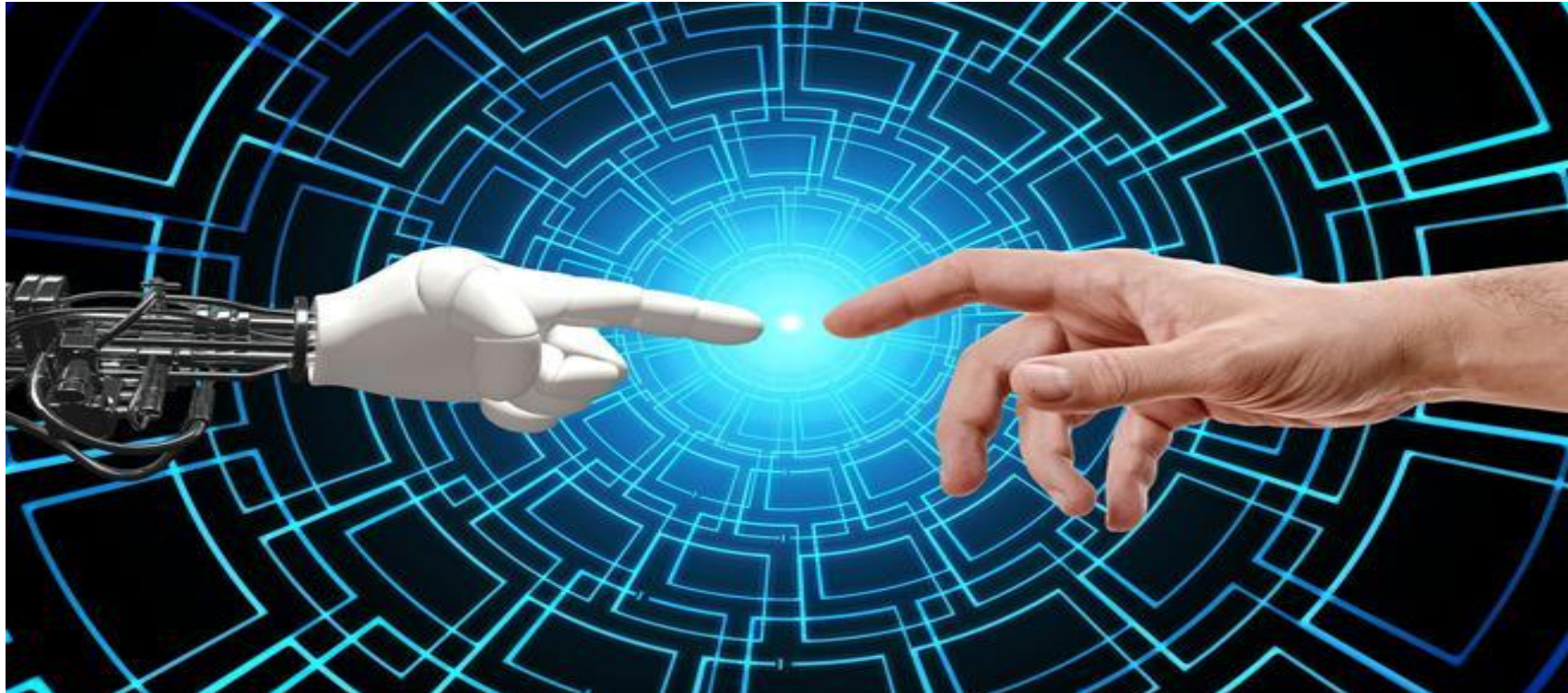


ARTIFICIAL INTELLIGENCE

AI is intelligence demonstrated by machines



Content

- Introduction to AI
- History of AI and Market Trends
- Introduction to AI and Machine Learning
- Types of Machine Learning
- Demo of Image Recognition using Microsoft Lobe
- Python Basics
- NumPy
- Data Visualization

What is Artificial Intelligence?



artificial

/ɑːtɪˈfɪʃ(ə)l/

adjective

1. made or produced by human beings rather than occurring naturally, especially as a copy of something natural.



intelligence

/ɪnˈtɛlɪdʒ(ə)ns/

noun

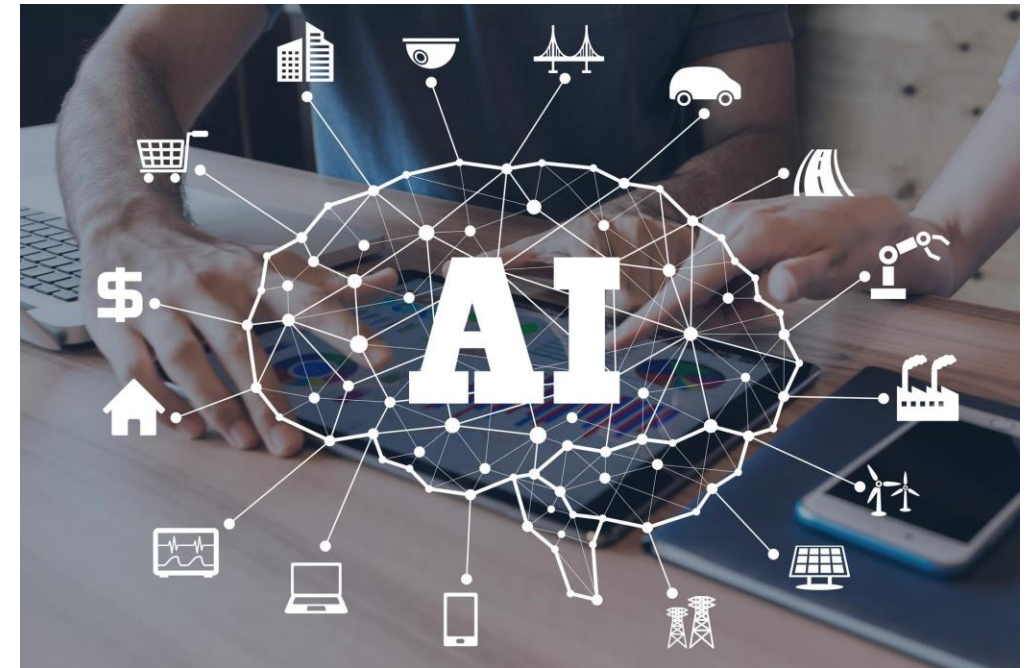
1. the ability to acquire and apply knowledge and skills.

Introduction of Artificial Intelligence

Intelligence : “The capacity to learn and solve problems.”

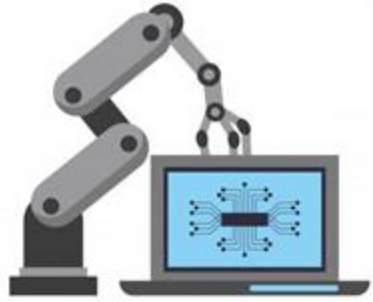
Artificial Intelligence : Artificial Intelligence (AI) is the simulation of human intelligence by machines.

- 1) The ability to solve problems.
- 2) The ability to act rationally.
- 3) The ability to act like humans.



https://www.tu-berlin.de/menue/summer_university/old_versions/winter_university/introduction_to_artificial_intelligence

Why Artificial Intelligence?



