverse, on-demand workforce. Developers can leverage this service to build human intelligence directly into their applications.

<https://www.mturk.com>

© 2018, Amazon Web Services, Inc. or its affiliates. All rights reserved.

AWS SUMMIT

# Supervised Learning



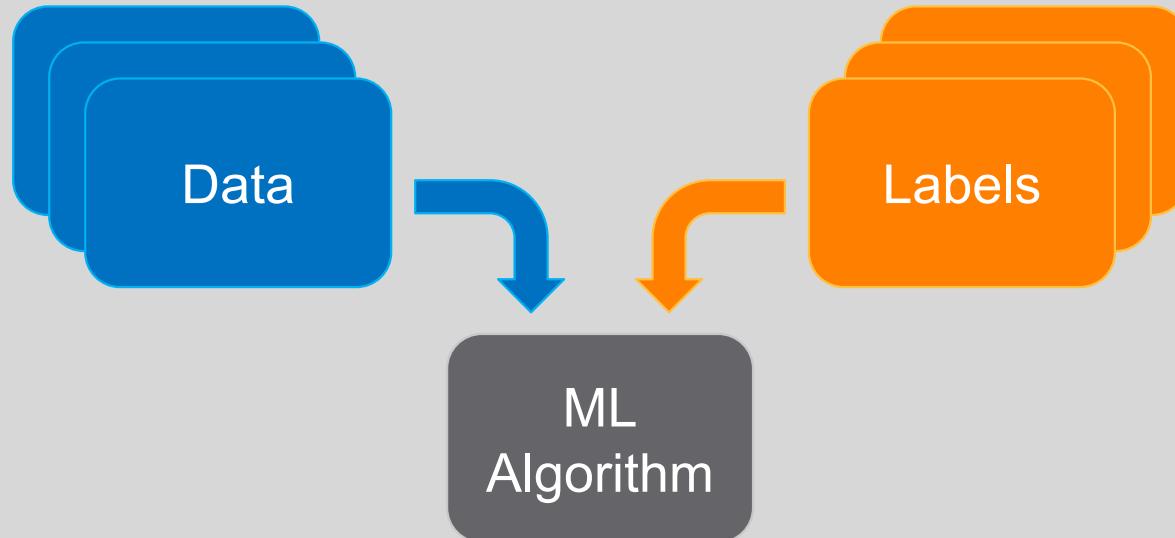
Data

X0,000  
or more

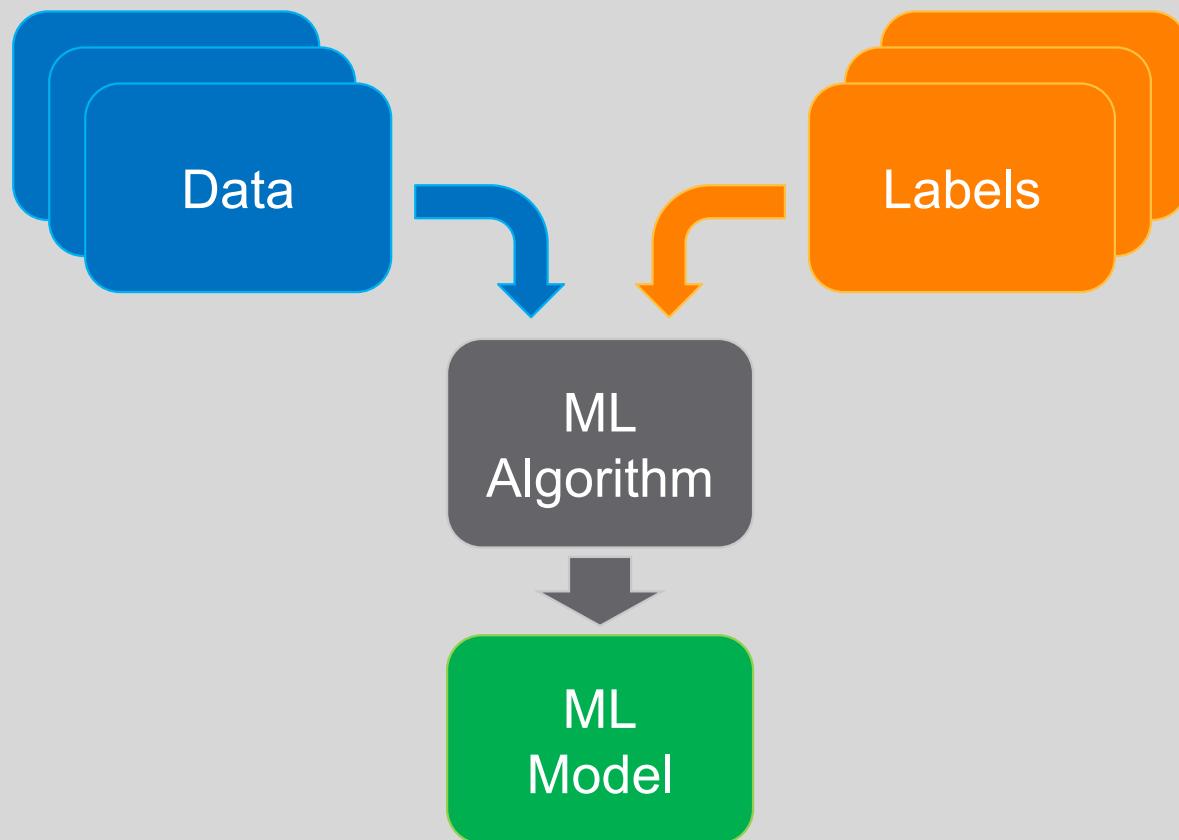


Labels

