

Overview

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AI Sight

Section 2

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Google Cloud
AutoML Vision



Google Cloud
Vision API



Google Cloud
Data Labeling



Google Cloud
AutoML Video
Intelligence



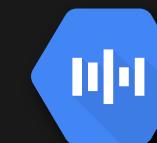
Google Cloud
Video Intelligence
API



Google Cloud
AutoML Natural Language



Google Cloud
Natural Language API



Google Cloud
Speech-to-Text



Google Cloud
Text-to-Speech



Google Cloud
Dialogflow



Google Cloud
AutoML Translation



Google Cloud
Translation API



Google Cloud
AutoML Tables



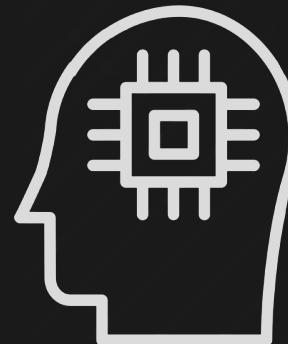
Google Cloud
Recommendations AI



Google Cloud
BigQuery ML

[What Is AI/ML?](#)[Understanding Google Cloud AI and Machine Learning](#)[Targeting Cloud AutoML](#)

ARTIFICIAL INTELLIGENCE



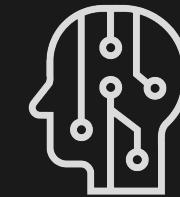
The science and engineering of making computers behave in ways previously believed to require human intelligence. AI is an aspirational, moving target based on those capabilities that humans possess but which machines do not.

MACHINE LEARNING



Focuses on the ability of machines to receive a set of data and learn for themselves, changing algorithms as they learn more about the information they are processing.

DEEP LEARNING



Deep learning is a set of algorithms that allow software to train itself by exposing an artificial neural network to a vast amount of data.

1950s

1960s

1970s

1980s

1990s

2000s

2010s

Next



What Is AI/ML?

Understanding Google Cloud AI and Machine Learning

Targeting Cloud AutoML

MACHINE LEARNING



Machine learning (ML) is the scientific study of **algorithms** and statistical models that computer systems use to perform a specific task without using explicit instructions, relying on patterns and predictions instead.

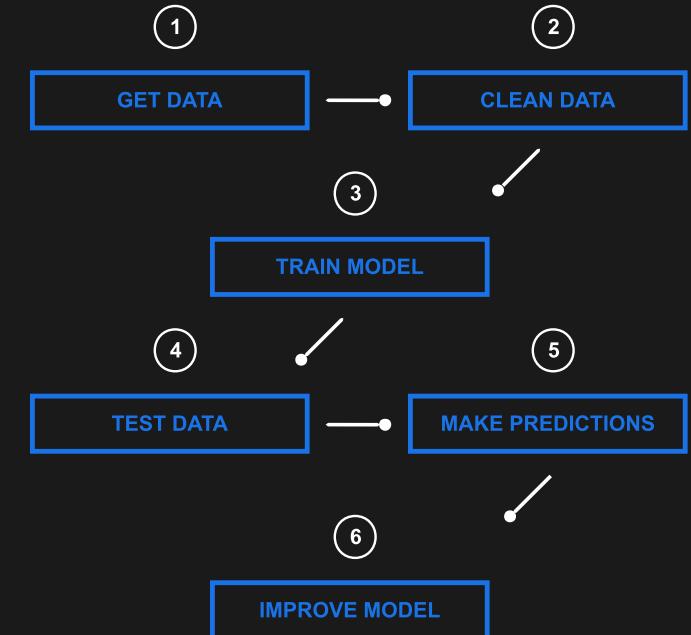
Machine learning algorithms create a mathematical model based on **training data** to make predictions or **inferences** without being explicitly programmed to perform the task.

ML Learning Styles:

- **Supervised Learning**
Inputs labeled training data with a known output to model a relationship so that new data will likely result in a predictable output
- **Unsupervised Learning**
Uses unlabeled data to discover any relationships within the data and detecting new patterns
- **Semi-Supervised Learning**
Combines labeled and unlabeled

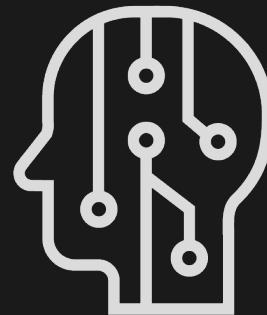
ML Algorithms:

- **Linear Regression**
For predicting a value
- **Logistic Regression**
When working with a binary prediction
- **Classification and Regression Trees (CART)**
For categorization
- **Naive Bayes**
Follows Bayes Theorem and assumes all the variables are independent of each other

