Cloud Computing Machine Learning / Generative AI

CIS437
Erik Fredericks // frederer@gvsu.edu

Adapted from Google Cloud Computing Foundations, Overview of Cloud Computing (Wufka & Canonico)

@teenybiscuit

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Watch separately - fluff piece on what AI is

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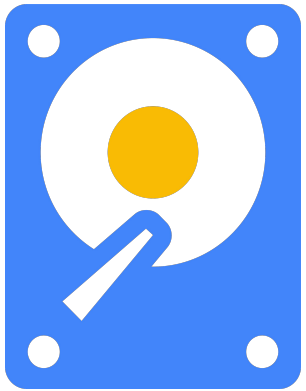
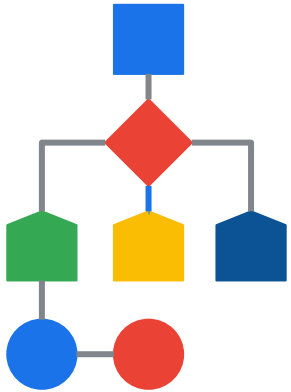
ML uses standard algorithms to derive predictive insights from data and make repeated decisions

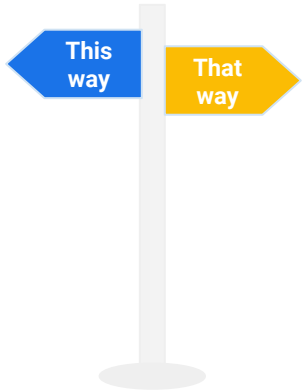


Data



Algorithm

Predictive insight



Decision

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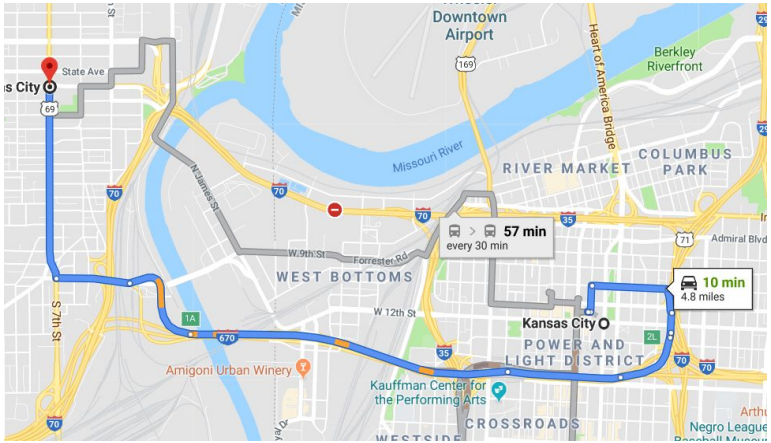
ML uses standard algorithms

Estimate the tax I owe



How long will it take me to get home?

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Model training requires examples

Examples of tax filings

Examples of trips

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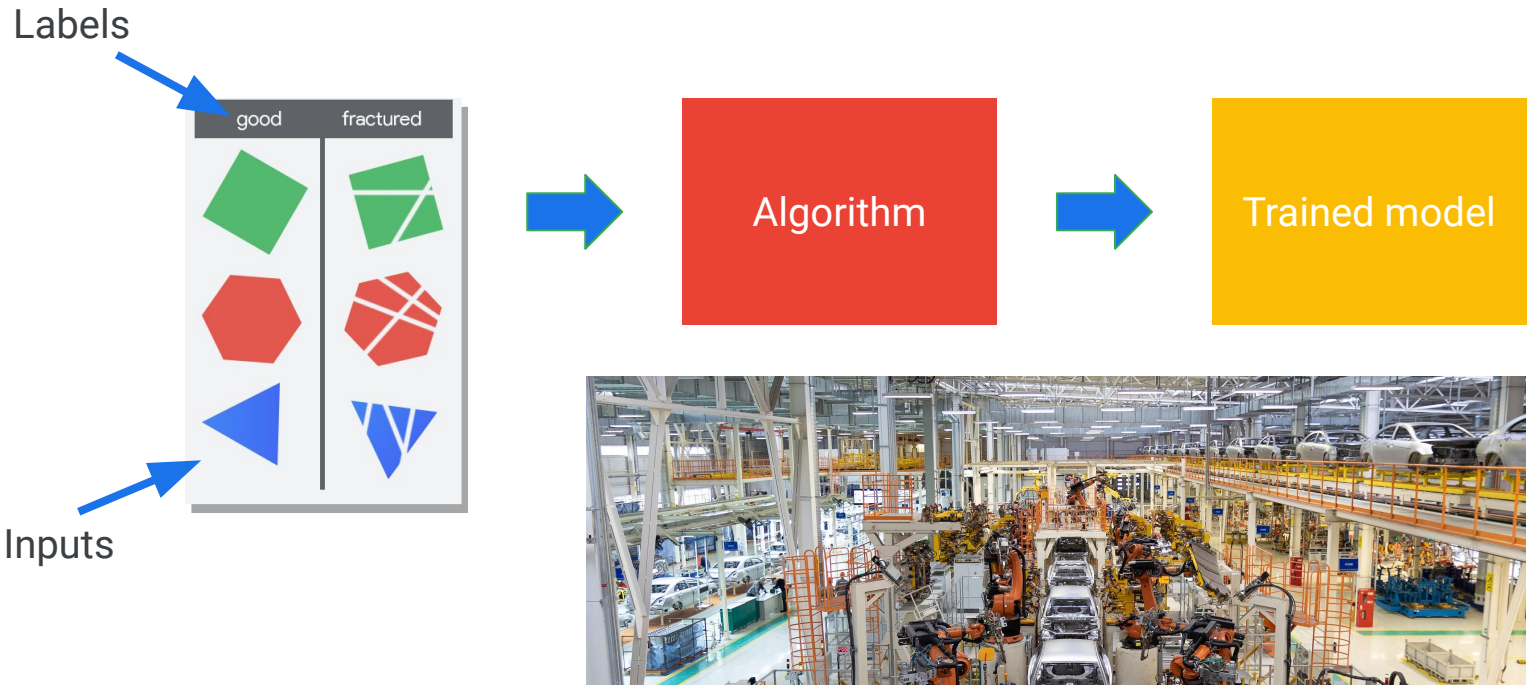
Train an ML model with examples



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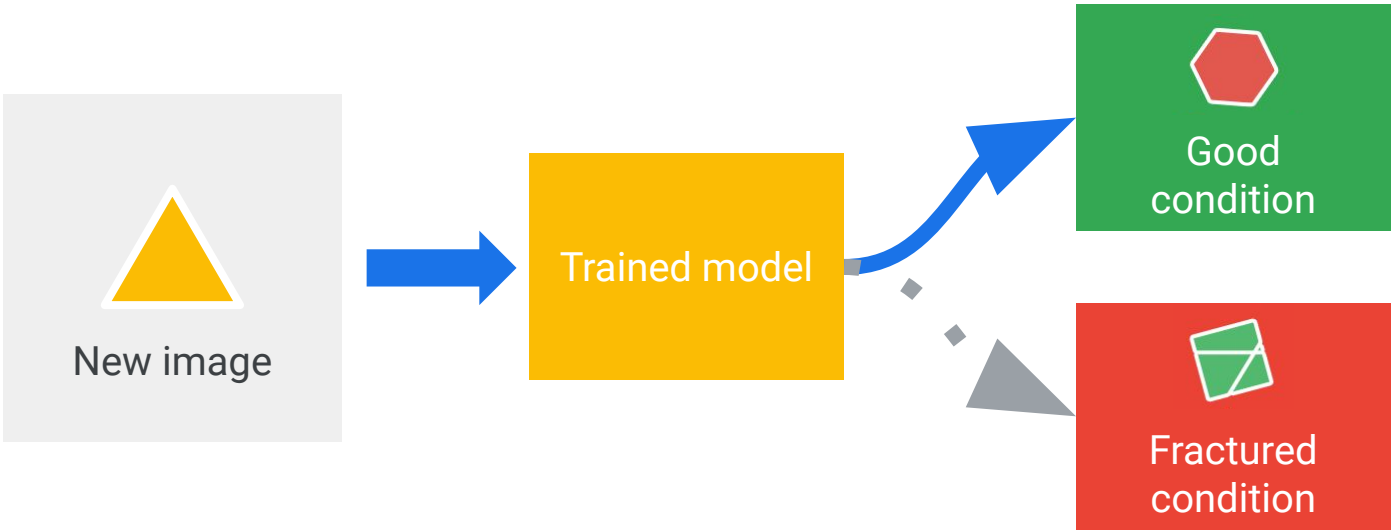
Predict with a trained model



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Standard algorithm use cases

1. Detect a pattern in an image.
2. Predict the future of a time series.
3. Understand or transcribe human speech or text.

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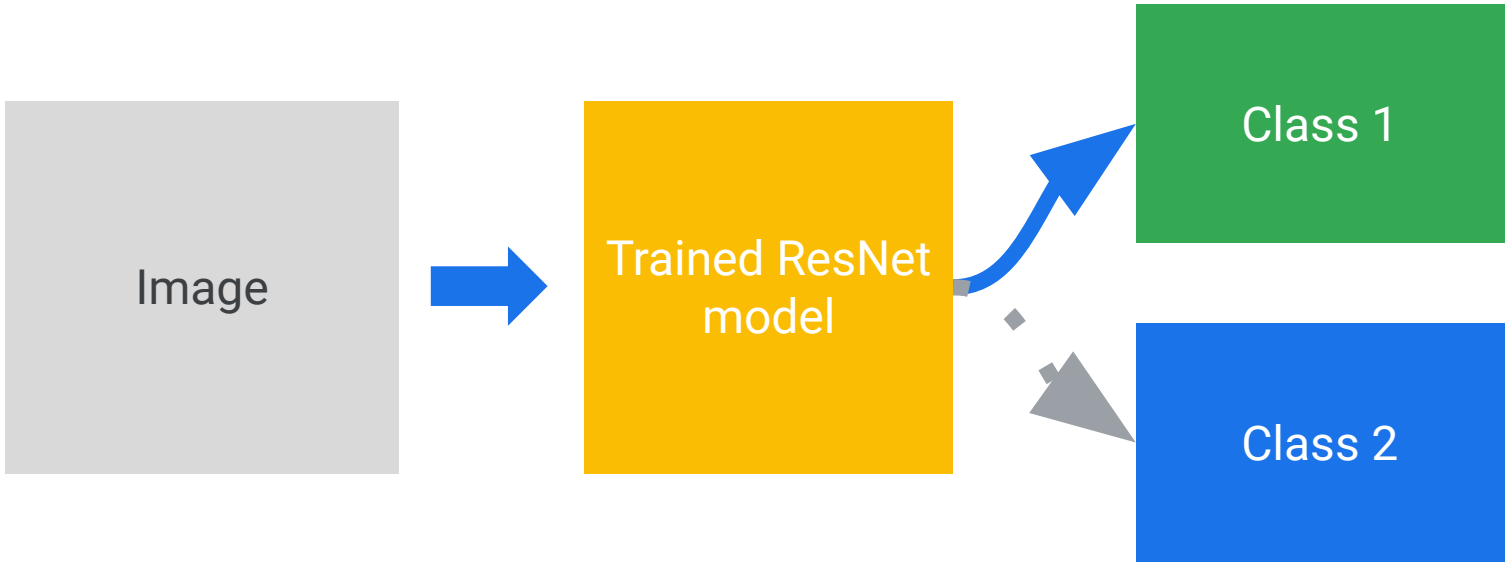
A standard algorithm for image classification



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The same algorithm applied to other data yields a different model

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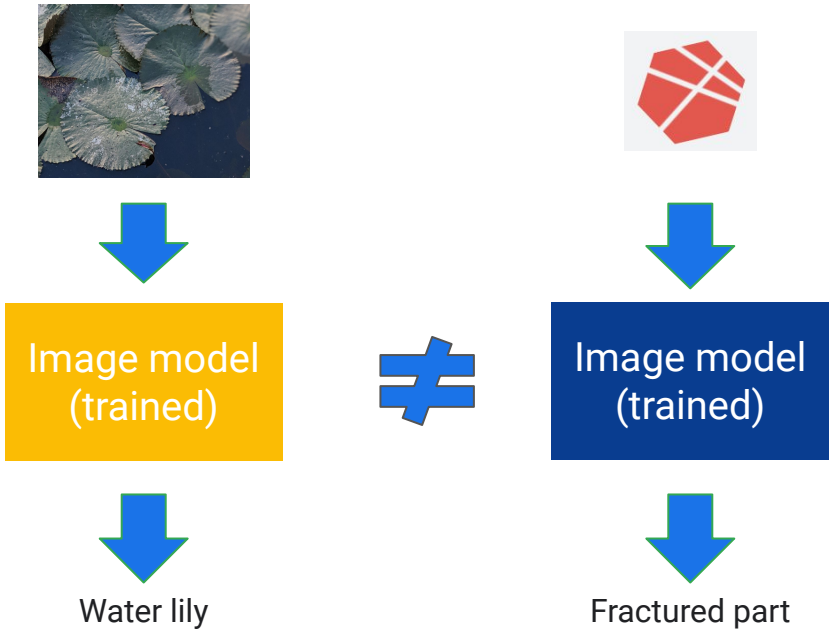
The algorithm is the same, but the trained model is different



