Google AI

HACC 2023 Google AI/ML Workshop

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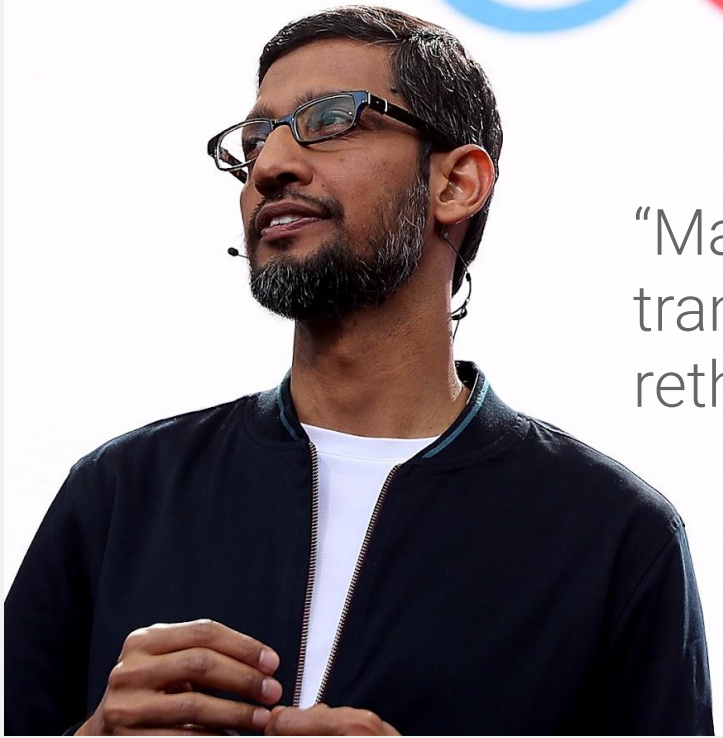
Google AI Mission Statement

Google AI is focused on bringing the benefits of AI to everyone.

We do this through research that advances the state-of-the-art in the field, efforts to apply AI to Google products and to new domains, and by developing tools to ensure that everyone can access AI.

Google



“Machine learning is a core, transformative way by which we’re rethinking how we’re doing everything.”

- Sundar Pichai, Google, 2016

What is AI?

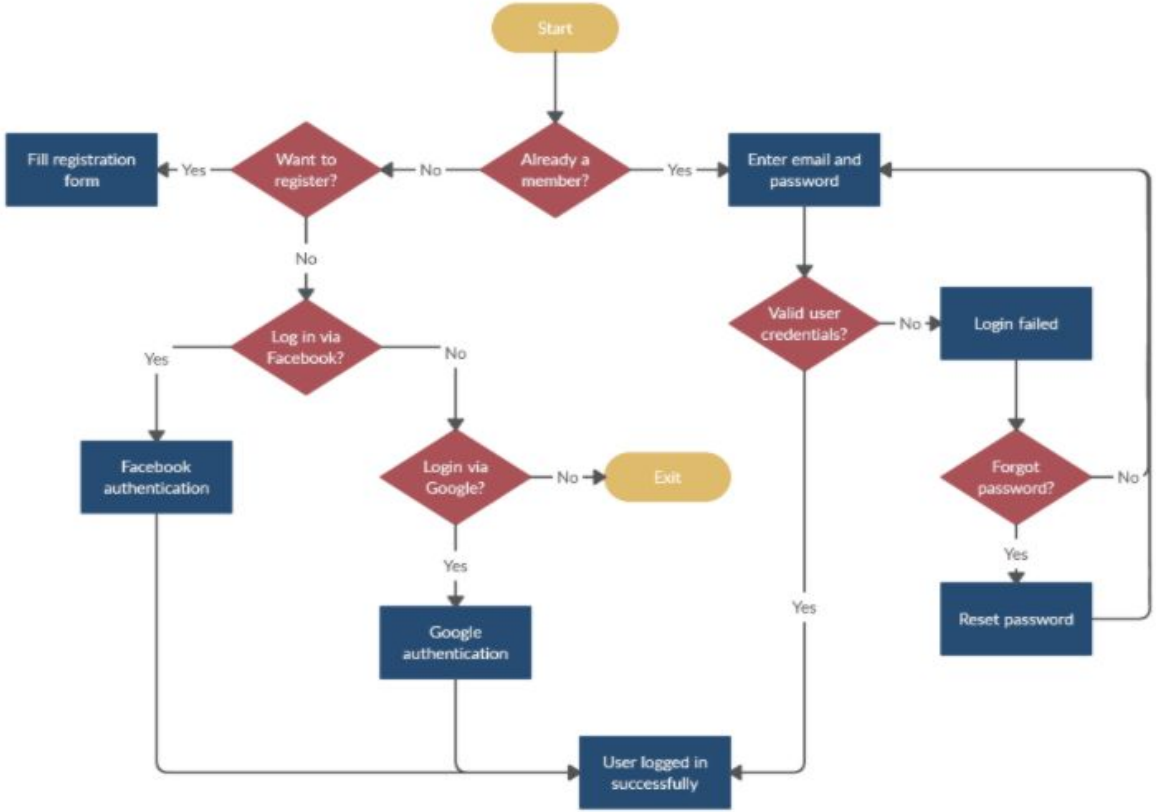
AI is a bigger concept to create intelligent machines that can simulate human thinking capability and behavior

Machine Learning is a specific field of AI where a system learns to find patterns in examples in order to make predictions.

Computers learning how to do a task without being explicitly programmed to do so.

Explicitly Programmed (Flowchart)

Google AI




```
if ($a > $b) {
    echo "a is bigger than b";
} elseif ($a == $b) {
    echo "a is equal to b";
} elseif (...) {
    echo "...";
} elseif (...) {
    echo "...";
} elseif (...) {
    echo "";
} elseif (...) {
    echo "";
} else {
    echo "a is smaller than b";
}
```

Machine Learning Allows You to Solve a Problem Without Codifying the Solution

Google Cloud AI

- ✓ Recognizes patterns in data
- ✓ Predictive analytics at scale
- ✓ Builds ML models seamlessly
- ✓ Fully managed service
- ✓ Deep Learning capabilities

Proprietary + Confidential

Google Cloud End-to End AI Platform

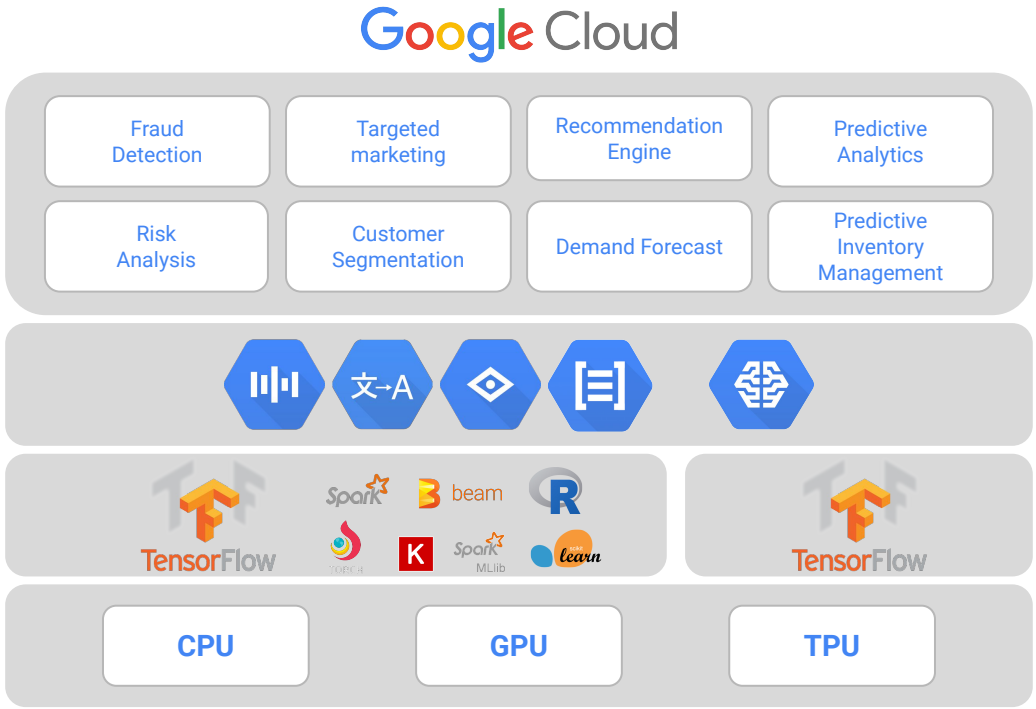
Accelerate Business Outcomes with Enterprise-Ready Machine Learning Pipeline