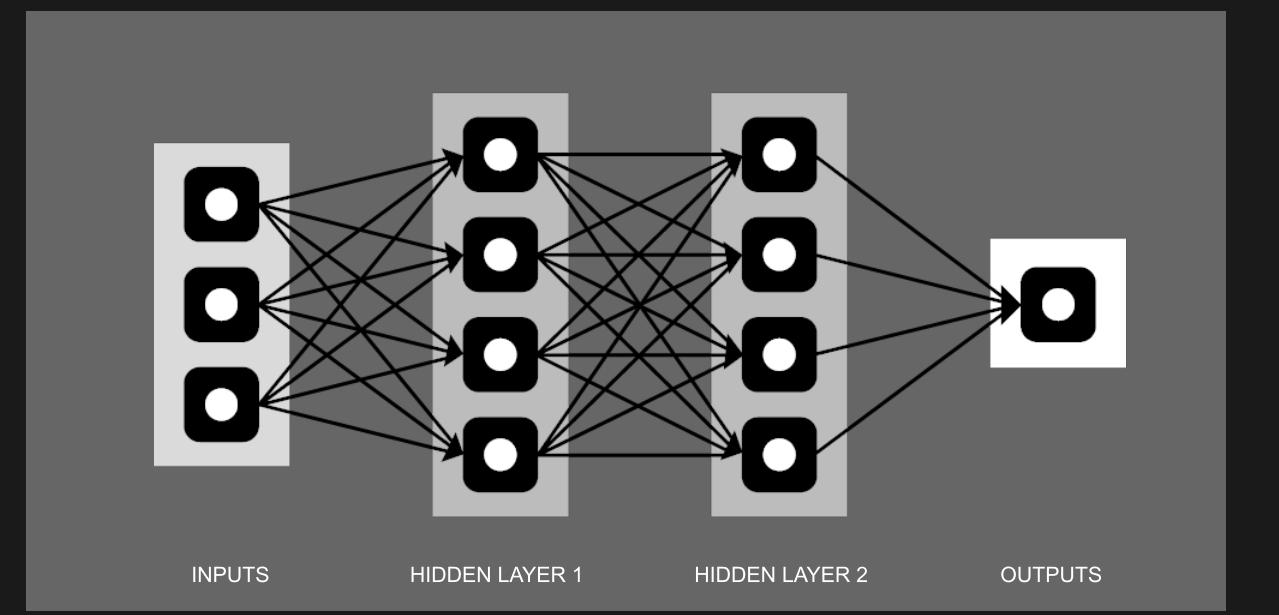


[What Is AI/ML?](#)[Understanding Google Cloud AI and Machine Learning](#)[Targeting Cloud AutoML](#)

DEEP LEARNING



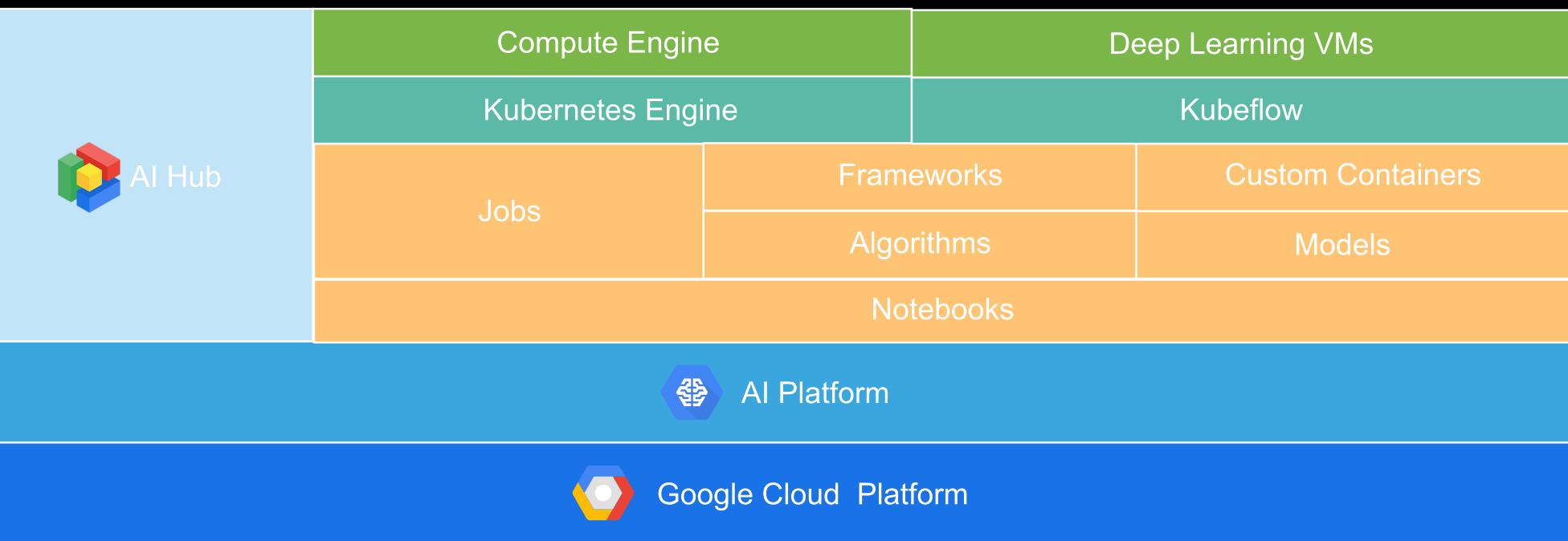
Deep learning is a subset of machine learning modeled on the organic brain. The artificial neurons have inputs and outputs, like organic neurons, as well as processing layers that hold **activation functions**. These layers are known as **hidden layers**. The number of hidden layers determines how "deep" the learning is.

