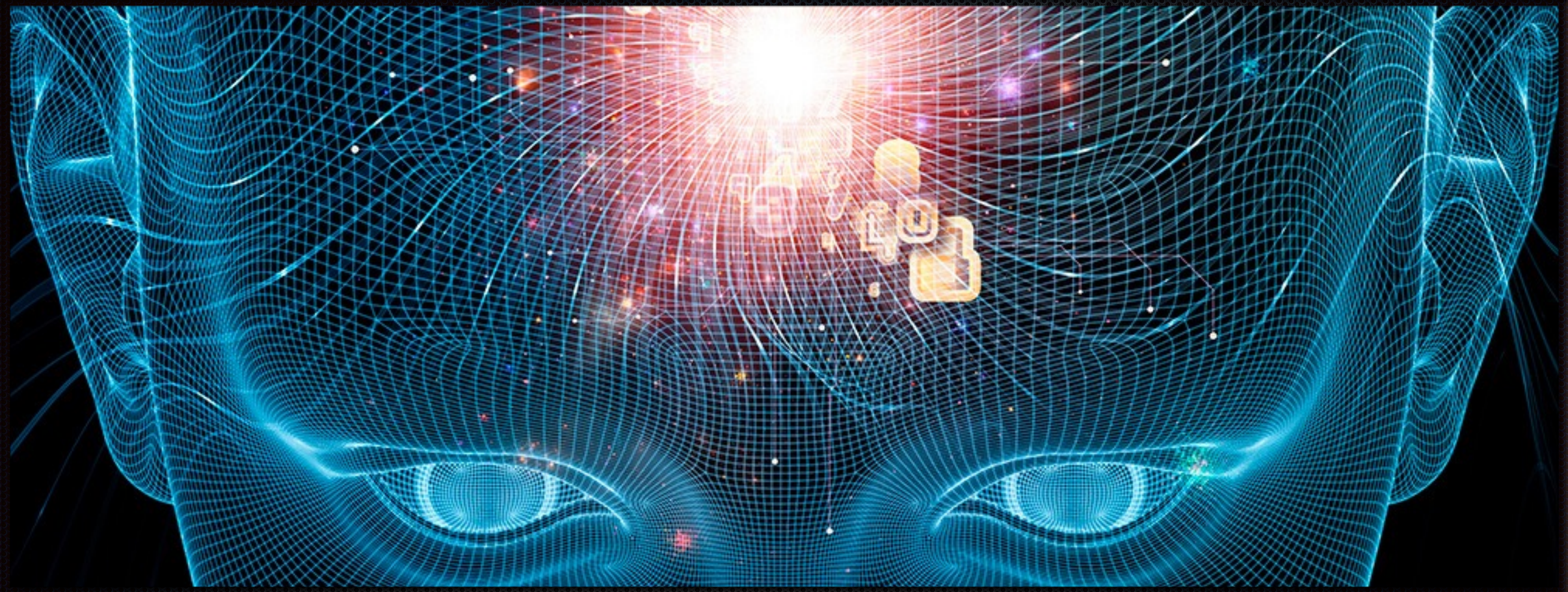


# Machine Learning in the Cloud

## A DATA ENGINEER'S GUIDE

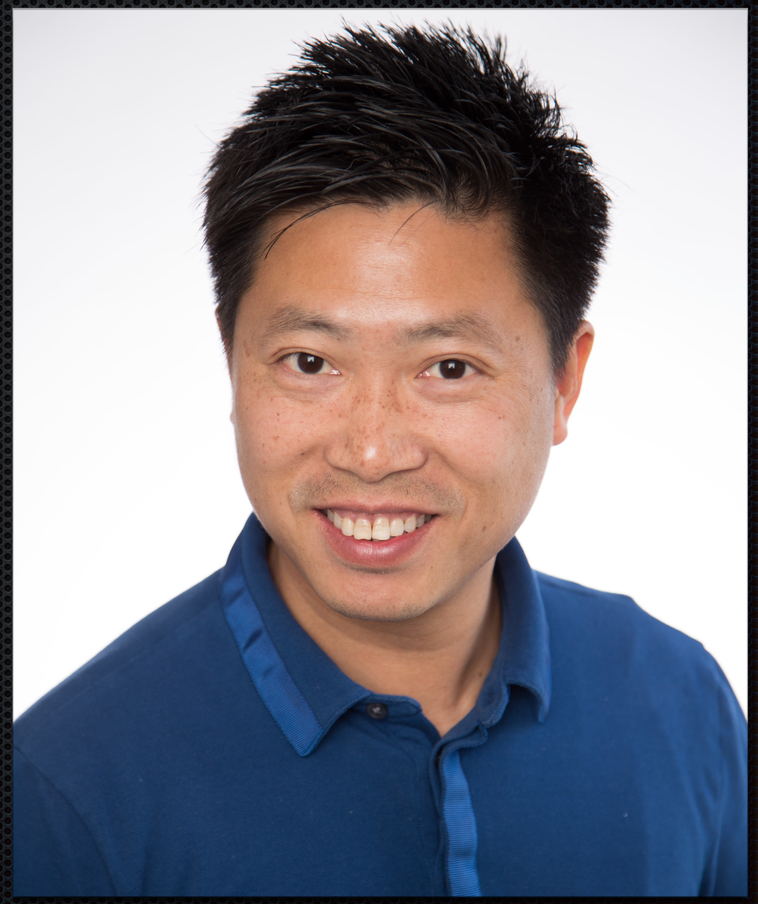
# Table of Content


- What is ML/DL/AI
- Machine Learning Life Cycle
- End-to-end Machine Learning Solution
- Demo
- Cloud Advantage
- Major Cloud Service Providers