Industry Use-cases
In-loop inferencing for trained models

Cloud AI products
Pre-trained ML APIs to
Building custom ML models

ML Framework
Industry-standard & widely adopted

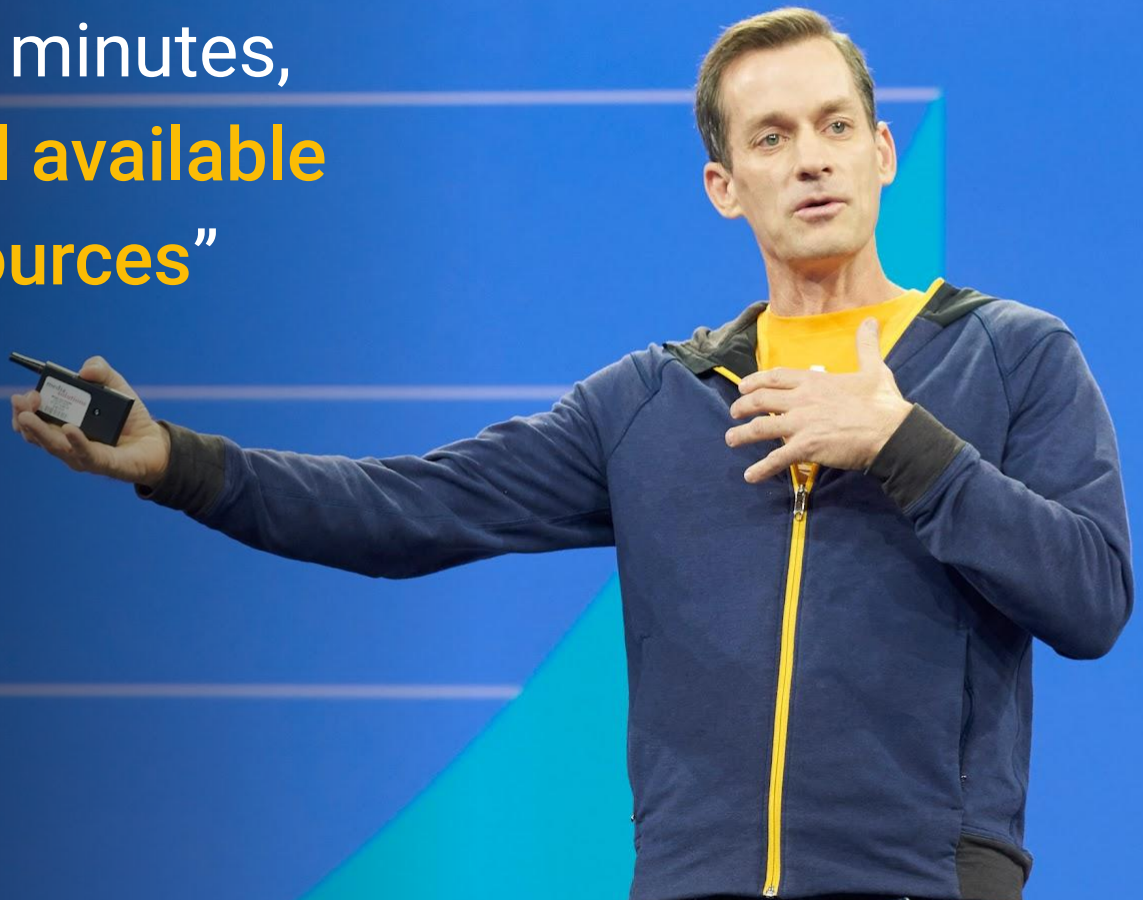
Infrastructure
Best-in class processors for ML/DL



Proprietary + Confidential

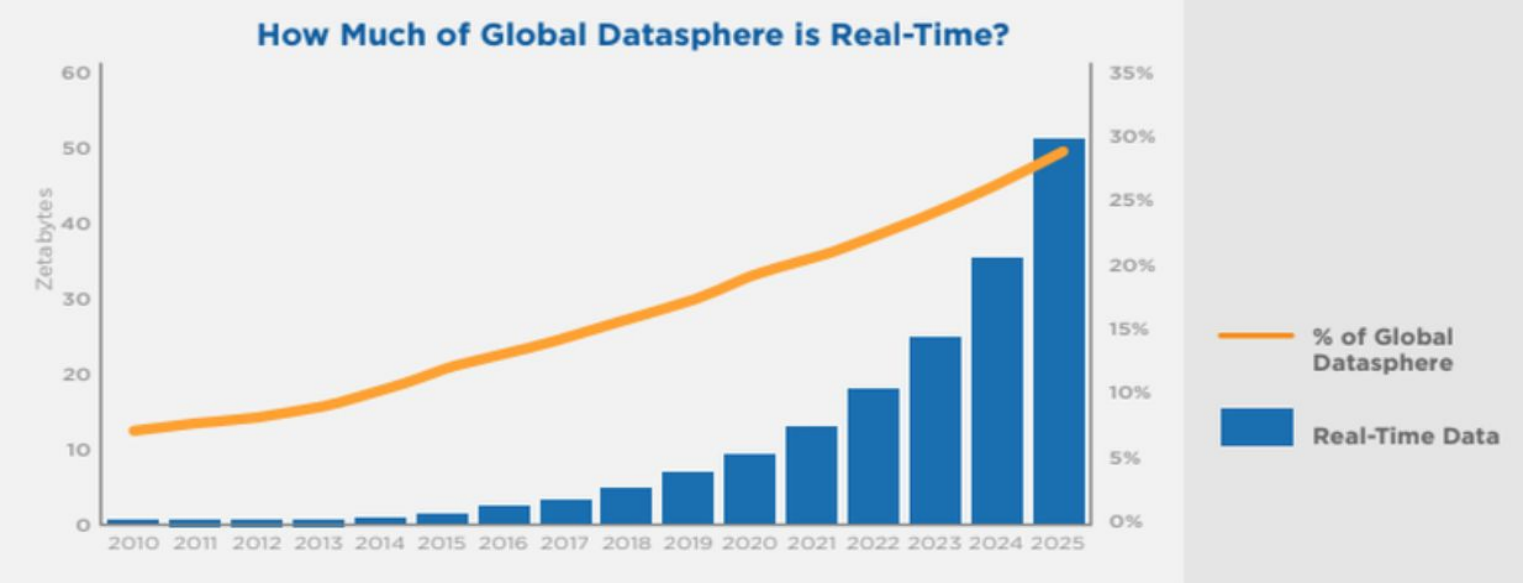
“If everyone spoke to their phone for three minutes, **we’d exhaust all available computing resources**”

Jeff Dean
Google Senior Fellow
2014



Global Datasphere

Survey by IDC

- IDC defines the "global datasphere" as "the quantification of the amount of data created, captured, and replicated across the world."
- 