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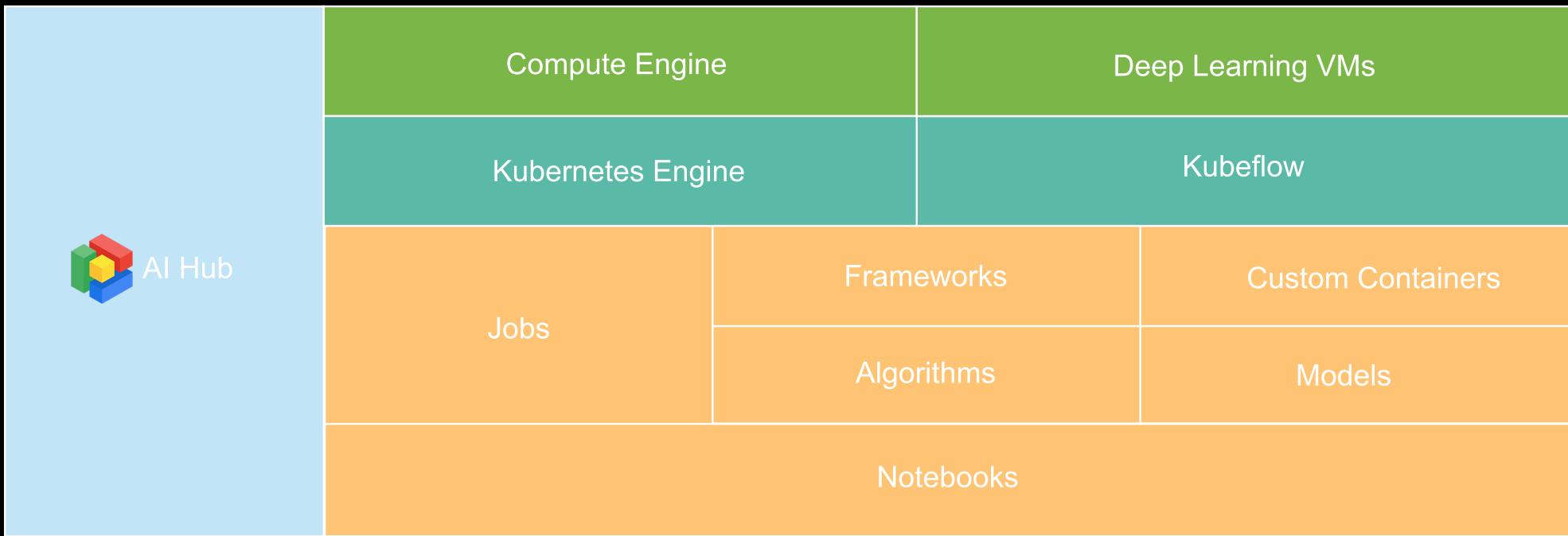
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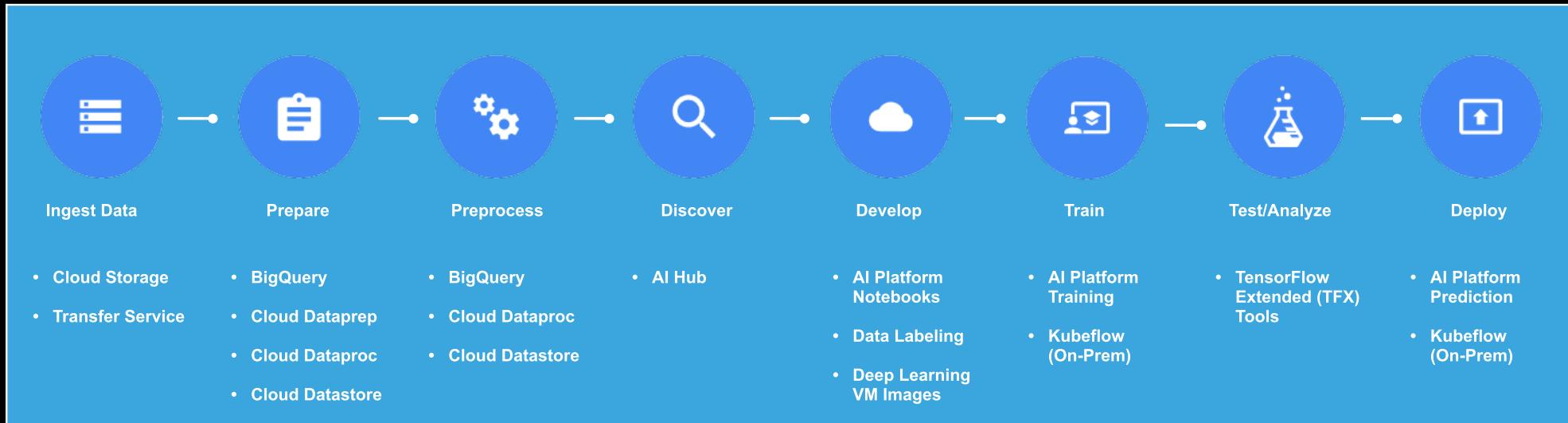
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AI Platform

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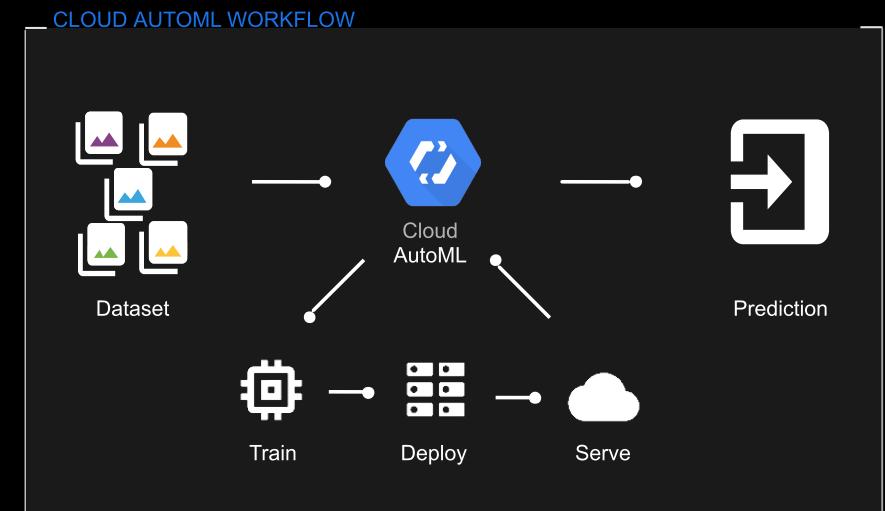


Google Cloud AutoML

A suite of machine learning products designed to give developers the ability to train high-quality models specific to their business needs.

Features include:

- Limited machine learning expertise required.
- A graphical UI.
- Integration with Google Cloud services, including Cloud Storage and machine learning APIs.
- Integration with in-house data labeling service (currently AutoML Vision only).