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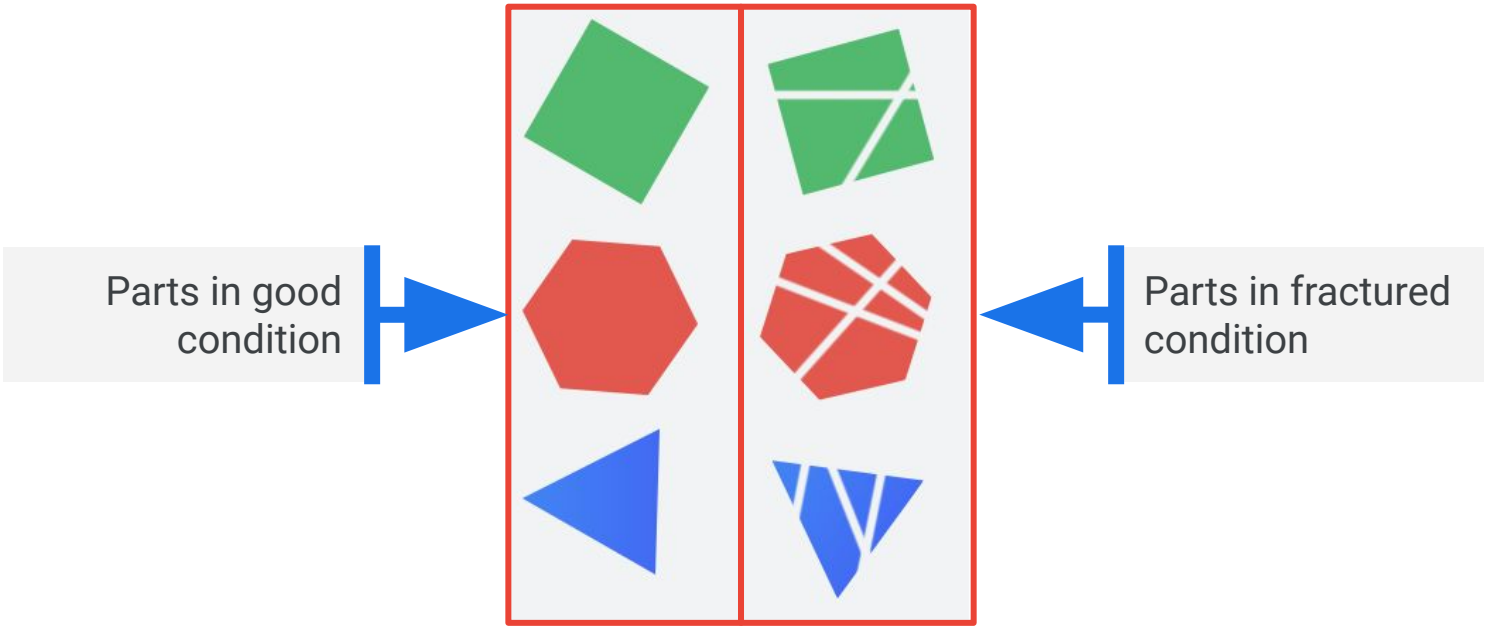
What data do you need?



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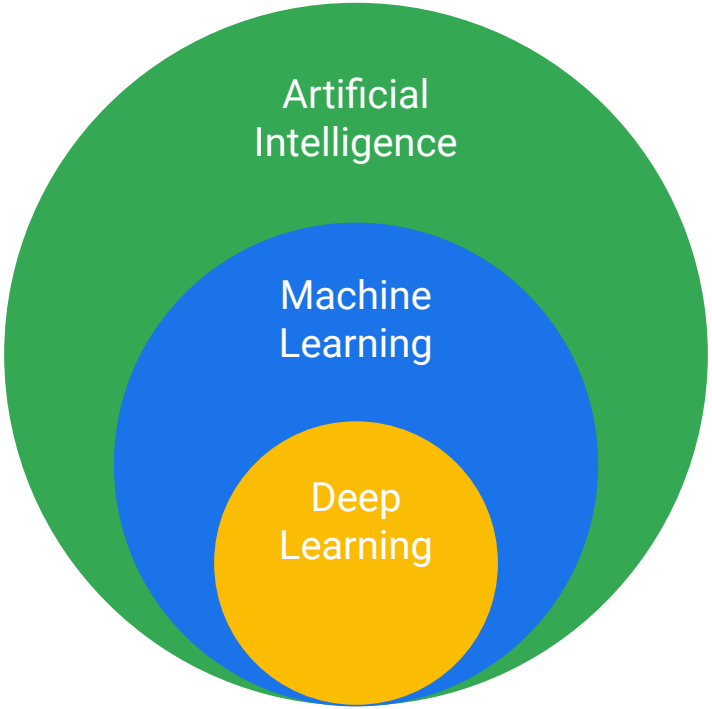
ML is a type of AI



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The impact of ML is scale

Not about saving money

But about doing it at greater scale

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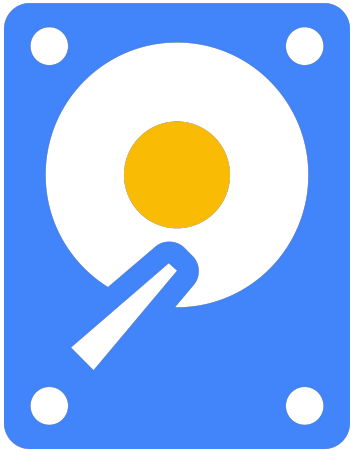
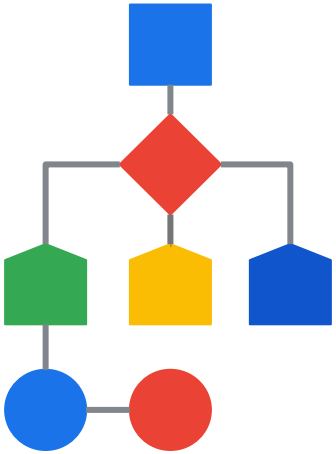
Barriers to entry have now fallen



Data



Algorithm

Hardware
Software

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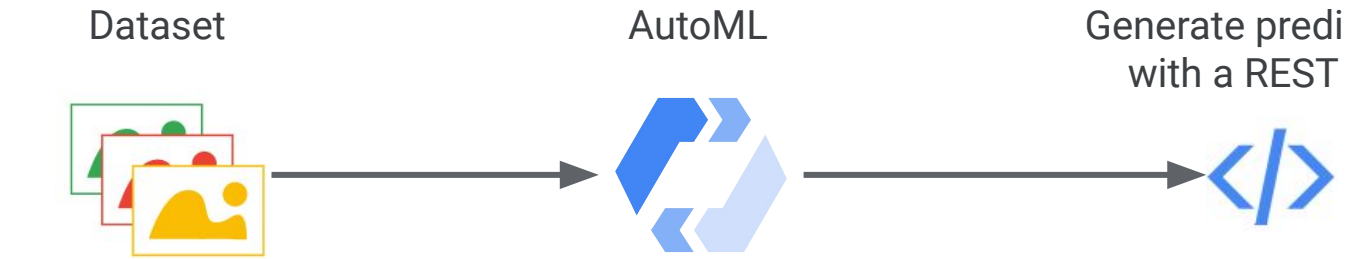
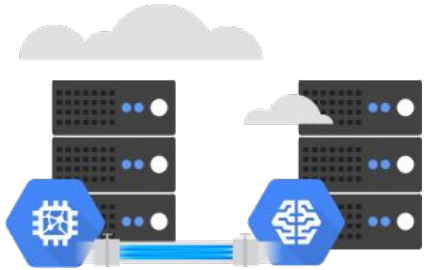
How does this translate to building an ML model to identify diseased leaves?





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The Google Cloud machine learning spectrum

Pre-trained ML models

Ready to go

Vision API

Speech - to - Text API

Cloud Talent Solution API

Cloud Translation API

Cloud Natural Language API

Video Intelligence API

AutoML

Bring your own data

Vision
Video Intelligence
Natural language
Translation
Data tables

ML frameworks

More control for advanced users

TensorFlow

Vertex AI

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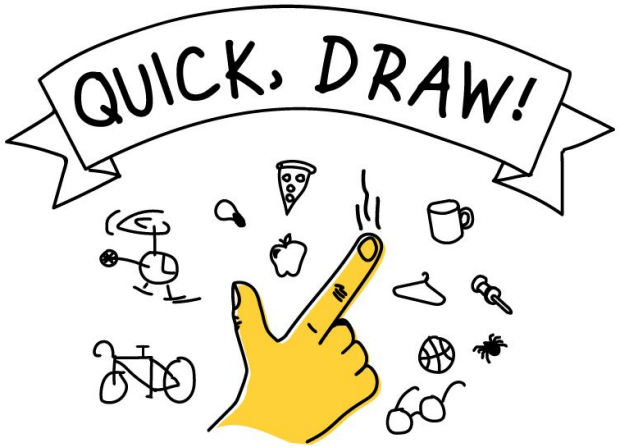
Having fun with ML: Quick, Draw



quickdraw.withgoogle.com

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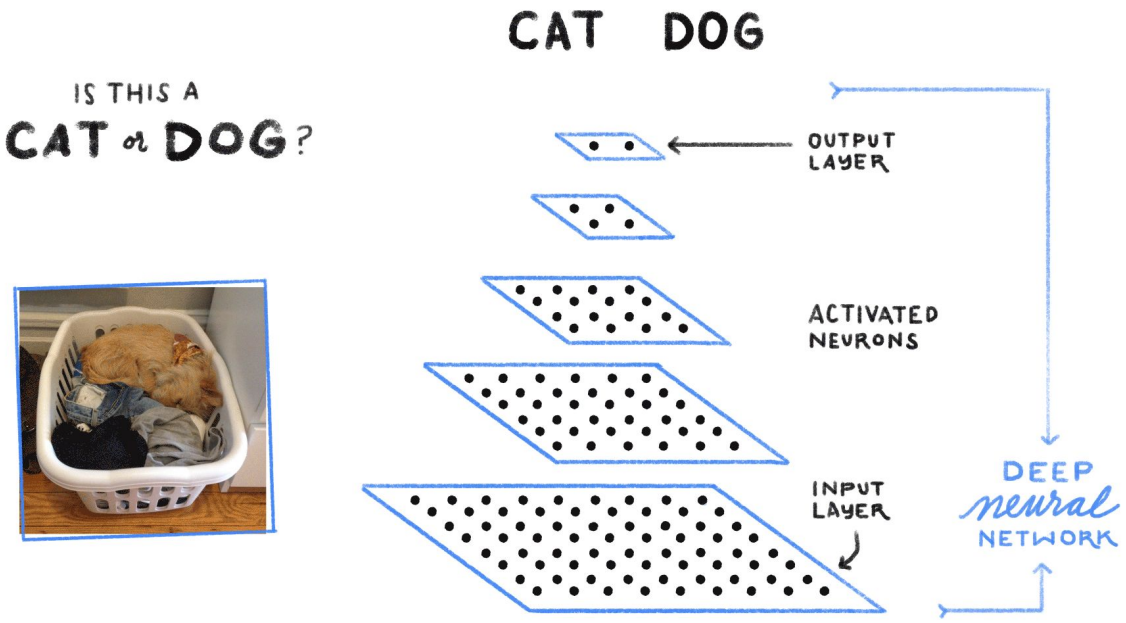
Modern AI applications use deep learning



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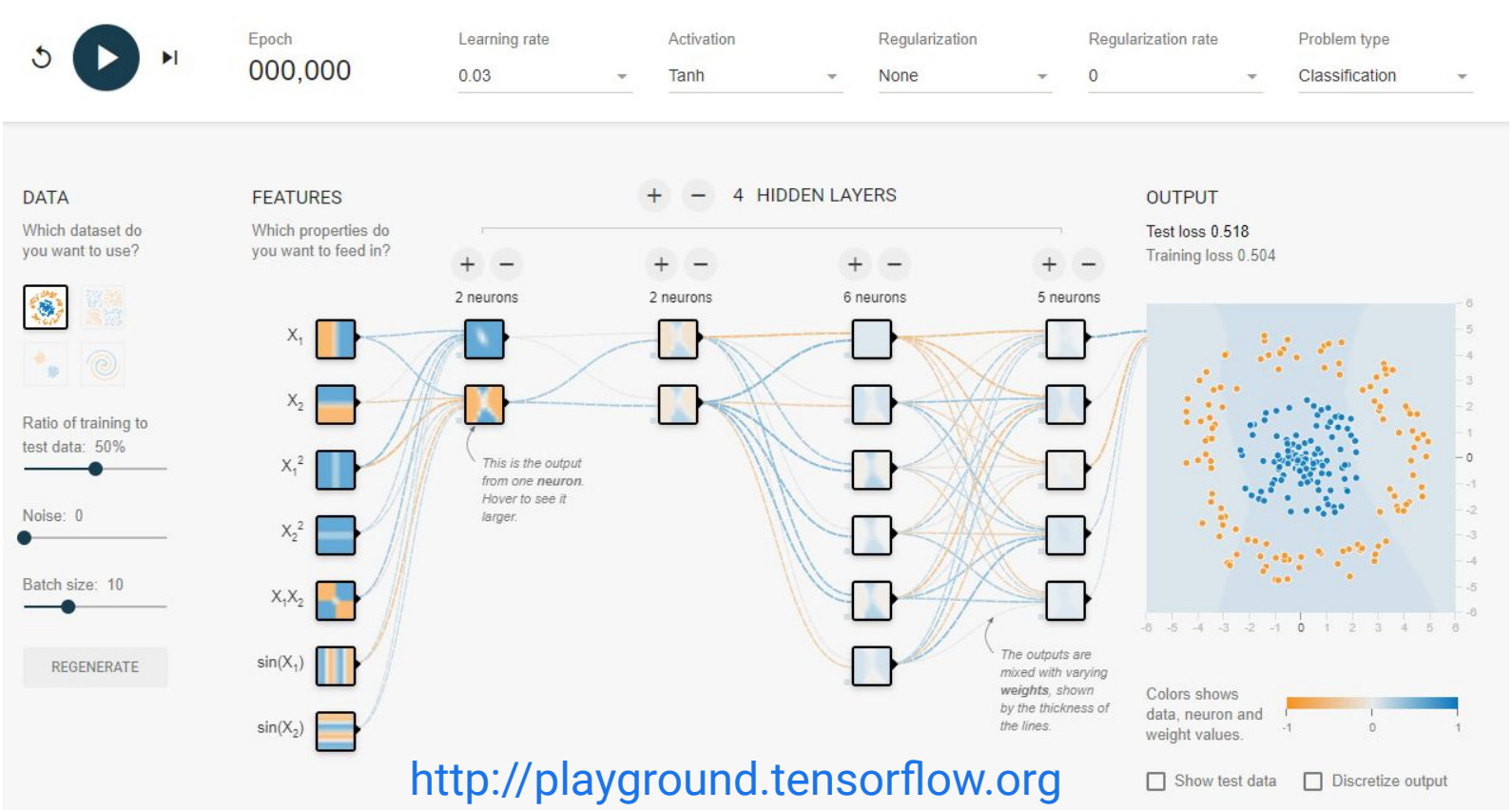