Google Cloud

Google Cloud TPU

Proprietary + Confidential

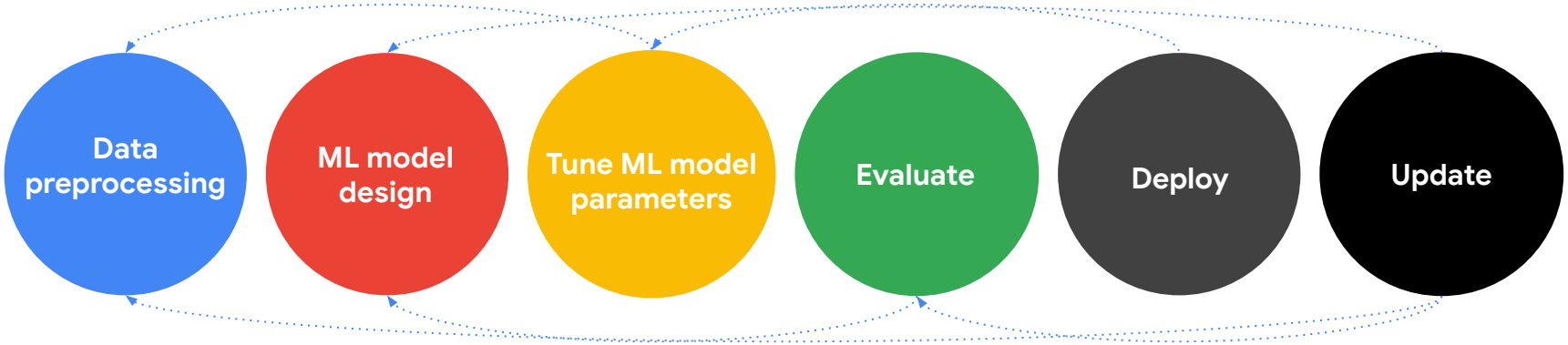
TPU vs Conventional processors

15 - 30x faster

30 - 80x operations per watt

Like fast-forwarding 7 years into the future

AI can be complex and time intensive



Large computational resource

Machine learning expertise

Manual data labeling

Google Cloud

End to End: Google Cloud AI Spectrum

Cloud MLE

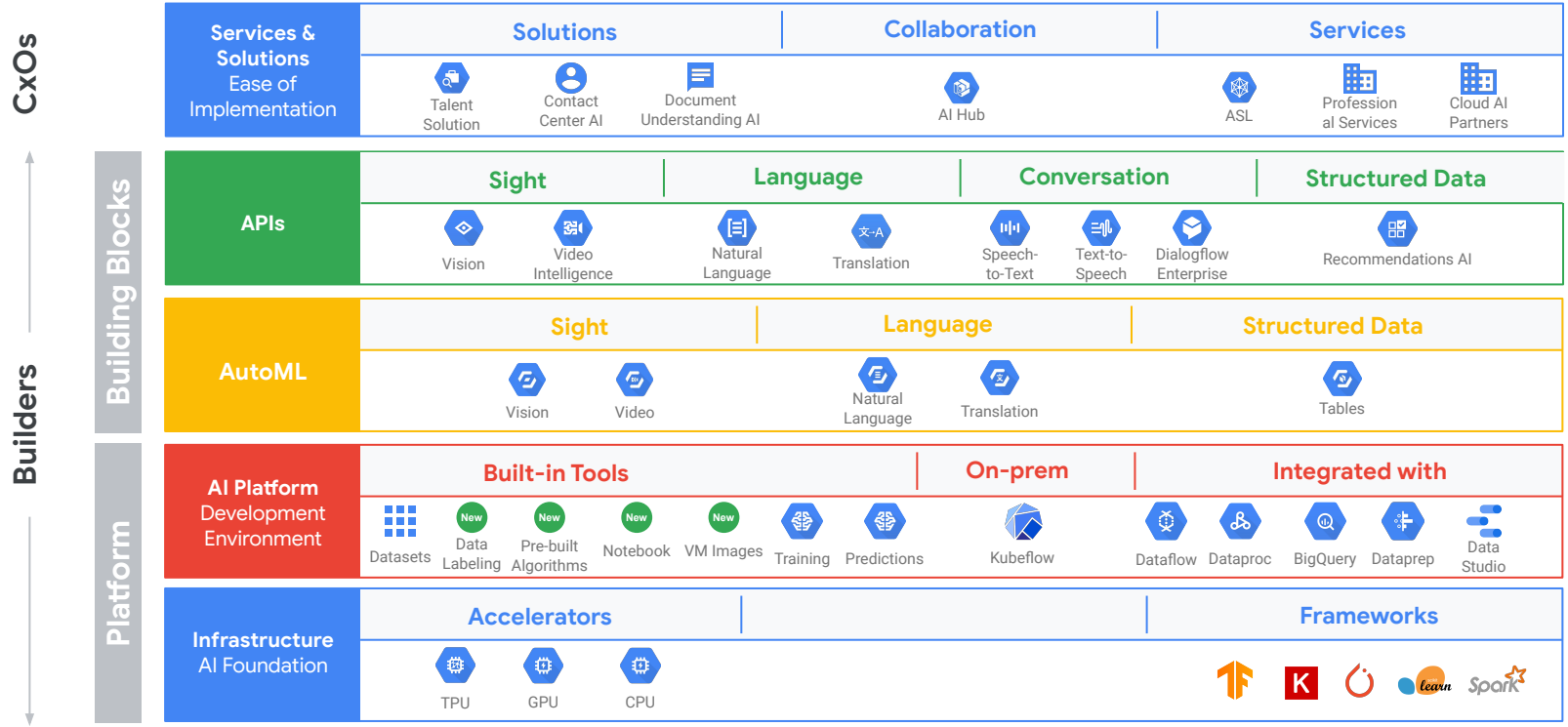
ML Perception services

Use/extend OSS SDK — Build custom models — Use pre-built models

ML researcher — Data Scientist — App Developer

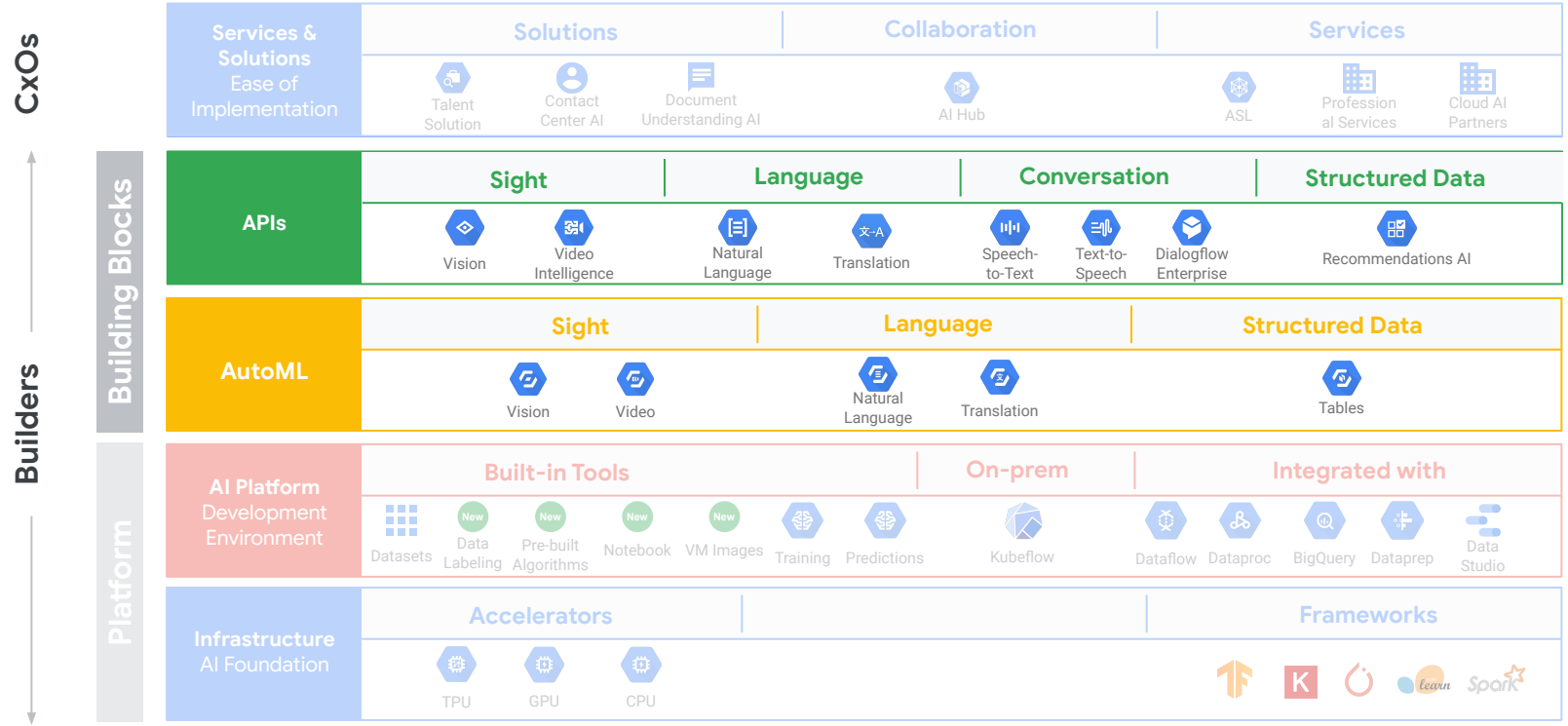
Proprietary + Confidential

Cloud AI products & solutions



Google Cloud

Cloud AI products & solutions

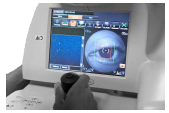


Google Cloud

Google is the pioneer in AI

2015

Google DeepMind AlphaGo defeats Go champion



2016

Google's DeepMind helps detect eye disease

2017

Google invents **Transformer** kickstarting LLM revolution

2018

Google's groundbreaking large language model, BERT

T5

2019

Text-to-Text Transfer Transformer LLM 10B P Model Open Sourced

2020

Google LaMDA Model Trained to converse

2022

AlphaFold predicts structures of all known proteins

Bard

2023

A conversational AI Service powered by LaMDA.

3,000 Researchers
7,000 Publications

Responsible AI

Built & Tested for Safety

Privacy in design

Upholds high scientific standards

Accountable to People

Socially Beneficial

Avoid creating unfair bias

Expanding our portfolio

To support the needs of Generative AI centric enterprise development

Powered by Foundation Models

CCAI

Powered by Foundation Models

Document AI

Powered by Foundation Models

Discovery AI

Powered by Foundation Models

Healthcare AI

Generative AI App Builder

Conversation AI

Foundation Models

Vertex AI Search (Enterprise Search)

Vertex AI

End-to-End ML Platform

Generative AI Studio | Generative AI APIs | Model Garden

Google Cloud Infrastructure

Business users

Developers

AI Practitioners

Highlight A few Google AI Solutions

1. Enterprise Translation Hub (ETH)
2. Cloud Video Intelligence and Vision
3. Document AI
4. Contact Center AI (CCAI)
5. Generative AI and LLM

Google Cloud
Enterprise Translation Hub

Google Cloud

Google Translation Hub

Enterprise-Ready Self-Serve Personal Translator

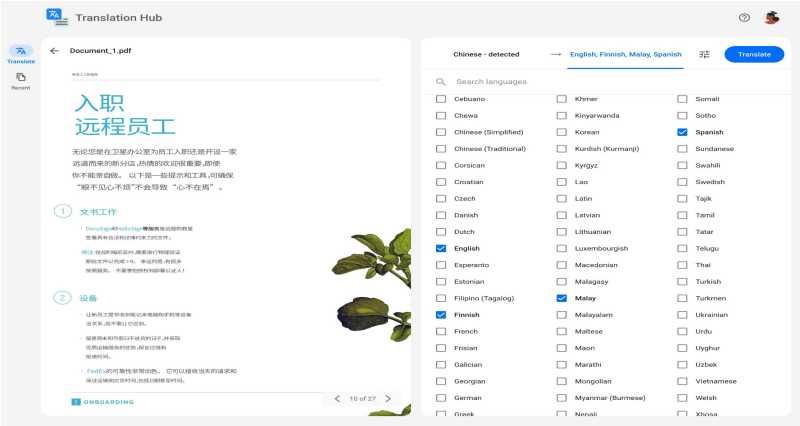
ETH brings automated doc translation directly to users

- Self-serve ease-of-use, convenience & velocity
- Instant translation to >100 languages
- Document format preservation

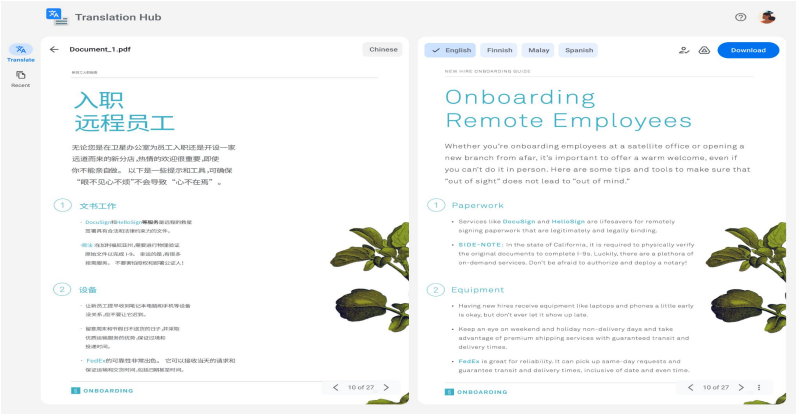
Strong enterprise administration & control

- Simple, transparent, per-page pricing
- Strong data security & access controls
- Access & deploy advanced features org-wide - custom models, glossaries, human review

Google Cloud



Upload your doc, select target languages…



… and get a great translation in a few seconds

Google Translation Hub

Enterprise-Ready Self-Serve Personal Translator

Get started today with translation tools known and loved by billions of users, thoughtfully connected together in a **Self-Serve** platform built for the **enterprise**

Customized Translations

Rich Layout Retention

Easy adoption

Google Cloud

Demo

translationhub.cloud.google.com/portal/e1cadc44d475773/document/8d8784253a61efd3

The Invention, Art and Science of Leonardo da Vinci_Hindi.pdf

paintings by using geometry. Several Renaissance scholars had developed theories of perspective, the presentation of three-dimensional objects on a two-dimensional surface, but Leonardo improved upon existing theories by Brunelleschi and Alberti, and his paintings became study pieces for the artists of his day. His scientific approach to art was in part an effort to persuade others that painting should be considered at the level of the liberal arts, i.e. rhetoric, philosophy, mathematics, poetry, etc. What is more scientific, he reasoned, than being able to see and to project what one sees onto a flat surface?

As Leonardo moved from Milan, to Venice, and finally France, he used his ability as an artist and inventor to gain access to the highest levels of power and wealth. His ability to cultivate wealthy and influential patrons of his work was a key factor in his remarkable career.