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Machine Learning

Targeting Cloud AutoML

Google Cloud
AutoML

Category	Services	
Sight	AutoML Vision	AutoML Video Intelligence
Language	AutoML Natural Language	AutoML Translation
Structured Data	AutoML Tables	

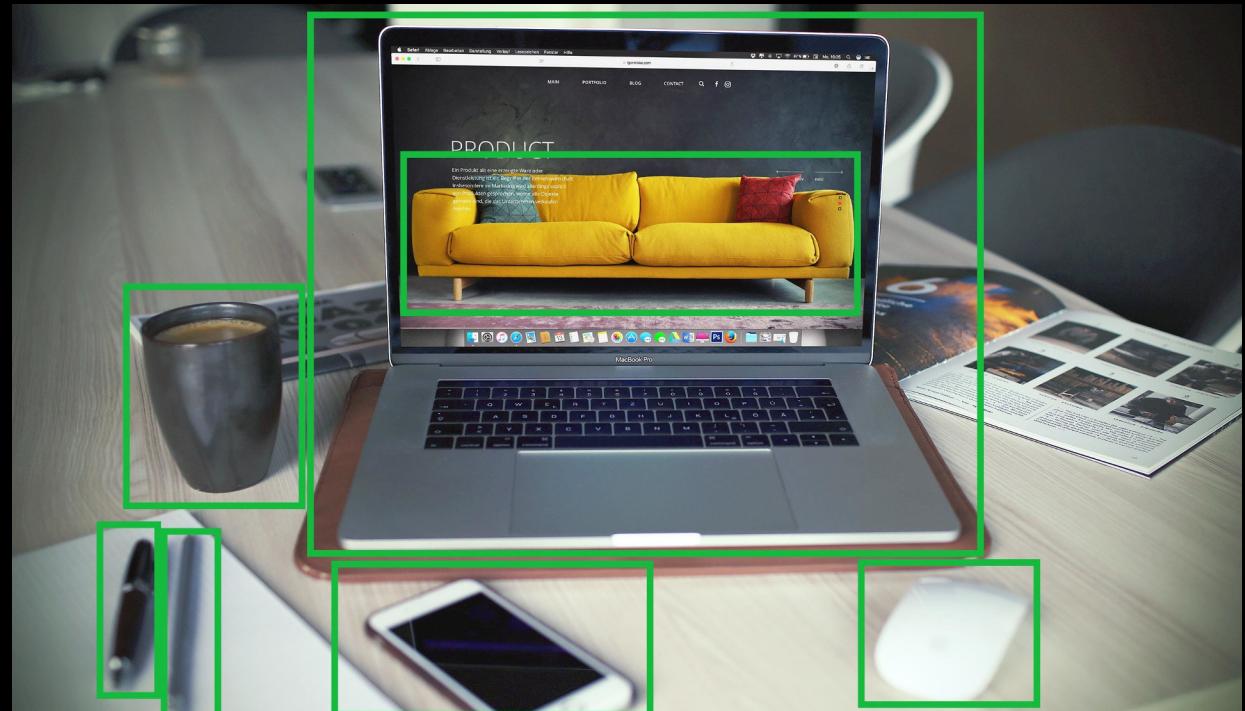
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[Identifying Images with Vision AI](#)

Examining Video AI

Primary Function: Object Detection

- Detection types available:
 - Single or multiple objects
 - Faces (facial recognition not currently supported)
 - Extracted text
 - Document text
 - Geographic landmarks
 - Company logos
- Safe Search supported to identify objectionable content:
 - Explicit
 - Violent
 - Medical
 - Spoofs
 - Racy
- Web content
 - Identifies topical content (including news, events, or celebrities)
 - Provides links to similar images online
- Supports synchronous online annotation
 - Provides immediate response
 - For small number of files (five or less)
- Supports asynchronous offline annotation
 - For larger number of files (up to 2,000)
 - Annotations written to JSON file in Cloud Storage



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Examining Video AI

Primary Function: Object Classification

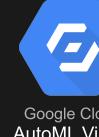
1 COPY DATA FILES TO CLOUD STORAGE

Google
Cloud Storage

2 CREATE AUTOML DATASET

Google Cloud
AutoML
VisionAutoML
Dataset

3 TRAIN THE MODEL

Google Cloud
AutoML
Vision

4 PREDICT TEST IMAGES

Google Cloud
AutoML
Vision

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Examining Video AI

Available AI Vision Services

Google Cloud
AutoML Vision

- Graphic UI
- Uses custom labels
- AutoML Vision Edge
- Edge devices, including mobile
- IoT devices supported
- Perform object detection as well as image classification
- Applications in augmented reality
- Integrate with ML Kit for Firebase — a mobile SDK that brings Google's machine learning expertise to Android and iOS

Google Cloud
Vision API

- Pre-trained models
- Use REST and RPC APIs
- Vision Product Search
 - Compares photos to images in your product catalog and returns a ranked list of similar items
- Crop hints — returns the coordinates for a bounding box around primary object or face in the image
- Process
 - Uses base64-encoded objects
 - Supports REST, CMD line, C#, Go, Java, Node.JS, PHP, Python, and Ruby

Google Cloud
Data Labeling

- In-house service
- Trained personnel
- Review and label images according to custom specifications