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Agenda

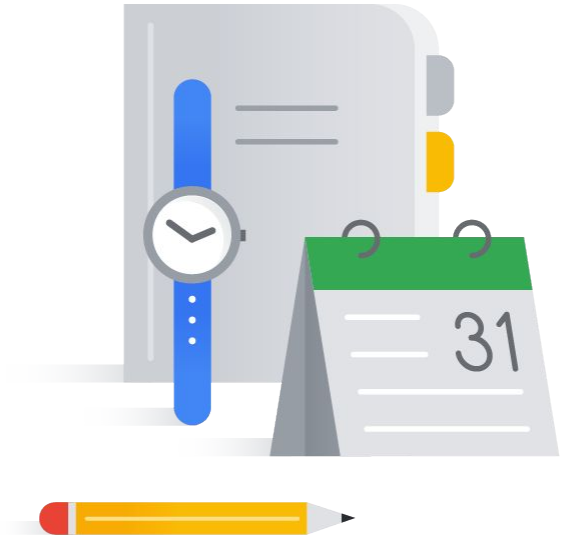
Introduction to Machine Learning in the Cloud

Building Bespoke Machine Learning Models with Vertex AI

Lab: AI Platform Qwik Start

AutoML

Google's Pre-trained Machine Learning APIs



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For the experts!

Pre-trained ML models

Ready to go

- Vision API
- Speech - to - Text API
- Cloud Talent Solution API
- Cloud Translation API
- Cloud Natural Language API
- Video Intelligence API

AutoML

Bring your own data

- Vision
- Video Intelligence
- Natural language
- Translation
- Data tables

ML frameworks

More control for advanced users

- TensorFlow
- Vertex AI

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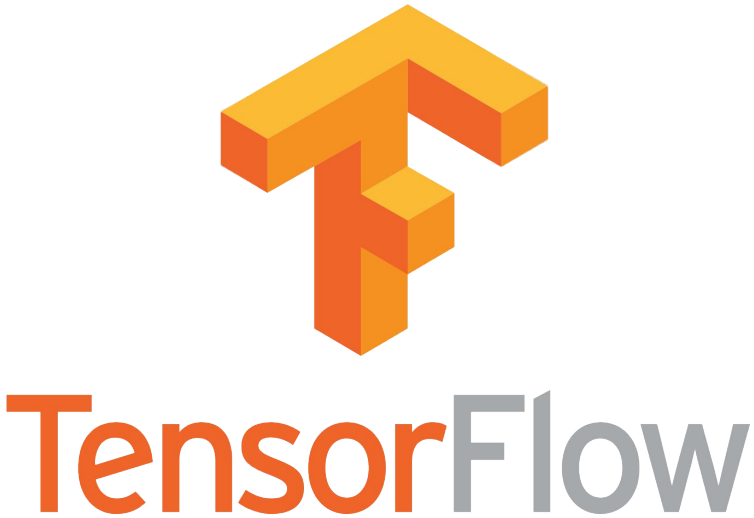
Create custom ML models with TensorFlow



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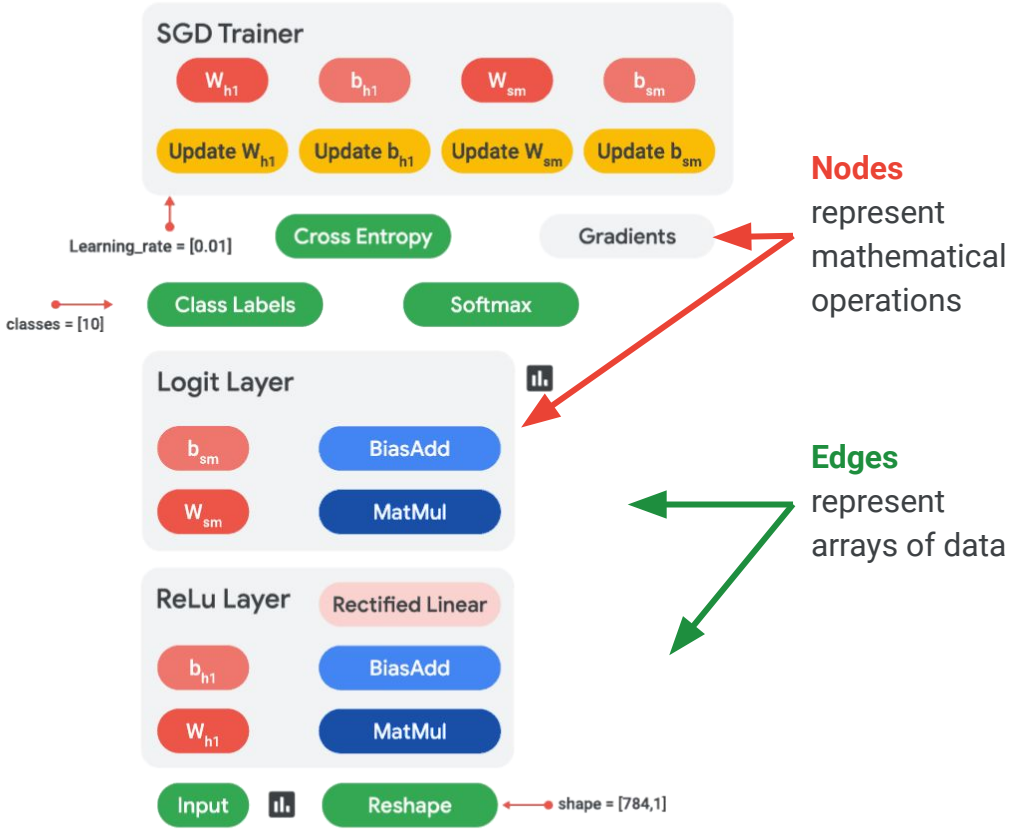
How TensorFlow works



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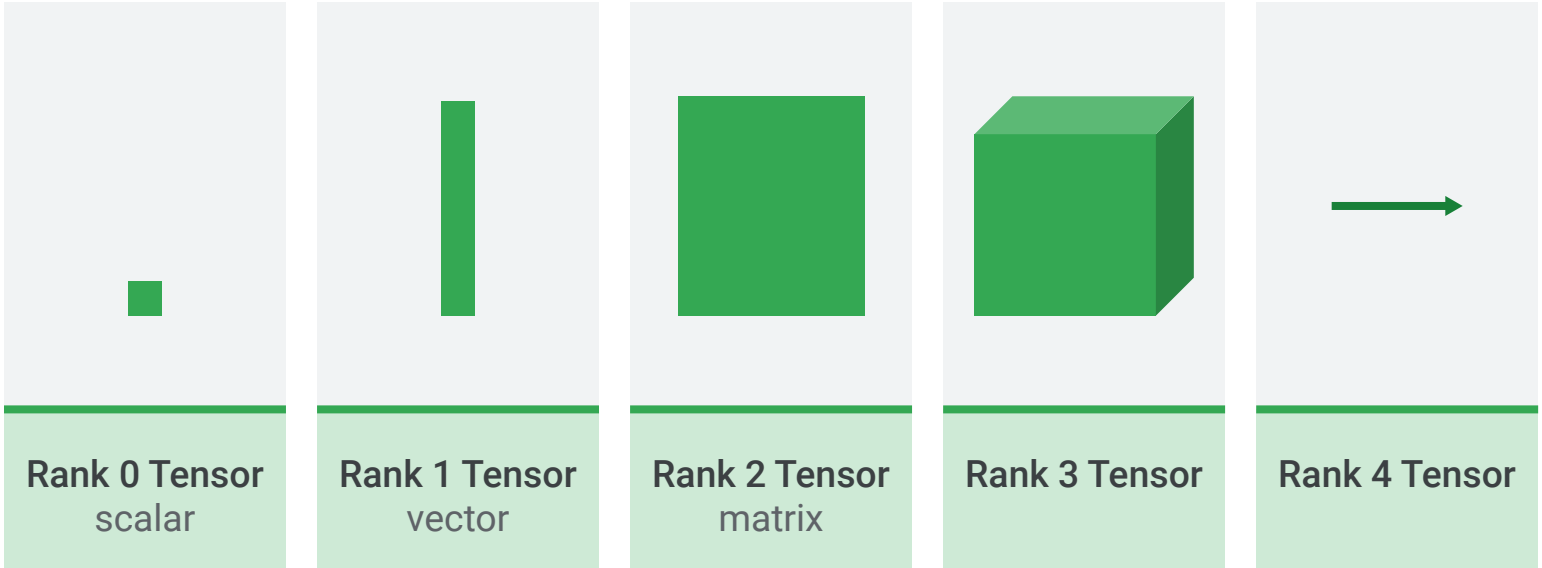
A tensor is an N-dimensional array of data



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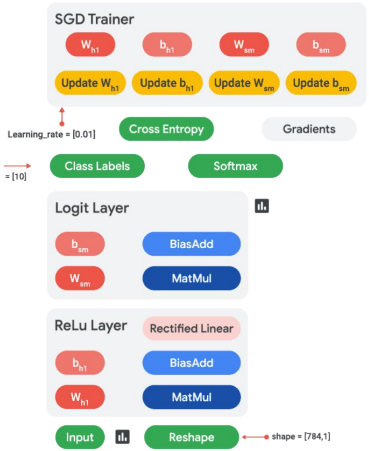
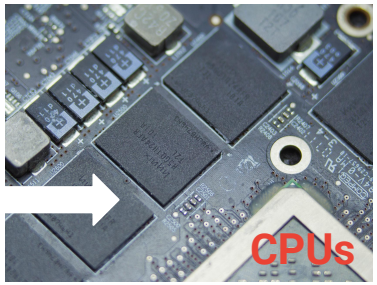
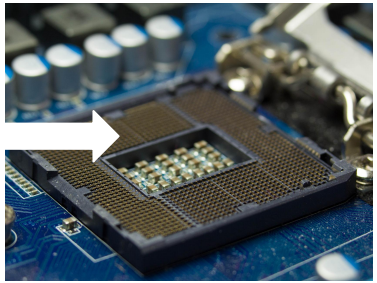
TensorFlow graphs are portable between different devices







Train on cloud.

Run inference on iOS, Android, Raspberry Pi, etc.