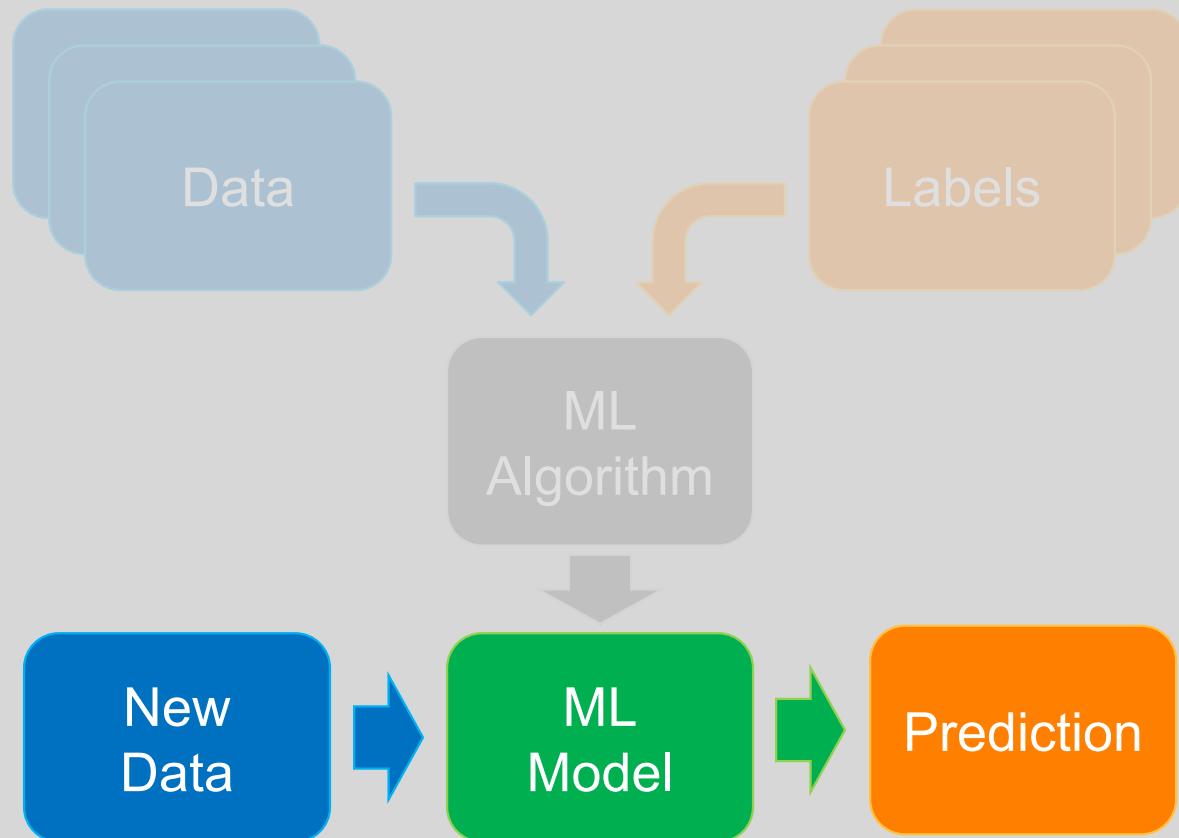
# Supervised Learning



# Supervised Learning



# Supervised Learning



# Checklist

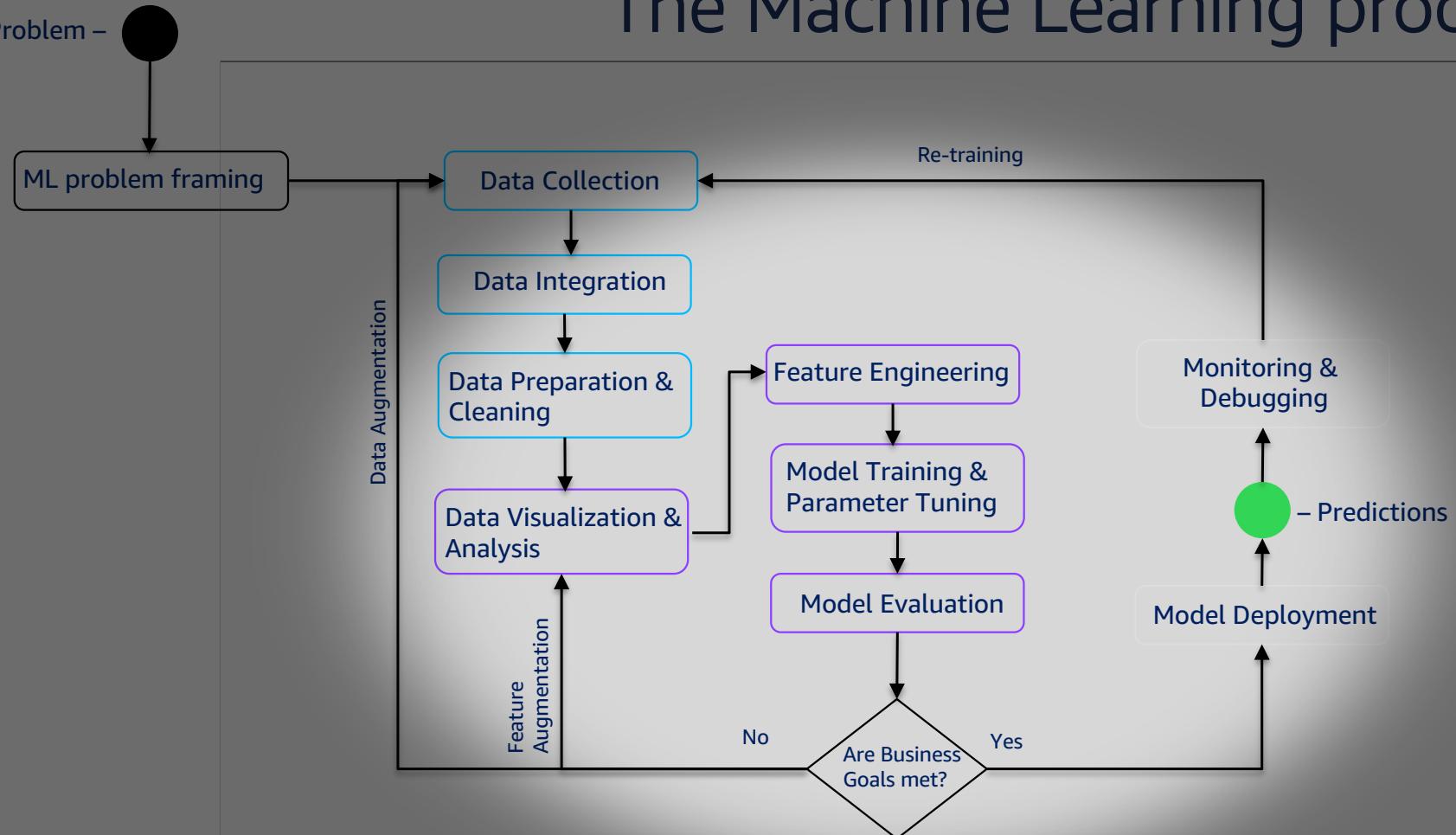
1. Create a flywheel model of your business
2. Find opportunities to add value through ML
3. Collect training data from your data lake
4. **Collect labels for your training data**
  - From historical data
  - From operations
  - From real humans