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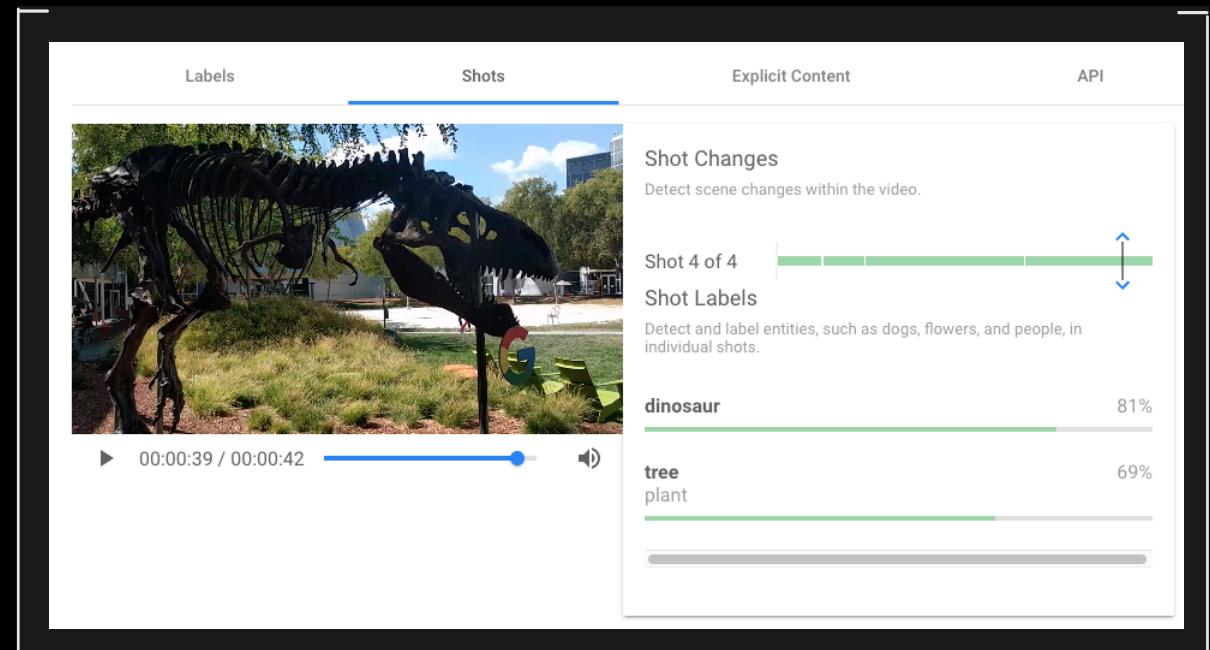
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Identifying Images with Vision AI

[Examining Video AI](#)

Primary Function: Object Detection

- Operates asynchronously on video in Cloud Storage
- Recognizes over 20,000 objects, places, and actions
- Label detection
 - Detects multiple objects
 - Lists video segments with specified object
 - Lists frames with specified object
 - Lists shots with specified object
- Shot change detection
 - Annotates video according to detected scenes
 - Based on content transition
- Explicit content detection
 - Nudity
 - Sexual activity
 - Pornography
 - Includes cartoons and anime
- Speech transcription
 - Outputs blocks of text for each transcribed video segment
 - Supports transcription hints
 - Identifies multiple speakers
 - Optional automatic punctuation
 - Optional profanity filtering
- Text detection



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Identifying Images with Vision AI

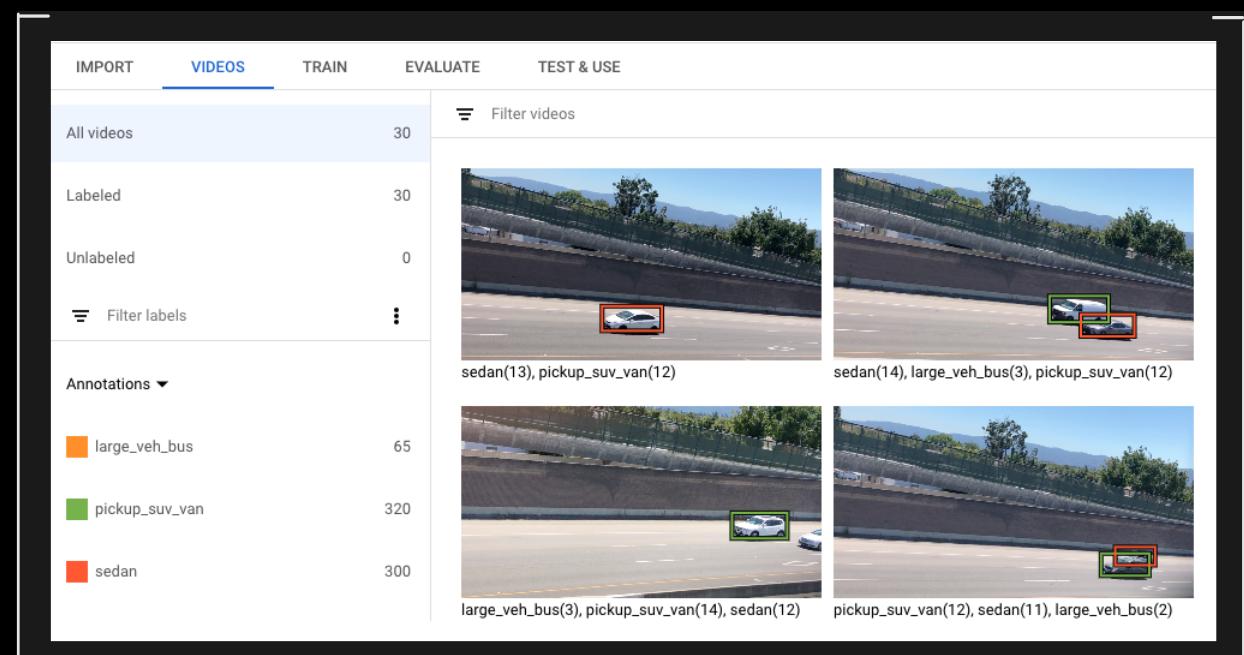
[Examining Video AI](#)

Primary Function: Object Tracking

- Operates asynchronously on video in Cloud Storage
- Tracks multiple objects detected in an input video or video segments
- Returns the following:
 - Labels for detected entities
 - Location of the entity in the frame
 - Bounding boxes showing object location
 - Time offset (timestamp) indicating duration offset from video beginning
- Small objects excluded from tracking

Current Beta Features

- Support for streaming video
- Support for live streaming video
- Includes:
 - Label, shot change, and explicit content detection
 - Object tracking supported in both
 - Store annotations in Cloud Storage
- Support for logo recognition