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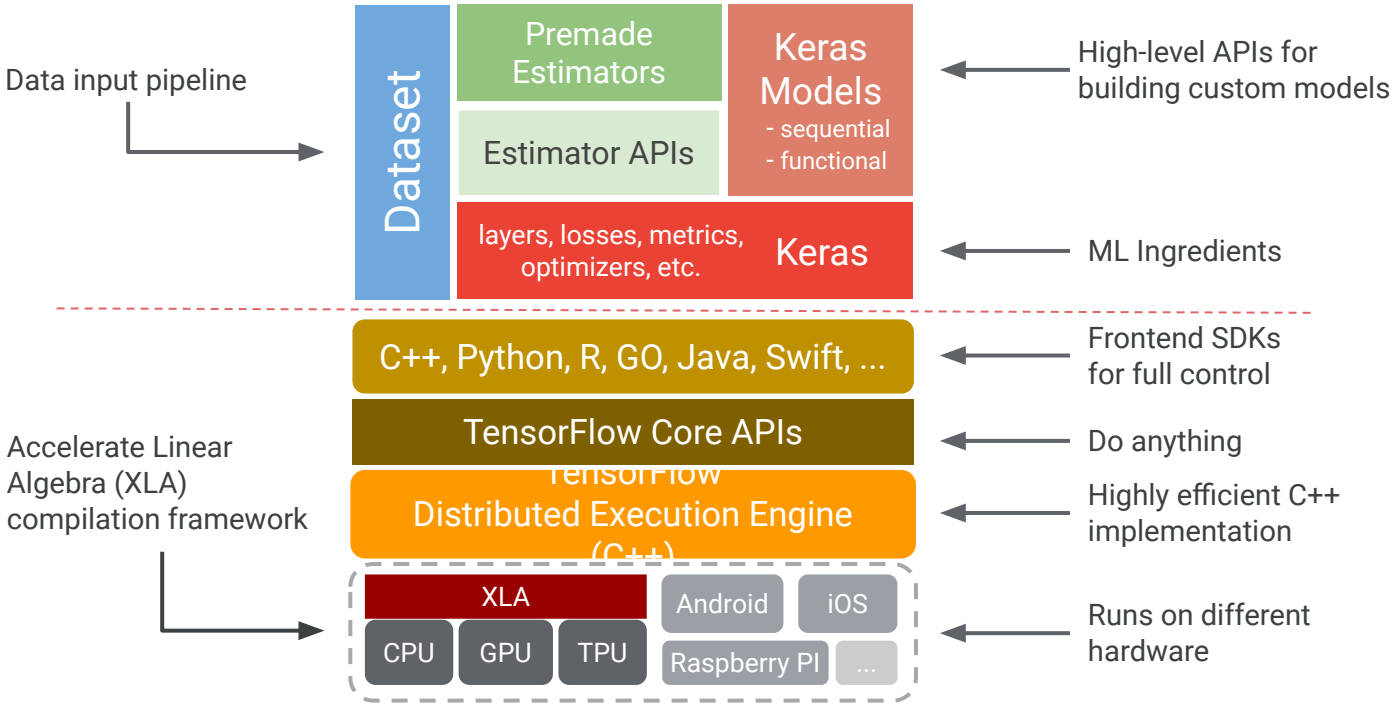
TensorFlow contains multiple abstraction layers



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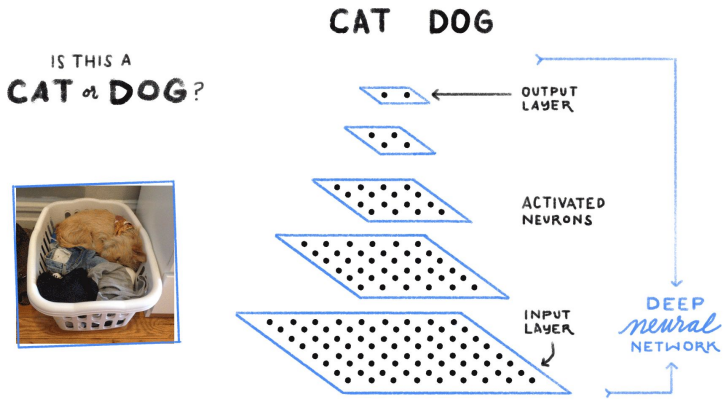
Keras is a friendly high-level API for DNNs



```
from keras.layers import Dense

model.add(Dense(units=64, activation='relu', input_dim=100))
model.add(Dense(units=10, activation='softmax'))
```

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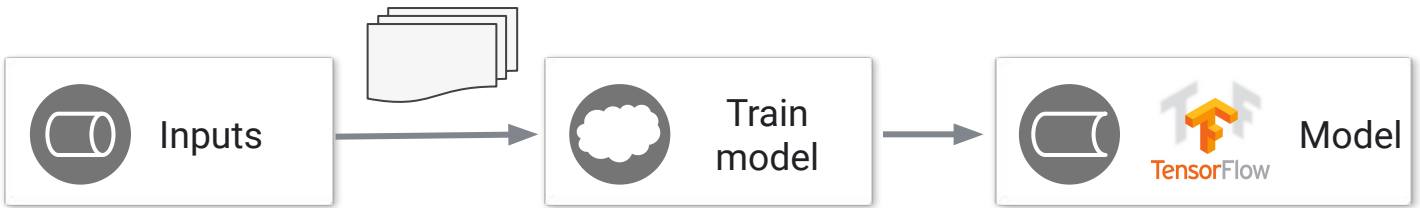
As your data size increases, batching and distribution become important



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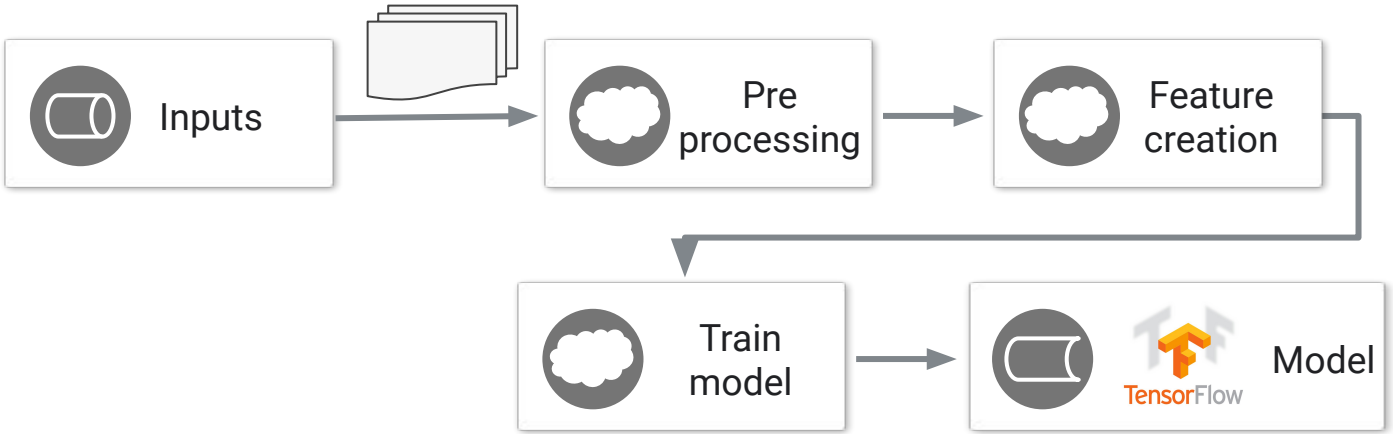
Input necessary transformations



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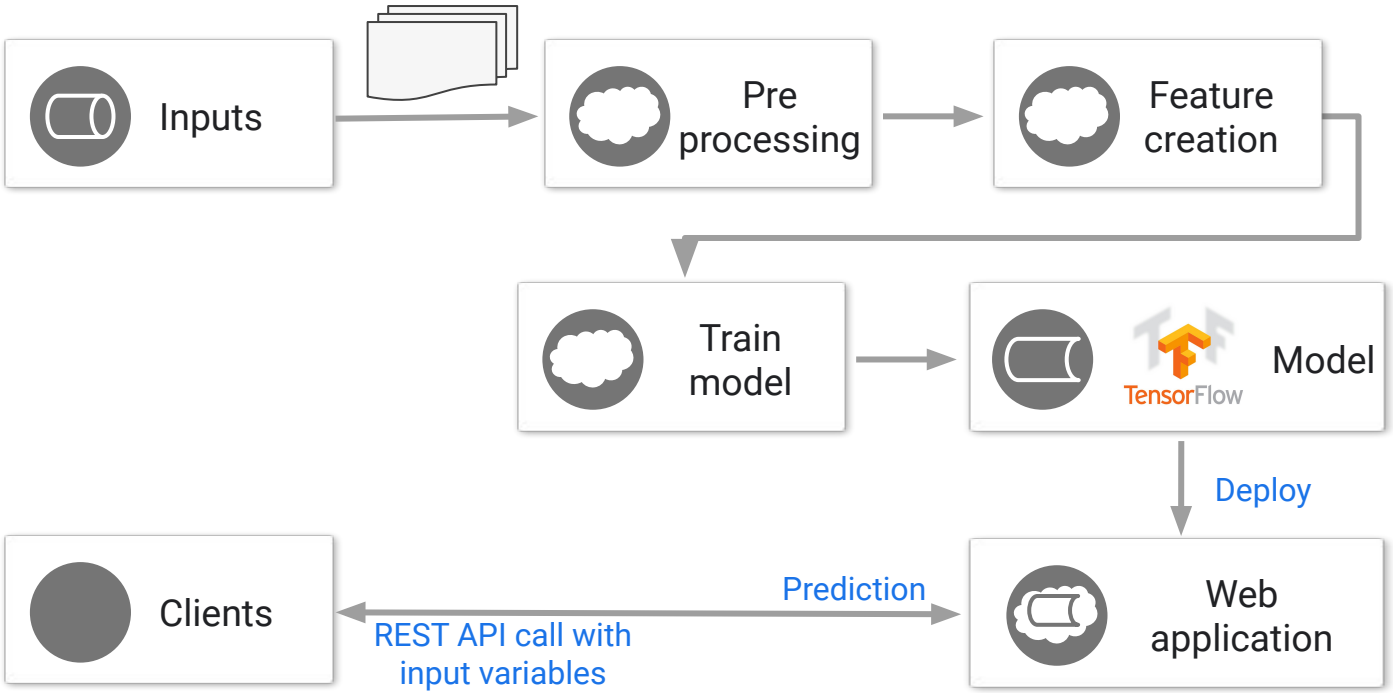
ML code needs to scale



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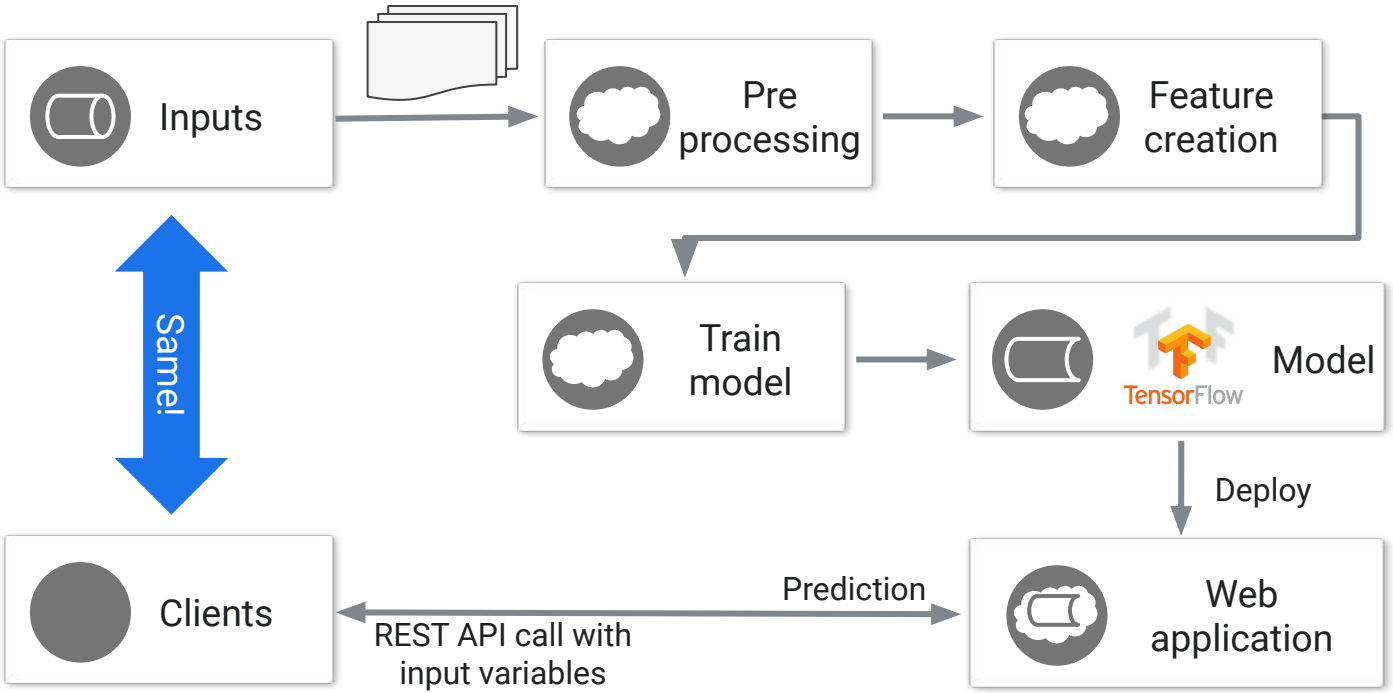
Preprocessing may be required



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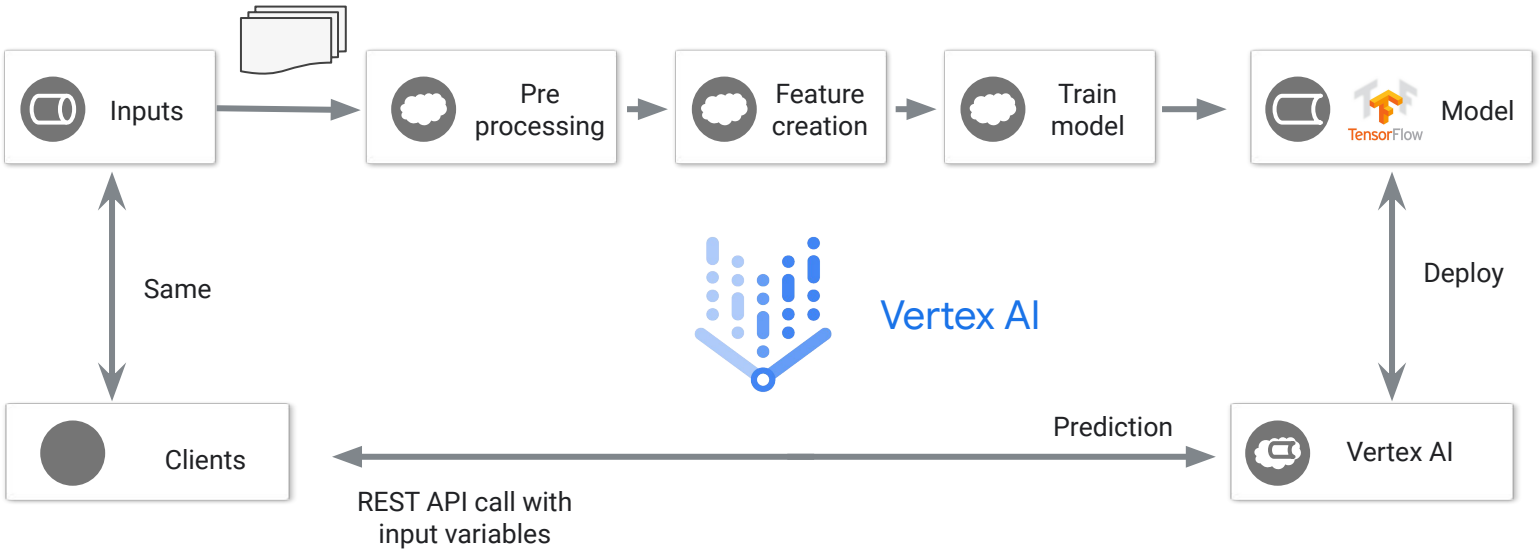
Vertex AI: Repeatable, scalable, tuned