Intelligent Automation



Adding to labor and capital



Collaborative Innovation



Boosting the economy

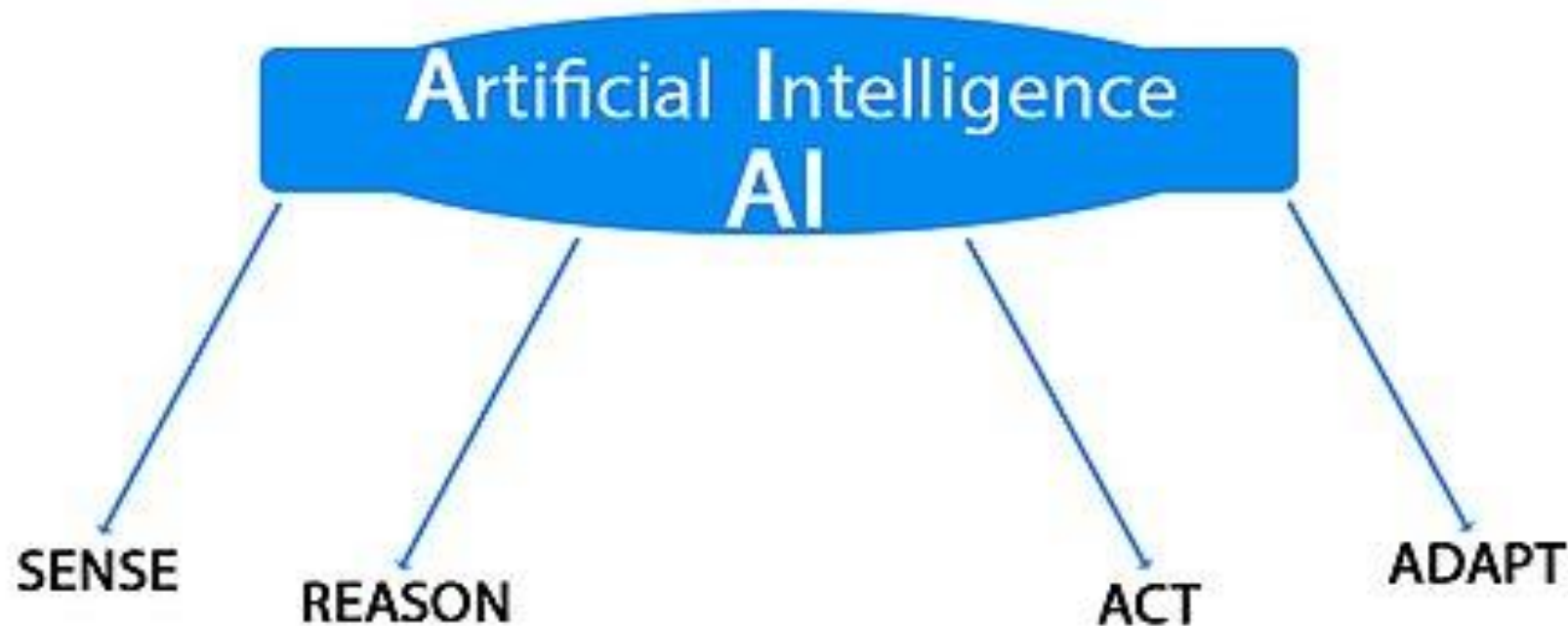


New and exciting solutions



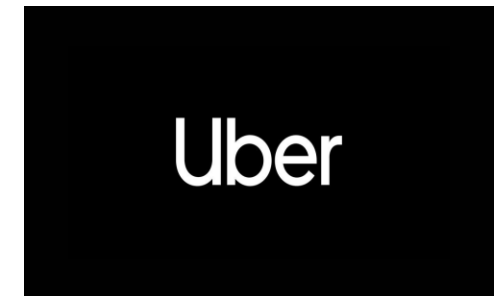
Uses in every sphere of life

What is Artificial Intelligence?



https://en.wikiversity.org/wiki/Artificial_intelligence/Introduction

Where is Artificial Intelligence?

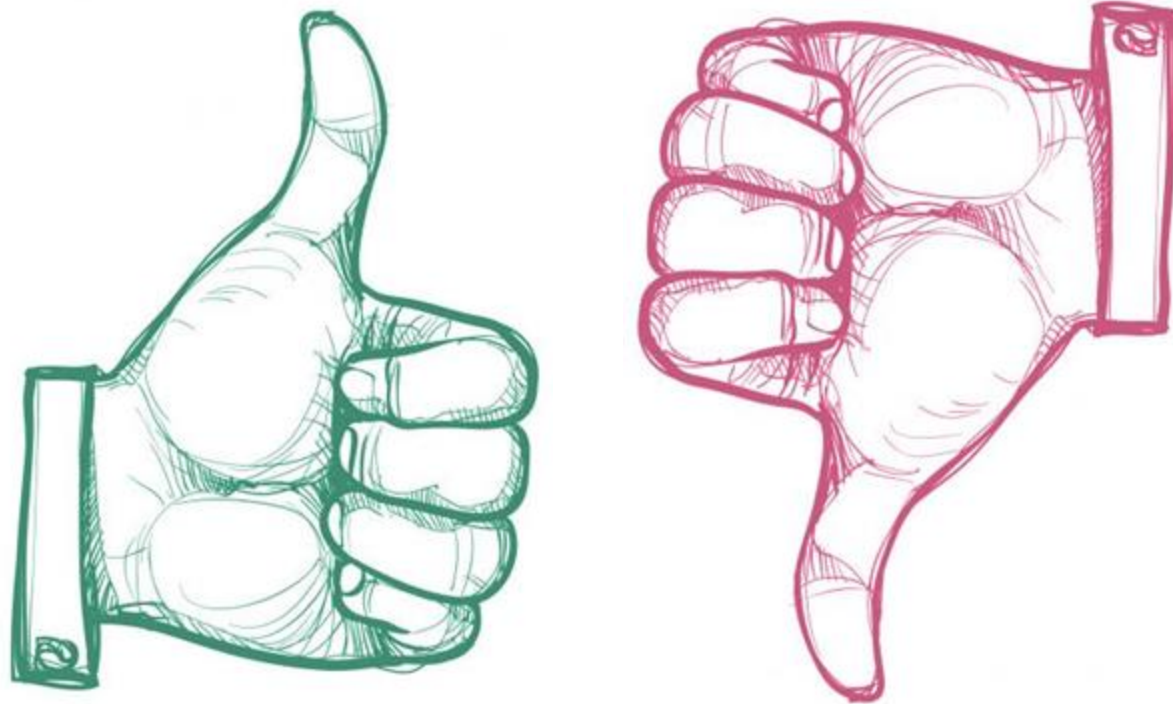


Applications of AI



<https://techvidvan.com/tutorials/artificial-intelligence-applications/>

What AI can and can not do?



What AI can and can not do?



Some examples of things AI can do:



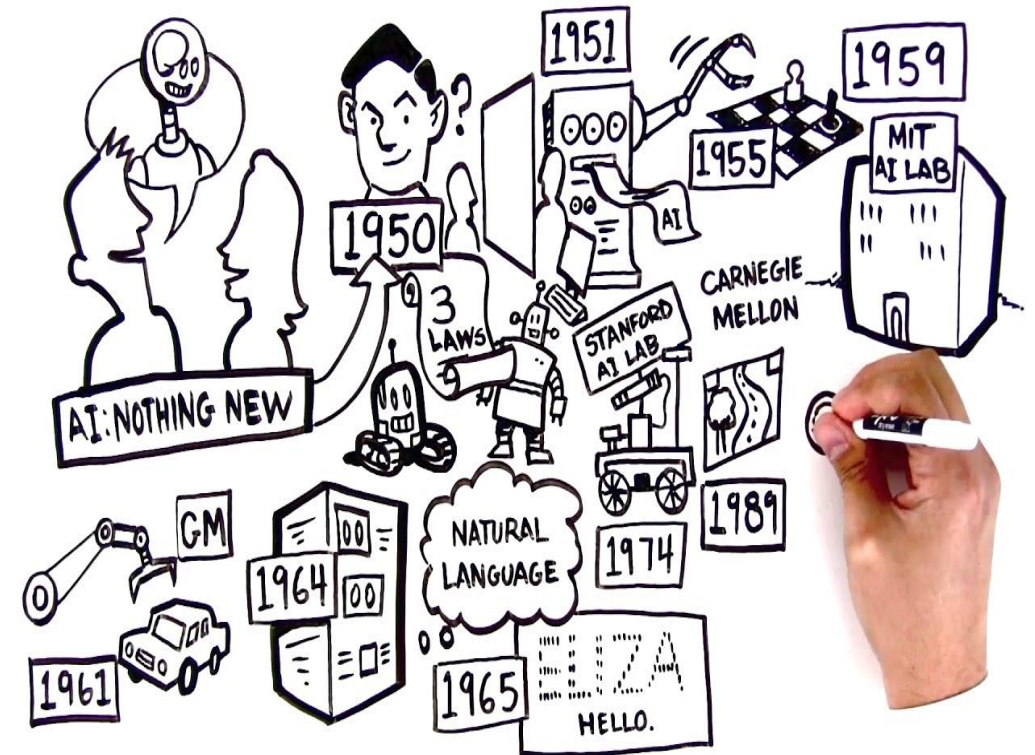
- Decide if a bulb is working or not by looking at it
- Sympathise with humans
- Differentiate between drawings of circles and rectangles
- Manage a workshop with various different machines
- Compare output value of system to a target value
- Get a job in a multinational company
- Identify compatibility with a machine among various parts
- Identify defective products coming out of an assembly line
- Run a social media account of its own
- Decide correct operating temperature and pressure for a new assembly line.