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[Extracting Data with Natural Language](#)[Automating Translation](#)

AI Natural Language Services Uses

Application	Description	Returns	Examples
Content Classification	Analyzes a document and returns a list of content categories that apply to the text found in the document.	Natural Language API returns the most specific of pre-trained categories; AutoML Natural Language returns custom category labels.	- /Adult - /Arts & Entertainment/Movies - /Internet & Telecom/Mobile & Wireless
Syntactic Analysis	Extracts linguistic information, dividing text into a series of sentences and tokens (e.g. words), and analyzes those tokens.	A Syntactic Analysis request returns a response containing distinct sentences and their tokens in JSON format.	- Content - the complete sentence - Part of speech tag (noun, verb, adverb) - Gender (feminine, masculine, unknown)
Entity Analysis	Inspects text for known entities, including proper nouns (i.e. public figures, landmarks, etc.) and common nouns (e.g. dog, church, etc.)	A JSON-formatted response containing the entity type, metadata, and salience (relative importance) score.	- Entity type (person, location, event) - Metadata (Wikipedia URL) - Salience score (0 - 1.0, least to most)
Sentiment Analysis	Identifies the prevailing emotional opinion of the writer within text as positive, negative, or neutral.	A JSON-formatted response containing the score and the magnitude. Positive scores are greater than 0 and negative, less than.	- Magnitude (non-negative number representing absolute magnitude) - Score (ranging from -1.0 to 1.0)
Entity Sentiment Analysis	Identifies the prevailing emotional opinion of noted proper and common nouns within the supplied text.	A JSON-formatted response containing the entity type, metadata, salience, score, and magnitude.	- Magnitude (non-negative number representing absolute magnitude) - Score (ranging from -1.0 to 1.0)

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Available AI Natural Language Services



Google Cloud
AutoML Natural Language

- Graphic UI
- Uses custom labels
- Available models:
 - Classification
 - Analyzes document and returns list of content categories
 - Entity Extraction
 - Inspects document for known entities and labels those entities
 - Sentiment Analysis
 - Inspects a document and identifies the prevailing emotional opinion



Google Cloud
Natural Language API

- Pre-trained models
- Use REST and RPC APIs
- Supports `gcloud` and `curl` commands
- Supports the following client libraries:
 - C#
 - Go
 - Java
 - Node.js
 - PHP
 - Python
 - Ruby
- Access over 700 categories for classification

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Available AI Translation Services



Google Cloud
AutoML Translation

- Graphic UI
- Uses custom labels
- Works best for domain specific translations
 - Medical terminology
 - Financial sector text
 - Technology jargon
- Requires files in tab-separated value (TSV) or Translation Memory eXchange (TMX) formats
- Uses CSV format to identify separate train, evaluate, and test files in above formats.



Google Cloud
Translation API

BASIC

- Uses REST and RPC APIs
- Pre-trained model
- Supports over 100 languages
- Language detection supported
- Results can be used with HTML snippets or entire pages
 - Include lang attribute, for example:

```
<span  
lang="fr-x-mtfrom-en">  
Bonjour</span>
```

ADVANCED

- All Basic features
- Allows custom language pairs
- Supports glossary
- Supports batch translation
- Three translation models available:
 - Neural Machine Translation (NMT) – for general use
 - Phrase-based Machine Translation (PBMT) – better quality
 - AutoML Translation model – domain-specific text.



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Available Speech-to-Text Services

Google Cloud
Speech-to-Text

- Cloud Speech-to-Text
- Transcribe recorded or streaming spoken audio to text
- Only API available, although different models optional
- Supports over 120 languages
- Identifies up to four languages simultaneously
- Capable of identifying multiple speakers
- Uses:
 - Transcribing audio recordings
 - Call center transcription
 - Spoken text commands
 - Vocal search
- Pre-built recognition models available:
 - Default
 - Phone (currently US English only)
 - Command and search
 - Video

SYNCHRONOUS RECOGNITION

- REST and gRPC
- One minute or less limitation
- Results returned after processing
- One process at a time
- Faster than real time (e.g. 30 seconds of audio processed in 15 seconds)

ASYNCHRONOUS RECOGNITION

- REST and gRPC
- Long-running operation initiated
- Up to 480 minutes (eight hours)
- Poll intermittently for results

STREAMING RECOGNITION

- gRPC bi-directional stream only
- Real-time applications from live mic
- Returns interim results while processing

JSON Configuration Options

- encoding** – A lossless format (such as FLAC or LINEAR16) is recommended.
- sampleRateHertz** - Specifies the sample rate (in Hertz) of the supplied audio. 16,000 Hz or higher is recommended.
- languageCode** – Language and region or locale of audio (e.g., en-us).
- maxAlternatives** – The number of alternative transcriptions. The default is 1. This is optional.
- profanityFilter** – Replaces detected profanity with the first letter, followed by asterisks. Only single words are supported. This is optional.
- speechContext** – Additional contextual information. Includes a phrases section; a list of words or phrases that provide hints especially for names and industry-specific terms.



Recognizing Speech-to-Text

Empowering Text-to-Speech

Conversing with Dialogflow

Available Text-to-Speech Services

Google Cloud
Text-to-Speech

- Converts text to natural-sounding, human-like speech audio
- Process known as synthesis, outputting synthetic speech
- Supports over 180 voices, varied by language, accent, and gender
- Supports over 30 languages and variants
- Standard voices supported
 - Technically called parametric text-to-speech, typically generates audio data by passing outputs through signal-processing algorithms known as vocoders
- WaveNet voices supported
 - WaveNet is a deep neural network for generating raw audio created by DeepMind
 - Voices are available at a premium
 - Trained using actual recordings of human speech
 - Typically regarded as warmer and more human-like



SSML File

Google Cloud
Text-to-Speech

Base64 File



Audio Output

Cloud Text-to-Speech accepts text files or SSML (Speech Synthesis Markup Language)

- SSML allows you to insert pauses, acronym pronunciations, and emphasize certain words or phrases.
- Also supported: cardinal and ordinal numbers, fractions, dates, and times
- Subset of SSML is supported

Output configurations include:

- Volume gain control
- Sample rate hertz
- Speaking rate
- Pitch
- Audio device profiles (smartphone, smartwatch, car speakers, etc.)
- Audio encoding (MP3, LINEAR16, Ogg Opus, etc.)