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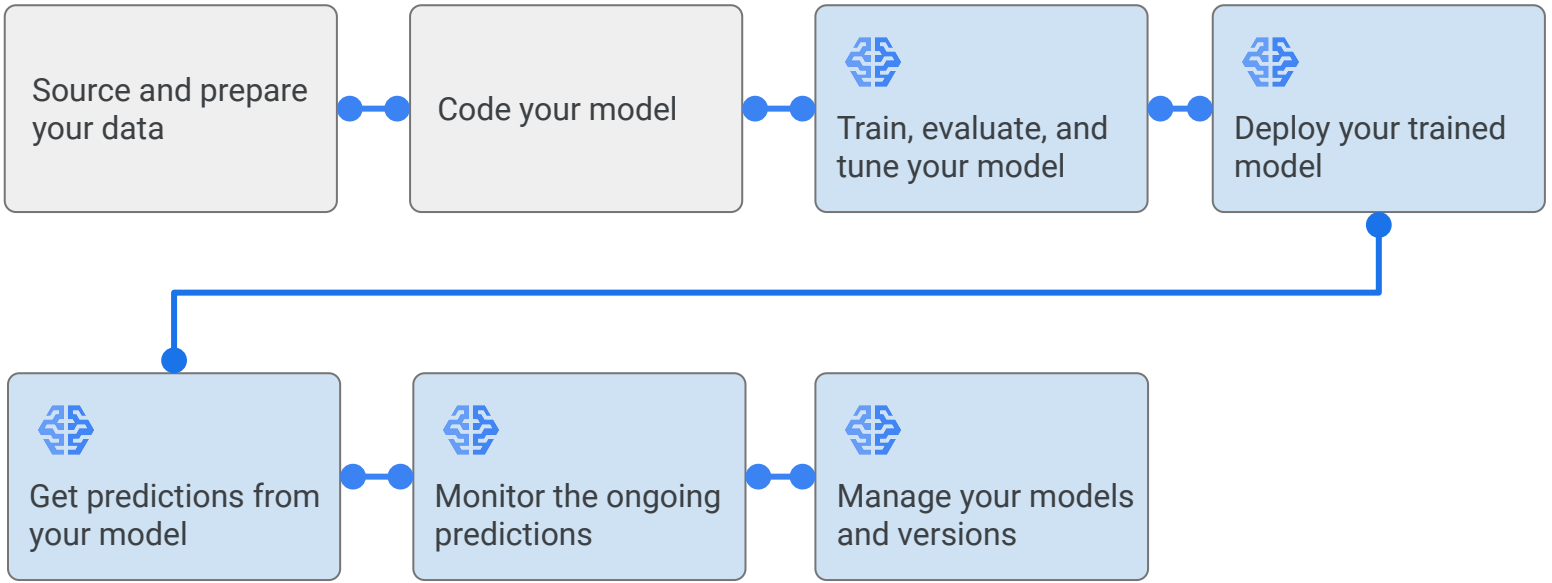
Vertex AI and the ML workflow



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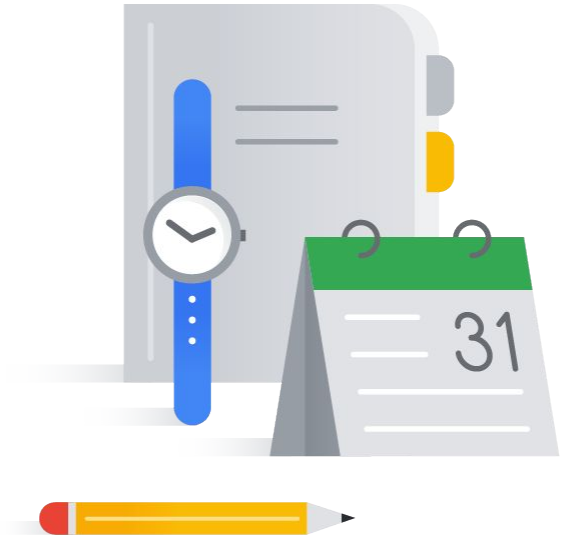

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Lab Intro

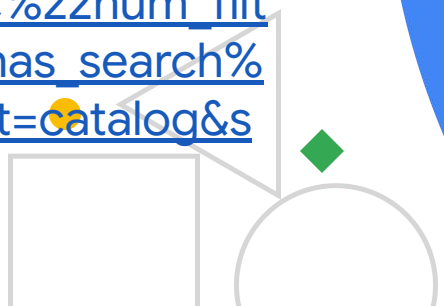
AI Platform: Qwik Start

Train and deploy a TensorFlow model to AI Platform for serving (prediction).

~~The lab can be found here.~~

(If you want to play with TF) Machine Learning with TensorFlow in Vertex AI

https://www.cloudskillsboost.google/focuses/3391?catalog_rank=%7B%22rank%22%3A6%2C%22num_filters%22%3A0%2C%22has_search%22%3Atrue%7D&parent=catalog&search_id=39816913



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Lab objectives (1/2)

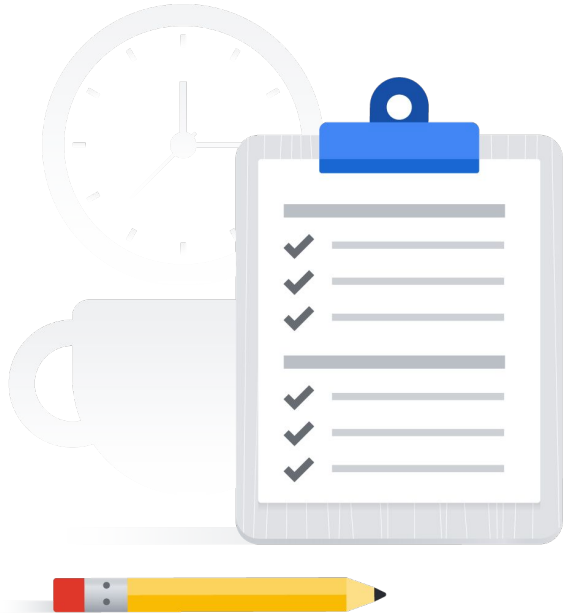
Create a TensorFlow training application and validate it locally.

Run your training job on a single worker instance in the cloud.

Run your training job as a distributed training job in the cloud.

Optimize your hyperparameters by using hyperparameter tuning.

Deploy a model to support prediction.



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Lab objectives (2/2)

Request an online prediction and see the response.

Request a batch prediction.

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Lab Intro

Scikit-learn Model Serving with Online Prediction Using AI Platform (Alternative)

Train a simple scikit-learn model, deploy the model to AI Platform Prediction, and make online predictions against that model.

The lab can be found here.

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Lab objectives

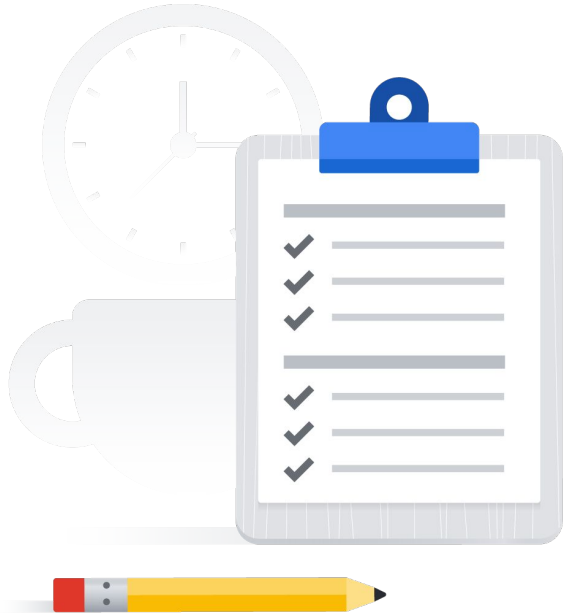
Create and save a model to a file.

Upload a saved model to Google Cloud Storage.

Create a model resource in AI Platform.

Create a model version (linking your scikit-learn model).

Make an online prediction.



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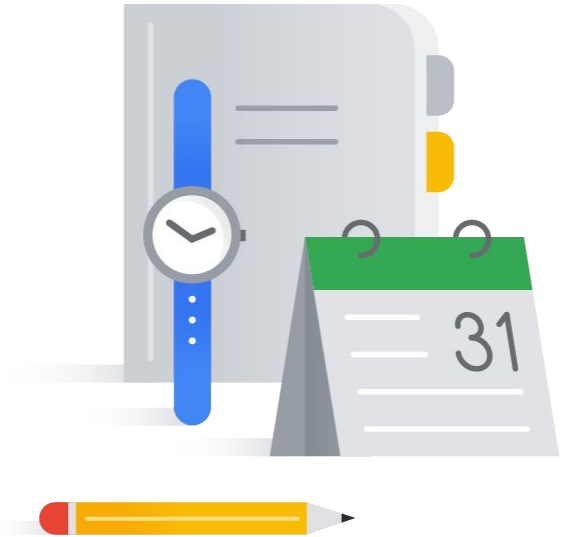

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Machine learning for the masses!

Pre-trained ML models

Ready to go

- Vision API
- Speech - to - Text API
- Cloud Talent Solution API
- Cloud Translation API
- Cloud Natural Language API
- Video Intelligence API

AutoML

Bring your own data

- Vision
- Video Intelligence
- Natural language
- Translation
- Data tables

ML frameworks

More control for advanced users

- TensorFlow
- Vertex AI

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What's required to solve an ML problem?

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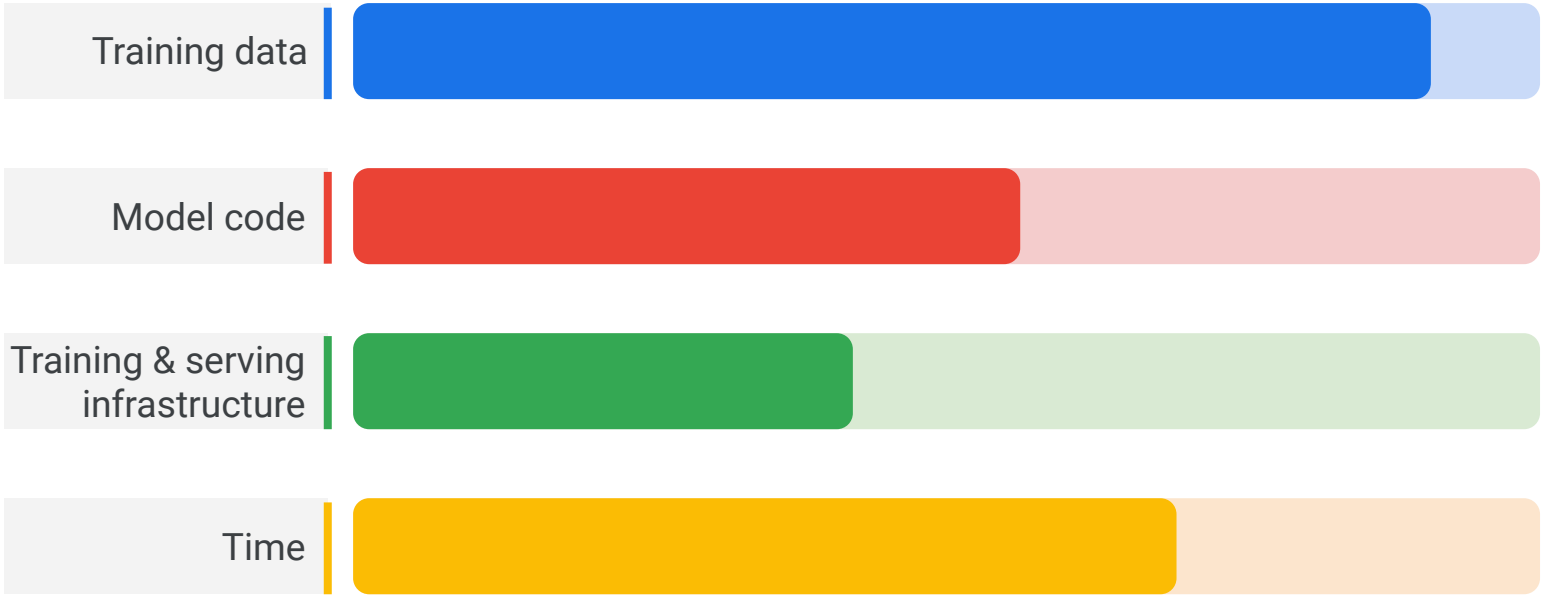
What's required when using a managed service?