Some examples of things AI can not do:

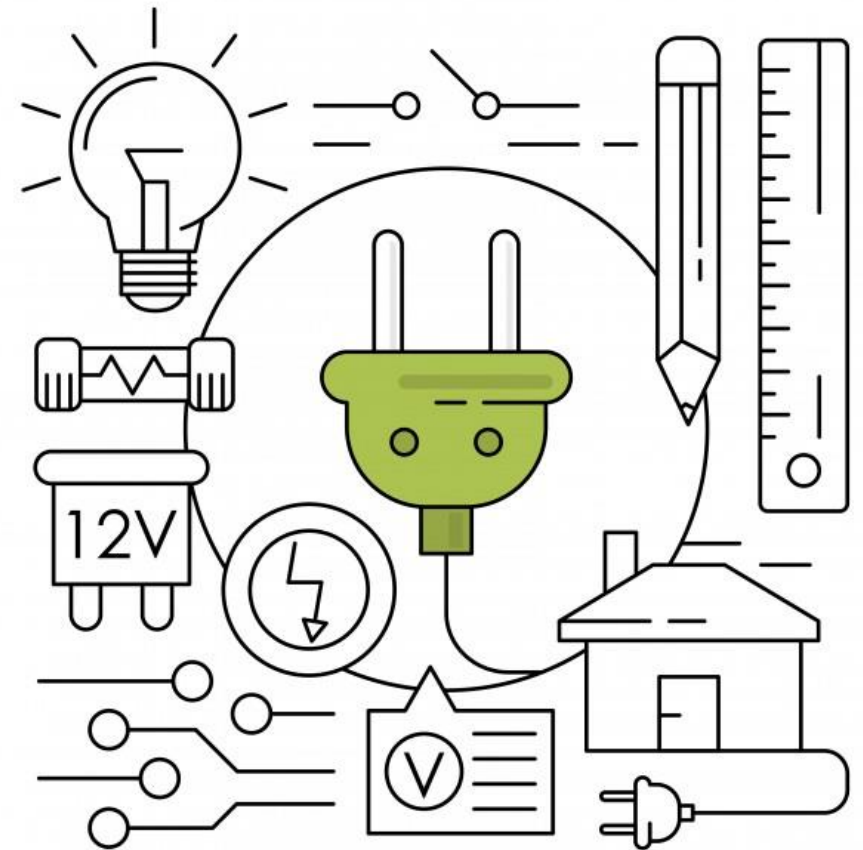
Artificial Intelligence: Past and Present

- **1950s** - Artificial Intelligence was born.
- **Late 1960s to 1970s** - The First AI Winter
- **Early 1980s** - The AI Boom due to development of learning techniques
- **Late 1980s to 1990s** - The Second AI Winter
- **Late 1990s to 2000s** - Renewed success in various fields.
- **2010s to Present** - Modern AI with cutting edge solutions in all walks of life