Renaissance Italy

The Renaissance, or rebirth, of Europe beginning in the 15th century was a time of great opportunity and achievement in culture, exploration, and the accessibility of knowledge. In Italy, wealthy ruling families such as the Medicis commissioned great works of art and architecture. Masterpieces like the Sistine Chapel remind us today of the great achievements of this time. Explorers such as Columbus and Magellan set out on voyages to lands and cultures unknown to Europeans at that time. They established contact and trade with cultures across the globe and made an unprecedented variety of goods from India, central Asia, and the Far East available.

Prior to the advent of the printing press in the late Middle Ages, books were hand-written by monks, one at a time. Information and knowledge was available only to those who had the wealth to obtain monastic manuscripts. Printed books were a crucial catalyst for the Renaissance, resulting in the publication and dissemination of classical texts and works by contemporary authors. Each successive generation grew increasingly literate due to the speed and availability of knowledge. Use of the vernacular languages (as opposed to Latin) increased, resulting in more books that could be read by literate, and not only learned people.

Scientific knowledge became accessible to many more people through books; this ability to share information also provided an opportunity for rebuttal and exchange of ideas. Leonardo carefully analyzed the approximately 116 books he owned and recorded his response and disagreements with them in his notebooks. For Leonardo, the most reliable source of knowledge was his own observation.

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English | Page 1 of 5

Machine Translated by Google

ज्यामिति का उपयोग करके पेंटिंग। कई पुनर्जागरण विद्वानों ने परिप्रेक्ष्य के सिद्धांत विकसित किए थे, दो आयामी सतह पर त्रि-आयामी वस्तुओं की प्रस्तुति, लेकिन लियोनार्डो ने ब्रुनेलेस्ची और अल्बर्टी द्वारा मौजूदा सिद्धांतों में सुधार किया, और उनके चित्र उनके दिन के कलाकारों के लिए अध्ययन के टुकड़े बन गए। कला के प्रति उनका वैज्ञानिक दृष्टिकोण आंशिक रूप से दूसरों को यह समझाने का एक प्रयास था कि चित्रकला को उदार कला के स्तर पर माना जाना चाहिए, अर्थात बयानबाजी, दर्शन, गणित, कविता, आदि।

जैसे ही लियोनार्डो मिलान से वेनिस और अंत में फ्रांस चले गए, उन्होंने एक कलाकार और आविष्कारक के रूप में अपनी क्षमता का उपयोग उच्चतम स्तर की शक्ति और धन तक पहुंच प्राप्त करने के लिए किया। अपने काम के धनी और प्रभावशाली संरक्षक पैदा करने की उनकी क्षमता उनके उल्लेखनीय करियर का एक महत्वपूर्ण कारक थी।

अधिक वैज्ञानिक क्या है,

उसने तर्क किया, जो एक सपाट सतह पर देखता है उसे देखने और प्रोजेक्ट करने में सक्षम होने के बजाय?

पुनर्जागरण इटली 15वीं शताब्दी में शुरू

हुआ यूरोप का पुनर्जागरण, या पुनर्जन्म,

संस्कृति, अन्वेषण और ज्ञान की पहुंच में महान अवसर और उपलब्धि का समय था। इटली में, मेडिसिस जैसे धनी शासक परिवारों ने कला और संस्कृति के महान कार्यों को शुरू किया। सिस्टिन चैपल जैसी उत्कृष्ट कृतियाँ आज हमें इस समय की महान उपलब्धियों की याद दिलाती हैं। कोलंबस और मैगेलन जैसे खोजकर्ता उस समय यूरोपीय लोगों के लिए अज्ञात भूमि और संस्कृतियों की यात्रा पर निकल पड़े। उन्होंने दुनिया भर में संस्कृतियों के साथ संपर्क और व्यापार स्थापित किया और भारत, मध्य एशिया और सुदूर पूर्व के सामानों की एक अभूतपूर्व विविधता उपलब्ध कराई।

प्रिंटिंग प्रेस के आगमन से पहले

मध्य युग के अंत में, किताबें भिक्षुओं द्वारा हाथ से लिखी जाती थीं, एक समय में एक। सूचना और ज्ञान केवल उन्हीं के लिए उपलब्ध था जिनके पास मठवासी पांडुलिपियों को प्राप्त करने के लिए धन था। मुद्रित पुस्तकें पुनर्जागरण के लिए एक महत्वपूर्ण उत्प्रेरक थीं, जिसके परिणामस्वरूप समकालीन लेखकों द्वारा शास्त्रीय ग्रंथों और कार्यों का प्रकाशन और प्रसार हुआ। ज्ञान की गति और उपलब्धता के कारण उत्तराधिकार की पीढ़ी तेजी से साक्षर हुई। स्थानीय भाषाओं का उपयोग (लैटिन के विपरीत) में वृद्धि हुई, जिसके परिणामस्वरूप अधिक पुस्तकें पढ़ी जा सकती थीं, जिन्हें पढ़े-लिखे लोग ही नहीं पढ़ सकते थे।

जानकारी साझा करने से खंडन और विचारों के आदान-प्रदान का अवसर भी मिला। लियोनार्डो ने अपने स्वामित्व वाली लगभग 116 पुस्तकों का सावधानीपूर्वक विश्लेषण किया और अपनी नोटबुक में उनके साथ अपनी प्रतिक्रिया और असहमति दर्ज की। लियोनार्डो के लिए, ज्ञान का सबसे विश्वसनीय स्रोत उनका अपना अवलोकन था।

पुस्तकों के माध्यम से वैज्ञानिक ज्ञान कई और लोगों तक पहुँचा;
करने की यह क्षमता

पेज 2 का 6

Hindi | Page 1 of 5

Google Cloud

Google Cloud Enterprise Translation Hub Demo

Google Cloud

Cloud Video Intelligence and Vision

Google Cloud

Using Google Cloud, the City of Memphis applies AI & ML to its toughest public works and urban planning problems

City of MEMPHIS

Google Cloud

Google DocAI

Google Cloud

Most business transactions begin, involve or end with a document

Document AI enables you to unlock insights from your documents with machine learning

Document AI extracts & classifies information from unstructured documents

01

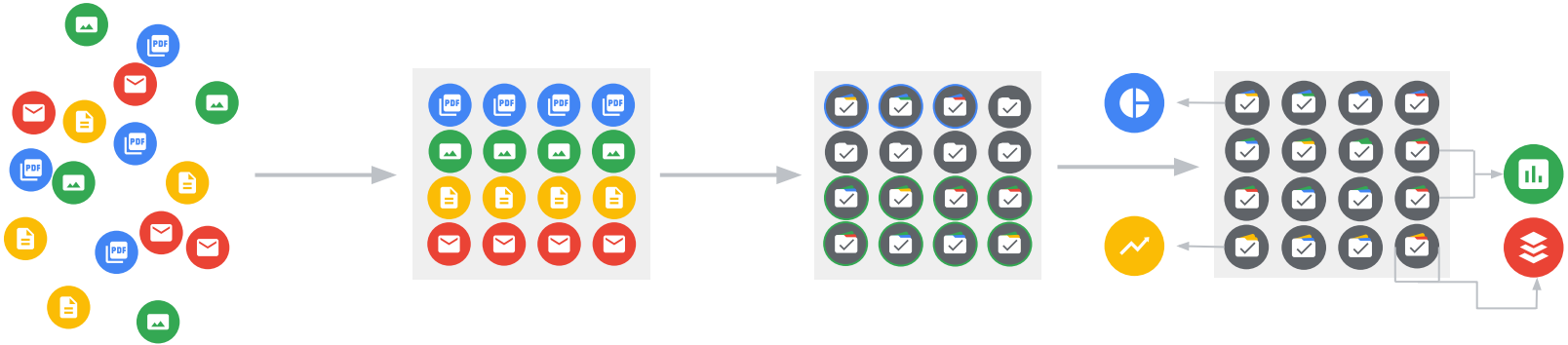
Read it

02

Understand it

03

Make it useful



Google Cloud

Which unlocks significant value

Operational efficiency

Customer experience

Insights

Google Cloud

Document AI approaches documents like people do

Read

- OCR (Optical Character Recognition)

Understand

- Natural language
- AutoML Natural Language

Natural Language API

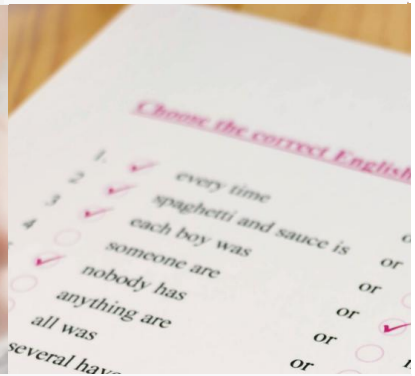
Classify, analyse & extract information about people, places, events, and more

