# Internet of Things Master Class Day 4

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www.pantechsolutions.net

# What you will learn Today

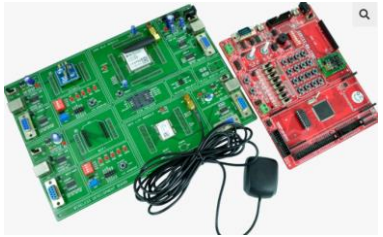
Why AI is important in IoT & How it works?

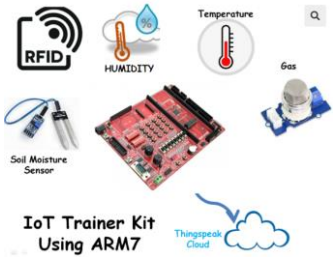
Why analytics is important in IoT?

Top IoT cloud service Providers.

# About Pantech Prolabs India Pvt Ltd

- ✓ Started in the Year 2004
- ✓ Lab equipments and Sensor Interface
- ✓ Manufacturer of Brainsense EEG Headset
- ✓ Reconfigurable Algorithms on AI
- ✓ Manufacture of AI development Boards
- ✓ Power electronics, Fuel cell and Renewable Energy trainers






## Vision

**To help 10 Million students around the globe to learn technology in a easy way**

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# About me

Education

**College of Engineering, Guindy**
Masters of Engineering, Applied Electronics
2002 – 2004

**Govt College of Engg,Bargur**
Bachelor of Engineering (B.E.), Electrical, Electronics and Communications Engineering, A
1998 – 2002

**My Primary Expertise**
Microcontroller Architecture: 8051,PIC,AVR,ARM,MSP430,PSOC3
DSP Architecture: Blackfin,C2000,C6000,21065L Sharc
FPGA: Spartan,Virtex,Cyclone
Image Processing Algorithms: Image/Scene Recognition, Machine Learning, Computer Vision, Deep Learning, Pattern Recognition, Object Classification ,Image Retrieval, Image enhancement and denoising.
Neural Networks : SVM,RBF,BPN
Cryptography :RSA,DES,3DES,Ellipti curve,Blowfish,Diffe Hellman
Compilers: Keil,Visual DSP++,CCS, Xilinx Platform studio,ISE, Matlab, Open CV

https://www.linkedin.com/in/jeevarajan/

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# Announcement

- Attendance Link at 9 pm
- Minimum attendance required for an E-Certificate is 27 Days. Attendance link will be valid for 1 hrs. after the event.
- For Internship Candidates no attendance required ,it will be accessed from the LMS Portal. (learn.pantechsolutions.net)
- Recorded Video Streaming for LAB classes to improve Learning Experience
- PPT in facebook group
- Source code and projects available download only for Internship canditates

# Mindset Lesson for the Day

You Become What  You Think all day long

“The Strangest secret in the World”
-Earl Nightingale

# What is Artificial Intelligence

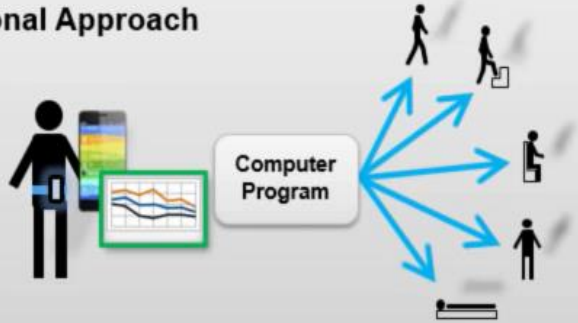
Video Credit –Raj ramesh

https://www.youtube.com/channel/UCbojg-FJgI1L6iLWUzgcsww

Machine learning uses **data** and produces a **program** to perform a **task**

**Task:** Human Activity Detection

**Traditional Approach**



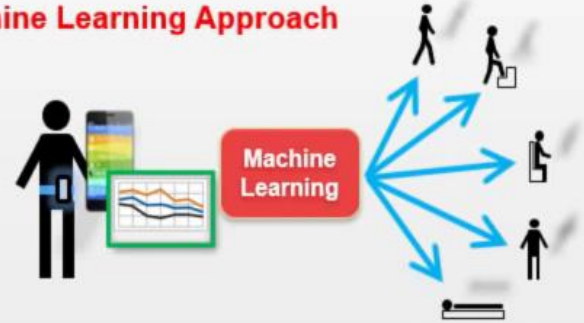

Hand Written Program

If X_acc > 0.5
then "SITTING"
If Y_acc < 4 and Z_acc > 5
then "STANDING"
…

Formula or Equation

$$Y_{activity} = \beta_1 X_{acc} + \beta_2 Y_{acc} + \beta_3 Z_{acc} + \dots$$

**Machine Learning Approach**

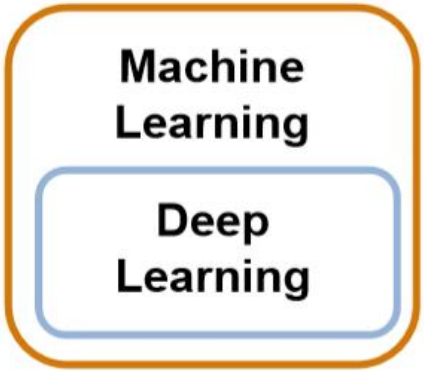


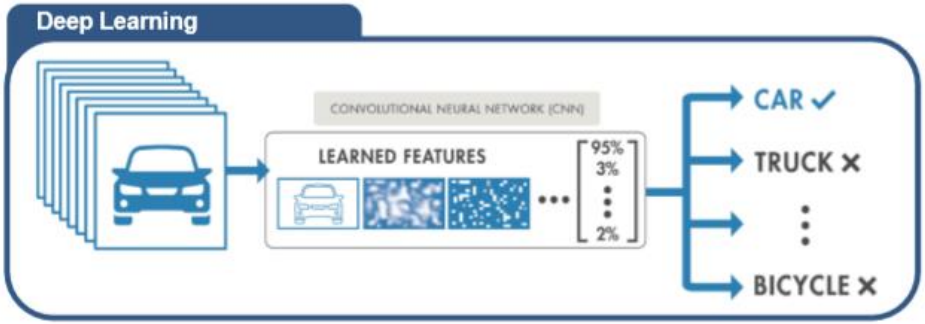

$model$: Inputs → Outputs

$$model = <^{Machine\ Learning\ Algorithm}>(sensor_data, activity)$$

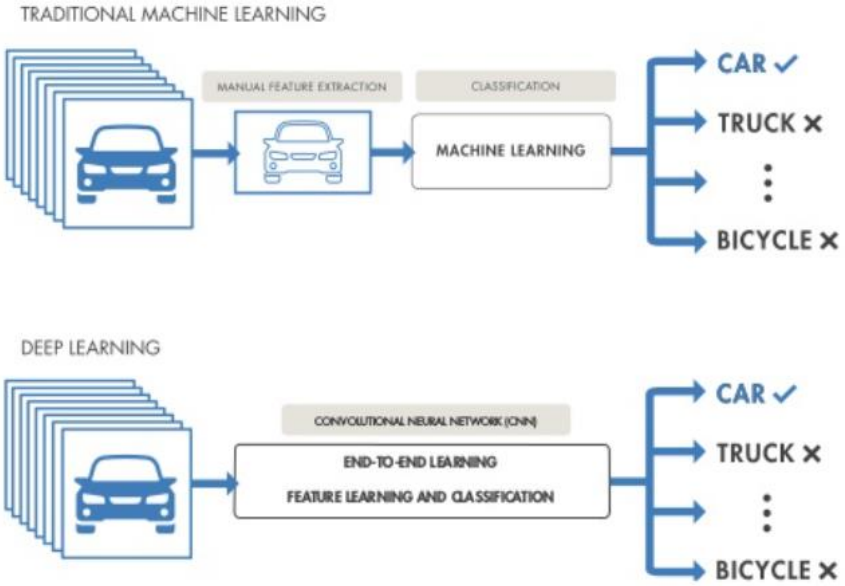
# What is Deep Learning

- Subset of machine learning with automatic feature extraction
  - Learns features and tasks directly from data
  - More Data = better model