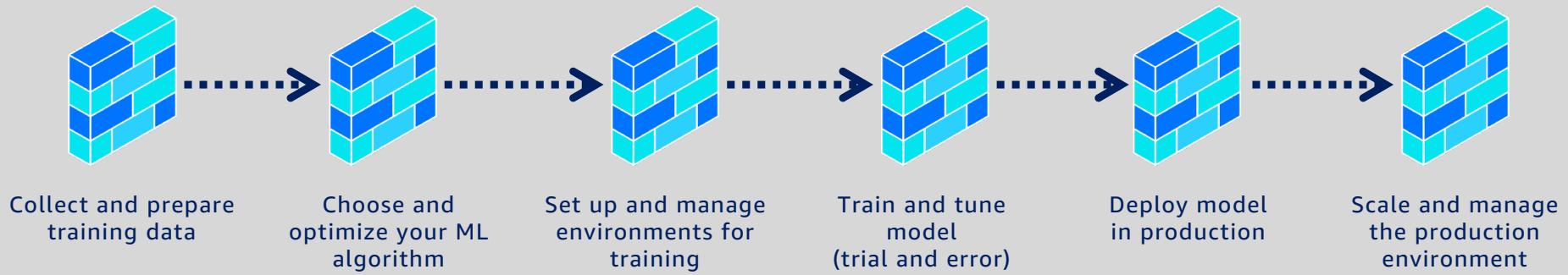
# Create, train and deploy ML models

# The Machine Learning process

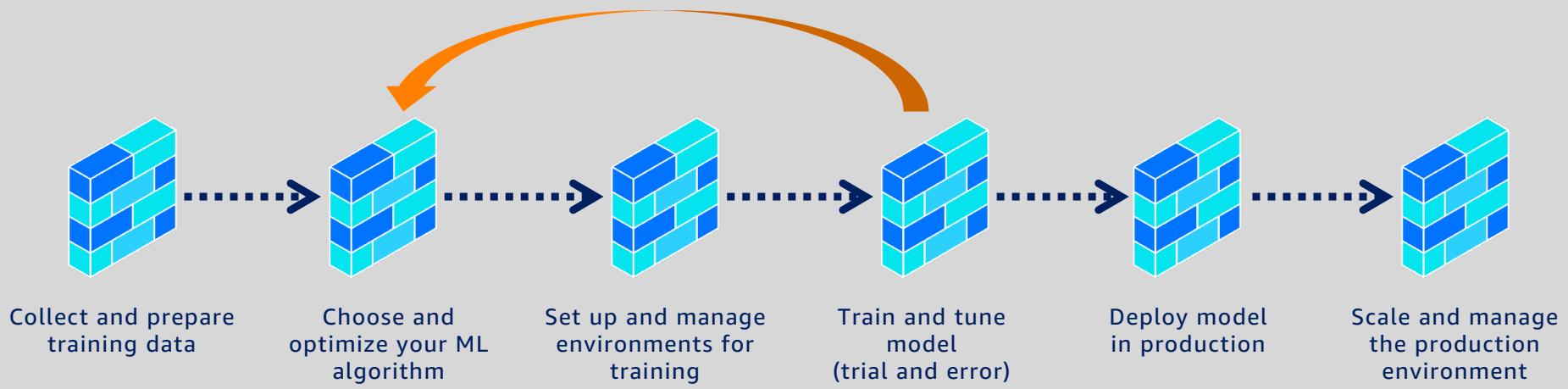
Business Problem –



