

4.2.1 Machine Learning (ML)

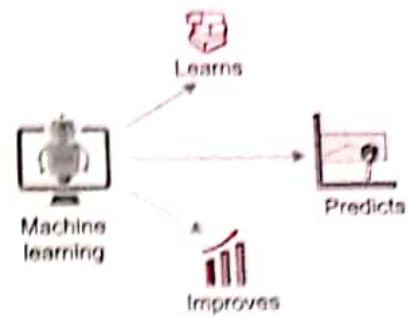
Machine Learning is a sub-area of artificial intelligence, which refers to the ability of computers to independently find solutions to problems by recognizing patterns in databases using statistical techniques. Machine Learning enables computers to recognize patterns on the basis of *specific algorithms called models* and data sets and to develop adequate solution concepts. Therefore, in Machine Learning, *artificial knowledge is generated on the basis of experience.*

MACHINE LEARNING

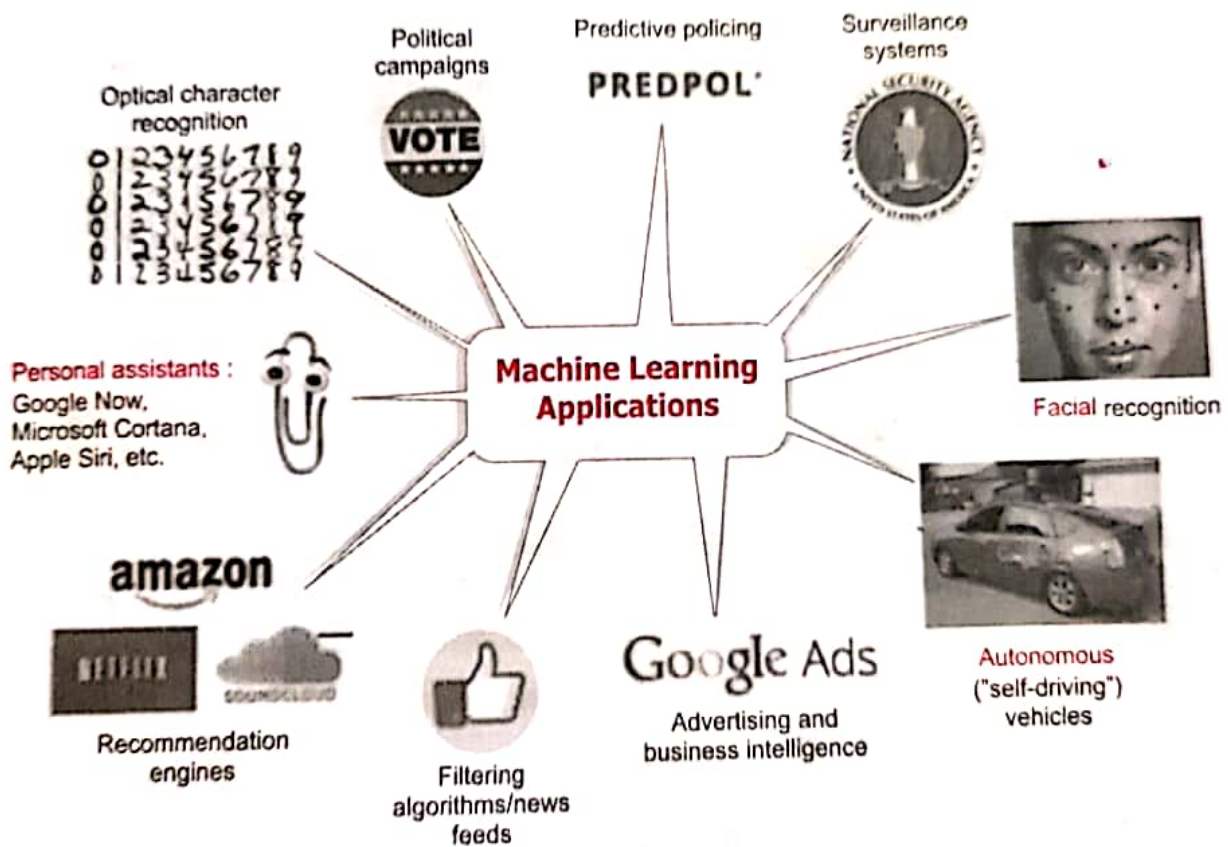
Machine Learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed, after initial trainings using test and training data and algorithms.

How ML works ?

In a way, Machine Learning works in a similar way to human learning. For example, if a child is shown images with specific objects on them, they can learn to identify and differentiate between them. Machine Learning works in the same way: Through specific data input (*training and testing data*), specific algorithms and certain commands (*models*), the computer is enabled to "learn" (i.e., *trained*) to identify certain patterns and to distinguish between them. With repeated such trainings and feedback, the systems evolve and learn to make predictions.