# Raymond Fu

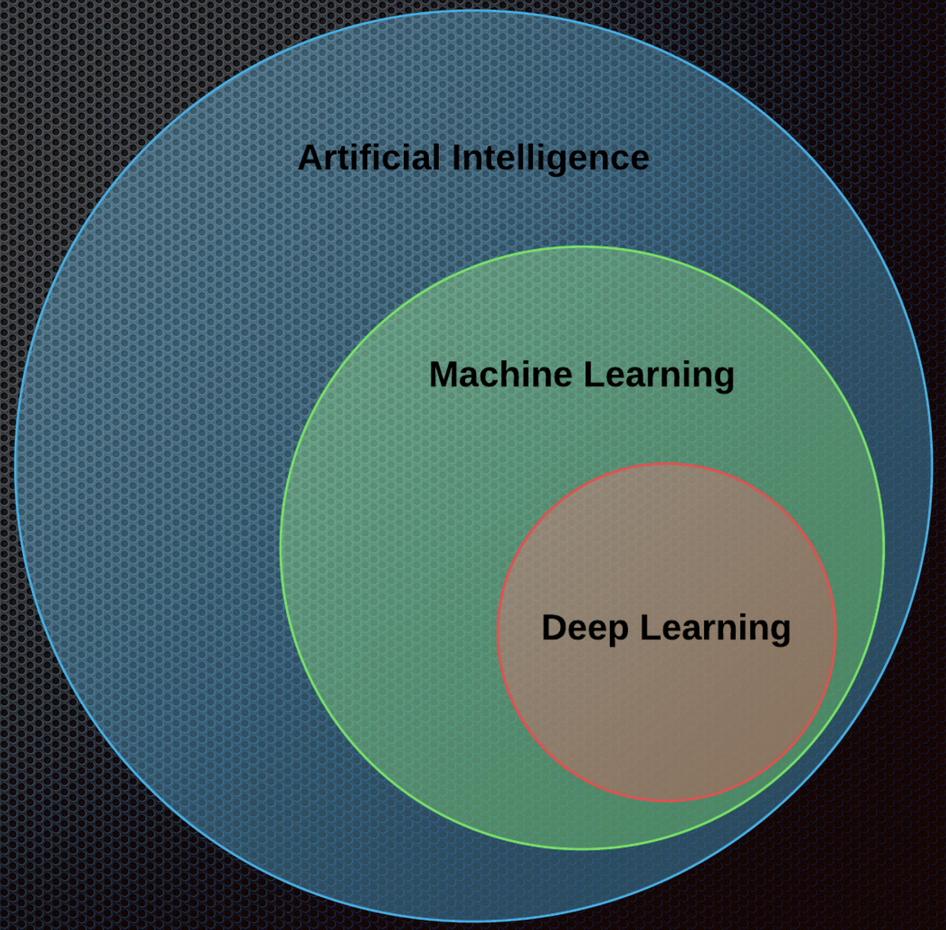
Data Architect
Trace3

Email: rfu@trace3.com
Twitter: @RaymondxFu

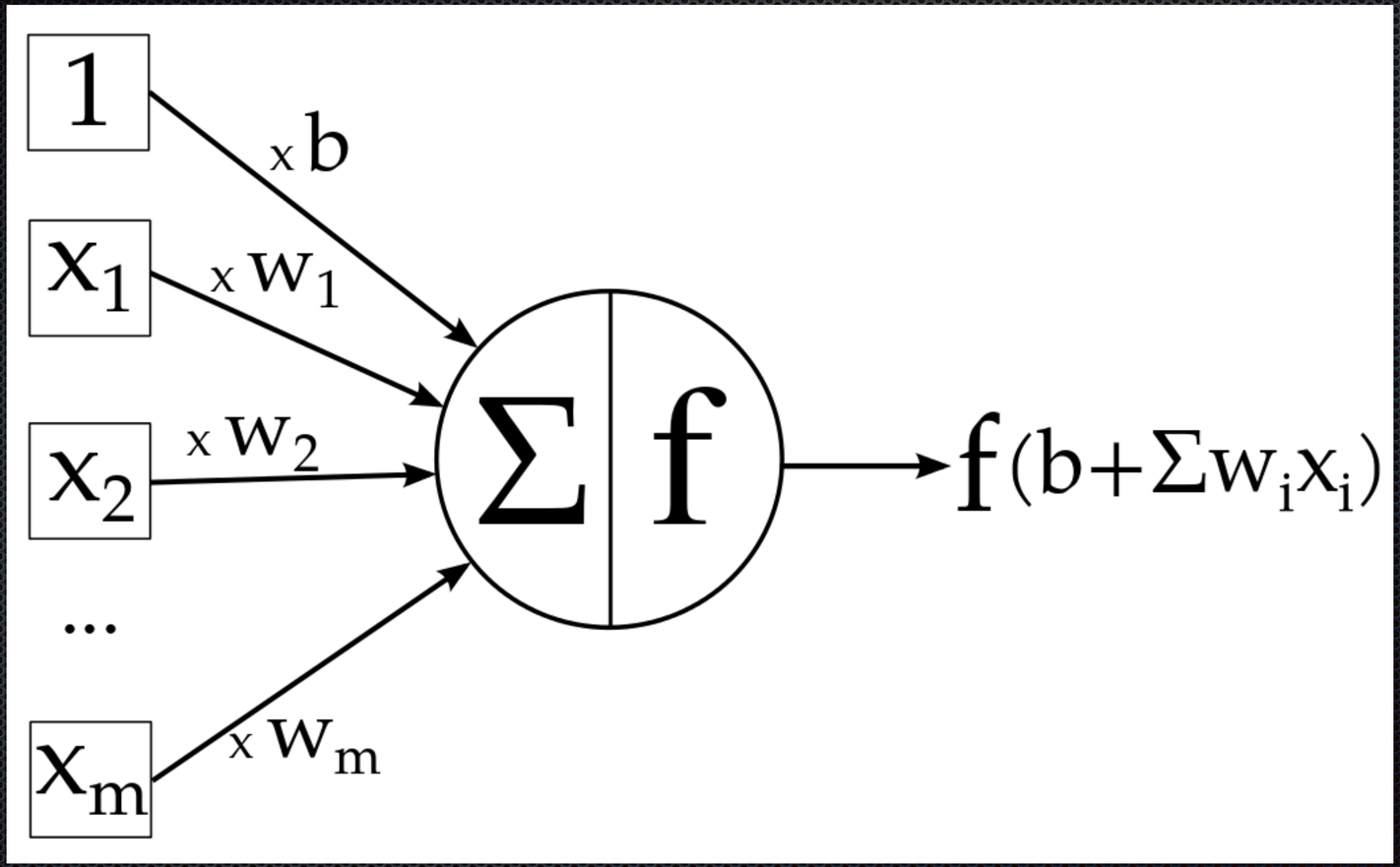