Cloud Text-to-Speech outputs raw audio as base64-encoded string, and this output must be decoded into audio file for playback.

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Recognizing Speech-to-Text

Empowering Text-to-Speech

Conversing with Dialogflow

Dialogflow Key Concepts

1

What Is It?

Dialogflow is an end-to-end, build-once deploy-everywhere development suite for creating conversational interfaces for websites, mobile applications, popular messaging platforms, and IoT devices.

2

Primary Details

- Available in two editions: **Standard** and **Enterprise**
- Integrates with:
 - Cloud Functions for Firebase
 - Cloud Natural Language
 - Cloud Speech-to-Text
 - Cloud Text-to-Speech
- Use cases:
 - Customer service
 - Commerce
 - Enterprise productivity
 - IoT devices

3

Agent

- A virtual agent that handles conversations with your end users with natural language understanding
- Over 40 prebuilt agents available
- Custom agents supported

4

Intent

- What an end user wants to do
- Intent includes:
 - Training expressions:** Possible phrases from users
 - Actions:** Next steps to take
 - Parameters:** Such as entity type, how data is extracted
 - Responses:** Possible replies
- Intent classification:** Matches an end-user expression to an intent
- Follow-up intents:** Sets context for pairs of intents

5

Context

- How the agent should consider the intent
- Input context:** Matches intent only if the user expression is a close match and context is active
- Output context:** Activates a context if it's not already active

6

Entities

- Things user mentions extracted from the end-user expression
- Ex.: dates, places, names
- Can be required
- System entities (dates, numbers)
- Developer entities:** Custom, with optional automated expansion
- User entities:** Specific to user

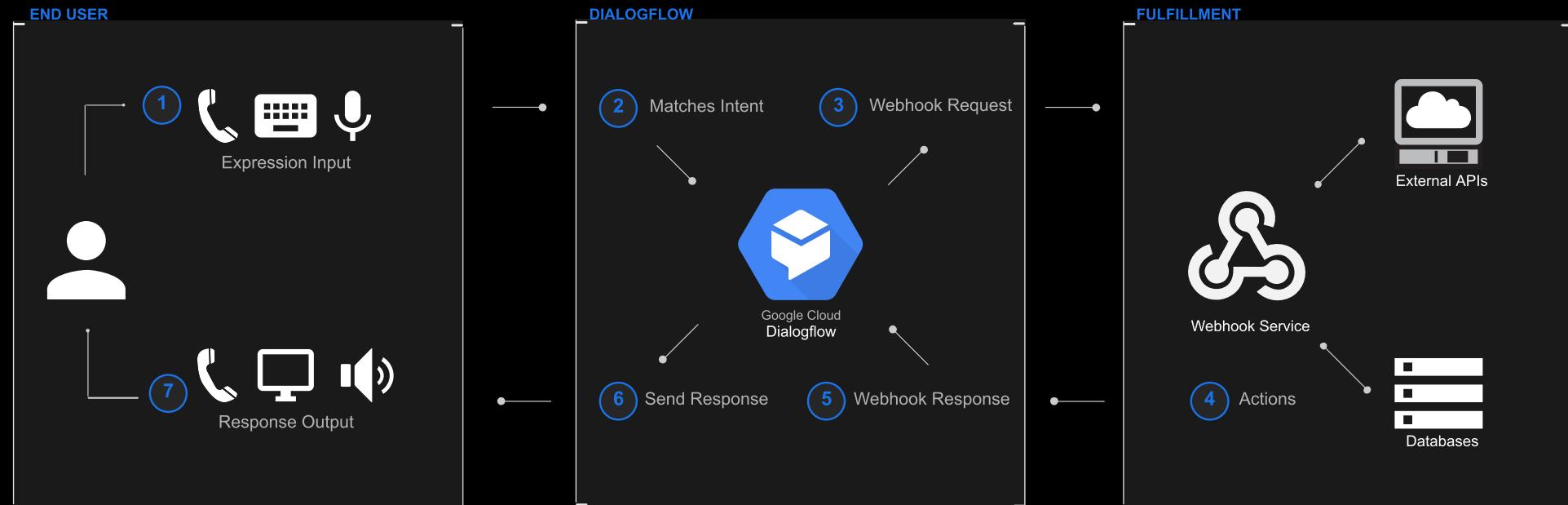
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Recognizing Speech-to-Text

Empowering Text-to-Speech

Conversing with Dialogflow

How Dialogflow Works



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Understanding AutoML Tables

Google Cloud
AutoML Tables

- Automatically build and deploy state-of-the-art machine learning models on structured data
- Turns tabular data into actionable predictive insights
 - Regression problems
 - Classification problems
- Use cases:
 - Supply chain management
 - Fraud detection
 - Lead conversion optimization
 - Increasing customer lifetime value
- Benefits:
 - Increases model quality
 - Handles real-world data
 - Easy to use graphic UI
 - Scalable
 - Efficient