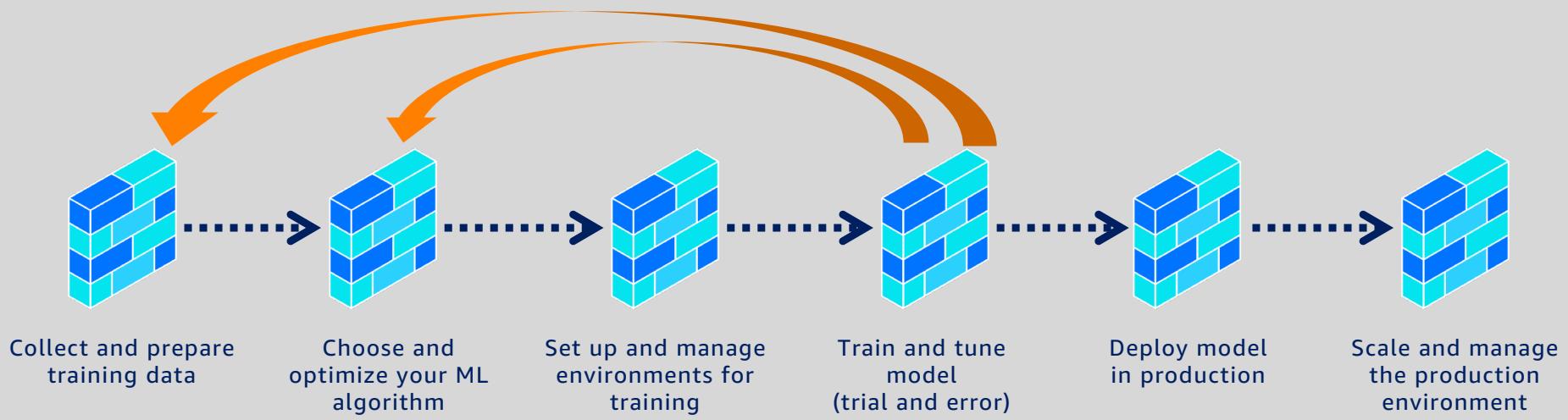
# The Machine Learning process (technical view)



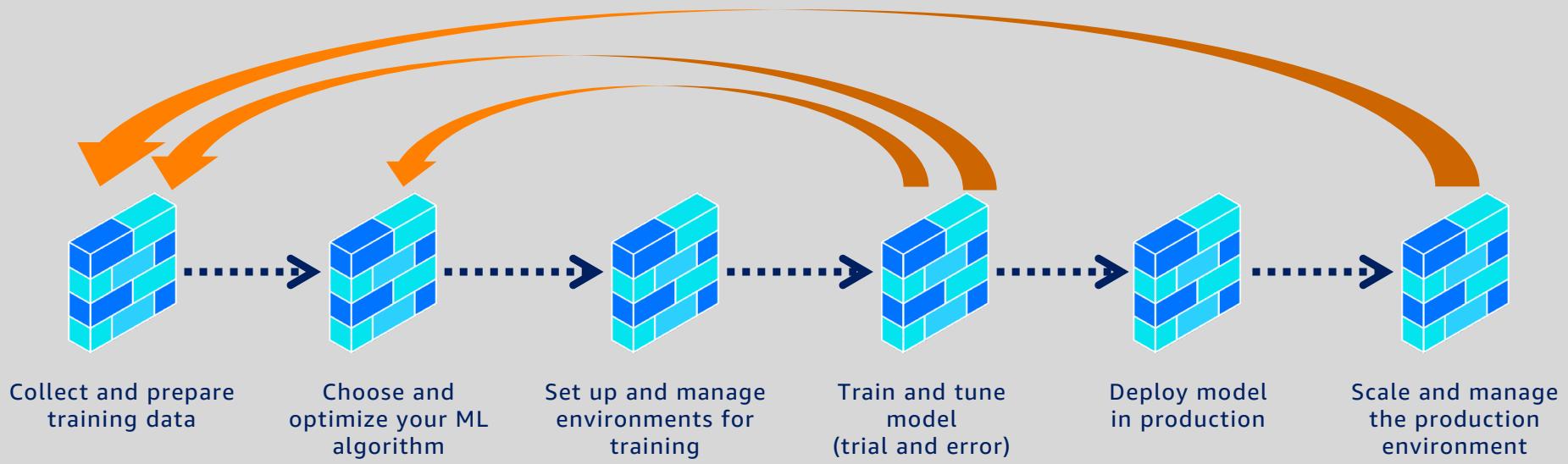
# The Machine Learning process (technical view)