- Multilingual support
- Extract key document entities
- Analyze sentiment

Classify content

Detect sentiment

Extract entities

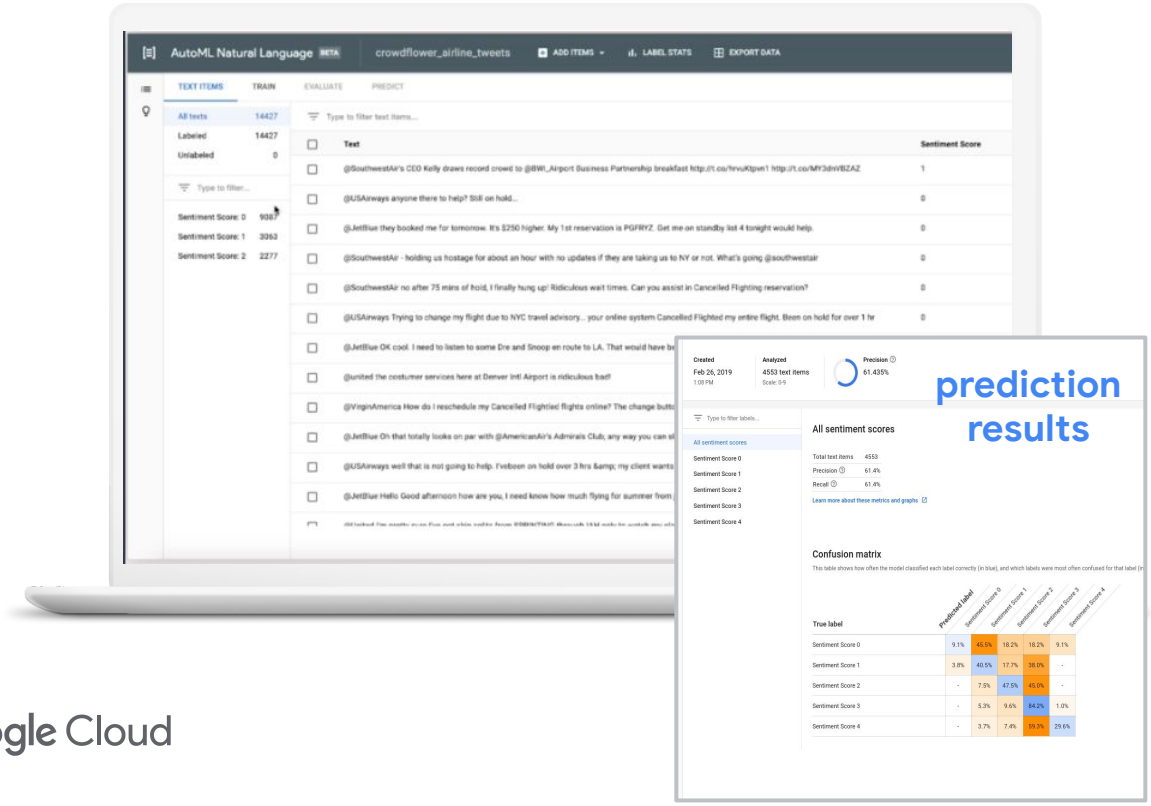


Analyze syntax

Google Cloud

AutoML Natural Language: Sentiment analysis

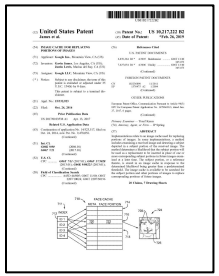
Understand the overall attitudes expressed based on domain-specific sentiment scores



Google Cloud

Life of a document

Meet **Patent**:
Unstructured document, multiple formats & languages



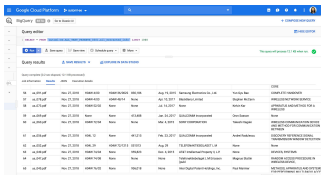
INGEST & FILTER
Patent is read in from Cloud Storage. Non-patents are filtered out.

CATEGORIZE CONTENT
Categorize patent's content using NLP model.

DETECT DIAGRAMS
Identify diagram and corresponding x & y coordinates.

OCR
Extract out raw text into json format for downstream NLP process.

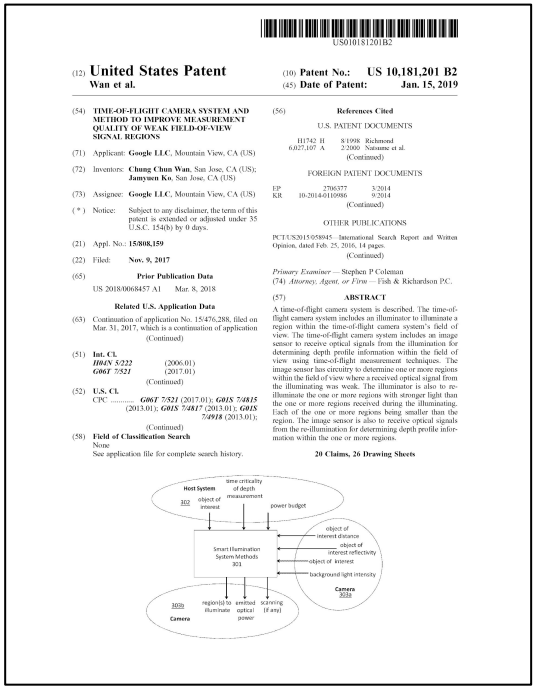
EXTRACT ENTITIES
Identify named entities in the raw text.



STORAGE
Write out and store results from the pipeline into BigQuery

Google Cloud

READ : OPTICAL CHARACTER RECOGNITION



US010181201B2

(12) **United States Patent**
Wan et al.

(10) **Patent No.: US 10,181,201 B2**
(45) **Date of Patent: Jan. 15, 2019**

(54) **TIME-OF-FLIGHT CAMERA SYSTEM AND METHOD TO IMPROVE MEASUREMENT QUALITY OF WEAK FIELD-OF-VIEW SIGNAL REGIONS**

(71) Applicant: **Google LLC**, Mountain View, CA (US)

(72) Inventors: **Chung Chun Wan**, San Jose, CA (US); **Jamyuen Ko**, San Jose, CA (US)

(73) Assignee: **Google LLC**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/808,159**

(22) Filed: **Nov. 9, 2017**

(65) **Prior Publication Data**

US 2018/0068457 A1 Mar. 8, 2018

Related U.S. Application Data

(63) Continuation of application No. 15/476,288, filed on Mar. 31, 2017, which is a continuation of application
(Continued)

(51) **Int. Cl.**
H04N 5/222 (2006.01)
G06T 7/521 (2017.01)
(Continued)

(52) **U.S. Cl.**
CPC ***G06T 7/521*** (2017.01); ***G01S 7/4815*** (2013.01); ***G01S 7/4817*** (2013.01); ***G01S 7/4918*** (2013.01);
(Continued)

(58) **Field of Classification Search**
None
See application file for complete search history.

(56) **References Cited**

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(Continued)

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KR 10-2014-0110986 9/2014
(Continued)

OTHER PUBLICATIONS

PCT/US2015/058945—International Search Report and Written Opinion, dated Feb. 25, 2016, 14 pages.
(Continued)

Primary Examiner — Stephen P Coleman
(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(57) **ABSTRACT**

A time-of-flight camera system is described. The time-of-flight camera system includes an illuminator to illuminate a region within the time-of-flight camera system's field of view. The time-of-flight camera system includes an image sensor to receive optical signals from the illumination for determining depth profile information within the field of view using time-of-flight measurement techniques. The image sensor has circuitry to determine one or more regions within the field of view where a received optical signal from the illuminating was weak. The illuminator is also to re-illuminate the one or more regions with stronger light than the one or more regions received during the illuminating. Each of the one or more regions being smaller than the region. The image sensor is also to receive optical signals from the re-illumination for determining depth profile information within the one or more regions.

20 Claims, 26 Drawing Sheets

US010114351B2
(12) United States Patent
Fadell et al.
(10) Patent No.: US 10,114,351 B2
(45) Date of Patent: Oct. 30, 2018
(54)
(56)
References Cited
SMART-HOME AUTOMATION SYSTEM THAT SUGGESTS OR AUTMATICALLY IMPLEMENTS SELECTED HOUSEHOLD POLICIES BASED ON SENSED OBSERVATIONS
U.S. PATENT DOCUMENTS
4,475,685 A *
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F23N 5/203
236/46 R
(71) Applicant: GOOGLE INC., Mountain View, CA (US)
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9/2016 Longhorn .....
(Continued)
H04L 43/50
(72)
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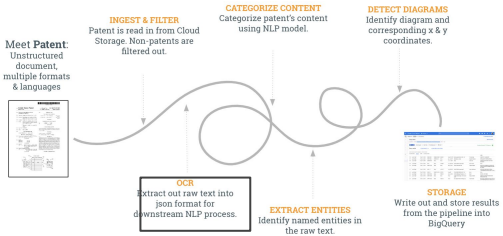
07158927 A 6/1995
2014174762 A 9/2014
(Continued)
(73) Assignee: GOOGLE LLC, Mountain View, CA



Google Cloud

CLASSIFY CONTENT

US010114351B2
(12) United States Patent
Fadell et al.
(10) Patent No.: US 10,114,351 B2
(45) Date of Patent: Oct. 30, 2018
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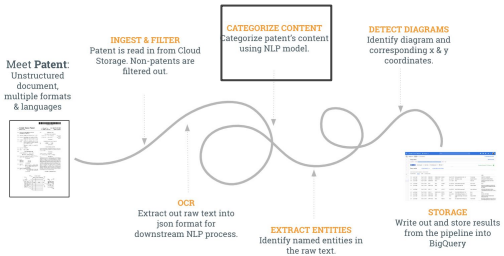
2014174762 A 9/2014
(Continued)
(73) Assignee: GOOGLE LLC, Mountain View, CA
(US)
OTHER PUBLICATIONS

Categorization	**Confidence**
Computer Vision	**0.961**
Med Tech	0.030
Cryptocurrencies	0.009



EXTRACT ENTITIES

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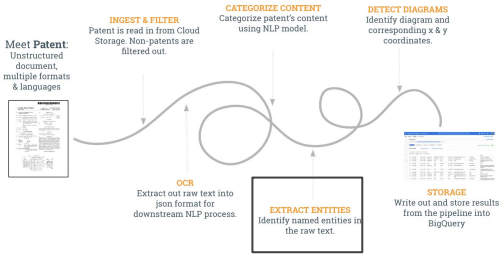
Publication date: Oct. 30, 2018
Classification_1: G05B 15/02
Classification_2: G05B 15/02
Application Number: 114,351
Filing Date: MAR. 5, 2015
Applicant: GOOGLE INC.
Inventor: *Returns inventor name*
First Line of Patent Title: SMART-HOME AUTOMATION SYSTEM