# What is Machine Learning

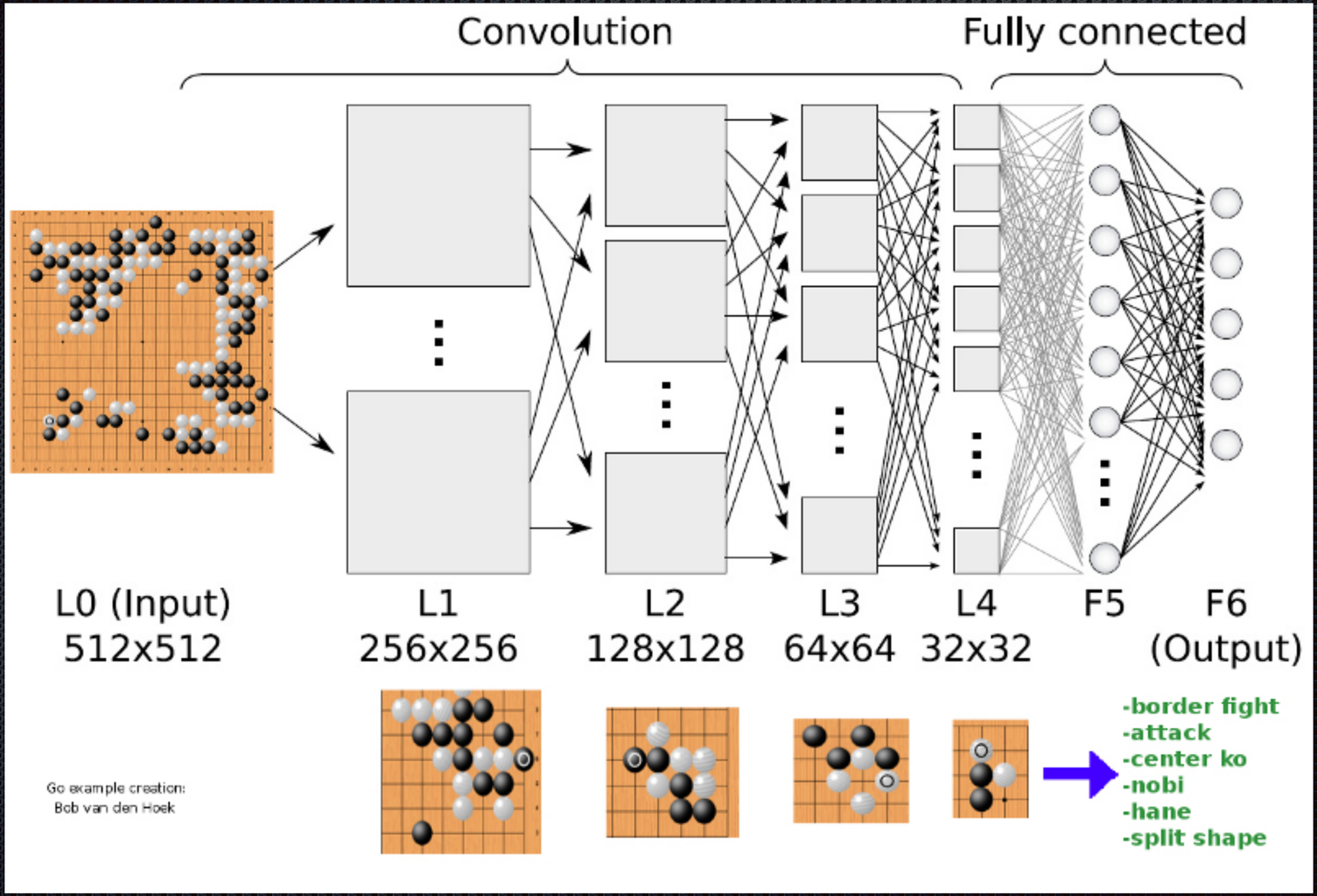
- Artificial Intelligence - Machine thinks, talks, and behaves as human.
- Machine Learning - Computer makes decision without being explicitly programmed.
- Deep Learning - A network of multi-layer non-linear processing unit capable of adapting itself to new data.