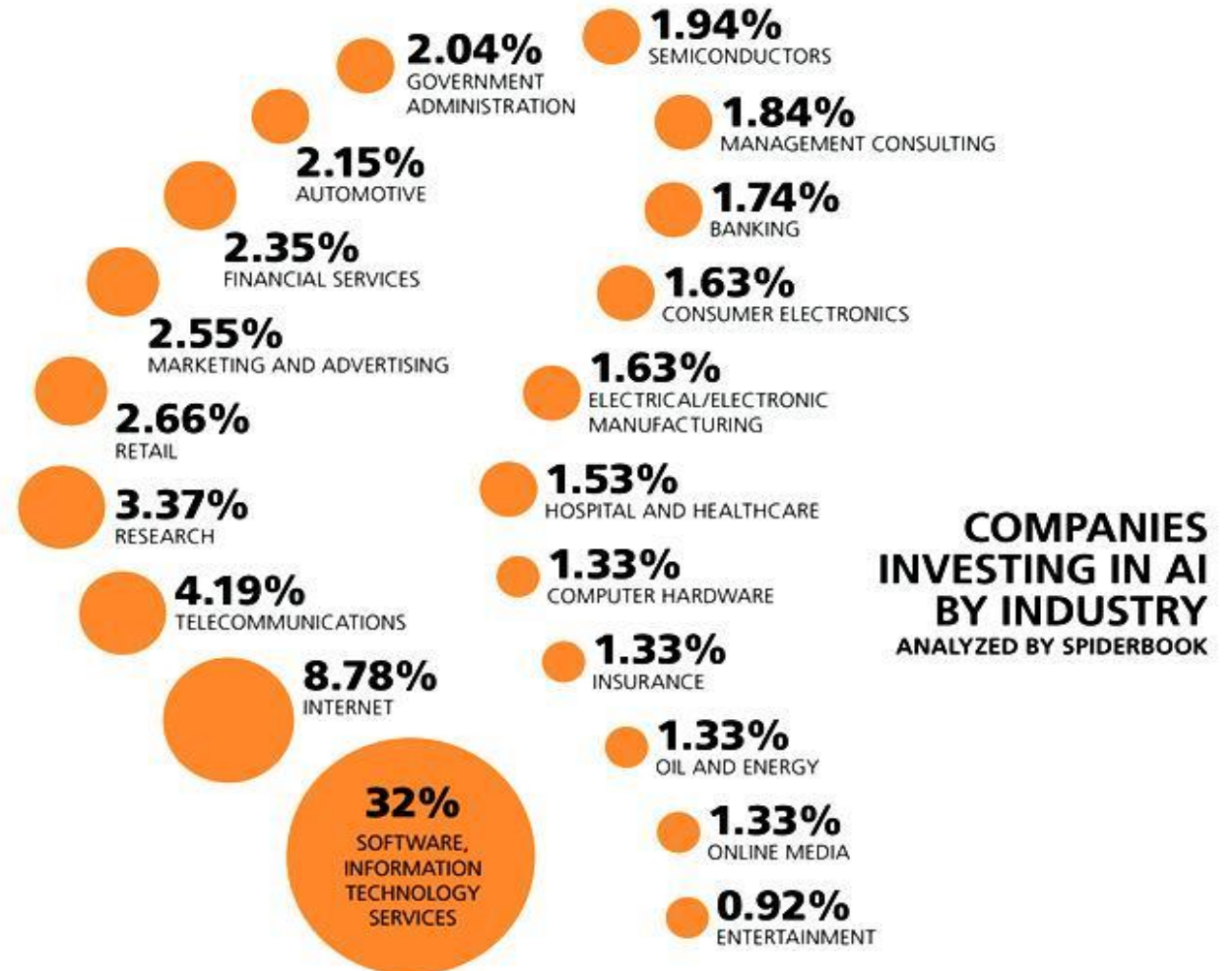
Market opportunities and career in AI

DATA IS THE NEW OIL AND ARTIFICIAL INTELLIGENCE IS THE NEW ELECTRICITY



Market opportunities and career in AI

- Current data visualization of companies investing in Artificial Intelligence

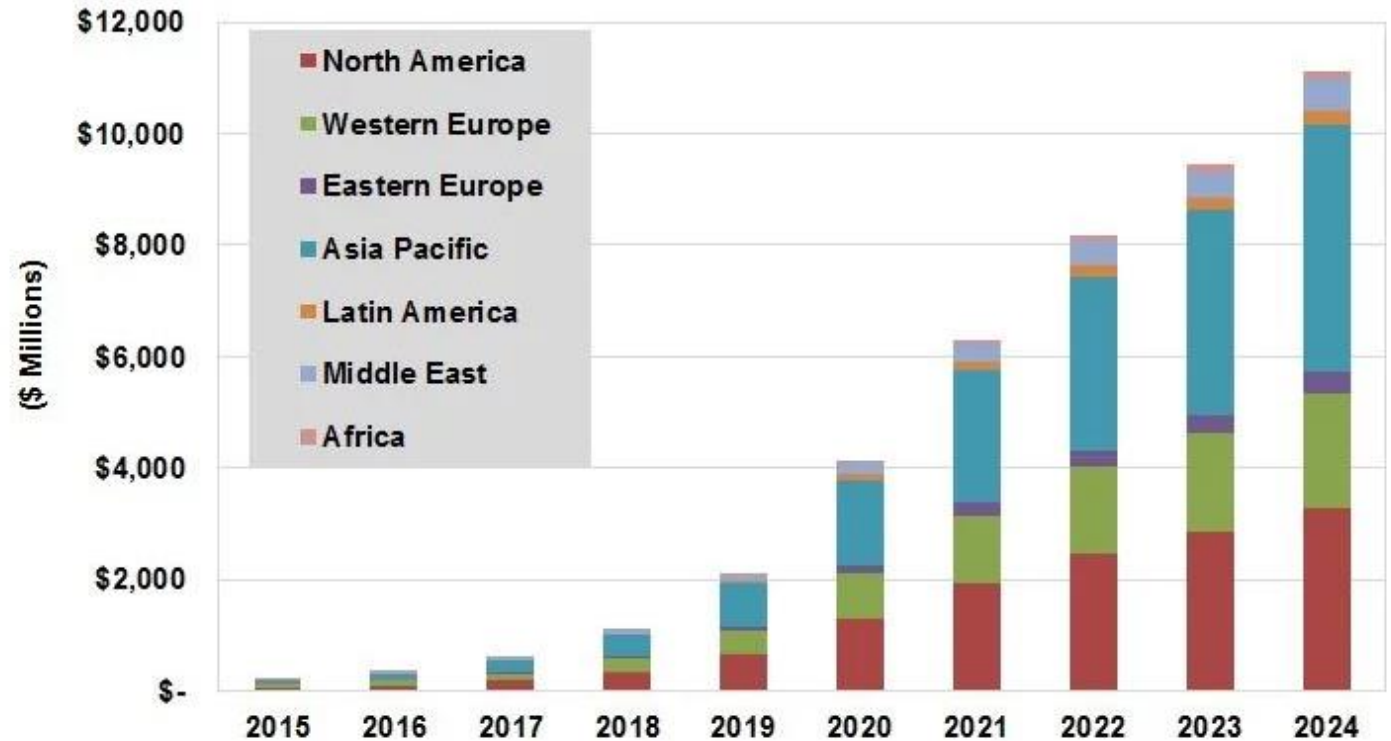


Source - <http://www.oreilly.com/data/free/the-new-artificial-intelligence-market.csp>

Market opportunities and career in AI



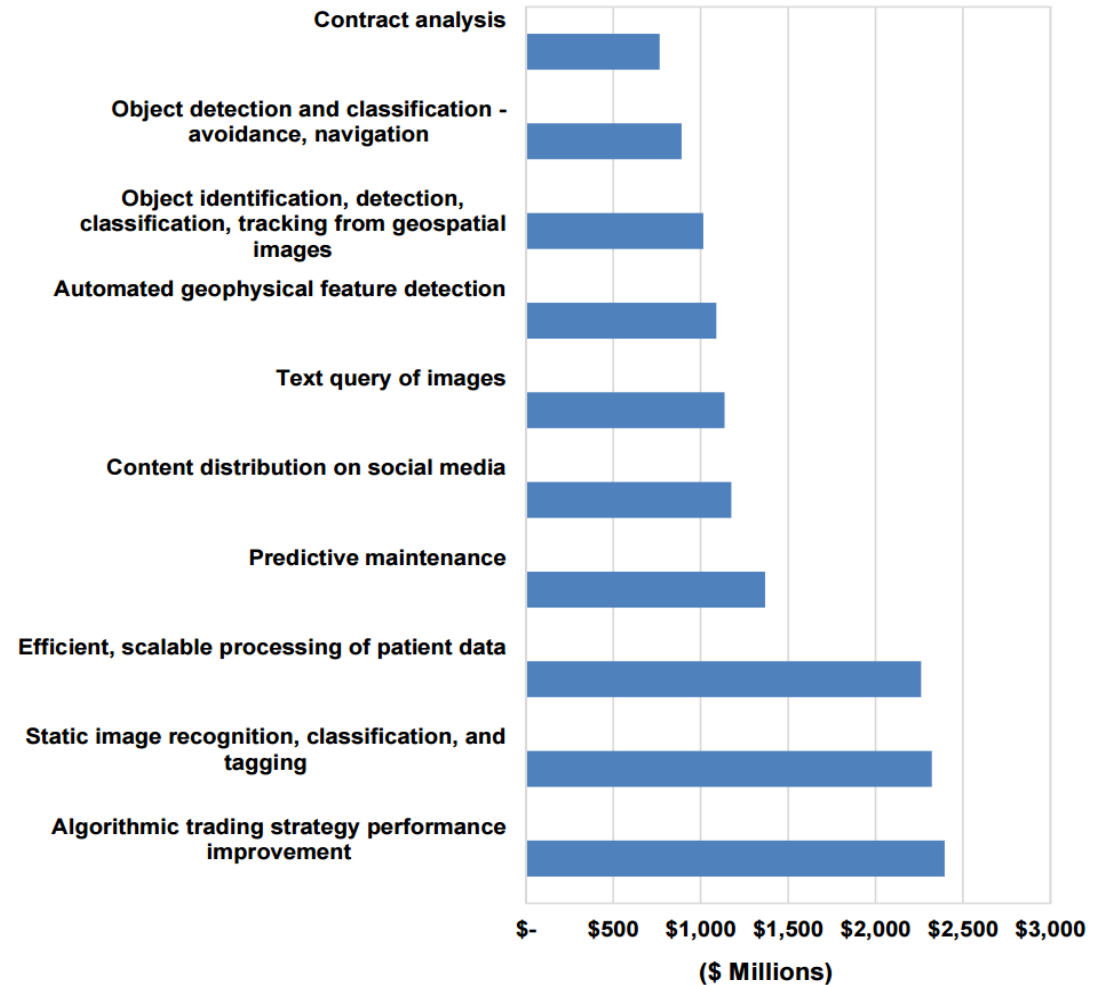
Artificial Intelligence Revenue by Region, World Markets: 2015-2024



Source - <https://www.tractica.com/newsroom/press-releases/artificial-intelligence-for-enterprise-applications-to-reach-11-1-billion-in-market-value-by-2024/>

Market opportunities and career in AI

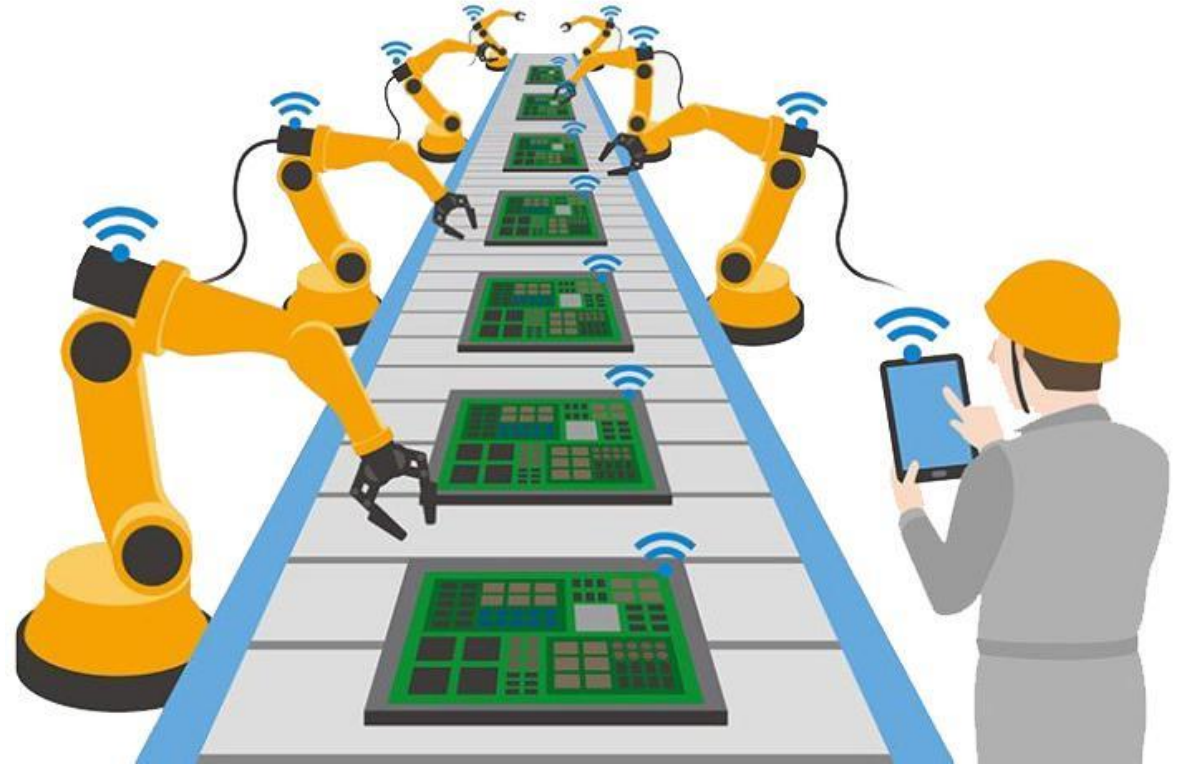
- Artificial Intelligence Revenue, Top 10 Use Cases, World Markets: 2025



Source - <https://www.tractica.com/wp-content/uploads/2016/08/MD-AIMF-3Q16-Executive-Summary.pdf>

Market opportunities and career in AI

- It's estimated that by 2025, the amount of work done by machines will jump from 29% to more than 50% - but that this rapid shift will be accompanied by new labour-market demands that may result in more, rather than fewer, jobs".
 - The Future of Jobs Report 2018 by World Economic Forum



Market opportunities and career in AI

- Jobs with future skills such as AI are on the rise.
- A number of highly “automatable” jobs fall into the top 10 most declining occupations.