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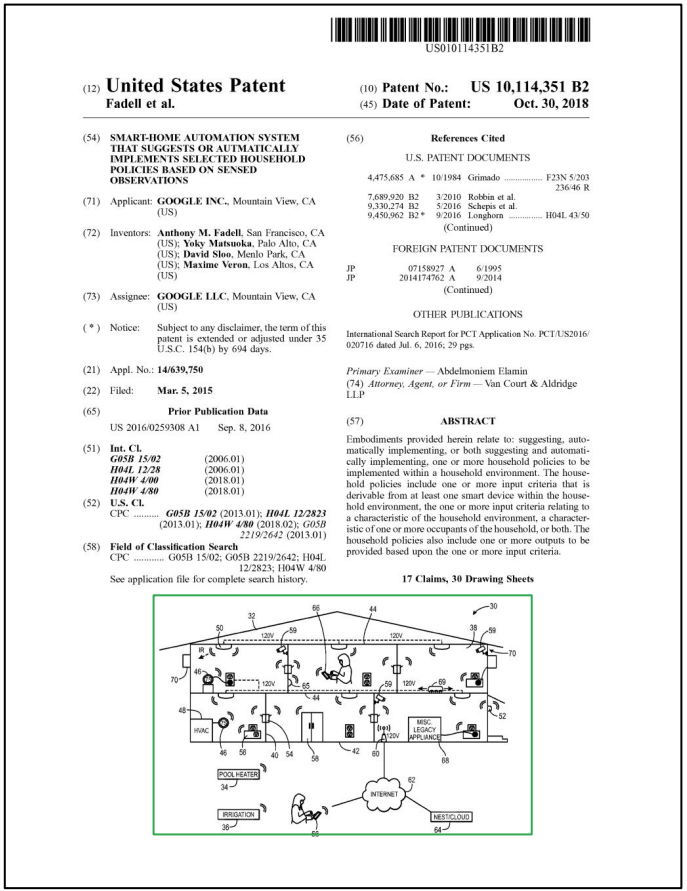

US010114351B2

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(10) **Patent No.: US 10,114,351 B2**
(45) **Date of Patent: Oct. 30, 2018**

(54) **SMART-HOME AUTOMATION SYSTEM THAT SUGGESTS OR AUTMATICALLY IMPLEMENTS SELECTED HOUSEHOLD POLICIES BASED ON SENSED OBSERVATIONS**

(71) Applicant: **GOOGLE INC.**, Mountain View, CA (US)

(72) Inventors: **Anthony M. Fadell**, San Francisco, CA (US); **Yoky Matsuoka**, Palo Alto, CA (US); **David Sloo**, Menlo Park, CA (US); **Maxime Veron**, Los Altos, CA (US)

(73) Assignee: **GOOGLE LLC**, Mountain View, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 694 days.

(21) Appl. No.: **14/639,750**

(22) Filed: **Mar. 5, 2015**

(65) **Prior Publication Data**

US 2016/0259308 A1 Sep. 8, 2016

(51) **Int. Cl.**
G05B 15/02 (2006.01)
H04L 12/28 (2006.01)
H04W 4/00 (2018.01)
H04W 4/80 (2018.01)

(52) **U.S. Cl.**
CPC ***G05B 15/02*** (2013.01); ***H04L 12/2823*** (2013.01); ***H04W 4/80*** (2018.02); *G05B 2219/2642* (2013.01)

(58) **Field of Classification Search**
CPC G05B 15/02; G05B 2219/2642; H04L 12/2823; H04W 4/80
See application file for complete search history.

(56) **References Cited**

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(Continued)

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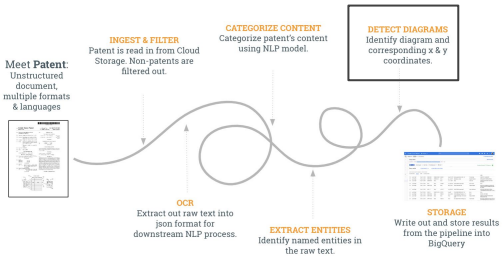
Primary Examiner — Abdelmoniem Elamin
(74) *Attorney, Agent, or Firm* — Van Court & Aldridge LLP

(57) **ABSTRACT**

Embodiments provided herein relate to: suggesting, automatically implementing, or both suggesting and automatically implementing, one or more household policies to be implemented within a household environment. The household policies include one or more input criteria that is derivable from at least one smart device within the household environment, the one or more input criteria relating to a characteristic of the household environment, a characteristic of one or more occupants of the household, or both. The household policies also include one or more outputs to be provided based upon the one or more input criteria.

17 Claims, 30 Drawing Sheets

Diagram: *Returns x, y coordinates of bounding boxes*



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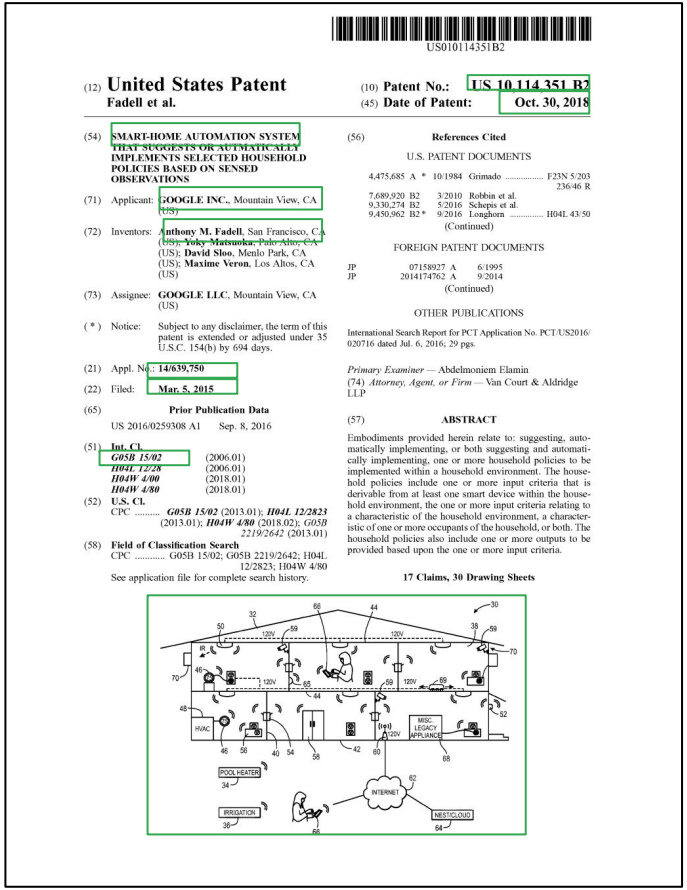

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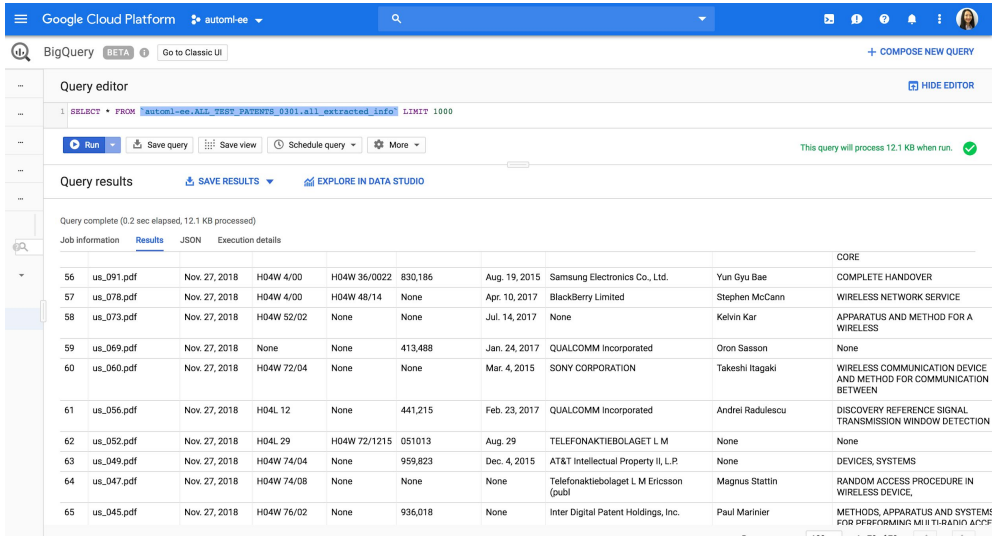
17 Claims, 30 Drawing Sheets