Following figure lists some common applications of Machine Learning :



ML applications learn from experience (well data) like humans without direct programming. When exposed to new data, these applications learn, grow, change, and develop by themselves. In other words, with Machine Learning, computers find insightful information without being told where to look. Instead, they do this by leveraging algorithms that learn from data in an iterative process.

Machine Learning has found applications in many areas of our lives such as *face recognition*, *online campaigns*, *virtual personal assistants* (like Siri, Alexa, Google Assistant, Cortana etc.) *online chatbots* (virtual chat assistants) and many more.

INTERNET OF THINGS (IOT)

You must have read stories like: "a person was able to monitor his home through his smartphone even while he himself was sitting in another country"; "scientists were able to monitor the progress of a tumor who was operated upon and a chip was inserted in her body"; "a car sensor alerted the car owner about low air pressure in tires in time" and so on. All these are nothing but some examples of applications of IoT. But what is IoT? Have we discussed that already? No, in a moment, we are going to do this ☺.

The IoT (Internet of Things) is a new age technology that allows computing devices (devices that can be programmed and can connect to Internet such as smart home appliances like smart refrigerators or smart air conditioners, a smart heart monitor chip etc.), to transfer data over a network like Internet without requiring human-to-human or human-to-computer interaction.

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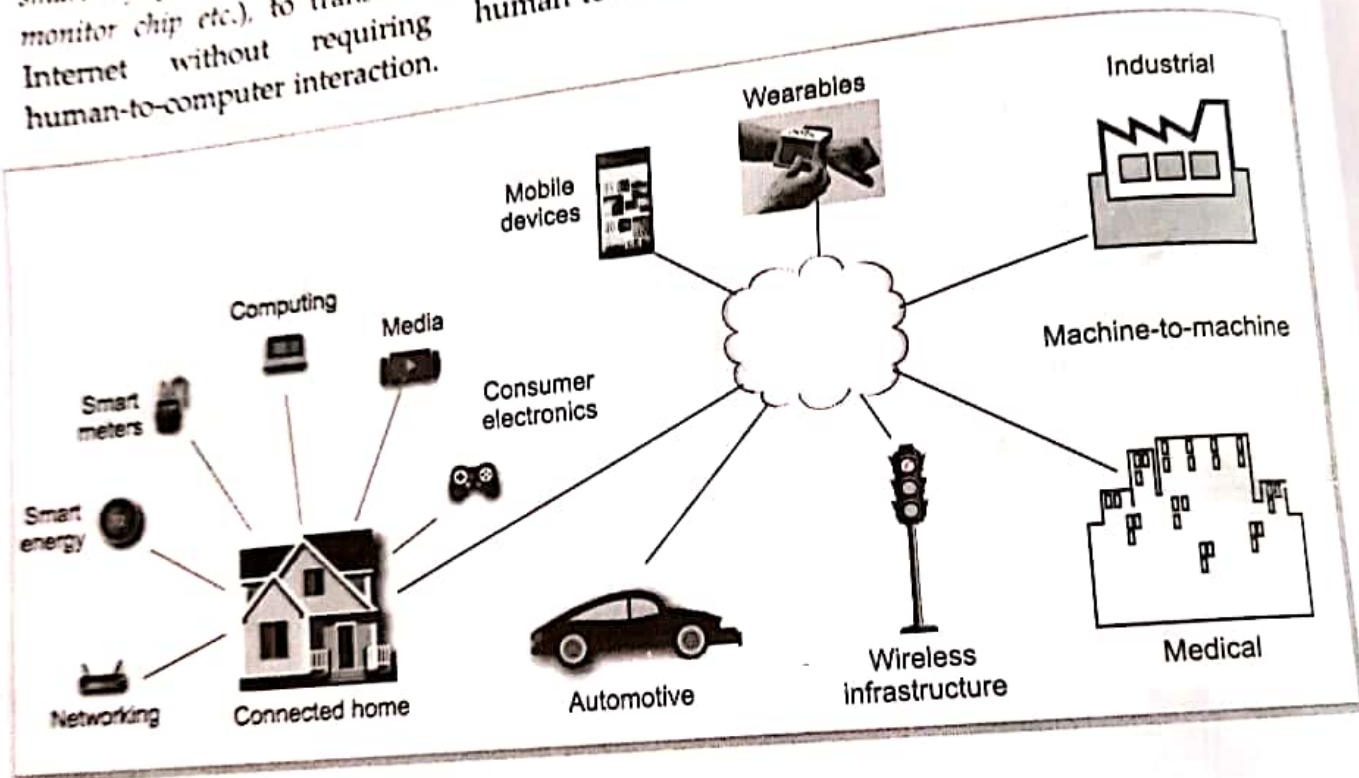