Source -

<https://www.weforum.org/agenda/2018/09/artificial-intelligence-shaking-up-job-market/>

Market opportunities and career in AI

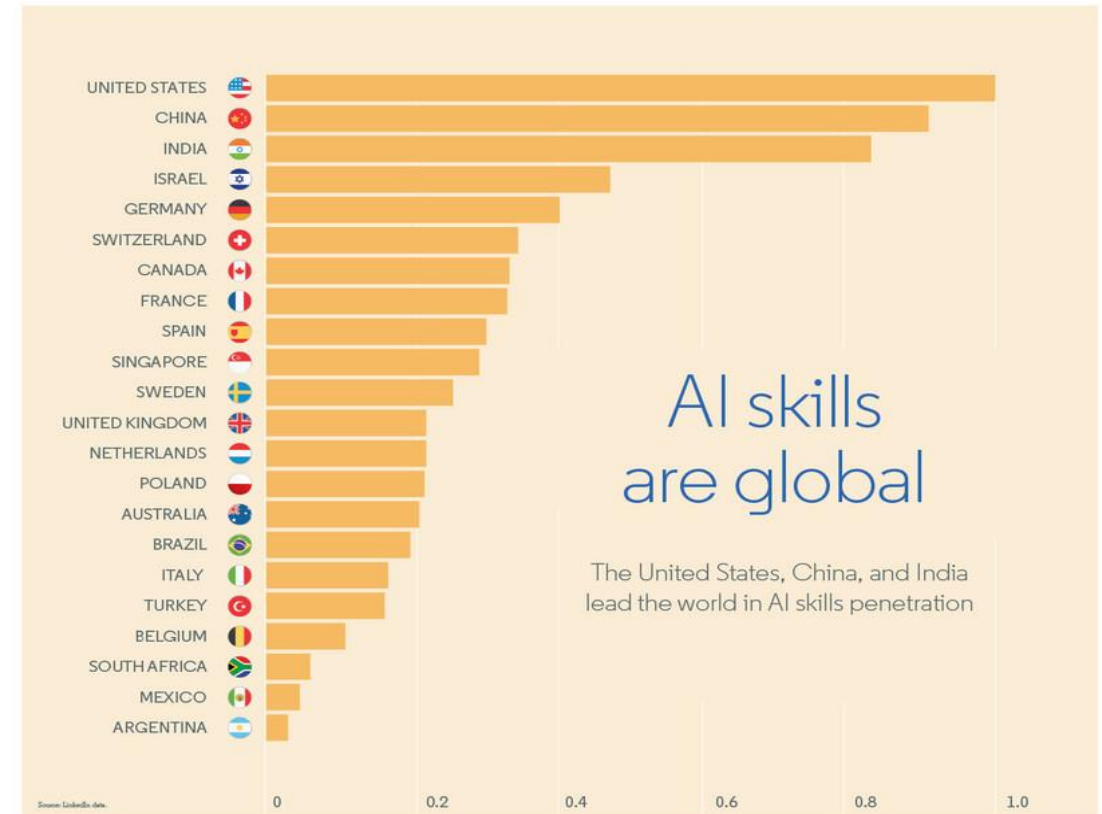
- AI skills are among the fastest-growing skills on LinkedIn.
- The proportion of core skills required to perform a job that will remain the same will be about 58% over the 2018–2022 period.

Trending, 2022	Declining, 2022
Analytical thinking and innovation	Manual dexterity, endurance and precision
Active learning and learning strategies	Memory, verbal, auditory and spatial abilities
Creativity, originality and initiative	Management of financial, material resources
Technology design and programming	Technology installation and maintenance
Critical thinking and analysis	Reading, writing, math and active listening
Complex problem-solving	Management of personnel
Leadership and social influence	Quality control and safety awareness
Emotional intelligence	Coordination and time management
Reasoning, problem-solving and ideation	Visual, auditory and speech abilities
Systems analysis and evaluation	Technology use, monitoring and control

Source - Future of Jobs 2018, World Economic Forum

Market opportunities and career in AI

- Future skills are global, and the countries with the highest penetration of such skills are the United States, China, **India**, Israel and Germany.

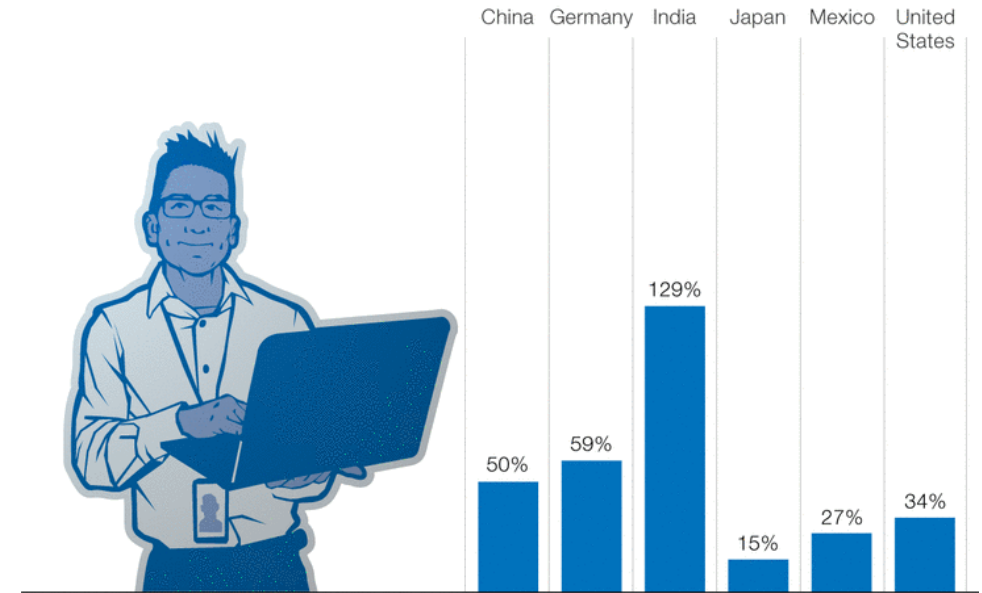


Source -

<https://www.weforum.org/agenda/2018/09/artificial-intelligence-shaking-up-job-market/>

Market opportunities and career in AI

- Employment growth and decline by occupation till 2030, brought on by automation through AI, in various disciplines:
 - Care providers - 242%
 - Teachers - 208%
 - Technology professionals -129%
 - Builders - 117%
 - Customer interaction - 46%
 - Office support - 21%
 - Predictable physical work - 15%
 - Unpredictable physical work - 9%



Source - US Bureau of Labor Statistics; McKinsey Global Institute analysis
<https://www.mckinsey.com/featured-insights/future-of-work/how-will-automation-affect-jobs-skills-and-wages>

Experiencing AI



Real life AI Projects

An **intelligent virtual assistant (IVA)** or **intelligent personal assistant (IPA)** is a software agent that can perform tasks or services for an individual based on commands or questions.

In 1990's Companies Started Working on **smart virtual assistants.**

Cortana was demonstrated for the first time at the Microsoft BUILD Developer Conference in San Francisco in April, 2014.



Real life AI Projects - Cleaning ROBOTS

A robotic vacuum cleaner, often called a Roomba as a generic trademark, is an autonomous robotic vacuum cleaner which has intelligent programming and a limited vacuum floor cleaning system.

In 2002 iRobot launches the Roomba floor vacuuming robot.