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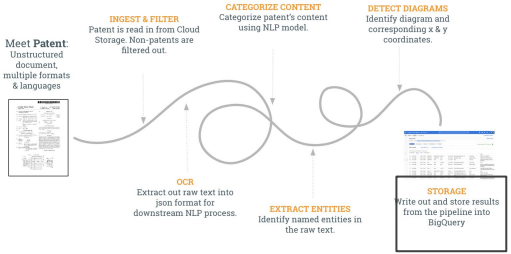
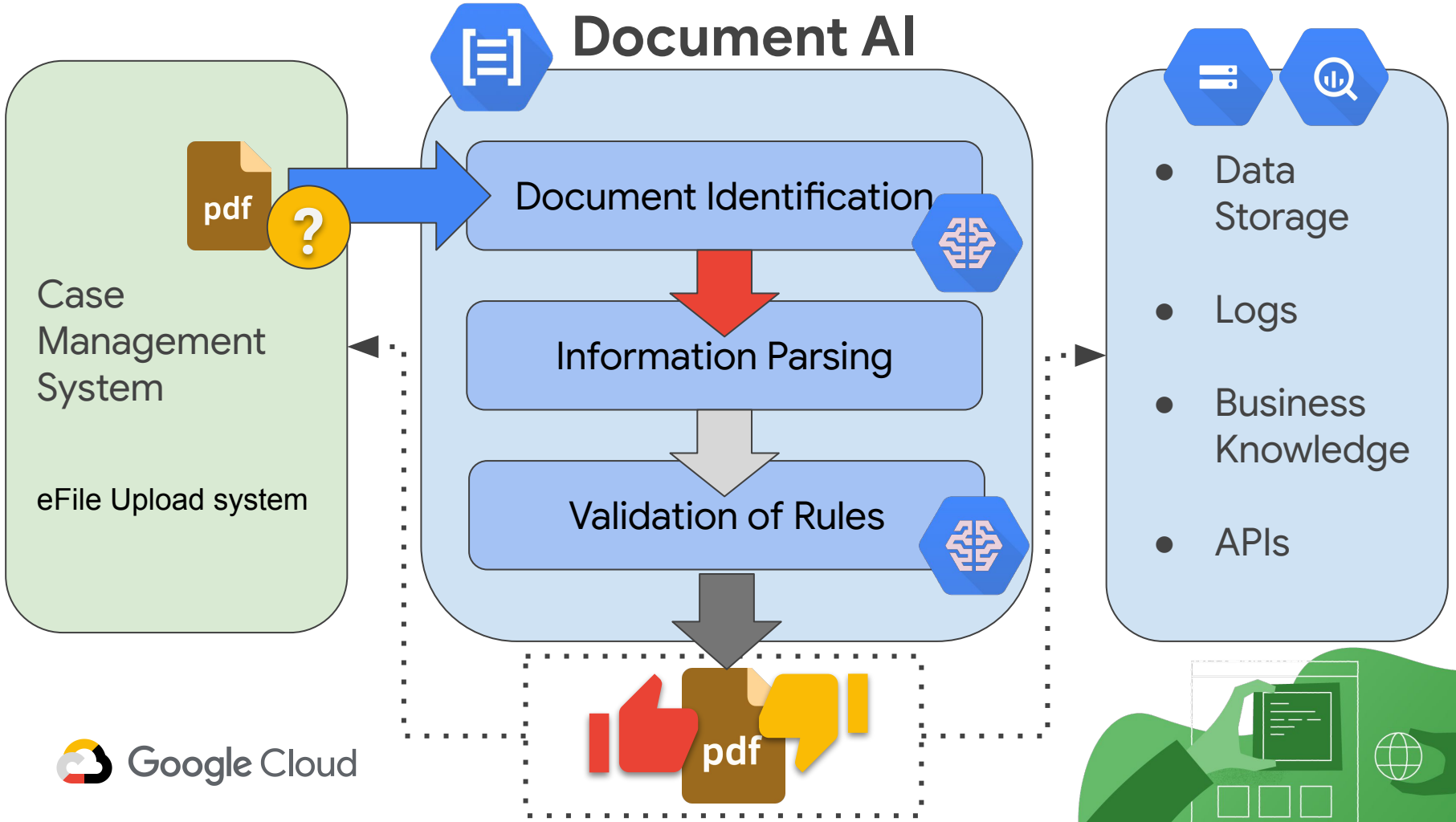
56	us_091.pdf	Nov. 27, 2018	H04W 4/00	H04W 36/0022	830,186	Aug. 19, 2015	Samsung Electronics Co., Ltd.	Yun Gyu Bae	COMPLETE HANDOVER
57	us_078.pdf	Nov. 27, 2018	H04W 4/00	H04W 48/14	None	Apr. 10, 2017	BlackBerry Limited	Stephen McCann	WIRELESS NETWORK SERVICE
58	us_073.pdf	Nov. 27, 2018	H04W 52/02	None	None	Jul. 14, 2017	None	Kelvin Kar	APPARATUS AND METHOD FOR A WIRELESS
59	us_069.pdf	Nov. 27, 2018	None	None	413,488	Jan. 24, 2017	QUALCOMM Incorporated	Oron Sasson	None
60	us_060.pdf	Nov. 27, 2018	H04W 72/04	None	None	Mar. 4, 2015	SONY CORPORATION	Takeshi Itagaki	WIRELESS COMMUNICATION DEVICE AND METHOD FOR COMMUNICATION BETWEEN
61	us_056.pdf	Nov. 27, 2018	H04L 12	None	441,215	Feb. 23, 2017	QUALCOMM Incorporated	Andrei Radulescu	DISCOVERY REFERENCE SIGNAL TRANSMISSION WINDOW DETECTION
62	us_052.pdf	Nov. 27, 2018	H04L 29	H04W 72/1215	051013	Aug. 29	TELEFONAKTIEBOLAGET L M	None	None
63	us_049.pdf	Nov. 27, 2018	H04W 74/04	None	959,823	Dec. 4, 2015	AT&T Intellectual Property II, L.P.	None	DEVICES, SYSTEMS
64	us_047.pdf	Nov. 27, 2018	H04W 74/08	None	None	None	Telefonaktiebolaget L M Ericsson (publ	Magnus Stattin	RANDOM ACCESS PROCEDURE IN WIRELESS DEVICE,
65	us_045.pdf	Nov. 27, 2018	H04W 76/02	None	936,018	None	Inter Digital Patent Holdings, Inc.	Paul Marinier	METHODS, APPARATUS AND SYSTEMS FOR PERFORMING MULTI-RADIO ACCE




Document AI
pdf
?
Case Management System
eFile Upload system
Document Identification
Information Parsing
Validation of Rules
pdf
Data Storage
Logs
Business Knowledge
APIs
Google Cloud

Hawaii Safe Travels Application

Application Overview

Google DocAI Demo

https://cloud.google.com/document-ai/docs/drag-and-drop

Google Cloud

Contact Center AI
CCAI

Google Cloud

CCAI automates simple interactions and enables agents to solve issues quickly, using industry-leading AI

1 Virtual Agent

Gives patients 24/7 access to immediate conversational self-service, with seamless handoffs to live agents for more complex issues.

2 Agent Assist

Empowers agents with continuous support during their calls by identifying intent and providing real-time, step-by-step assistance.

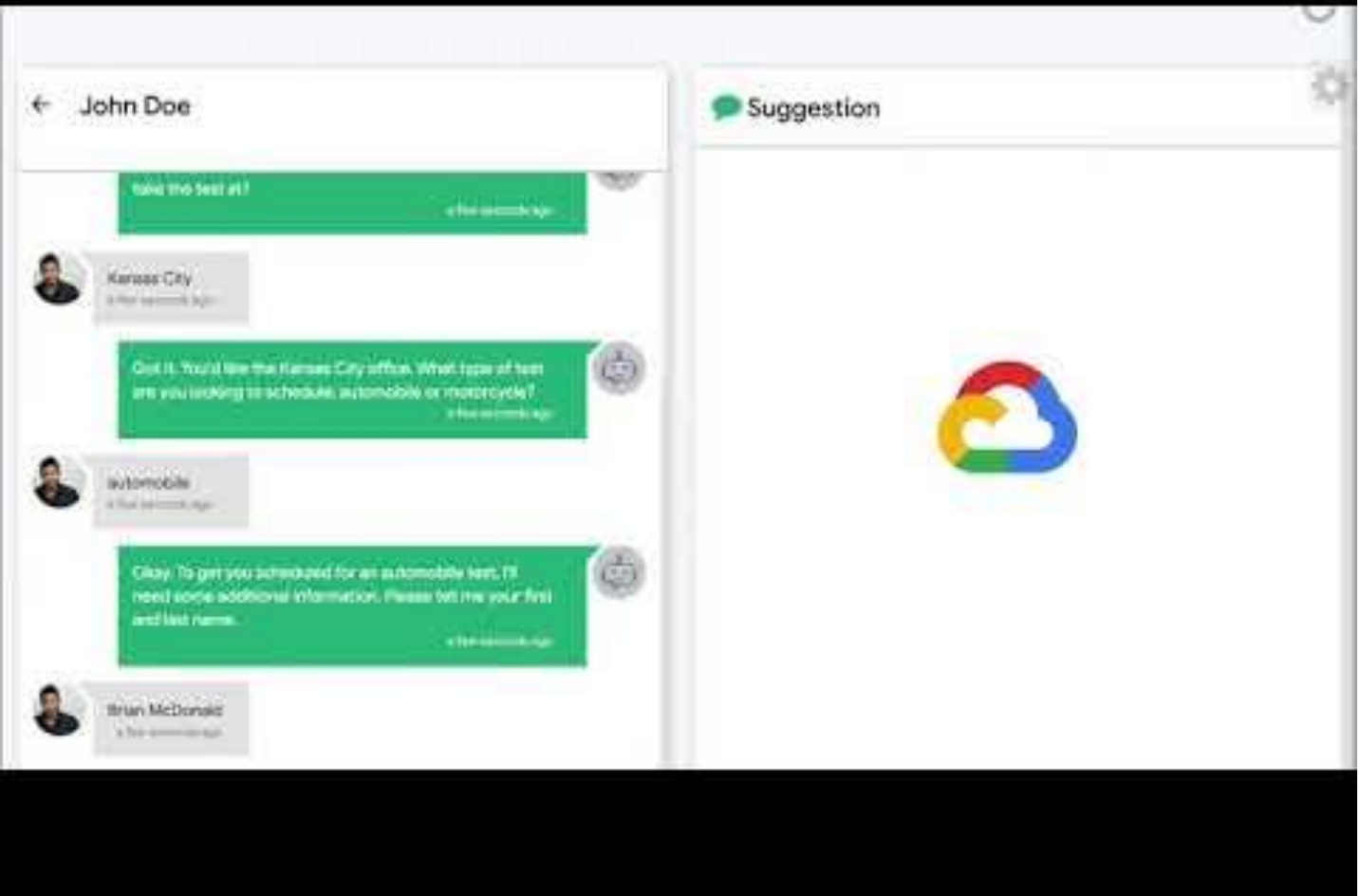
3 Insights

Uses natural language processing to identify call drivers, popular questions, and other information that helps contact center managers learn about patient interactions to improve call outcomes.

CCAI Demo Department of Motor Vehicles (DMV)

Google Cloud

Proprietary + Confidential



Use Cases

- Vehicle Registration Renewal
- Identity Verification
- Credit Card Payment
- Drive Test Scheduling
- Agent Assist

Demo URL
https://youtu.be/j8Y4qPgR-C0

^Contains state specific information

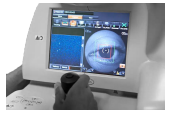
Generative AI and LLM

Google Cloud

Google is the pioneer in AI

2015

Google DeepMind AlphaGo defeats Go champion



2016

Google's DeepMind helps detect eye disease

2017

Google invents **Transformer** kickstarting LLM revolution

2018

Google's groundbreaking large language model, BERT

T5

2019

Text-to-Text Transfer Transformer LLM 10B P Model Open Sourced

2020

Google LaMDA Model Trained to converse

2022

AlphaFold predicts structures of all known proteins

Bard

2023

A conversational AI Service powered by LaMDA.