# Machine Learning



# Deep Learning

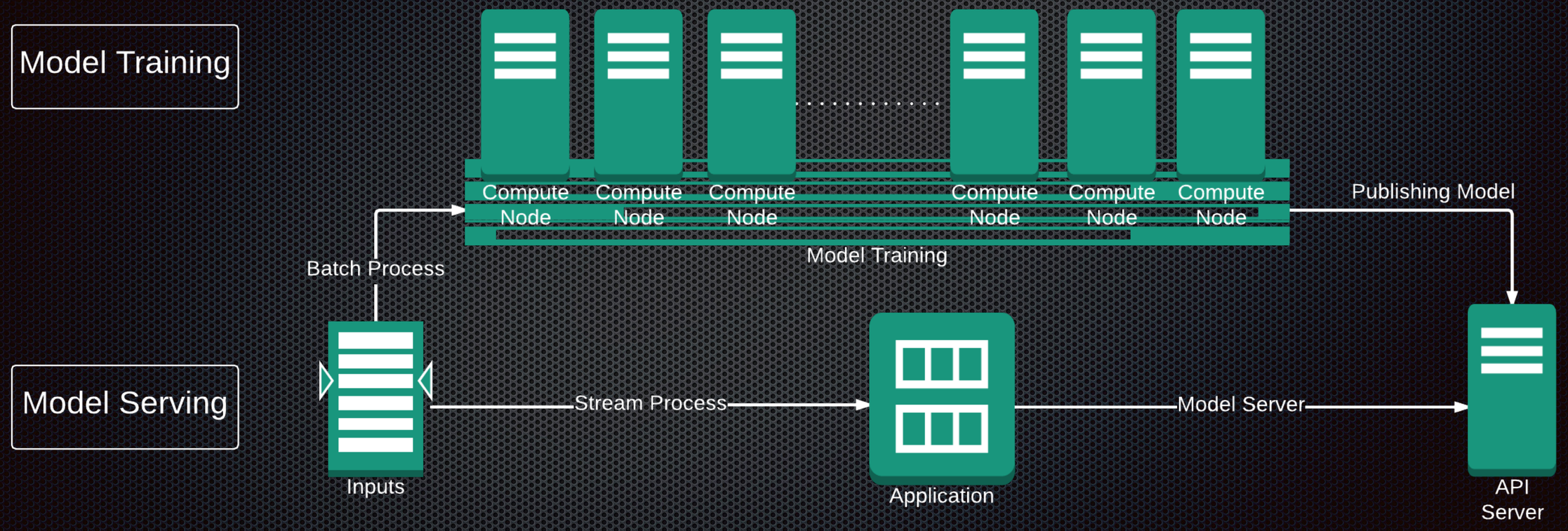


# Artificial Intelligence

# Machine Learning Lifecycle

- Business - define goals - build use cases - acquire resources
- Data - collect data - extract/transform/load - analyze
- Model - select - train - evaluate - optimize models
- Operationalization - deploy models - integrate with other apps
- Post-Operation - quality assurance - retrain models - manage