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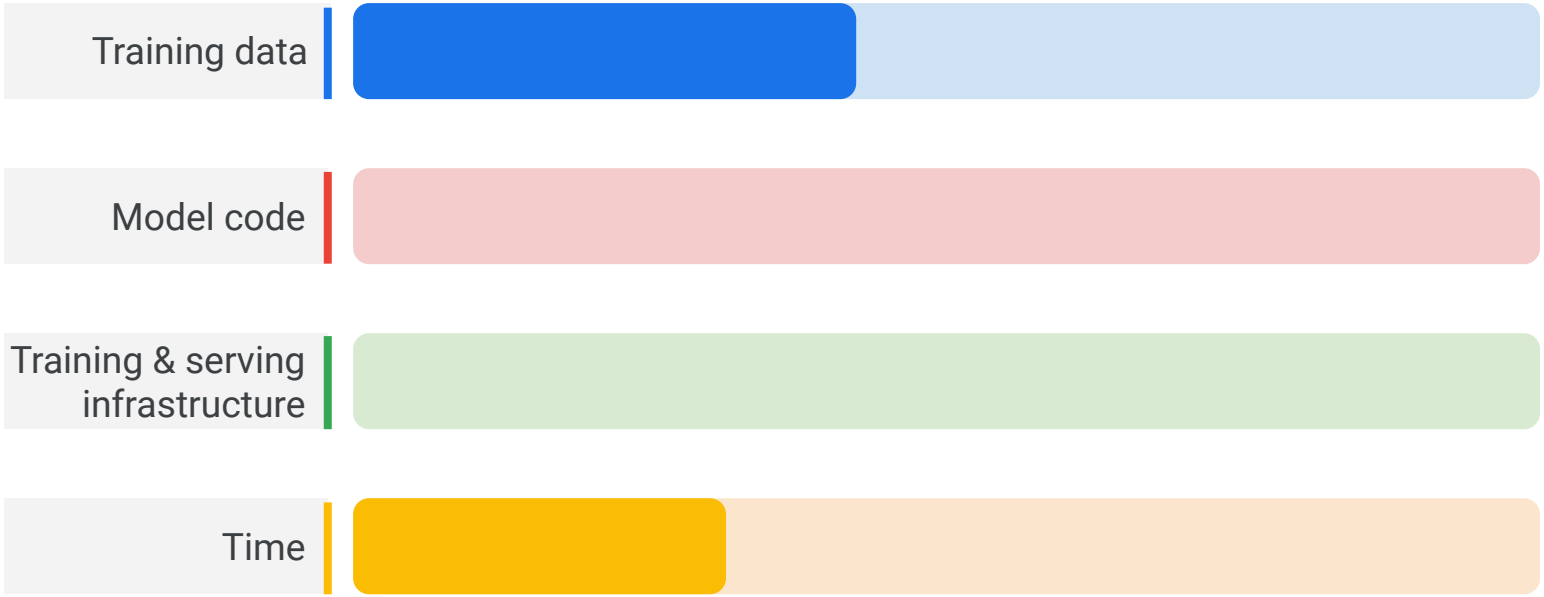
What's required when using AutoML?



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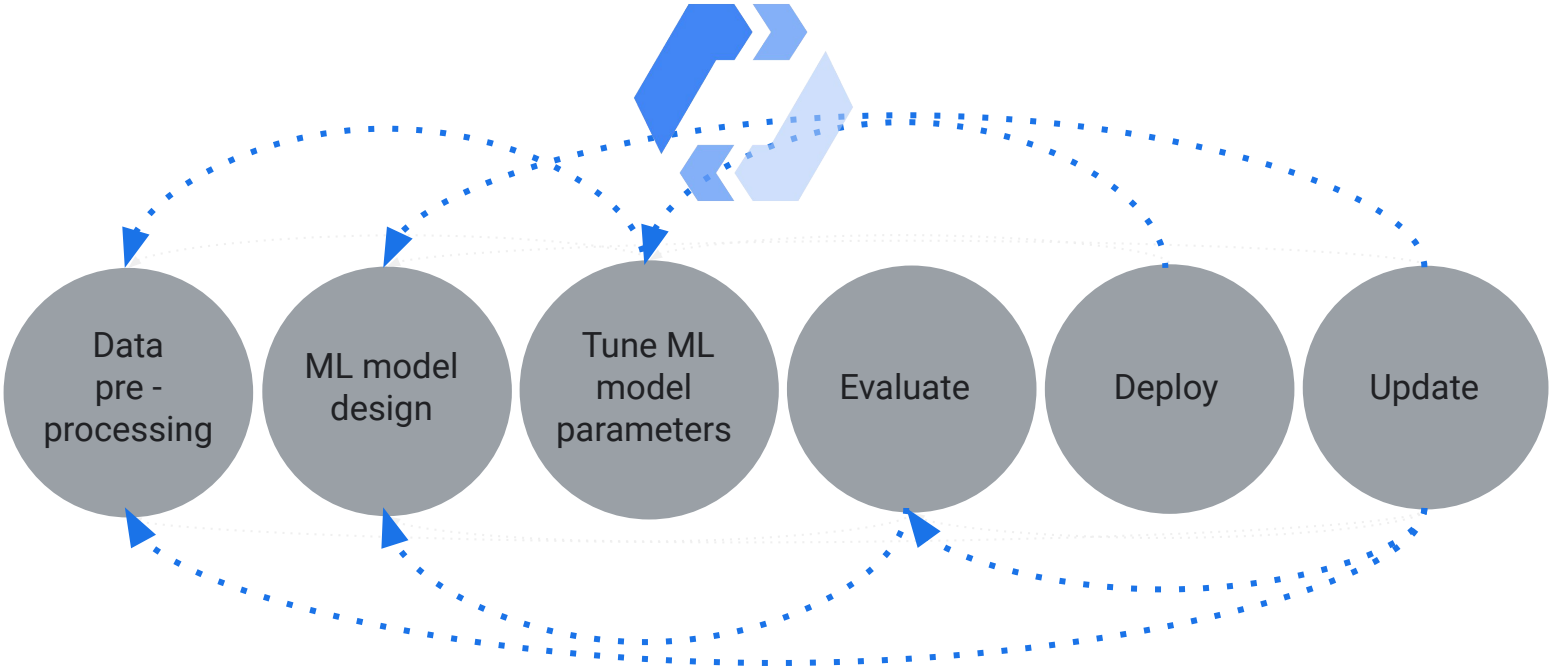
AutoML simplifies the process



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Use AutoML for what you can see

AutoML Vision

Derive insights from images in the cloud or at the edge.

AutoML Video Intelligence

Enable powerful content discovery and engaging video experiences.

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Use AutoML for what you can hear

AutoML Natural Language

Reveal the structure and meaning of text through machine learning.

AutoML Translation

Dynamically translate between languages.

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Use AutoML to turn structured data into predictive insights

AutoML Tables

Automatically build and deploy state-of-the-art machine learning models on structured data.

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Agenda (1/3)

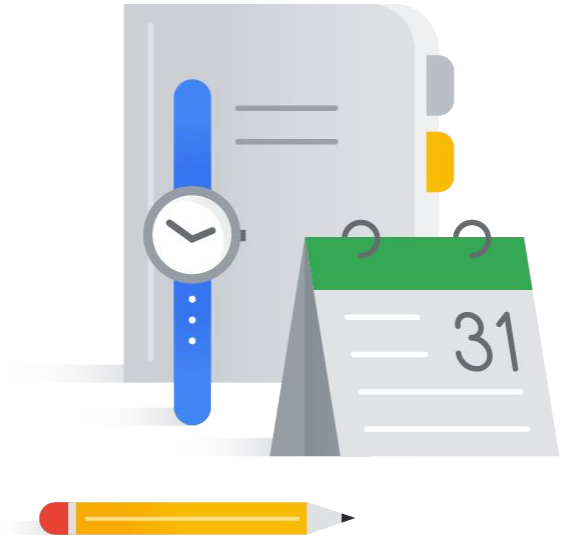
Introduction to Machine Learning in the Cloud

Building Bespoke Machine Learning Models with Vertex AI

Lab: AI Platform Qwik Start

AutoML

Google's Pre-trained Machine Learning APIs



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Access pre-trained ML APIs for common applications

Pre-trained ML models

Ready to go

- Vision API
- Speech - to - Text API
- Cloud Talent Solution API
- Cloud Translation API
- Cloud Natural Language API
- Video Intelligence API

AutoML

Bring your own data

- Vision
- Video Intelligence
- Natural language
- Translation
- Data tables

ML frameworks

More control for advanced users

- TensorFlow
- Vertex AI

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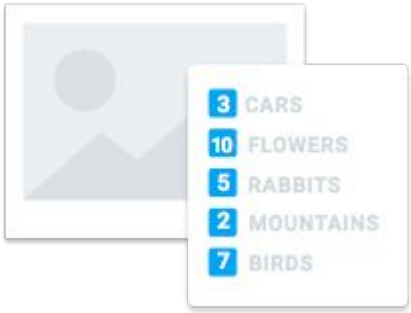
Use the Vision API to understand image content



Detect and label

Extract text

Identify entities

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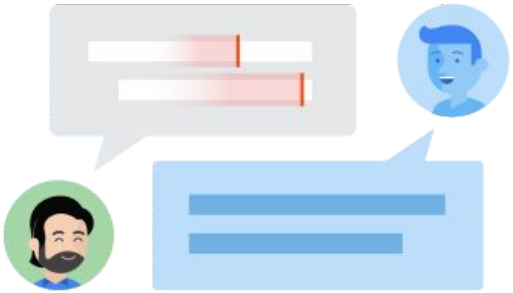
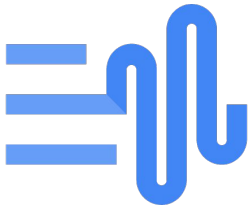
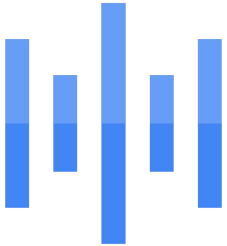
Convert speech to text and vice versa





Text-to-Speech



Speech-to-Text

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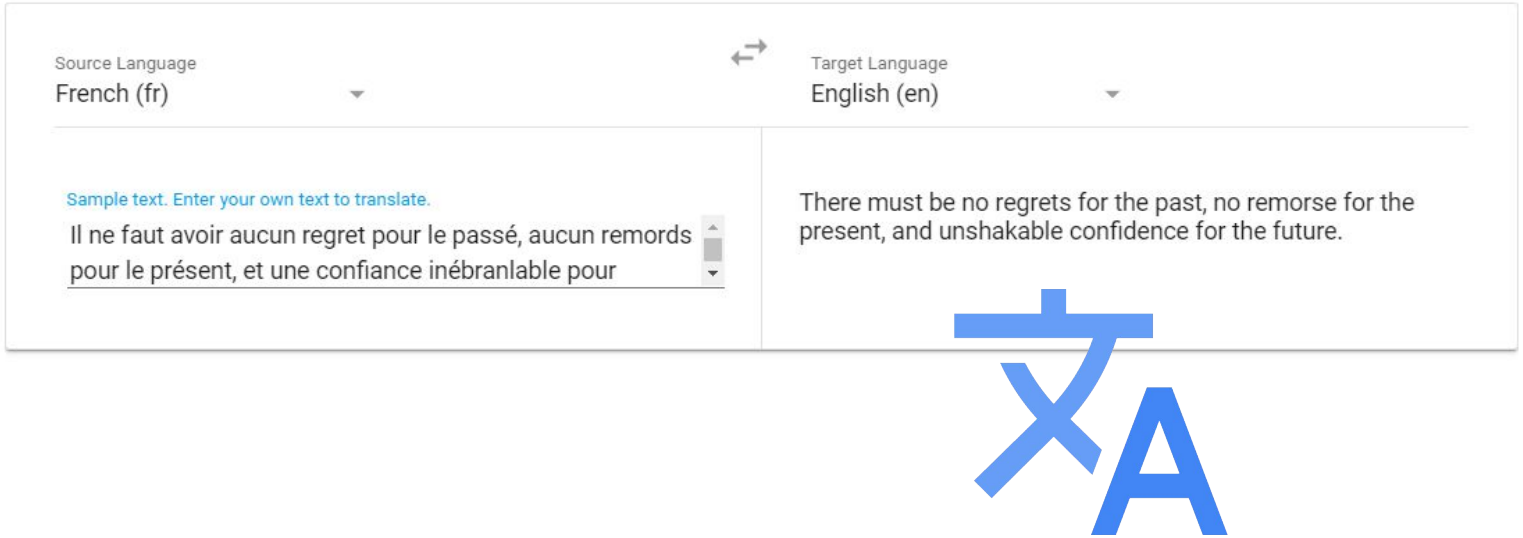
Dynamically translate between languages using the Cloud Translation API