Real life AI Projects- Cleaning ROBOTS



Real life AI Projects – Health Care

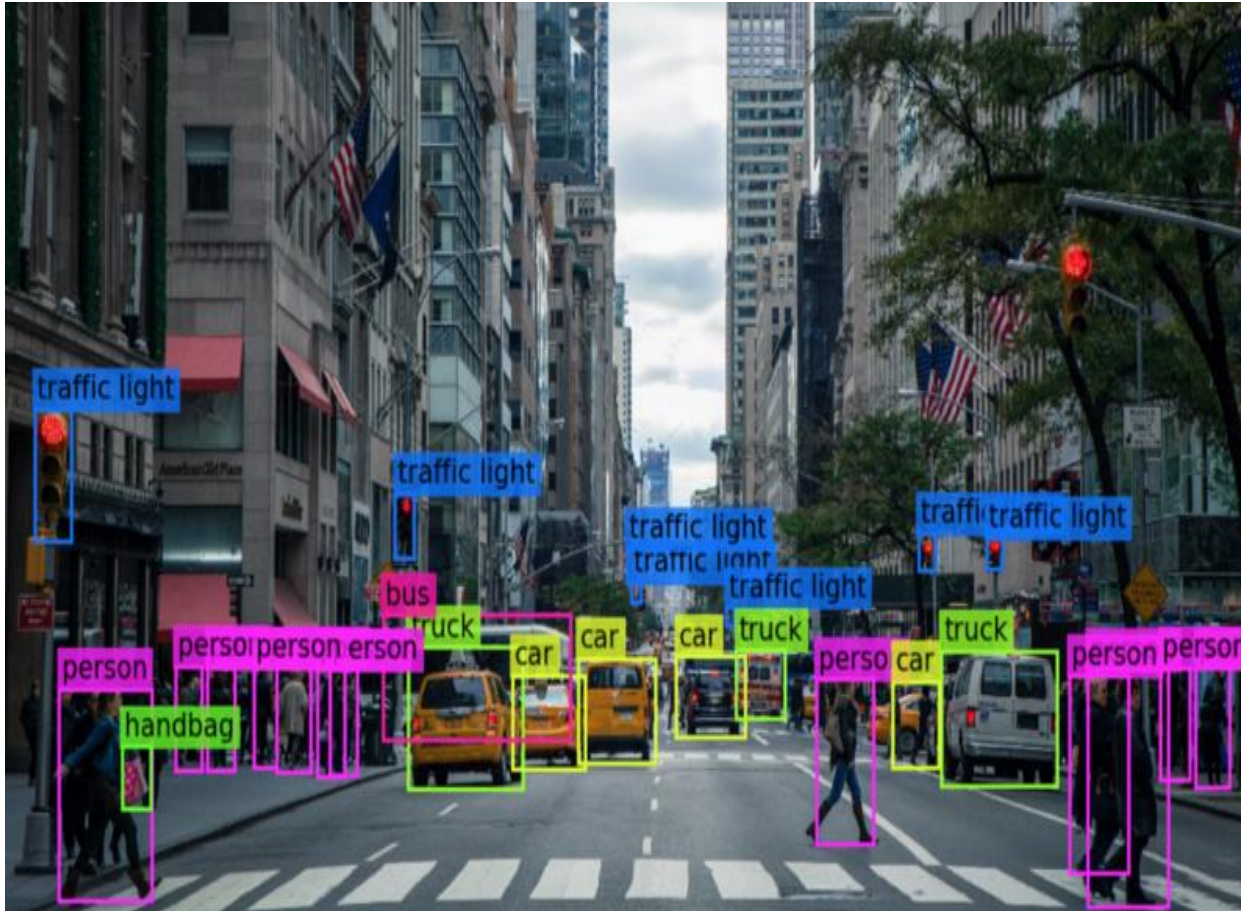
Artificial intelligence in healthcare is an overarching term used to describe the use of machine-learning algorithms and software, or artificial intelligence (AI), to mimic human cognition in the analysis, presentation, and comprehension of complex medical and health care data.

Specifically, AI is the ability of computer algorithms to approximate conclusions based solely on input data.

As a result, many business and analytics leaders are trying to integrate augmented intelligence (AI) into their analytic processes to better address these critical issues.

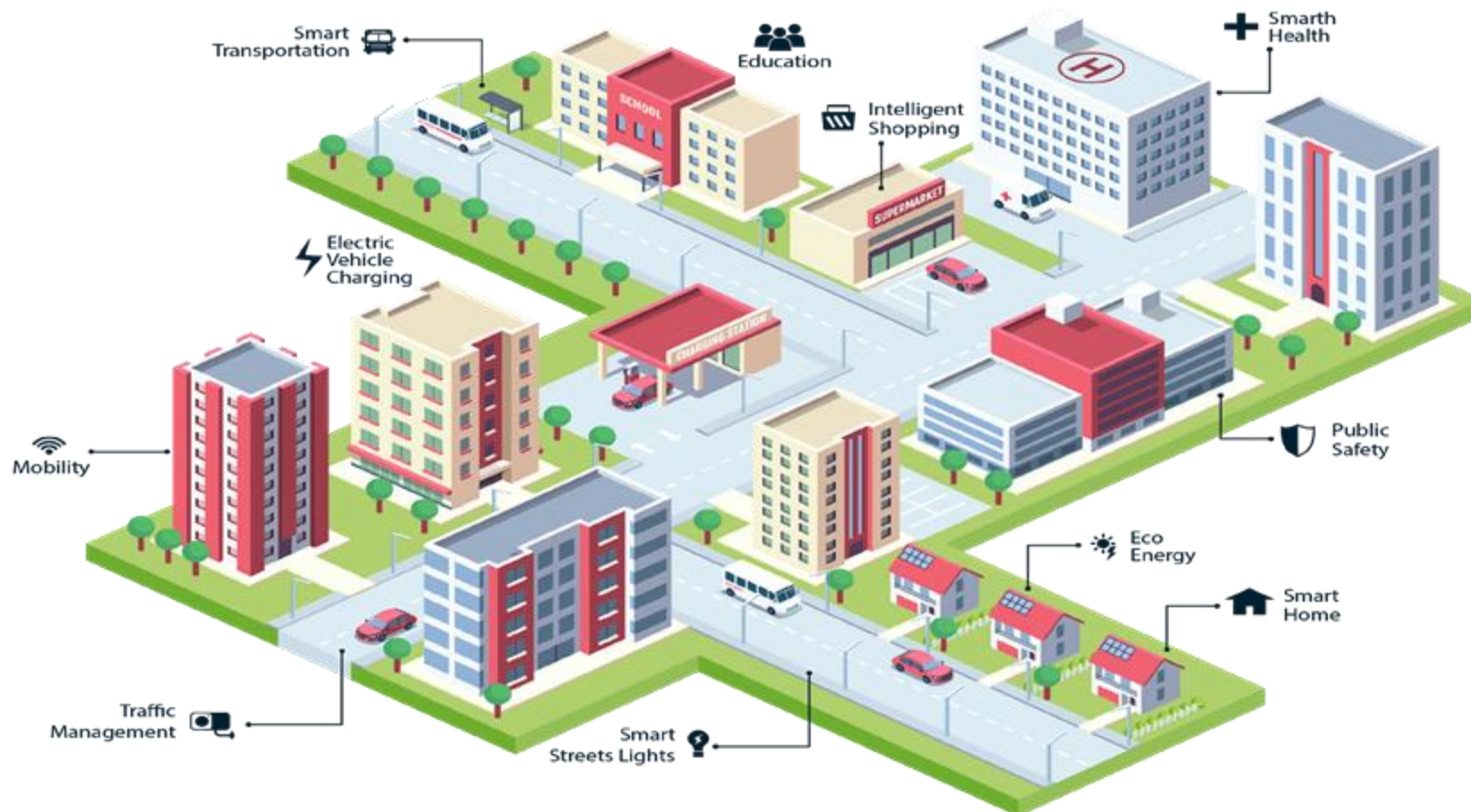


The AI Computer Vision



Computer Vision

What is a smart city?



Application of Smart Cities

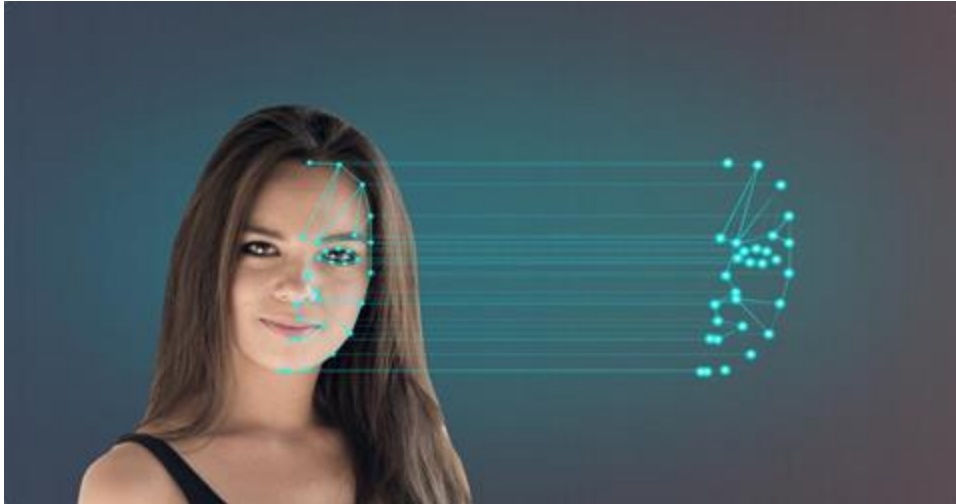
Artificial Intelligence is making cities smarter
- safer, healthier, more efficient, more accessible, and more livable.