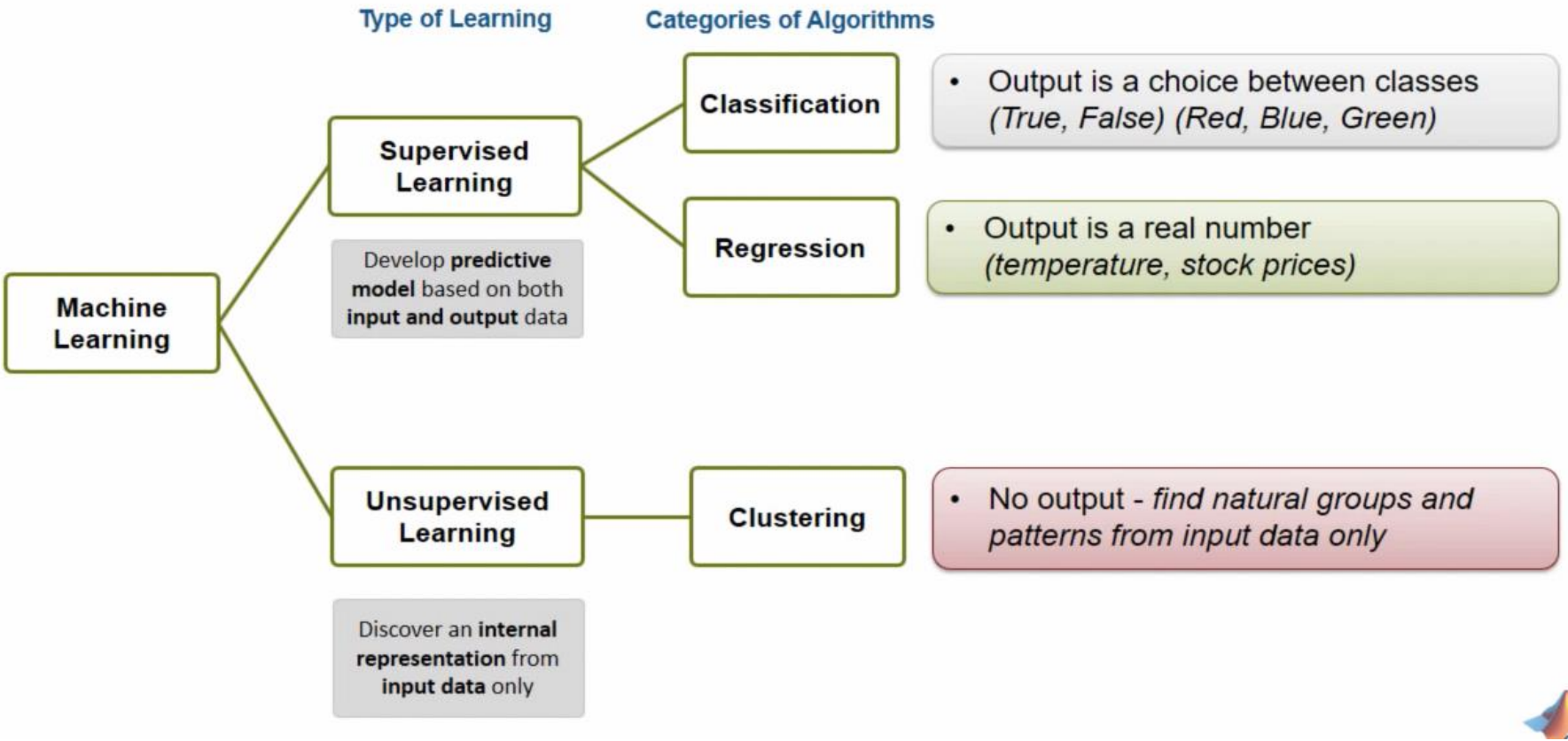


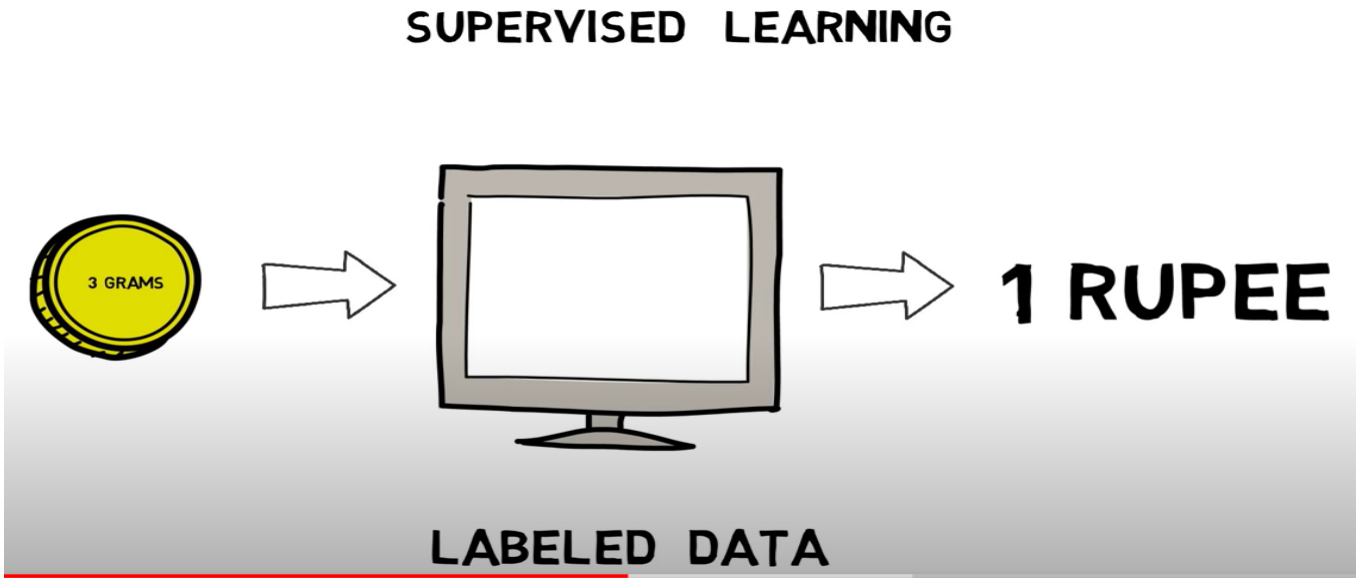
# Machine Learning Vs Deep Learning



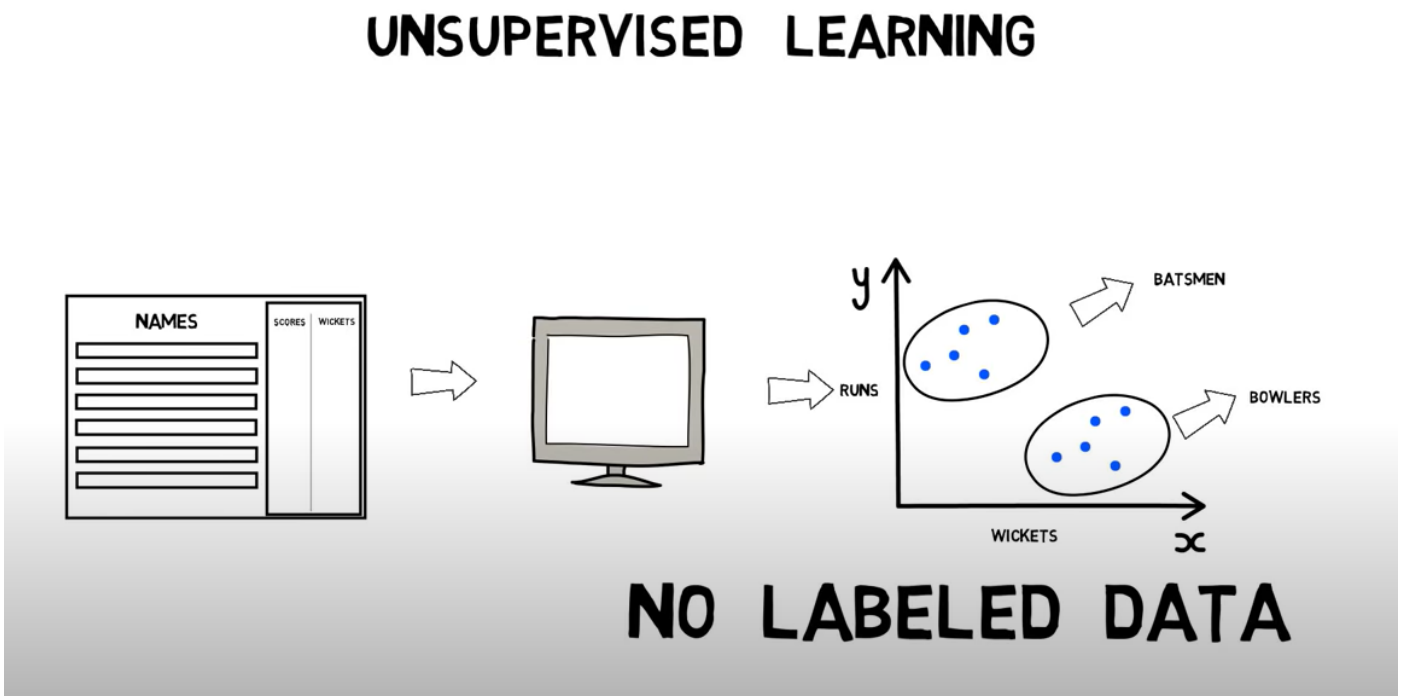

| Machine Learning | Deep Learning |
|---|---|
| + Good results with small data sets | — Requires very large data sets |
| + Quick to train a model | — Computationally intensive |
| — Need to try different features and classifiers to achieve best results | + Learns features and classifiers automatically |
| — Accuracy plateaus | + Accuracy is unlimited |


Type of Learning
Categories of Algorithms
Machine Learning
Supervised Learning
Develop predictive model based on both input and output data
Classification
Regression
Output is a choice between classes (True, False) (Red, Blue, Green)
Output is a real number (temperature, stock prices)
Unsupervised Learning
Discover an internal representation from input data only
Clustering
No output - find natural groups and patterns from input data only