# The Machine Learning process (technical view)

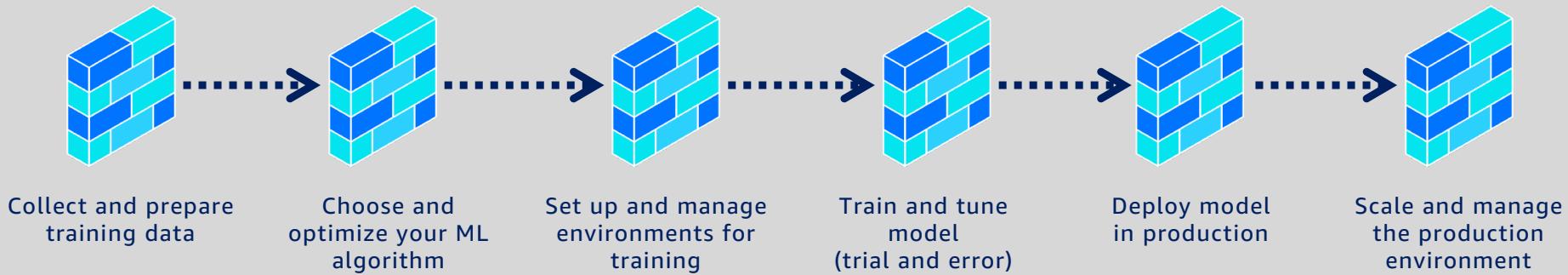


# The Machine Learning process (technical view)

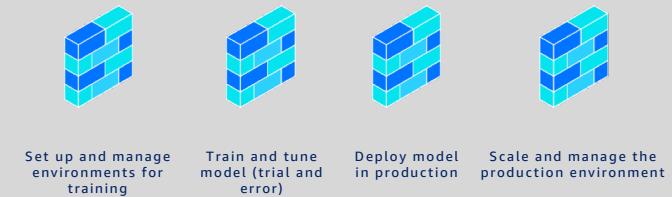
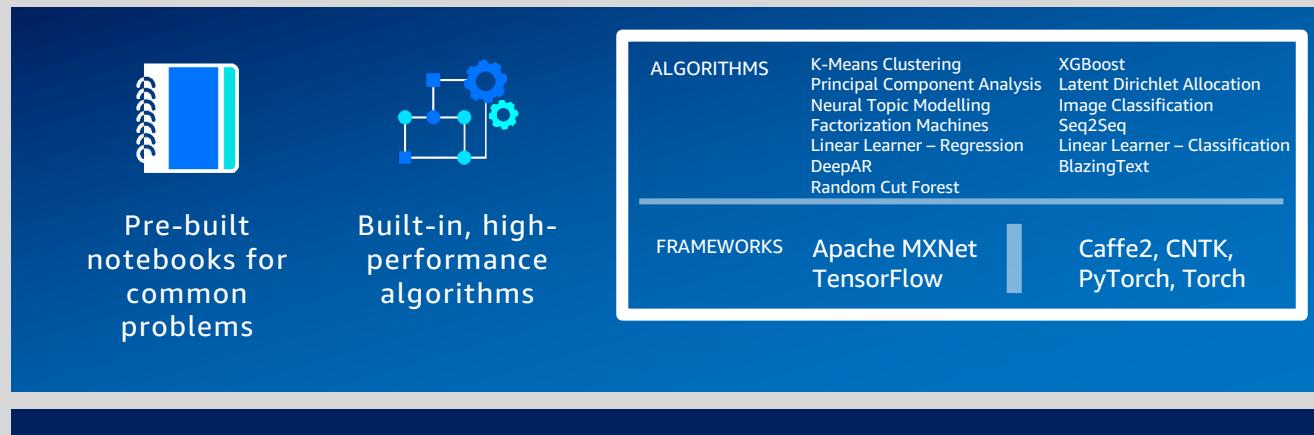