Figure 4.1 IoT (Internet of Things)

Practical applications of IoT technology can be found in many fields/areas today, such as :

- ❖ **Health and Fitness.** IoT smart gadgets like Fitbit, Jawbone, Nike and Misfit etc., that monitor your heart rate, blood pressure etc. and take action accordingly such as sending emergency messages or updating daily fitness log or contacting appointed doctor etc.
- ❖ **Home Security.** There are many home safety and security devices for everyone that enable video surveillance, motion, temperature and air quality control to help you protect your family and your home when you're not around.
- ❖ **Transport.** Driverless cars can 'not only' drive on road without drivers but also can be in touch with servers all time.
- ❖ **Shopping.** There are smart refrigerators nowadays that can order for grocery items as soon their quantity in fridge goes below a set level.

We all have access to sensors around us, directly or indirectly. In your school building, smoke sensors are mounted, which raise an alarm the moment some smoke is detected. Today's smartphones can sense change in direction, your hands near the top, phone near another device and so forth. All these are sensors around us.

Sensors are the devices which measure some physical energy (like temperature or change in direction etc.) and convert it into some type of signals. Sensors are used for measuring the physical properties or changes in them, such as Temperature, Resistance, Capacitance, Conduction, Heat Transfer etc.

SENSORS

Sensors are devices which measure some physical quantity (like temperature or change in direction etc.) and convert it into some type of signals.

Different types of sensors that are commonly used in various applications are :

Temperature Sensor (measure change in temperature), **Proximity Sensor** (measures proximity/position of an object relative to the screen of a device), **Accelerometer** (measure position, tilt, shock, vibration, and acceleration). **Pressure Sensor** (measure the pressure or change in pressure), **Light Sensor** (measure change in the light intensity), **Ultrasonic Sensor** (measure ultrasonic waves), **Smoke, Gas and Alcohol Sensor** (measure the leakage of smoke, gas or alcohol), **Tactile Sensor** (sense the position and pressure on a specific position of device), **Colour Sensor** (sense change in colour), **Humidity Sensor** (senses the humidity changes), **Gyroscope sensor** (sense position, motion, tilt, shock, vibration, and acceleration).

SMART SENSORS
 Smart sensors are intelligent sensors that can convert the measured quantities into digital data, digitally process them, transmit them and can perform some form of decision making.

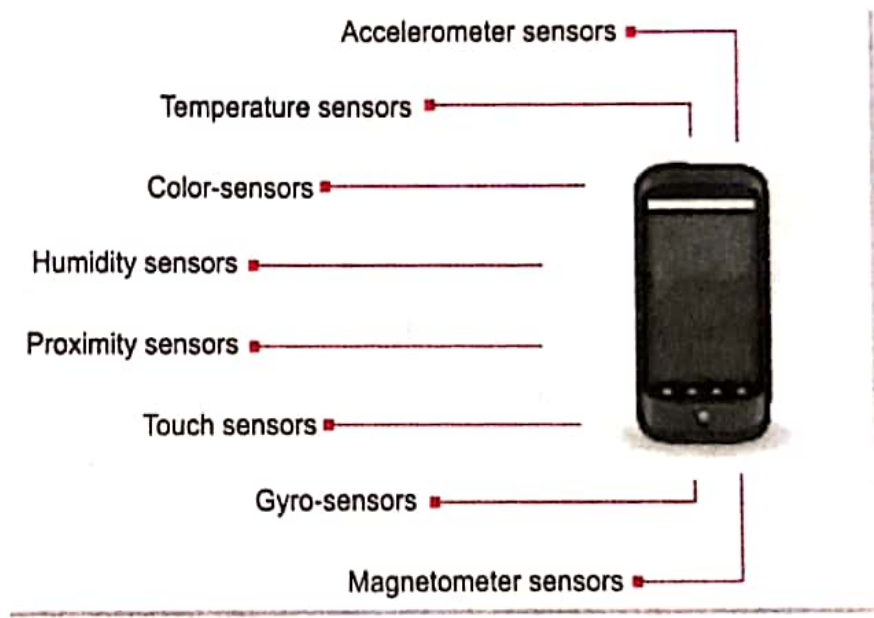


Figure 4.2 Smartphone Sensors

Sensors also play a very important role in Internet of Things (IoT). The sensors of IoT are mainly smart sensors. Smart sensors convert the real-world quantity that they're measuring into a digital data stream able to transmit them wirelessly over a network. The smart sensors have intelligent capabilities such as wireless communication and being an on-board microcontroller. They are used for analog to digital conversion, digital processing, decision making and two-way communications.