# Model Training vs. Model Serving



# End-to-end Machine Learning Solution

- Model Training
  - Data Storage
  - ETL
  - Sampling / Small scale training
  - Distributed training
- Model Serving
  - Data Ingestion
  - Inference
- Data Visualization
  - Prediction as a Report

# Machine Learning in Business

## Manufacturing

- Predictive maintenance or condition monitoring
- Warranty reserve estimation
- Propensity to buy
- Demand forecasting
- Process optimization
- Telematics

## Retail

- Predictive inventory planning
- Recommendation engines
- Upsell and cross-channel marketing
- Market segmentation and targeting
- Customer ROI and lifetime value

## Healthcare and Life Sciences

- Alerts and diagnostics from real-time patient data
- Disease identification and risk satisfaction
- Patient triage optimization
- Proactive health management
- Healthcare provider sentiment analysis

## Travel and Hospitality

- Aircraft scheduling
- Dynamic pricing
- Social media—consumer feedback and interaction analysis
- Customer complaint resolution
- Traffic patterns and congestion management

## Financial Services

- Risk analytics and regulation
- Customer Segmentation
- Cross-selling and upselling
- Sales and marketing campaign management
- Credit worthiness evaluation

## Energy, Feedstock and Utilities

- Power usage analytics
- Seismic data processing
- Carbon emissions and trading
- Customer-specific pricing
- Smart grid management
- Energy demand and supply optimization

# Challenge - Customer Churn

- What is Customer Churn
- Business Goal: reduce the customer churn.
- Requirement: Find out all customers who might stop subscribing from us, and persuade them to stay.
- Project: Use historical customer data to build a prediction model.
- Solution Design: Use Google Cloud Platform. Load sample data into BigQuery, and build a prediction model using TensorFlow and DataLab.