# Amazon SageMaker

Easily build, train, and deploy machine learning models

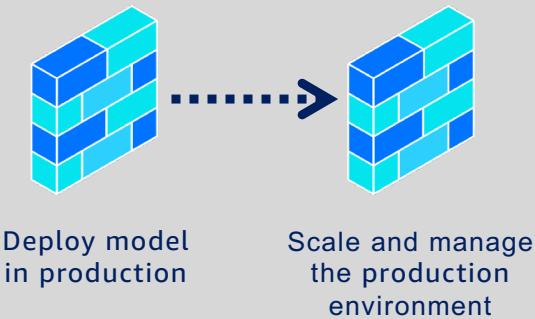
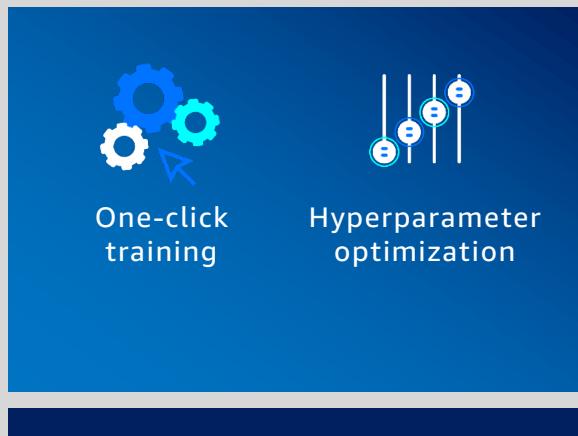
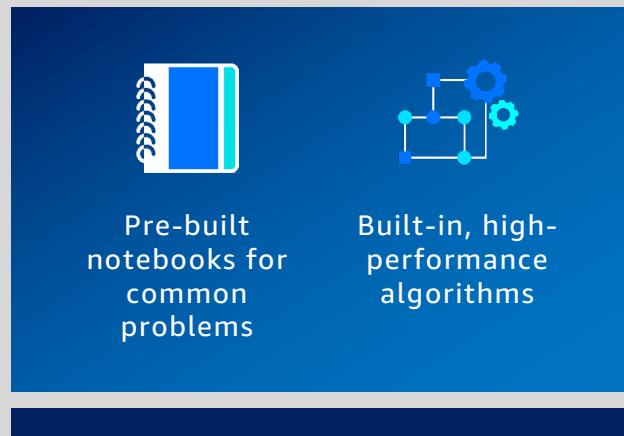