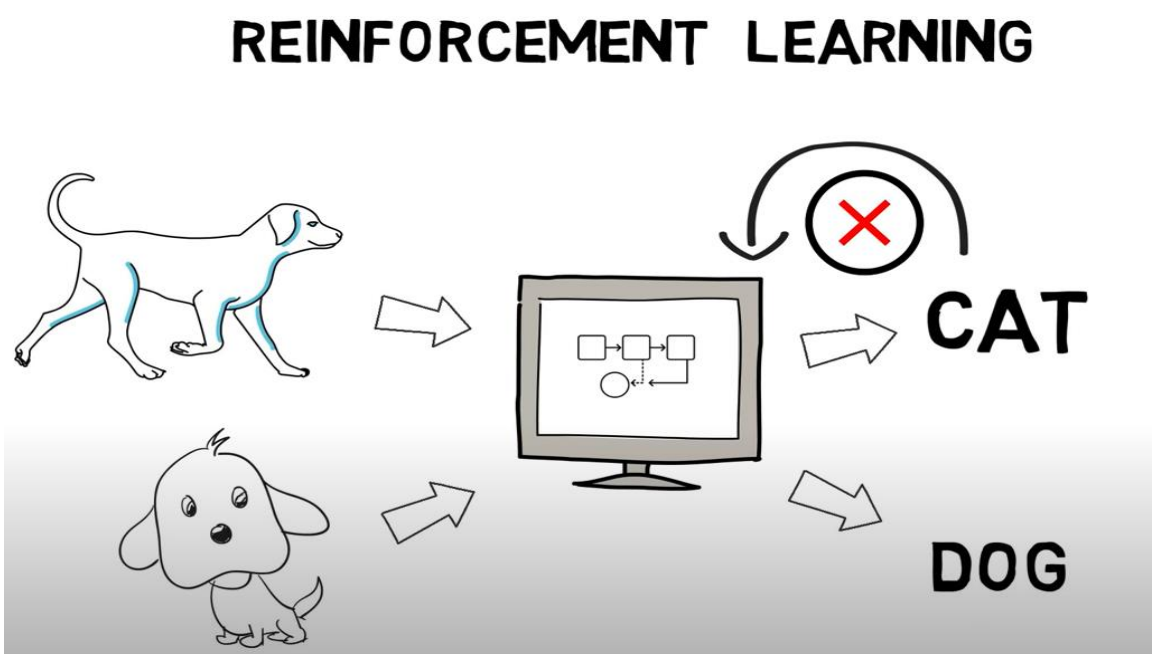
# Supervised learning



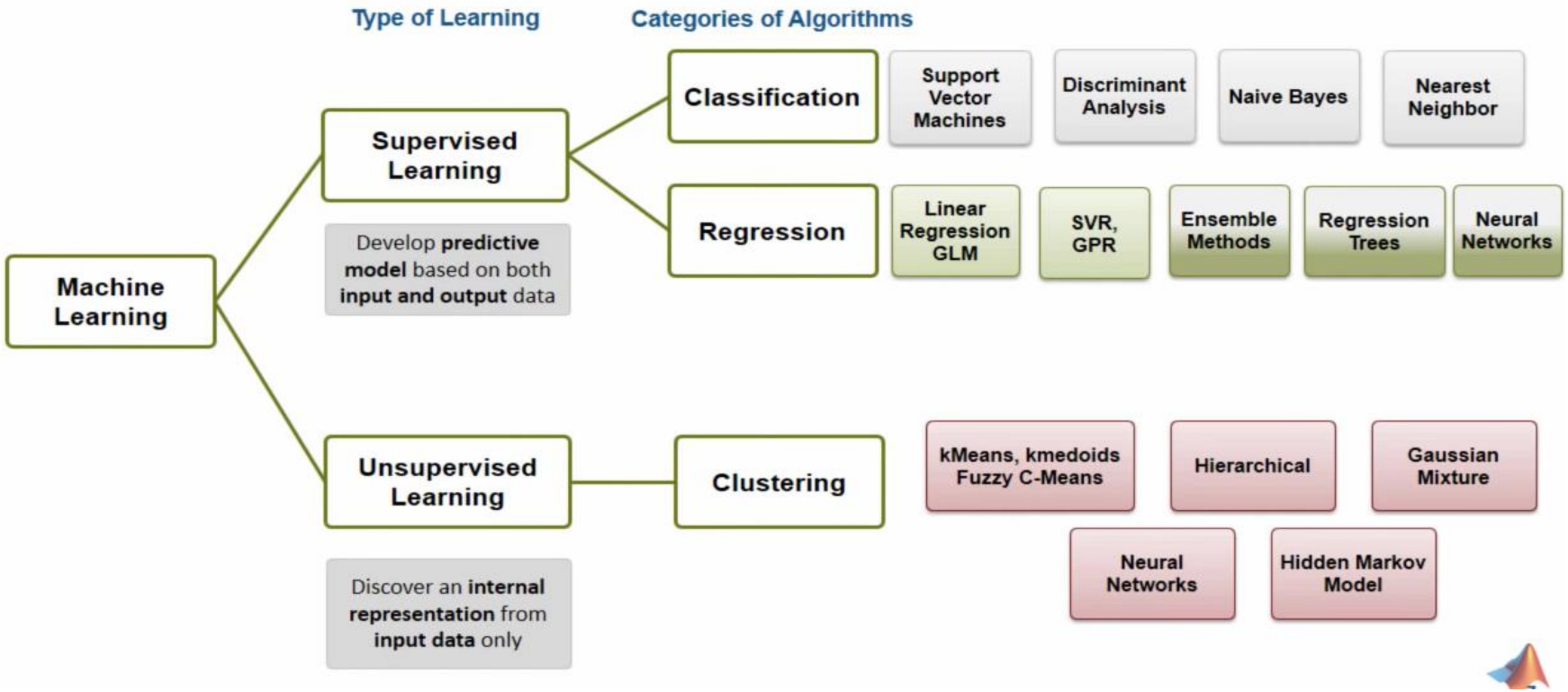
# Unsupervised learning



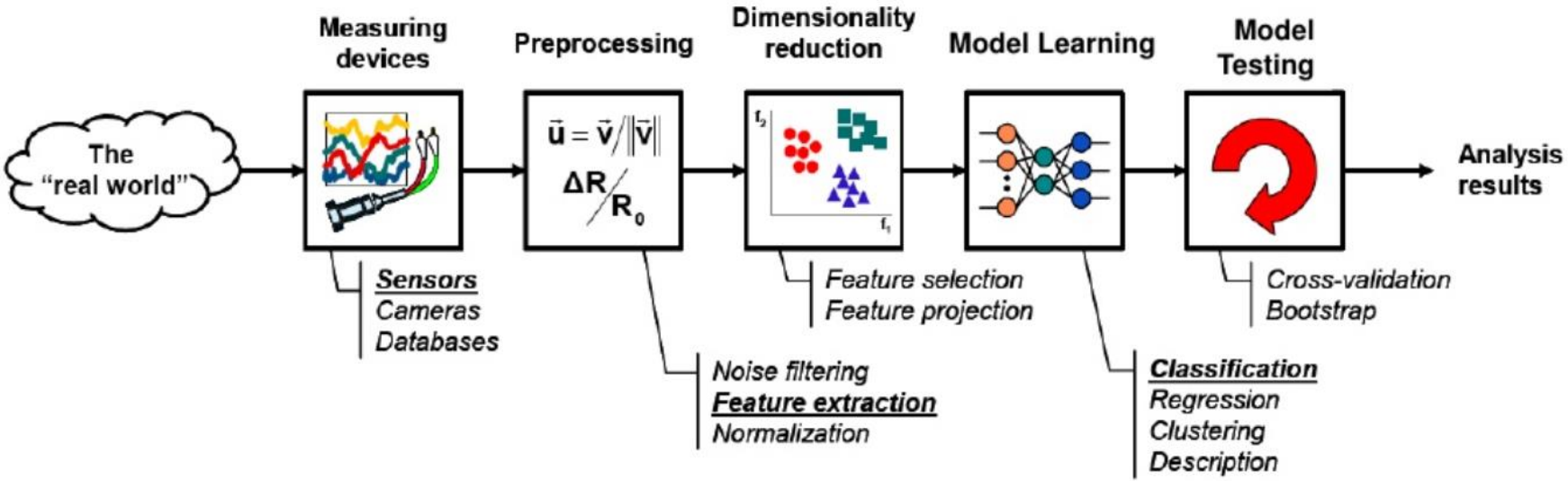
# Reinforcement Learning



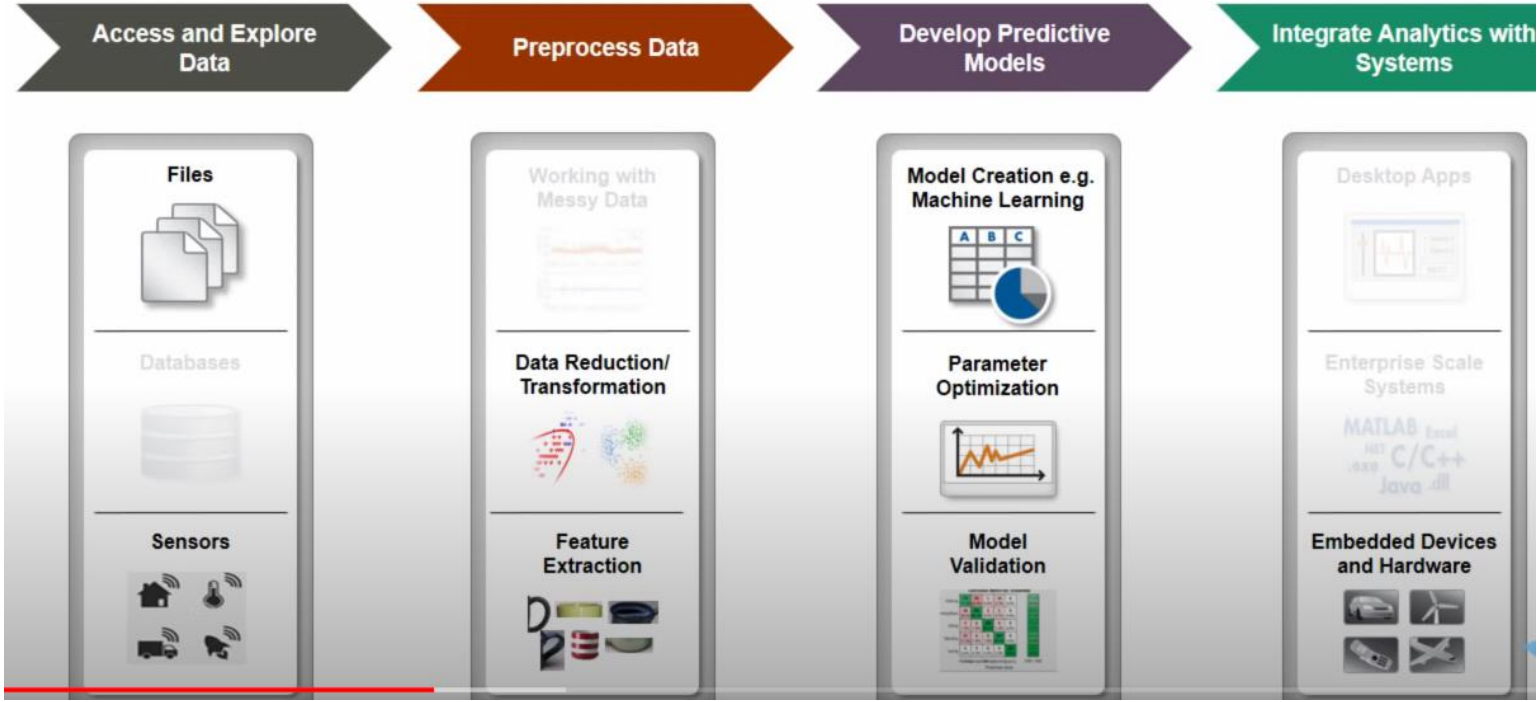
# Categories of Algorithms



# The Learning Process

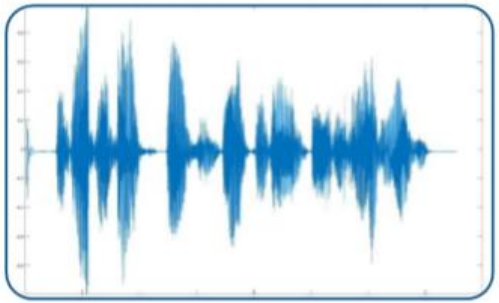


# Machine Learning Stages



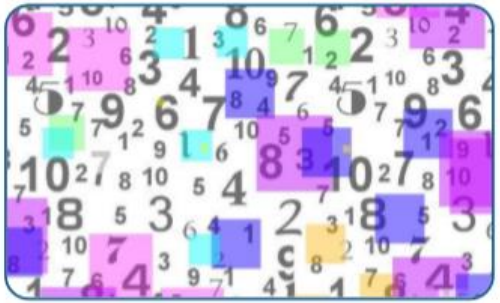
# Deep Learning Data types

Image



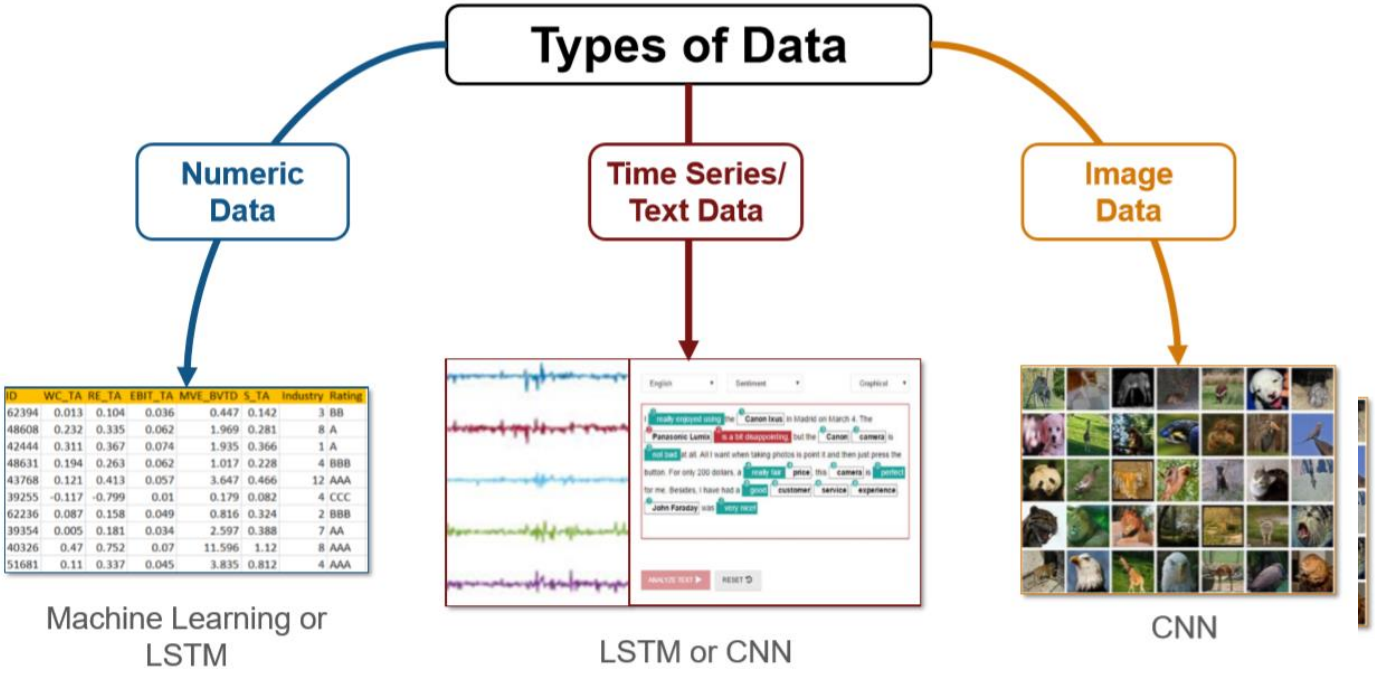
Signal

Numeric

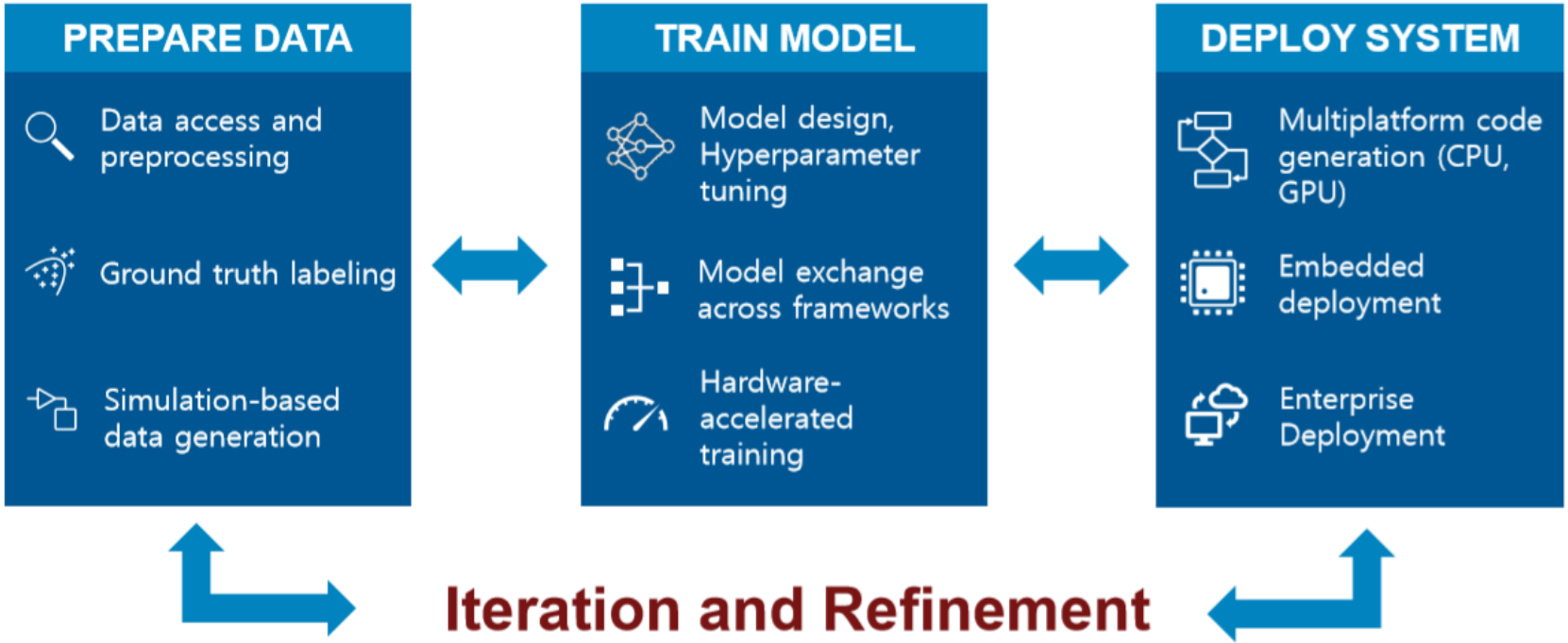


Text

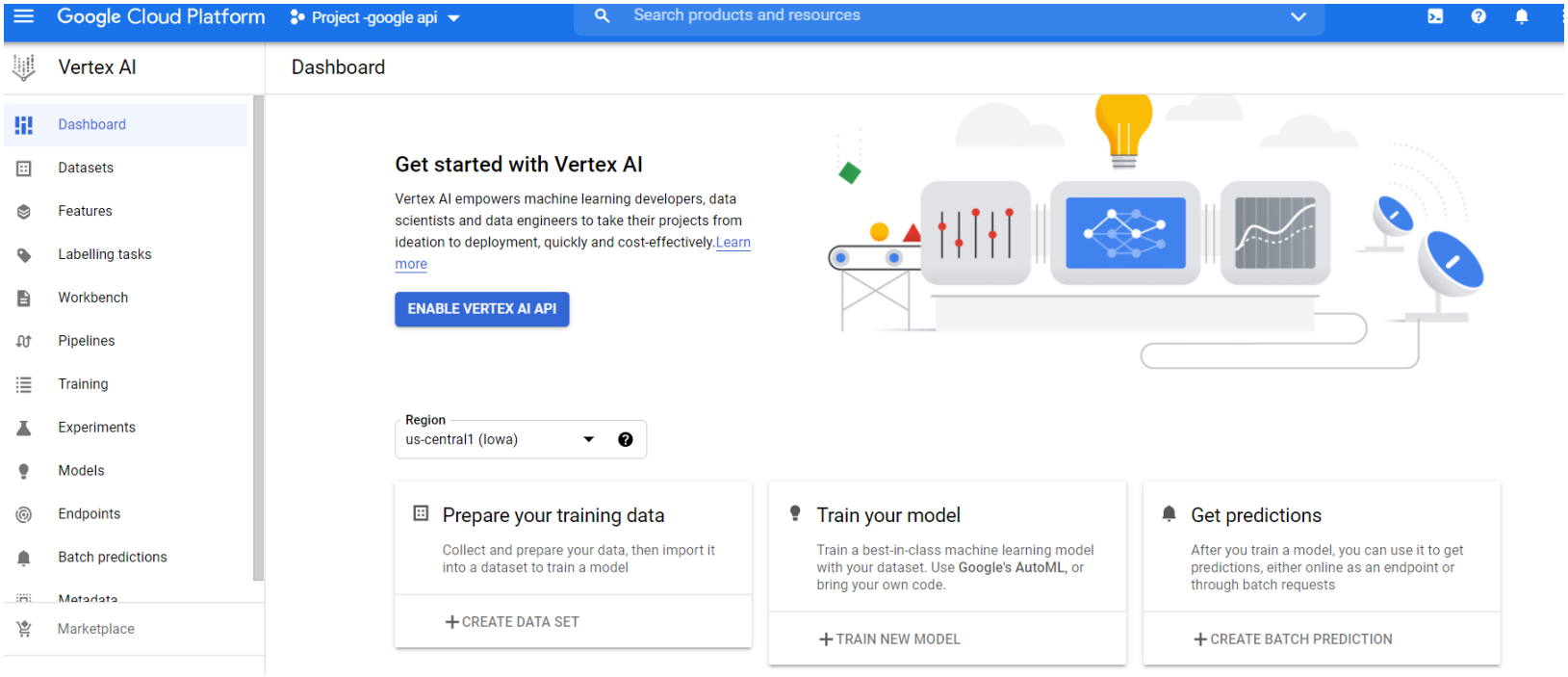
# Different Neural Networks for Different Data



# Deep Learning workflow



# Google Vertex AI



# Data science for IoT How and Why.

# What is Analytics & IoT Analytics

- Analytics is the scientific process of discovering and communicating the meaningful patterns which can be found in data.It is concerned