Let us discuss How Artificial Intelligence and Smart City where you will read about:

- What is a Smart City?
- Using AI to learn how to improve and optimize infrastructure of a city
- Using AI to improve public safety in a city

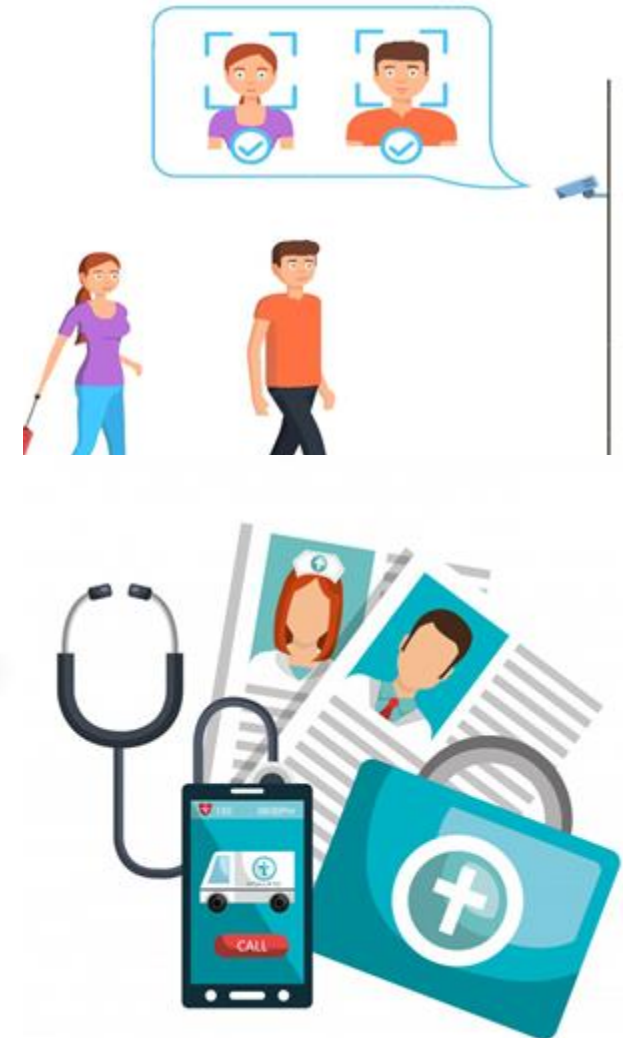


What is Image Recognition

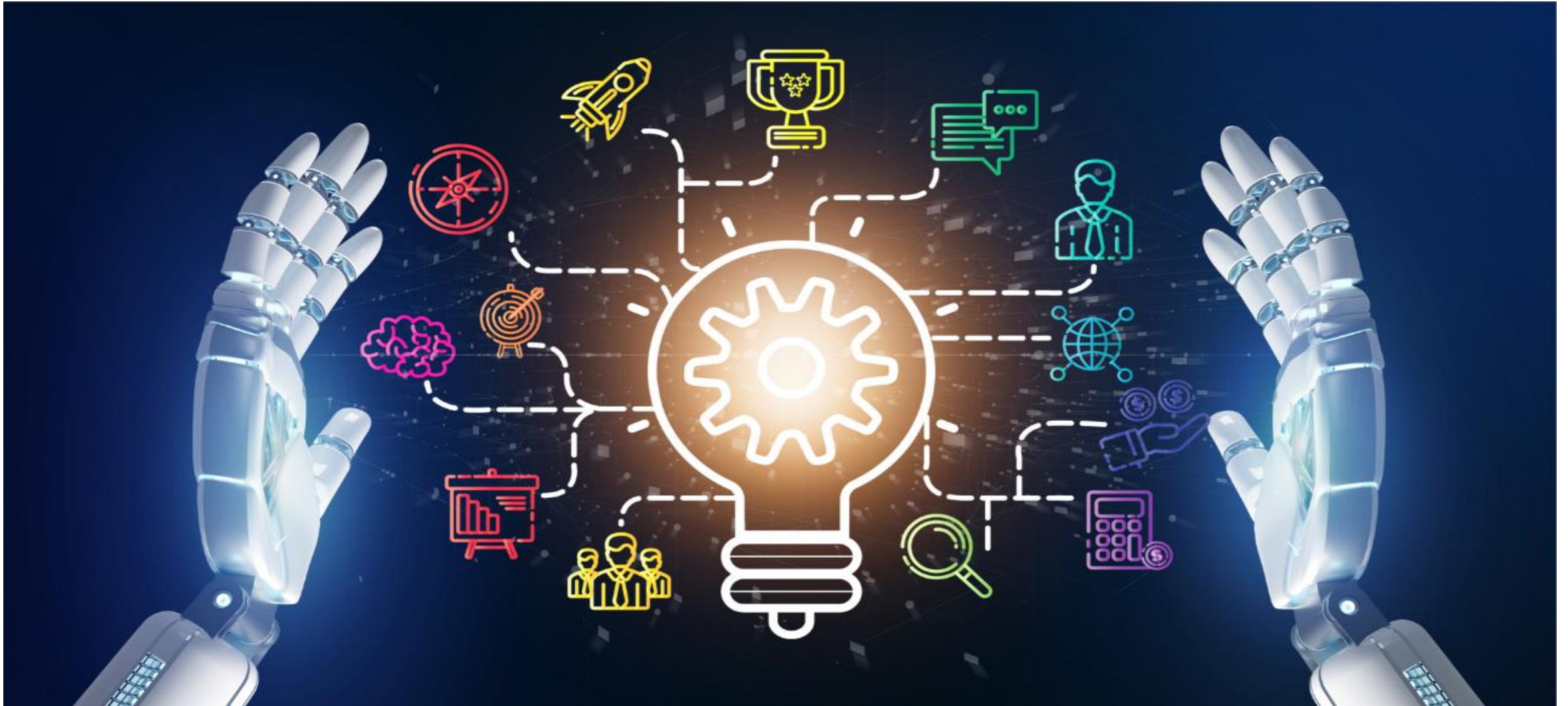


Applications of Image Recognition

- Image Recognition has lead to cutting-edge solutions in different areas - security, medical diagnosis, entertainment to name a few.
- Let us discuss about Artificial Intelligence and Image Recognition:
 - What is a Image Recognition?
 - How will Image Recognition technology be a part of my life?
 - Facial Recognition - An application of Image Recognition
 - Defect detection- An application of Image Recognition
- Where do you think you can use Image Recognition?



Future of AI



FUTURE OF AI

Once you Trust Self
Driving Cars with your life you
Pretty much will Trust in Artificial
Intelligence with Anything

-DAVE WATERS



Self Driving Cars

At level 0, the driver is responsible for performing all tasks to drive the car- from applying brakes to changing gear to control the steering.

Level 1 is driver assistance, where the driver assistance systems support the driver but do not take full control. One such feature is the park assist feature. Here, the driver only takes care of the car's speed, while the car controls the steering.

Level 2 is when the car can drive alone, but the driver has to be present in case the system fails. Tesla's Auto-Pilot and Nissan's Pro-Pilot, both provide the steering, acceleration and braking systems, but the driver has to be able to intervene in case of a failure. Here, the driver still needs to be alert and keep an eye on the road.