# Amazon SageMaker



## Build

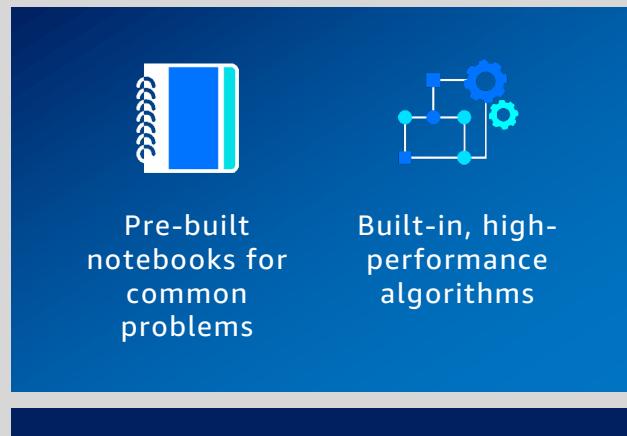
# Amazon SageMaker



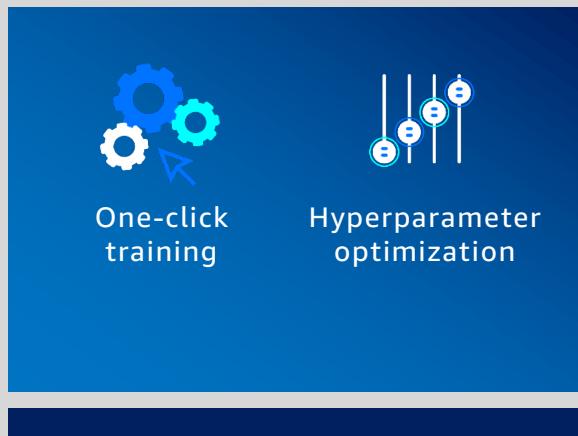
Build

Train

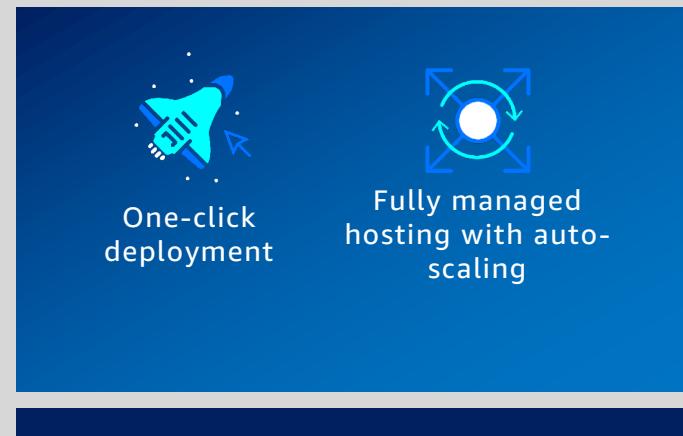
# Amazon SageMaker



Build

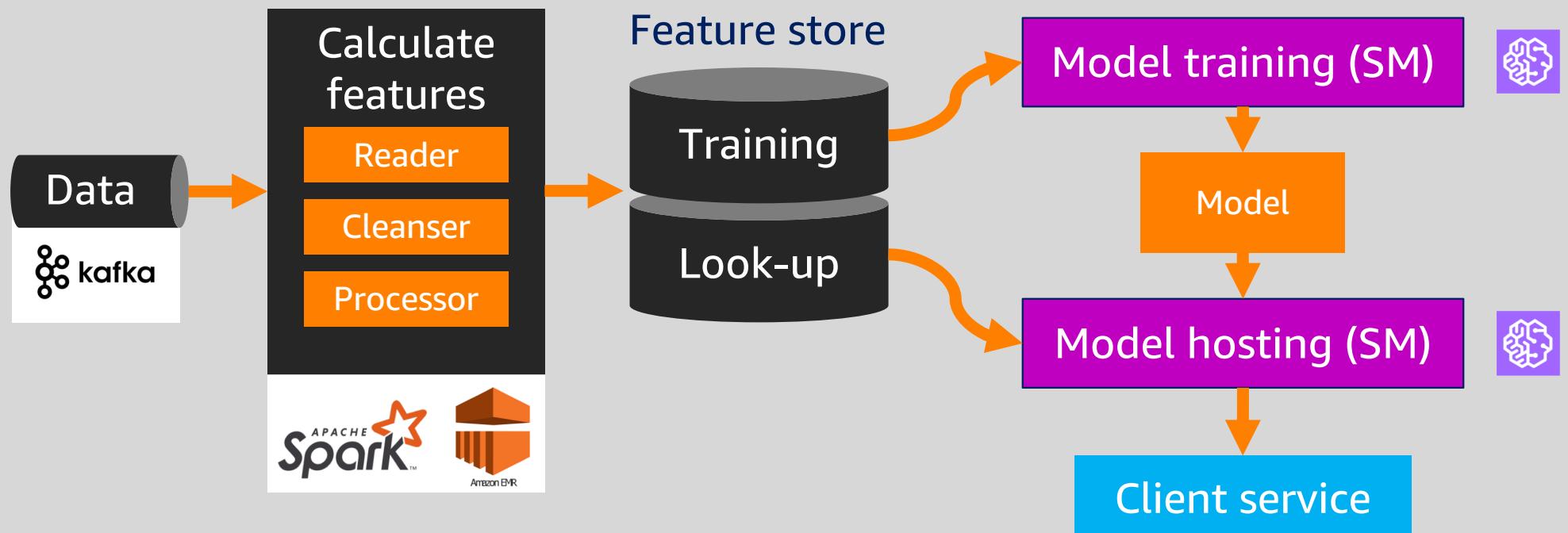


Train



Deploy

# Real-time fraud detection in AWS with Amazon SageMaker



intuit®

© 2018, Amazon Web Services, Inc. or its affiliates. All rights reserved.

aws SUMMIT

# Checklist

1. Create a flywheel model of your business
2. Find opportunities to add value through ML
3. Collect training data from your data lake
4. Collect labels for your training data
5. Build, train and deploy your ML model with Amazon SageMaker

# Checklist

1. Create a flywheel model of your business
  2. Find opportunities to add value through ML
  3. Collect training data from your data lake
  4. Collect labels for your training data
  5. Build, train and deploy your ML model with Amazon SageMaker
- ...or use a ready-to-run Amazon ML application service
- 

# Checklist

1. Create a flywheel model of your business
2. Find opportunities to add value through ML
3. Collect training data from your data lake
4. Collect labels for your training data
5. Build, train and deploy your ML model with Amazon SageMaker  
...or use a ready-to-run Amazon ML application service
6. Repeat from step 2

# When should you consider using ML for a problem?

- Software too complex
- Manual process not cost effective
- Lots of training data available
- Easy to express in ML terms