with turning raw data into insight for making better decisions. Analytics relies on the application of statistics, computer programming, and operations research in order to quantify and gain insight to the meanings of data. It is especially useful in areas which record a lot of data or information.

- IoT analytics is the application of data analysis tools and procedures to realize value from the huge volumes of data generated by connected Internet of Things devices.

# What you get from Analytics

- What Happened
- Why it Happened
- How it is Happened
- How to make it  Happen

# Use Cases for IoT Data Analytics

- Use Case #1: Consumer Product Usage Analysis for Marketing
- Use Case #2: Serving Consumers and Business Users With the Same Analytics
- Use Case #3: Sensors and Cameras Enable Connected Events
- Use Case #4: Video Analytics for Surveillance and Safety

# List of Popular IoT clouds

- Google Cloud IoT
- Cisco IoT Cloud Connect
- Salesforce IoT Cloud
- Particle
- IBM Watson IoT
- ThingWorx
- Amazon AWS IoT Core
- Microsoft Azure IoT Hub
- Oracle IoT
- Arduino IoT Cloud
- Thingspeak
- Blynk.io

# IoT on IBM Cloud

**Watson IoT Platform**

Accelerate enterprise IoT insights with cognitive APIs, visual dashboards, rich developer resources and industry-leading security.

**IBM Maximo®**

Optimize asset utilization, increase uptime, drive efficiency and reduce operating costs with intelligent asset management.

**IBM TRIRIGA®**

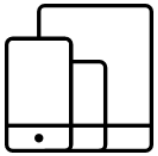
Manage your facilities with data-driven insights that support greater well-being and engagement for your workforce.

**IBM Engineering Lifecycle Management**

Foster communication, collaboration and visibility in your engineering processes to accelerate delivery, improve quality and support better decision-making.

An IoT platform built on IBM Cloud is a fully managed cloud service for device management, flexible and scalable connectivity options, secure communications and data lifecycle management. With IBM Watson IoT, you can collect insights from automobiles, buildings, equipment, assets and things

# How it all fits together



**Your device or gateway**

Start with your device — whether it's a sensor, gateway or something else — and let IBM help you connect it with an IBM Cloud recipe.

**MQTT and HTTP**

Your device data is always secure when you connect to IBM Cloud using open, lightweight MQTT messaging protocol or HTTP.

**IBM Watson IoT Platform**

The hub of the IBM IoT approach; set up and manage your connected devices so your apps can access live and historical data.

**REST and real-time APIs**

Use the secure APIs of IBM Cloud to connect your apps with data from your devices.