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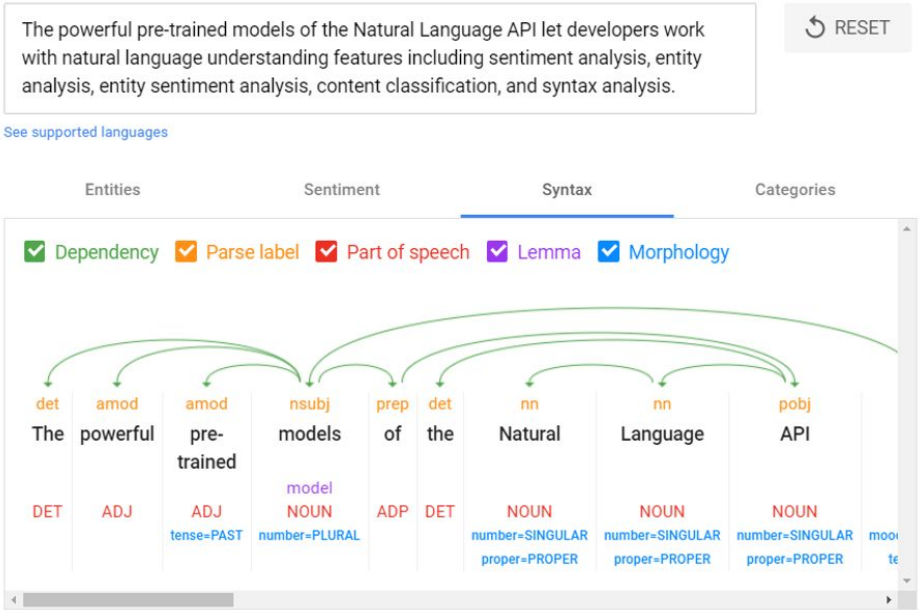
Derive insights from unstructured text with the Cloud Natural Language API



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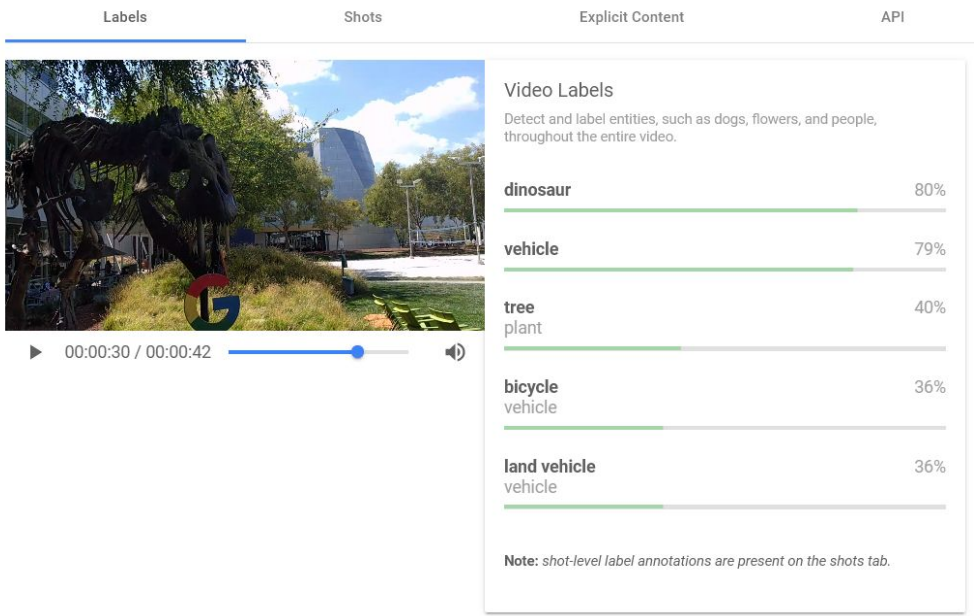
Make your media more discoverable with the Video Intelligence API



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Agenda

Lab: Cloud Natural Language API: Qwik Start

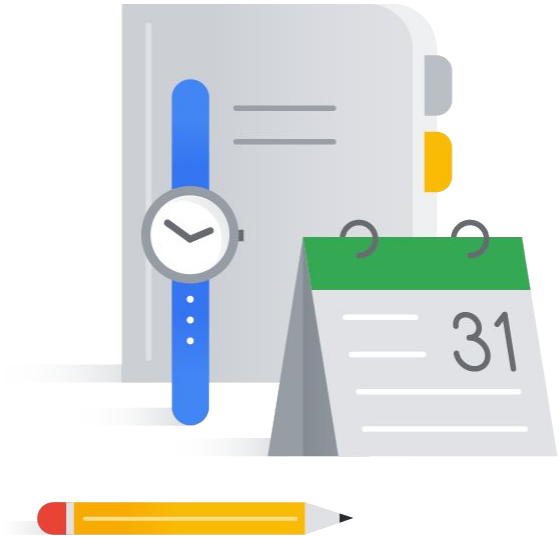
Lab: Google Cloud Speech API: Qwik Start

Lab: Video Intelligence: Qwik Start

Lab: Reinforcement Learning: Qwik Start

Quiz

Summary



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Lab Intro

Cloud Natural Language API: Qwik Start

Apply the analyze-entities method to ask the Cloud Natural Language API to extract "entities" from a snippet of text.

You can find the lab here.

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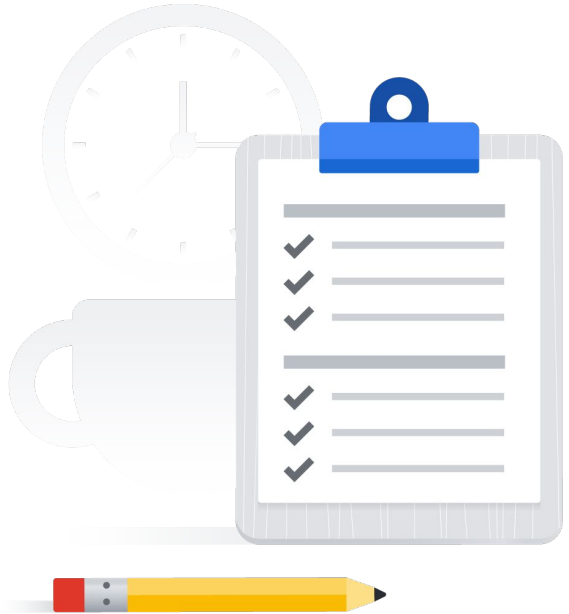
Lab objectives

Create an API key.

Make an entity analysis request.



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Lab Intro

Entity and Sentiment Analysis with the Natural Language API (Alternative)

Use the Natural Language API to analyze entities, sentiment, and syntax.

You can find the lab here.

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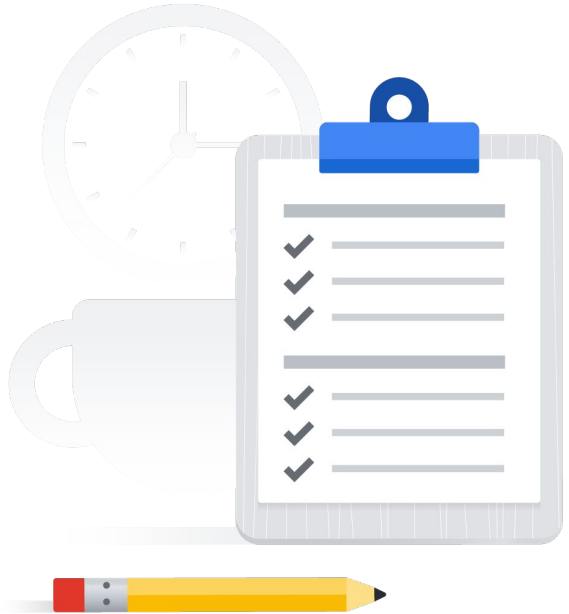
Lab objectives

Create a Natural Language API request and call the API with curl.

Extract entities and run sentiment analysis on text with the Natural Language API.

Perform linguistic analysis on text with the Natural Language API.

Create a Natural Language API request in a different language.



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Agenda

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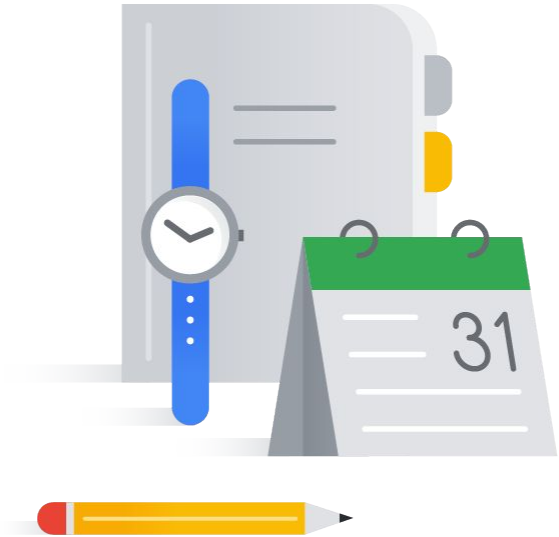
Lab: Google Cloud Speech API: Qwik Start

Lab: Video Intelligence: Qwik Start

Lab: Reinforcement Learning: Qwik Start

Quiz

Summary



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Lab Intro

Google Cloud Speech API: Qwik Start

Create and call a Cloud Speech API request.

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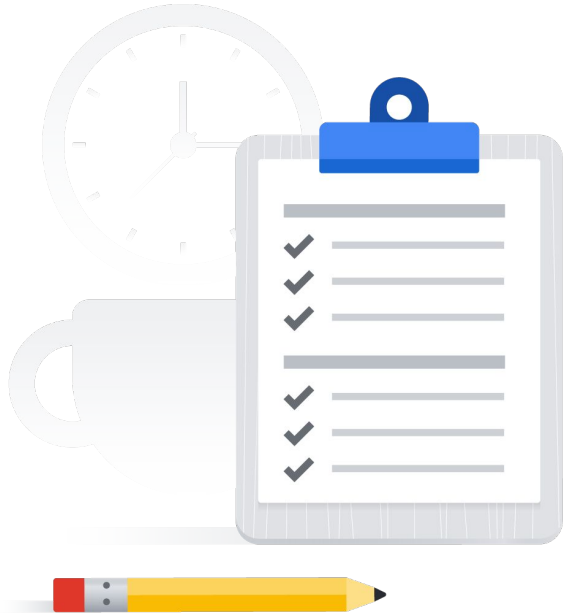
Lab objectives

Create an API key.

Create a Speech API request.

Call the Speech API request.



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Lab Intro

Speech to Text Transcription with the Cloud Speech API (Alternative)

Send an audio file to the Cloud Speech API for transcription.

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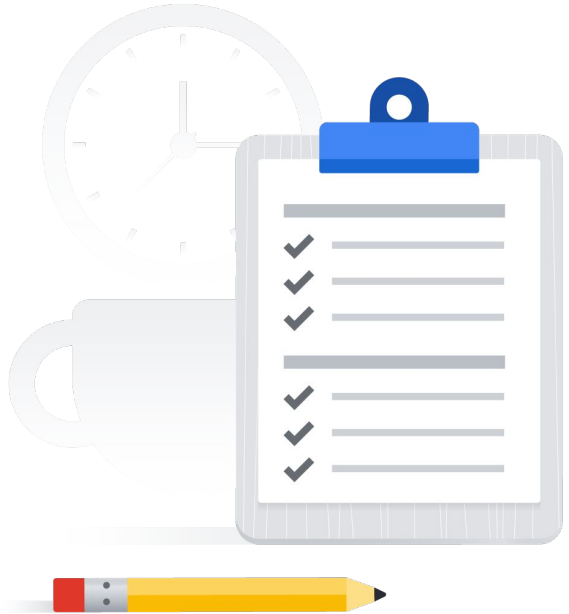
Lab objectives

Create a Speech API request and calling the API with curl.

Call the Speech API with audio files in different languages.



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Lab: Reinforcement Learning: Qwik Start

Quiz

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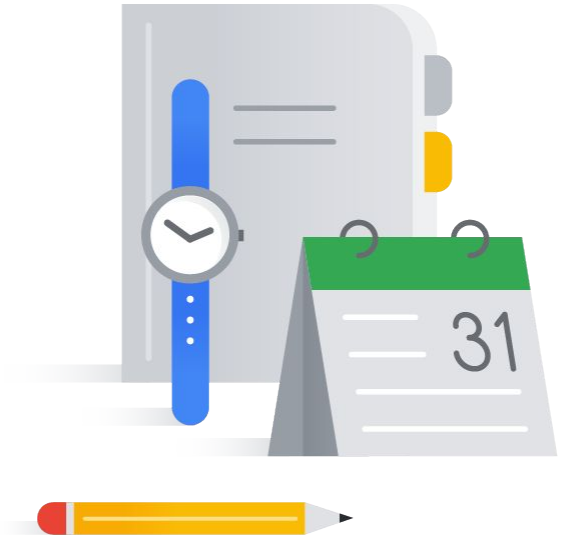

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Lab Intro

Video Intelligence: Qwik Start

Make an annotate video request using the Video Intelligence API.

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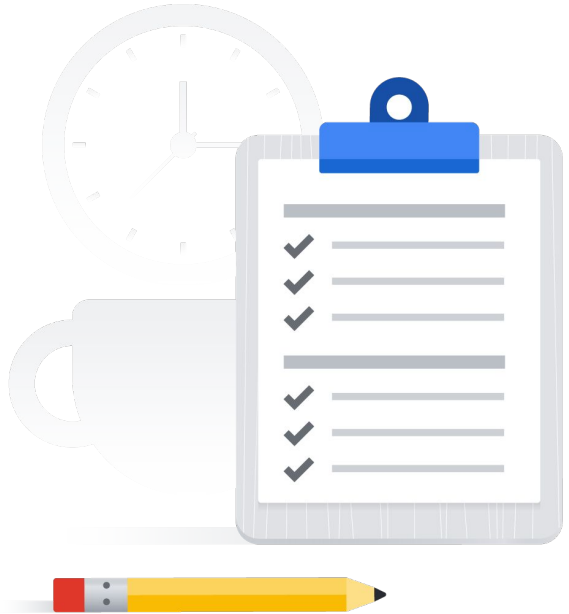
Lab objectives

Enable the Video Intelligence API.