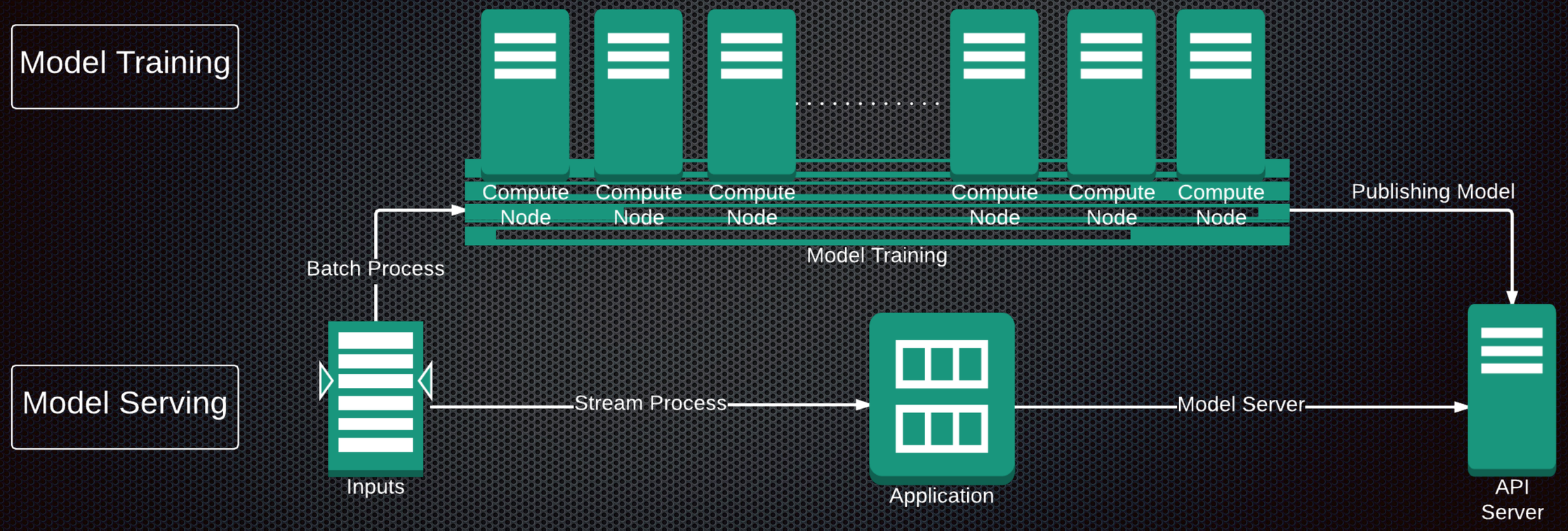
# DEMO

## Google Cloud Platform

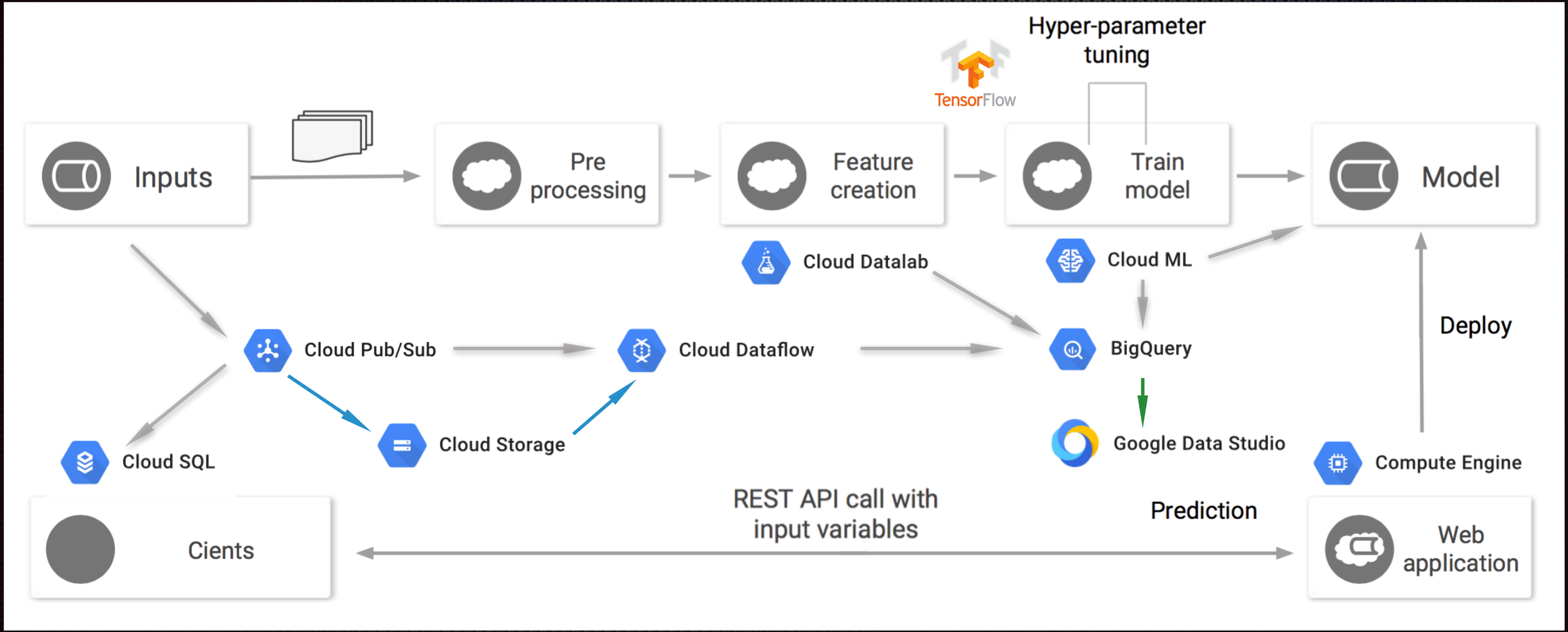
# Set up Google Cloud Platform

- Create an account in Google Cloud http://cloud.google.com
- Create a project. Activate Billing. Don't worry, you get a lot of free goodies.
- Activate BigQuery. Load CSV file.
- Start a DataLab and train models. DataLab Quick Start
- The notebook is shared here: https://github.com/fraymond/telco_customer_churn/blob/master/Telco%2BCustomer%2BChurn%2BPrediction%2B20160620.ipynb
- Next step:
  - Train models in Google Cloud ML
  - Publish models as API
  - Create Dataflow job to ingest data to BigQuery