**Your application and analytics**

Create applications within IBM Cloud, another cloud or your own servers to interpret data.

# Features and solutions

**Core features of IBM Watson IoT:**

- Data ingestion from any source with the help of MQTT
- Direct access to the latest data in the Cloudant NoSQL DB solution
- Built-in monitoring dashboards to control your assets
- Analytics Service to process raw metrics
- The Cloud Object Storage solution for long-term data archiving

**Core use cases:**

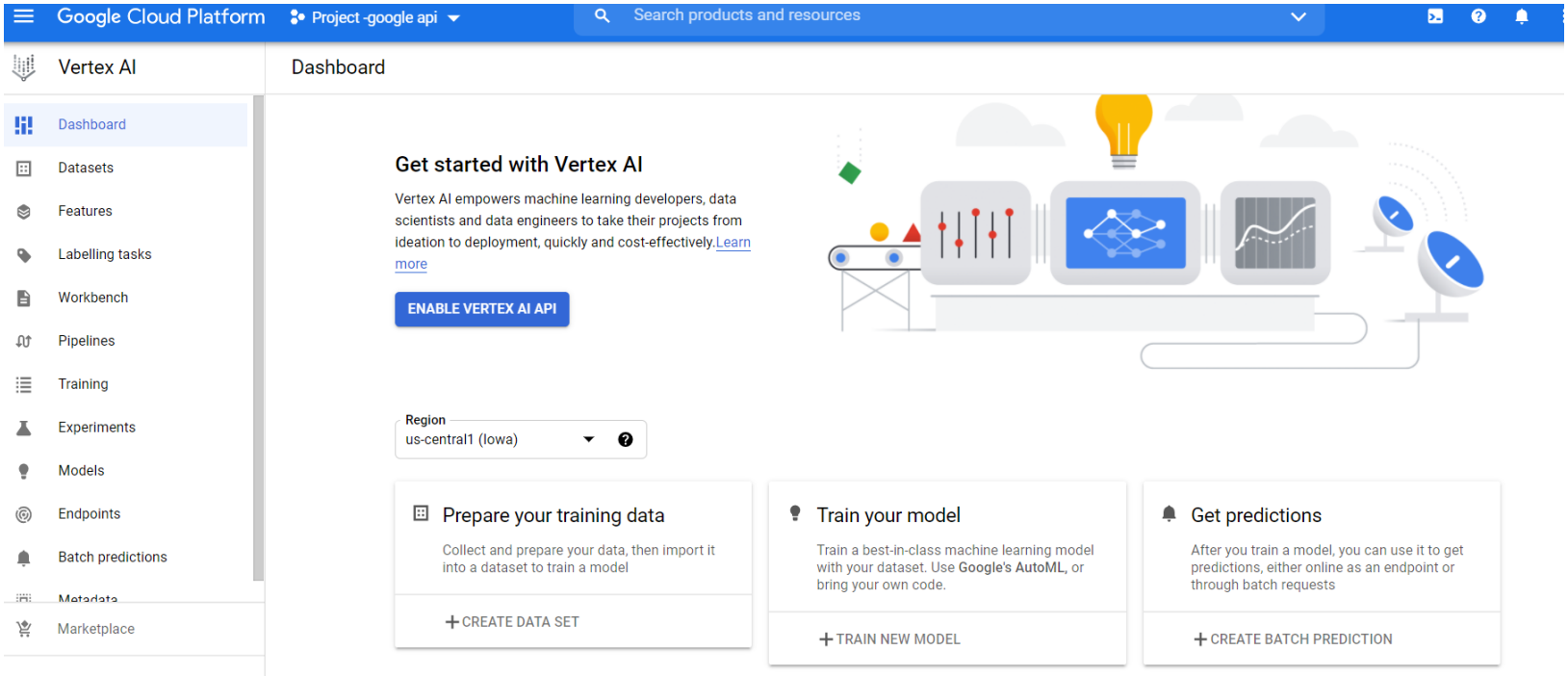
- Supply chain management
- Regulatory compliance
- Building management
- Energy consumption
- Shipping and logistics

# Google Cloud IoT solutions

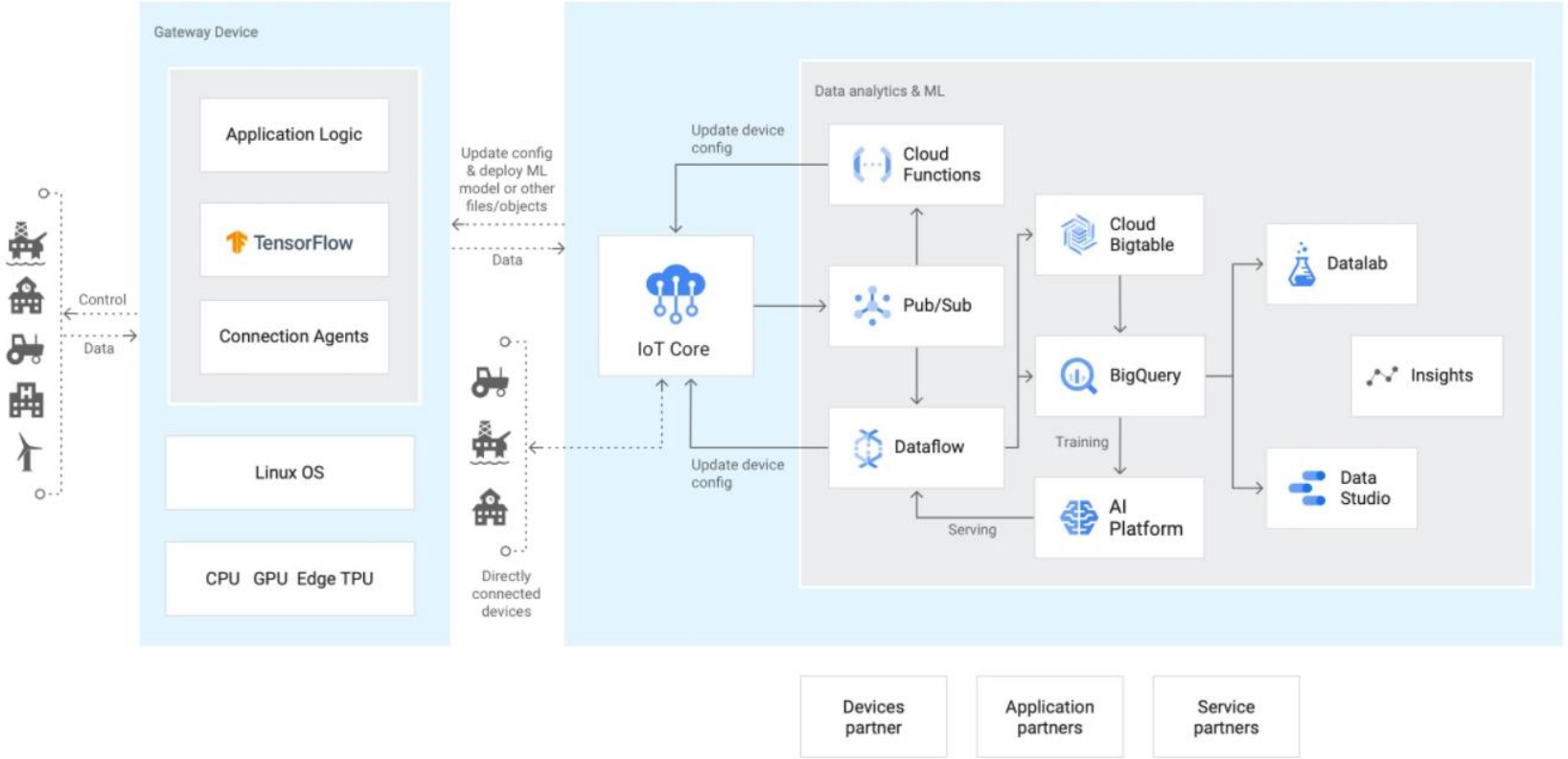
•**Cloud IoT Core** enables you to collect and manage device data. A device management component registers devices with the service and monitors and configures them. For device connectivity and communication with the Google Cloud Platform, MQTT and HTTP protocol bridges are utilized.
•**Cloud Pub/Sub** handles data ingestion and message routing for additional data processing.
•**Google BigQuery** allows for secure real-time data analytics.
•**AI Platform** makes use of machine learning capabilities.
•**Google Data Studio** visualizes data through the creation of reports and dashboards.
•The **Google Maps Platform** aids in visualizing the location of linked items.