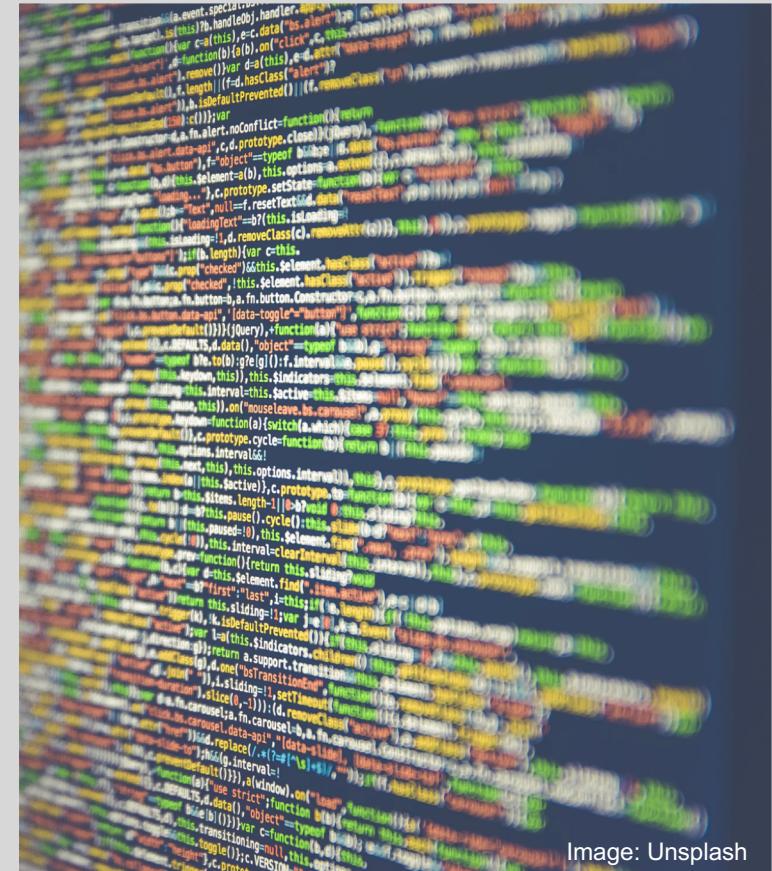


Image: Unsplash

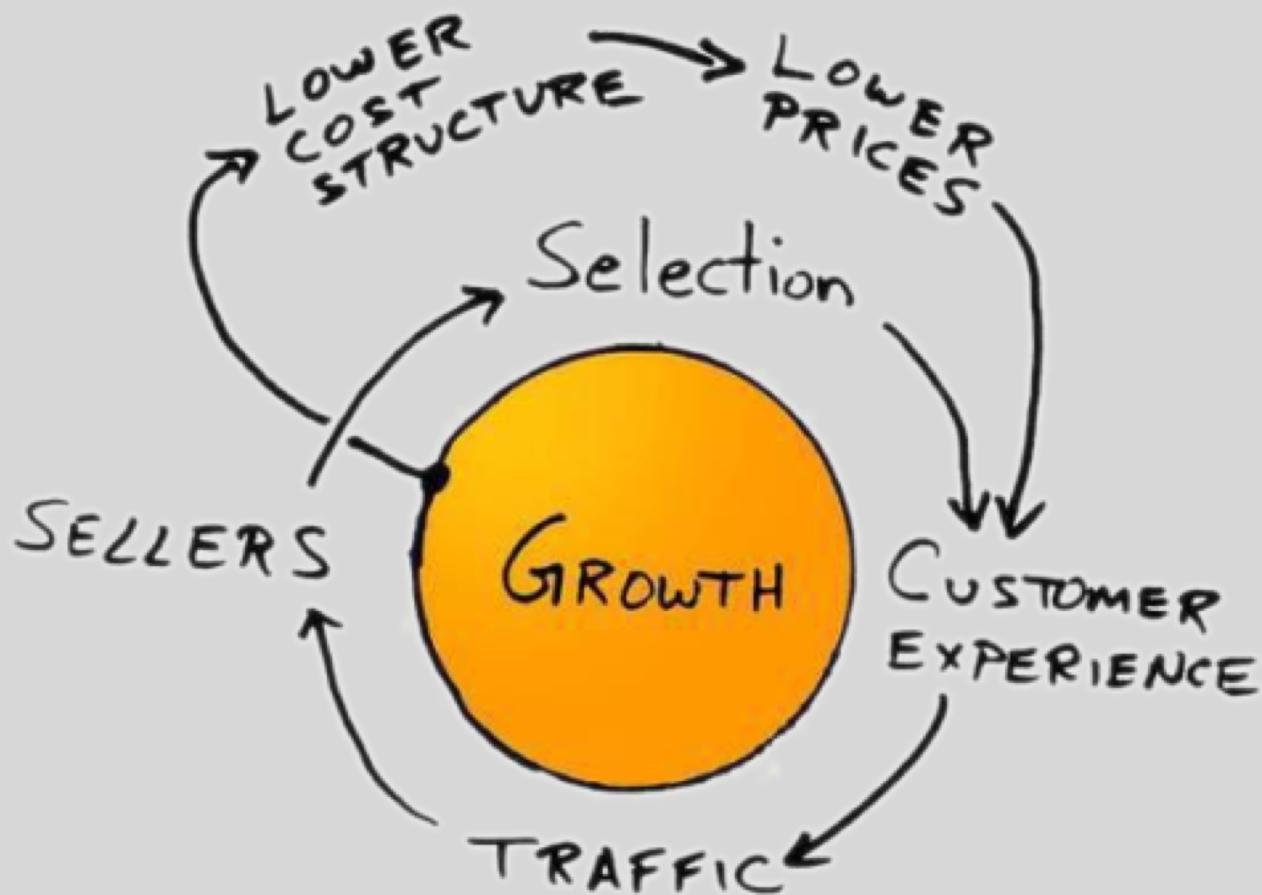
# When is ML probably not a good idea?

- No data
- No labels
- Not a lot of time
- No tolerance for mistakes



Image: Unsplash

# Let us know what you built on AWS!



Please complete the session survey in  
the summit mobile app.



# Thank you!