Set up authorization.

Make an annotate video request.



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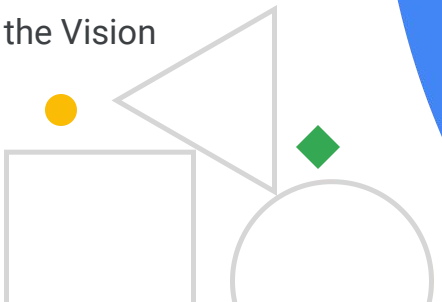
Lab Intro

Scanning User-generated Content Using the Cloud Video Intelligence and Cloud Vision APIs (Alternative)

Deploy a set of Cloud Functions in order to process images and videos with the Vision API and Video Intelligence API.

The lab can be found here.



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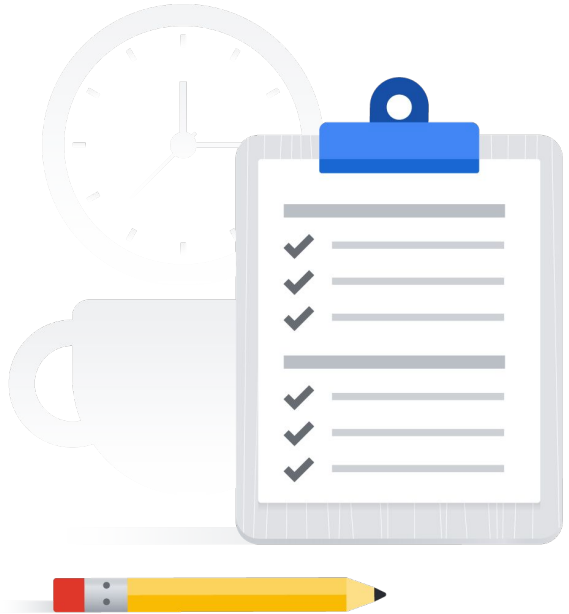
Lab objectives

Deploy four Cloud Functions.

Create the supporting Cloud Storage buckets, Pub/Sub topics, and Cloud Storage Pub/Sub Notifications.

Create the supporting BigQuery dataset and table.



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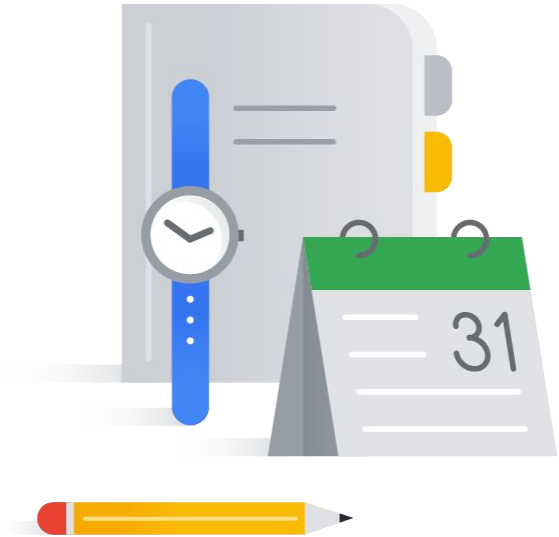

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Lab Intro

Reinforcement Learning: Qwik Start

Learn the basics of reinforcement learning by building a simple game.

The lab can be found here.

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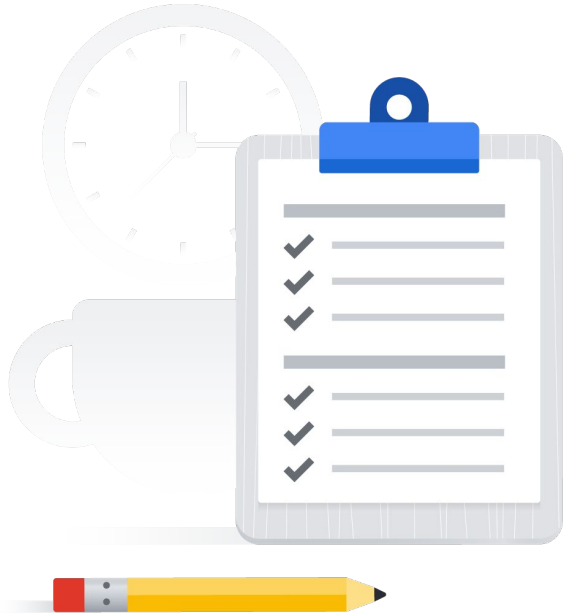
Lab objectives

Understand the fundamental concepts of reinforcement learning.

Create an AI Platform Tensorflow 2.1 Notebook.

Clone the sample repository from the training data analyst repo found on Github.

Read, understand, and run the steps found in the notebook.



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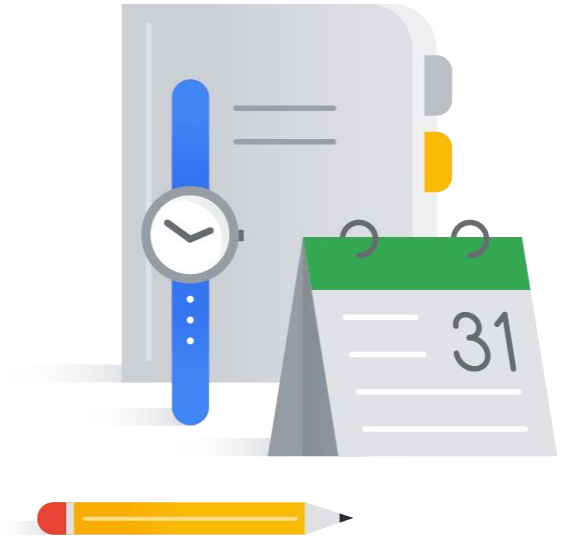

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Scenario #1

Question

Which machine learning tool would be the best option for someone that wants a custom model but has limited application development or data science skills?

A. Vertex AI

B. AutoML

C. Tensorflow

D. Speech API

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Scenario #1

Answer

Which machine learning tool would be the best option for someone that wants a custom model but has limited application development or data science skills?

A. Vertex AI

B. AutoML

C. Tensorflow

D. Speech API

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Scenario #2

Question

What Google machine learning API can be used to gain meaning and sentiment from text?

A. Natural Language API

B. Speech-to-Text API

C. Vision API

D. Video Intelligence API

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Scenario #2

Answer

What Google machine learning API can be used to gain meaning and sentiment from text?

A. Natural Language API

B. Speech-to-Text API

C. Vision API

D. Video Intelligence API

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Scenario #3

Question

Which machine learning service can run Tensorflow at scale?

A. Pre-trained machine learning APIs

B. AutoML

C. Vertex AI

D. Tensorflow

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Scenario #3

Answer

Which machine learning service can run Tensorflow at scale?

A. Pre-trained machine learning APIs

B. AutoML

C. Vertex AI

D. Tensorflow

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Agenda

Lab: Cloud Natural Language API: Qwik Start

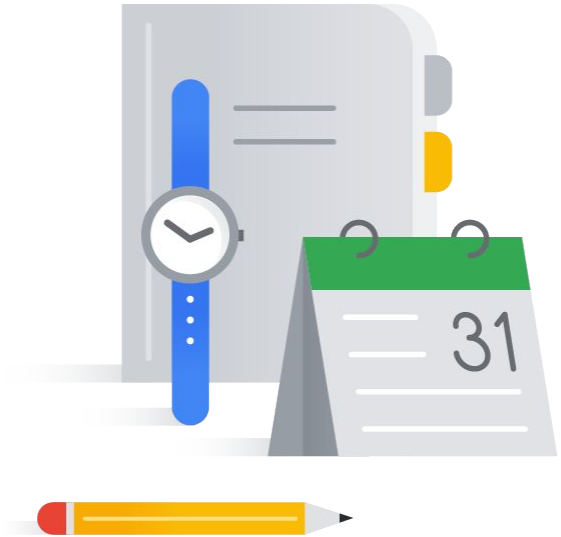
Lab: Google Cloud Speech API: Qwik Start

Lab: Video Intelligence: Qwik Start

Lab: Reinforcement Learning: Qwik Start

Quiz

Summary



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Summary (1/2)

- ML is a way to get predictive insights from data to make repeated decisions.
- ML uses standard algorithms.
- Model training requires examples.
- Trained ML models can be used to make predictions.
- An algorithm can be applied to other data to yield a different model.
- ML models need good data.

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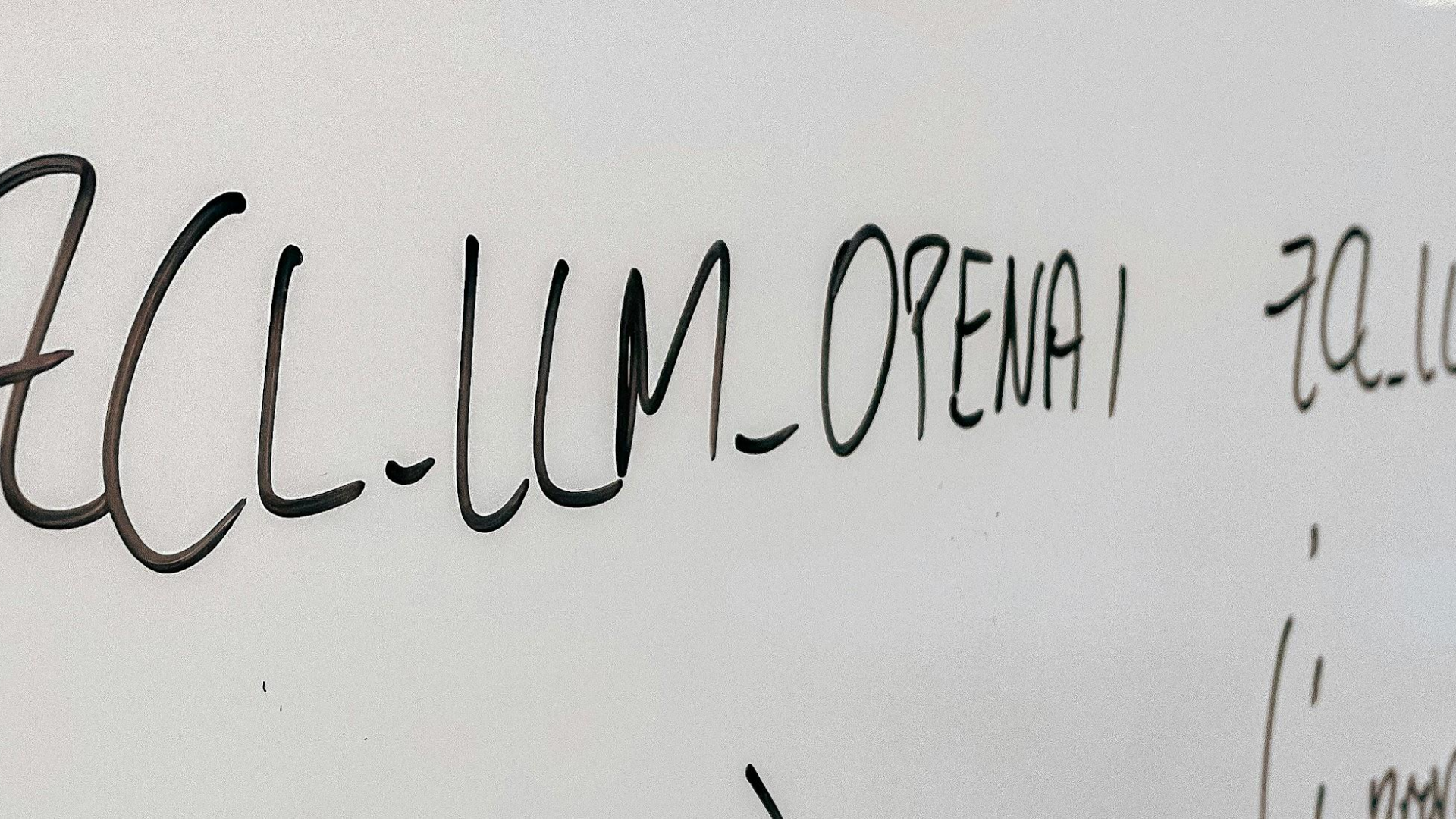
Summary (2/2)

- TensorFlow was developed by Google and has become the leading open-source tool for building ML models.
- Vertex AI allows you to train, evaluate, and tune your model, deploy your trained model and get predictions, and monitor predictions on an ongoing basis.
- AutoML allows you to train high-quality custom machine learning models with minimal effort or machine learning expertise.
- Google has a range of pre-trained ML APIs that can be used for common applications.


ACL-LLM_ORENA1

What is Generative AI but a wild application of machine learning

https://cloud.google.com/ai/generative-ai

and

https://cloud.google.com/vertex-ai/generative-ai/docs/learn/overview

Seems like fun

Build an AI Image Generator app using Imagen on Vertex AI

https://www.cloudskillsboost.google/focuses/96792?catalog_rank=%7B%22rank%22%3A4%2C%22num_filters%22%3A0%2C%22has_search%22%3Atrue%7D&parent=catalog&search_id=39778861

If you want to play with a RAG

Multimodal Retrieval Augmented Generation (RAG) using the Vertex AI Gemini API

https://www.cloudskillsboost.google/focuses/85643?catalog_rank=%7B%22rank%22%3A2%2C%22num_filters%22%3A0%2C%22has_search%22%3Atrue%7D&parent=catalog&search_id=39817455