Google Cloud
BigQuery

CSV File

① Define Schema

Google Cloud
AutoML Tables

② Select Target

Google Cloud
AutoML Tables

⑤ Deploy Model



Prediction Outputs

④ Evaluate Results

③ Train Model



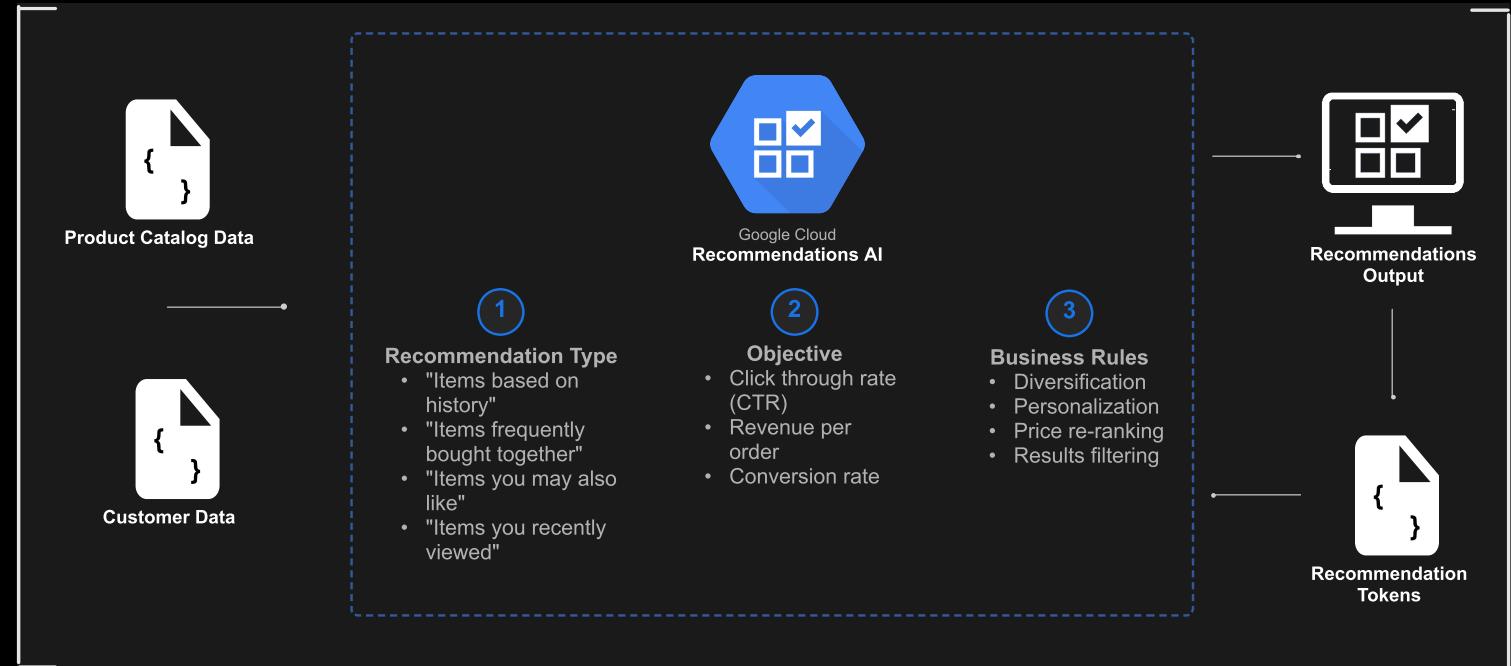
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Working with Recommendations AI

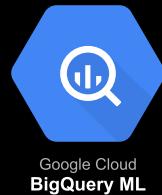
Google Cloud
Recommendations AI

- Builds high-quality personalized product recommendation systems
- Input requirements:
 - Product catalog: Product details
 - User events: End user behavior from website/apps
- API capabilities:
 - Data Ingestion: Managing product catalog information and user event logs
 - Prediction: Requesting recommendations based on product catalog and user event logs
- Recommendation tokens:
 - Unique IDs, generated by Recommendations AI
 - Associated with user event connected to recommended product
 - Optional



[Structuring AutoML Tables](#)[Establishing Recommendations](#)[Executing BigQuery ML](#)

Running BigQuery Machine Learning

Google Cloud
BigQuery ML

- Creates and executes machine learning models with standard SQL queries
- Accessible via:
 - BigQuery web UI
 - bq command tool
 - BigQuery REST API
 - BigQuery-compatible external tools
- Advantages:
 - Empowers data analysts
 - Models are trained and accessed using SQL
 - No need to export data
- Supported models:
 - Linear regression
 - Binary logistic regression
 - Multiclass logistic regression
 - K-means clustering
 - TensorFlow model importing

1

Create dataset

2

Create model

3

Evaluate model

4

Run predictions

Google Cloud
BigQuery ML

```
#standardSQL
CREATE MODEL `bqml_tutorial.sample_model`
OPTIONS(model_type='logistic_reg') AS
SELECT
  IF(totals.transactions IS NULL, 0, 1) AS label,
  IFNULL(device.operatingSystem, "") AS os,
  device.isMobile AS is_mobile,
  IFNULL(geoNetwork.country, "") AS country,
  IFNULL(totals.pageviews, 0) AS pageviews
FROM
  `bigquery-public-data.google_analytics_sample.ga_sessions_*`
WHERE
  _TABLE_SUFFIX BETWEEN '20160801' AND '20170630'
```



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Natural Language APIGoogle Cloud
Speech-to-TextGoogle Cloud
Text-to-SpeechGoogle Cloud
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AutoML TranslationGoogle Cloud
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AutoML TablesGoogle Cloud
Recommendations AIGoogle Cloud
BigQuery ML

[Summary](#)[What's Next?](#)**1 Run the labs!**

Experience Google Cloud AI services for yourself with any of the available hands-on labs.

2 Enjoy the Playground!

Sign in to Linux Academy's Google Cloud Playground to try out any of the available AI services for yourself, with your own experiments.

3 Take another course!

Try another one of my Deep Dive courses in [Cloud Functions](#) or [Kubernetes Engine](#), or — if you're ready — go for a certification course, like our [Google Cloud Certified Professional Cloud Architect](#) course.