**Google Cloud IoT's main characteristics include:**
•AI and machine learning capabilities.
•Data analysis in real-time
•Data visualization that is impressive
•Tracking your location
**Core use cases:**
•Maintenance that is planned in advance
•Real-time asset tracking
•Management of logistics and supply chains
•Smart cities and buildings

# Google Vertex AI



# Build and train ML models in the cloud



# Cisco IoT Cloud Connect

- **Cisco IoT Control Center** ensures impeccable cellular connectivity management, allowing you to integrate all your IoT devices in one SaaS solution.
- **Extended Enterprise Solution** allows for the development of IoT business applications at the edge and ensures rapid deployment and centralized network management.
- **Edge Intelligence** simplifies data processing by allocating data flows either to local or multi-cloud environments.
- **Industrial Asset Vision** utilizes sensors to monitor your assets continuously and deliver data for better decision-making.
- **Cisco IoT Threat Defense** protects sensible data and devices against cyberattacks, providing secure remote access, segmentation, visibility and analysis, and other security services.

# Features and solutions

**Core features of Cisco IoT Cloud Connect:**

- Powerful industrial solutions
- High-level security
- Edge computing
- Centralized connectivity and data management

**Core use cases:**

- Connected cars
- Fleet management
- Home security and automation
- Payment and POS solutions
- Predictive maintenance
- Industrial networking
- Smart meters
- Healthcare

# Salesforce IoT Cloud

- The Salesforce IoT Cloud platform gathers valuable information from connected devices to deliver personalized experiences to and build stronger relationships with your customers. It works in tandem with Salesforce CRM: data from connected assets is delivered directly to the CRM system where context-based actions are initiated immediately.
- For example, if sensors detect an error in windmill performance, it is instantly reflected in the CRM dashboard and the system can either adjust parameters automatically or create a service ticket.

# Features and solutions

**Core features of Salesforce IoT Cloud:**

- Full integration of customers, products and CRM
- No need for programming skills to create rules, conditions and events due to a simple point-and-click UI
- Compatibility with third-party websites, services and other products
- A proactive approach to customer issues and needs

**Core use cases:**

- Government administration
- Machinery
- Financial services
- Marketing and advertising
- Chemicals

# ThingWorx

- The specialized Industrial Internet of Things (IIoT) platform ThingWorx is used in a variety of manufacturing, service and engineering scenarios. The platform addresses common challenges across industries, from remote monitoring and maintenance to workforce efficiency and asset optimization.

# Features and solutions

**Core features of ThingWorx:**

- Access to multiple data sources due to the extension of traditional industrial communications
- Powerful ready-to-use tools and applications to create and scale IIoT solutions quickly
- Real-time insights from complex industrial IoT data to proactively optimize operations and prevent issues
- Total control over network devices, processes and systems

**Core Use Cases:**

- Remote asset monitoring
- Remote maintenance/service
- Predictive maintenance and asset management
- Optimized equipment effectiveness

# Amazon AWS IoT Core

- One of the leading players in the market, Amazon AWS IoT Core allows you to connect devices to AWS cloud services without the need to manage servers. The platform provides reliability and security for managing millions of devices.

# Features and solutions

**Core features of Amazon AWS IoT Core:**

- A wide choice of connection protocols, including MQTT, MQTT over WSS, HTT and LoRaWAN
- Ability to use with other AWS services such as AWS Lambda, Amazon Kinesis, Amazon DynamoDB, Amazon CloudWatch, Alexa Voice Service and more to build IoT applications
- A high level of security provided by end-to-end encryption throughout all points of connection, automated configuration and authentication
- Machine learning capabilities
- A variety of services for edge computing

**Core use cases:**

- Connected vehicles
- Connected homes
- Asset tracking
- Smart building
- Industrial IoT

# Microsoft Azure IoT Hub

- With the open-source Azure IoT platform from Microsoft, you can quickly build scalable and secure edge-to-cloud solutions. Utilizing ready-to-use tools, templates and services, you can develop flexible applications according to your company's needs.

# Features and solutions

**Core features of Azure IoT Hub:**

- Data protection all the way from the edge to the cloud
- The ability to operate even in offline mode with Azure IoT Edge
- Seamless integration with other Azure services
- Enhanced AI solutions
- Continuous cloud-scale analytics
- Fully managed databases
- Azure Industrial IoT solution

**Core use cases:**

- Automotive industry
- Discrete manufacturing
- Energy sector
- Healthcare
- Transportation
- Retail

# Oracle IoT

**Core features of Oracle IoT:**

- The ability to create applications and connect them to devices with JavaScript, Java, Android, iOS, C POSIX and REST APIs
- Integration with enterprise applications, web services and other Oracle Cloud Services
- Real-time analysis tools to aggregate and filter incoming data streams
- Automatic synchronization of data streams with Oracle Business Intelligence Cloud Service
- Unique digital identity for each device to establish trust relationships among devices and applications

**Core use cases:**

- Connected logistics
- Predictive maintenance
- Smart manufacturing
- Workplace safety

# Arduino IoT Cloud

## Arduino Cloud IoT

Configure, program and connect your devices - all through the Arduino IoT Cloud service.

QUICKSTART GUIDE →  ARDUINO IOT CLOUD ↗

# What you can do with Arduino IoT

### Arduino IoT Cloud, MKR RGB Shield and Alexa integration

Learn how to build a smart lamp by integrating the Arduino IoT Cloud and Alexa.

### Environmental data in the Arduino IoT Cloud

Learn how to collect environmental data from the MKR ENV Shield and display it in the Arduino IoT Cloud.

### Controlling relays from the Arduino IoT Cloud

Learn how to control the relays onboard the MKR Relay Shield through the Arduino IoT Cloud dashboard.

### Connecting ESP32 & ESP8266 to Arduino Cloud IoT

Learn how to send data between an ESP32 / ESP8266 development board and the Arduino Cloud IoT.

### Uploading sketches Over-The-Air (OTA)

Learn how to utilize Over-The-Air (OTA), a feature that allows you to upload sketches remotely.

### Sharing dashboards

Learn how to share your dashboards with other Arduino Cloud users.

### Thing to Thing communication with Arduino IoT Cloud

Learn how two Things can communicate with each other through variable syncing.

# Questions and Answers

# Thank you