3,000 Researchers
7,000 Publications

Responsible AI

Built & Tested for Safety

Privacy in design

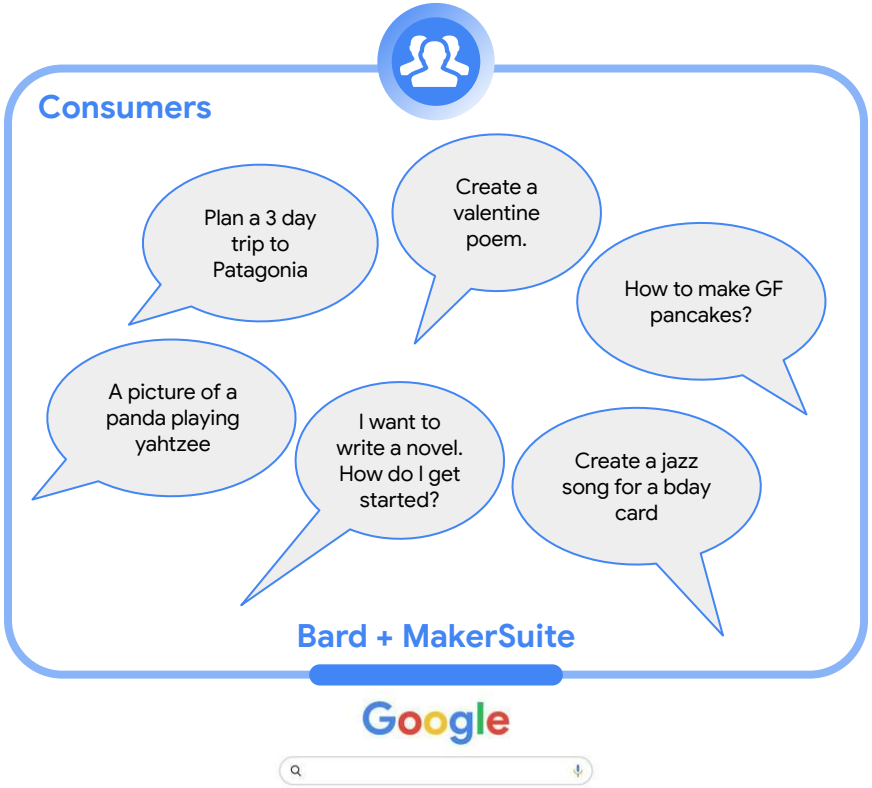
Upholds high scientific standards

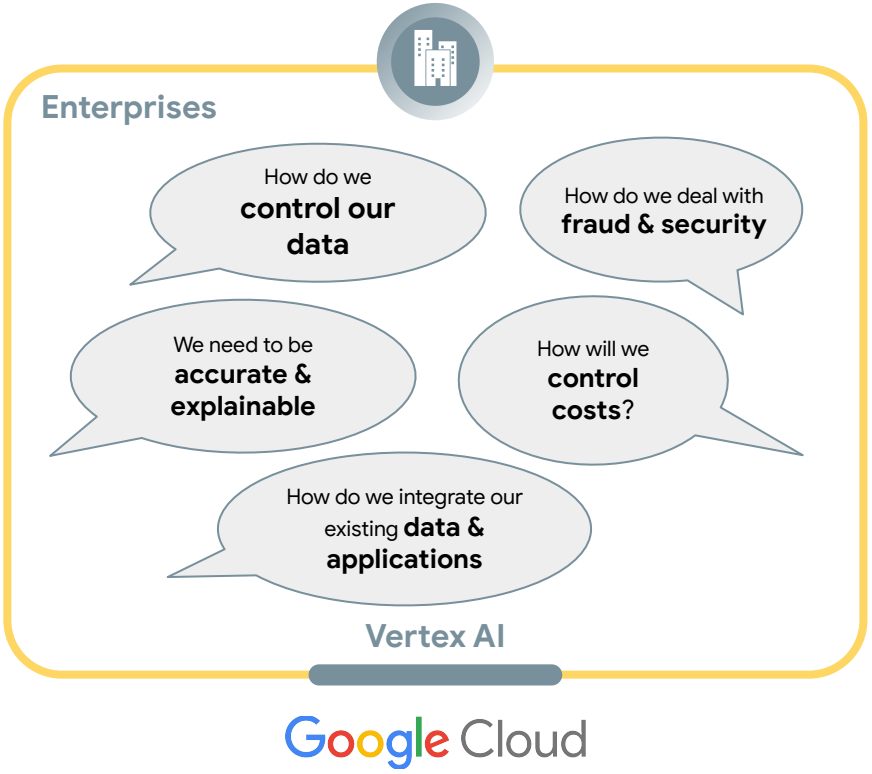
Accountable to People

Socially Beneficial

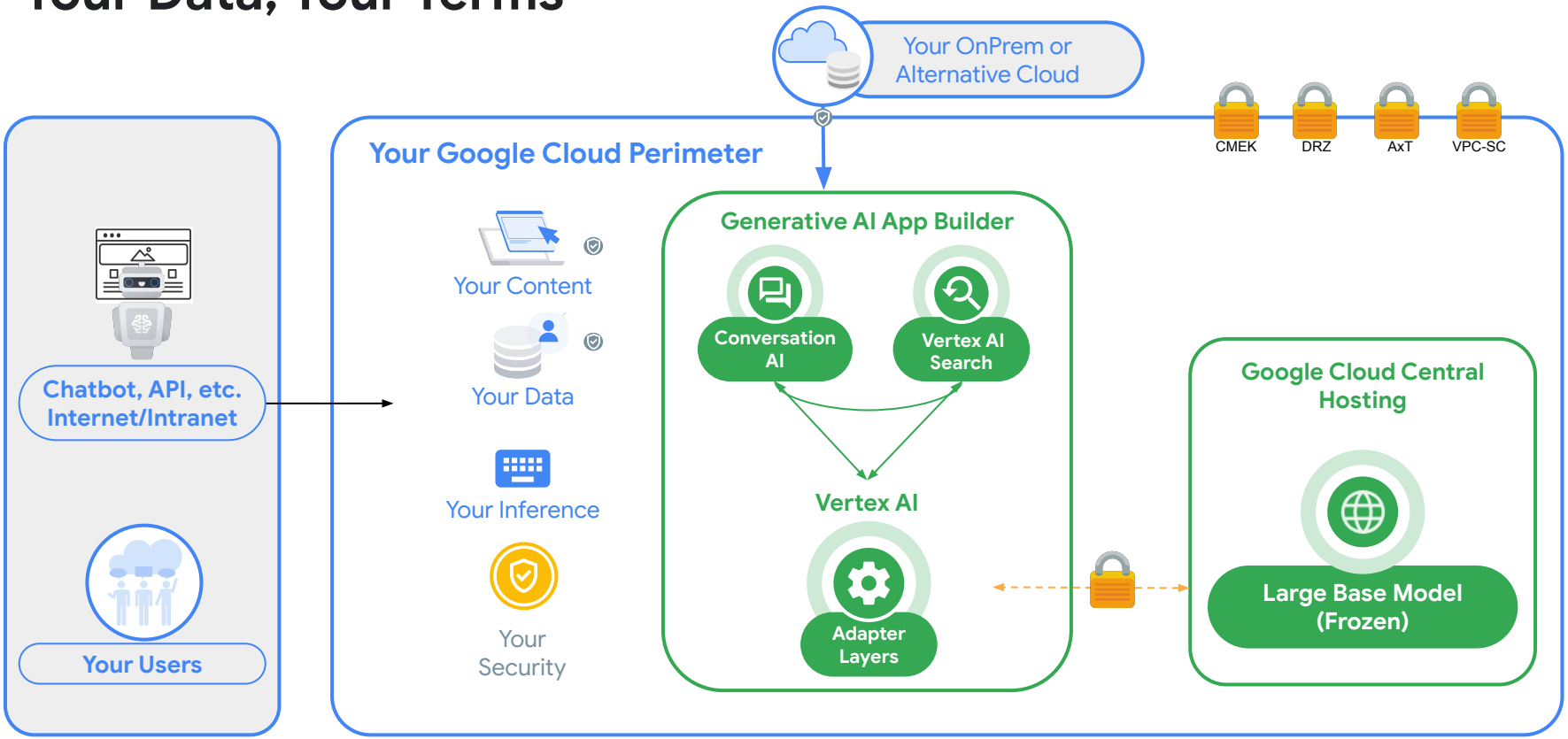
Avoid creating unfair bias

Consumers & enterprises have different needs….





Your Data, Your Terms



Expanding our portfolio

To support the needs of Generative AI centric enterprise development

Powered by Foundation Models

CCAI

Powered by Foundation Models

Document AI

Powered by Foundation Models

Discovery AI

Powered by Foundation Models

Healthcare AI

Generative AI App Builder

Conversation AI

Foundation Models

Vertex AI Search (Enterprise Search)

Vertex AI

End-to-End ML Platform

Generative AI Studio | Generative AI APIs | Model Garden

Google Cloud Infrastructure

Business users

Developers

AI Practitioners

Google Cloud Foundation Models

Across a variety of model sizes to address use cases

PaLM for Text

Custom language tasks

PaLM for Chat

Multi-turn conversations with session context

Imagen for Text to Image

Create and edit images from simple prompts

Embeddings API for Text and Image

Extract semantic information from unstructured data

Chirp for Speech to Text

Build voice enabled applications

Codey for Code Generation

Improve coding and debugging

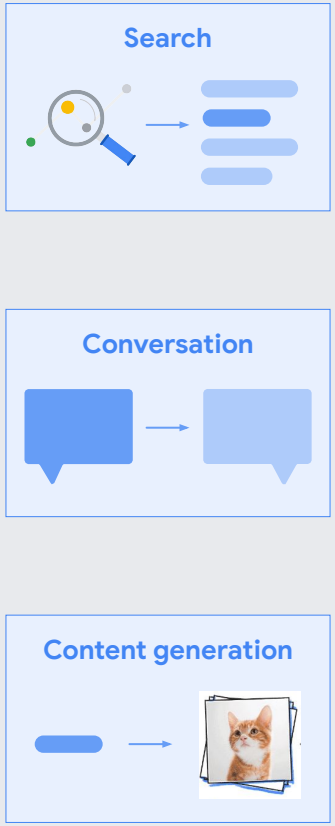
The future of customer experience

Enhanced conversational capabilities and easier chatbot development

Section 04

LLMs vs. virtual agents

- LLMs are characterized by **emergent abilities**, or the ability to perform tasks that were not included in their training examples.
- LLMs contextual understanding of human language **changes how we interact** with data and intelligent systems.
- LLMs can find patterns and connections in **massive, disparate data corpora**.



Google Cloud

Thank You

Thank you

Google Cloud