# Model Training vs. Model Serving



# Model Training and Serving with Google Cloud Platform



# Cloud Advantage

- Drive down costs - from Capex model to Opex model.
- Cope with demand - elastic infrastructure.
- More on business, less on IT - IT administration is part of the service.
- Innovate and lead - Changing business requirements need flexible Infrastructure.
- Improved security and compliance - cloud is not bullet proof, but major cloud companies invest more in security and compliance than individual organizations.

# ML Advantages in the Cloud

- Start from data analytics and insight vs. start from data storage and processing.
- Data Science is experimental that requires elasticity in planning.
  - Storage
  - Compute
- Easy deployment and maintenance.
- Pretained models available in cloud as a service.

# Big Players

in the cloud

# Gartner Magic Quadrant for Cloud Infrastructure as a Service, Worldwide

# Amazon AWS

Pioneer and Market Leader of Cloud Service

Services | Resource Groups

History

- Console Home
- EC2
- Billing
- S3
- IAM
- Support

Find a service by name or feature (for example, EC2, S3 or VM, storage).

Group | A-Z

## Compute
- EC2
- EC2 Container Service
- Lightsail
- Elastic Beanstalk
- Lambda
- Batch

## Storage
- S3
- EFS
- Glacier
- Storage Gateway

## Database
- RDS
- DynamoDB
- ElastiCache
- Redshift

## Networking & Content Delivery
- VPC
- CloudFront
- Direct Connect
- Route 53

## Migration
- Application Discovery Service
- DMS
- Server Migration
- Snowball

## Developer Tools
- CodeStar
- CodeCommit
- CodeBuild
- CodeDeploy
- CodePipeline
- X-Ray

## Management Tools
- CloudWatch
- CloudFormation
- CloudTrail
- Config
- OpsWorks
- Service Catalog
- Trusted Advisor
- Managed Services

## Security, Identity & Compliance
- IAM
- Inspector
- Certificate Manager
- Directory Service
- WAF & Shield
- Compliance Reports

## Analytics
- Athena
- EMR
- CloudSearch
- Elasticsearch Service
- Kinesis
- Data Pipeline
- QuickSight

## Artificial Intelligence
- Lex
- Polly
- Rekognition
- Machine Learning

## Internet Of Things
- AWS IoT
- AWS Greengrass

## Contact Center
- Amazon Connect

## Game Development
- Amazon GameLift

## Mobile Services
- Mobile Hub
- Cognito
- Device Farm
- Mobile Analytics

## Application Services
- Step Functions
- SWF
- API Gateway
- Elastic Transcoder

## Messaging
- Simple Queue Service
- Simple Notification Service
- SES

## Business Productivity
- WorkDocs
- WorkMail
- Amazon Chime

## Desktop & App Streaming
- WorkSpaces
- AppStream 2.0

# Microsoft Azure

https://azure.microsoft.com/en-us/services/?v=17.04b

# Google Cloud Platform

Leading Advanced Analytics

# End-to-end Machine Learning Solution

- Model Training
  - Data Storage — Cloud SQL, Spanner, Data Store, DataProc, BigTable, BigQuery
  - ETL — Dataflow
  - Sampling / Small scale training — Datalab
  - Distributed training — TensorFlow, BigQuery
- Model Serving
  - Data Ingestion — Pub/Sub, Dataflow
  - Inference API — Cloud ML
- Data Visualization
  - Prediction as a Report — Data Studio

Google Cloud Platform

Thank you!