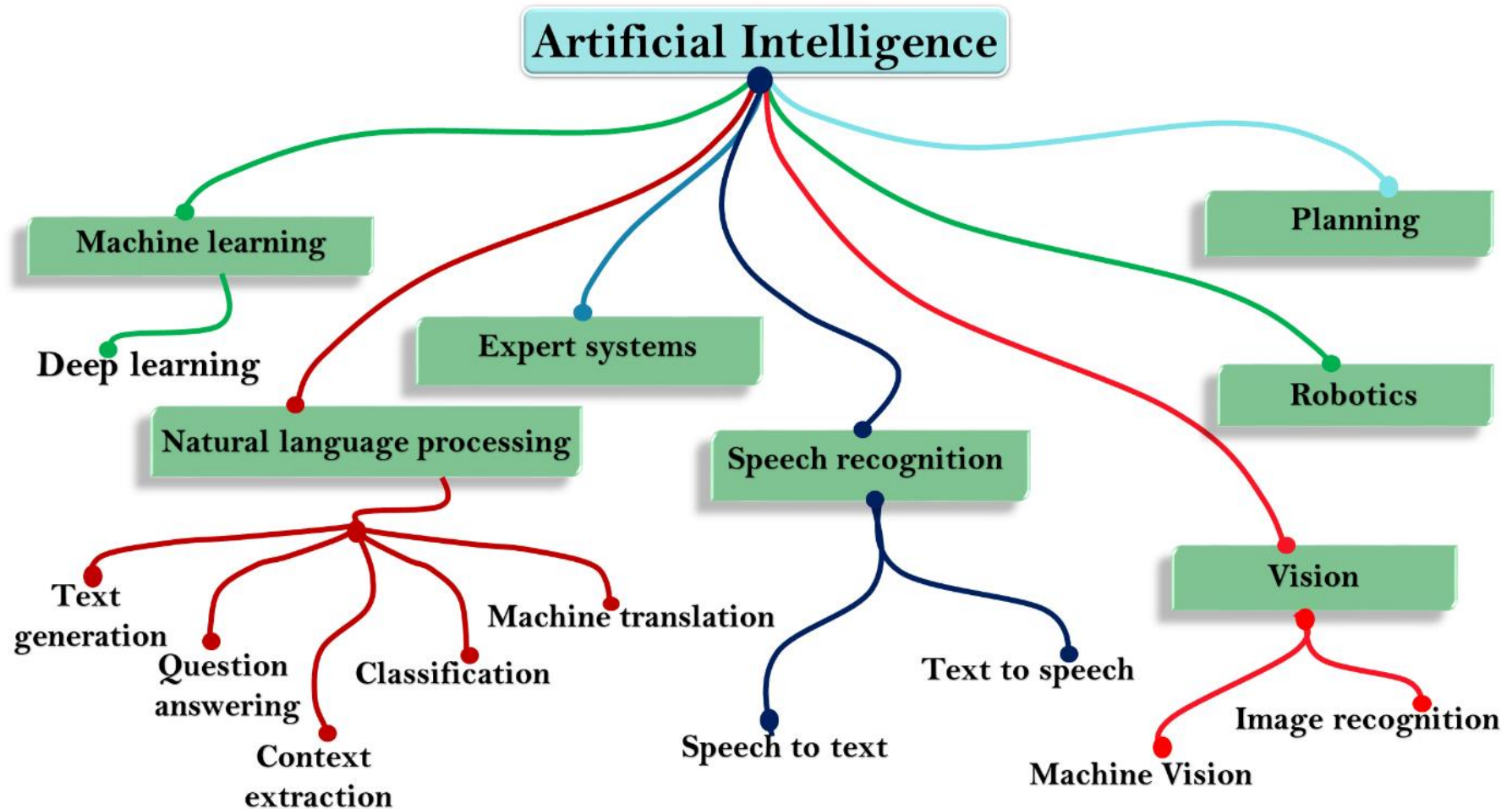
Self Driving Cars

At level 3, the driver can entirely disengage from driving. But, the driver has to be present to handle any unforeseen failures. Audi's A8L can take up full driving responsibility in slow-moving traffic. This was the first car to claim level 3 autonomy.

We can activate full self-driving mode at level 4 in certain conditions only, like cities and states. They can drive independently but do require a driver. Google's Waymo project is one such car, which has been operating in the US driver free for some time now.

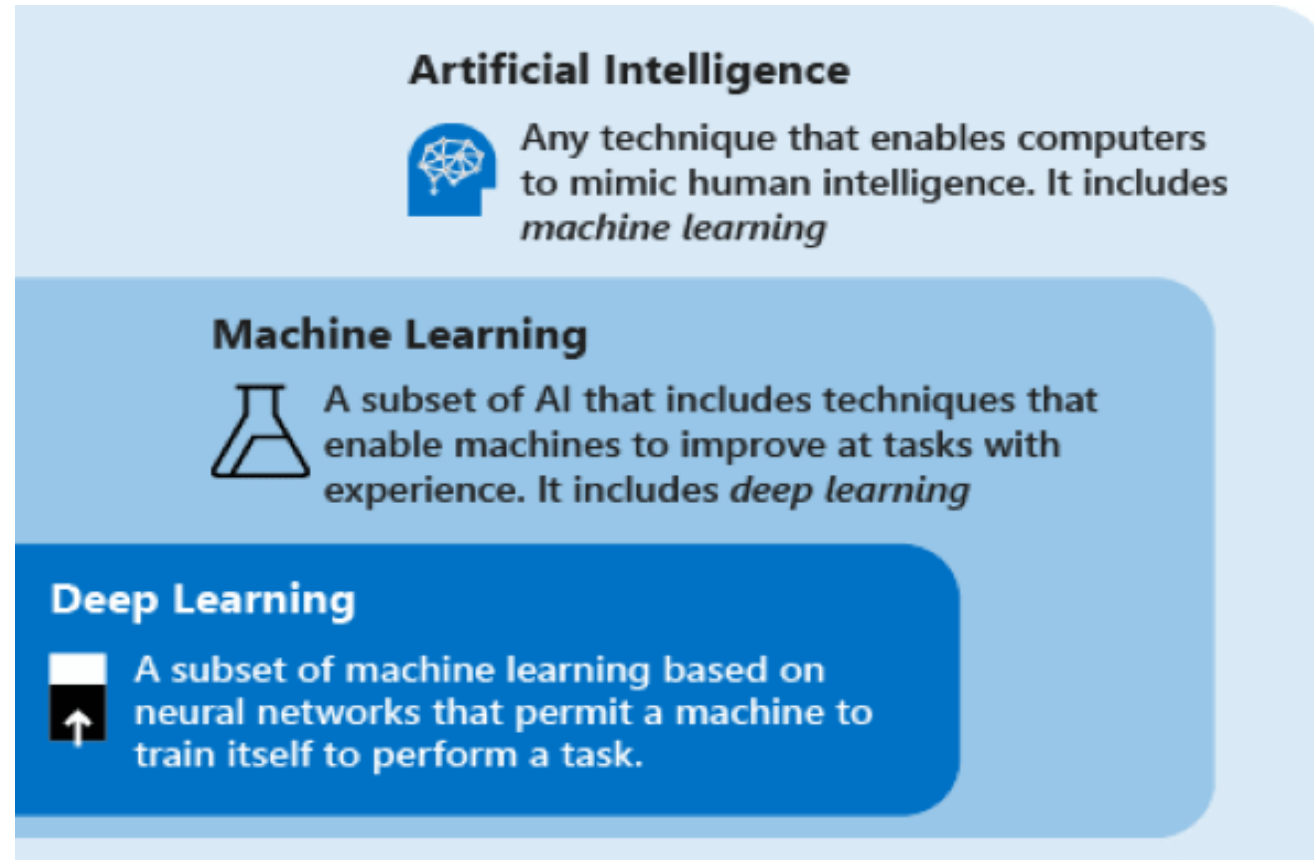
Level 5 is the ultimate level of autonomous transportation, which requires zero human interaction to maneuver. One example of such cars can be a robotic taxi. However, Elon Musk, the CEO of Tesla claims that they will be ready for this level in 2021.

AI Subdomains



<https://static.javatpoint.com/tutorial/ai/images/subsets-of-ai.png>

AI vs ML vs DL



<https://docs.microsoft.com/en-us/azure/architecture/data-guide/big-data/ai-overview>

Difference between AI and ML

ARTIFICIAL INTELLIGENCE	MACHINE LEARNING
AI stands for Artificial intelligence, where intelligence is defined as acquisition of knowledge intelligence is defined as an ability to acquire and apply knowledge.	ML stands for Machine Learning which is defined as the acquisition of knowledge or skill
The aim is to increase chance of success and not accuracy.	The aim is to increase accuracy, but it does not care about success
It works as a computer program that does smart work.	It is a simple concept machine takes data and learn from data.
The goal is to simulate natural intelligence to solve complex problem.	The goal is to learn from data on certain task to maximize the performance of machine on this task.
AI is decision making.	ML allows system to learn new things from data.

Machine Learning

Herbert Alexander Simon:

“Learning is any process by which a system improves performance from experience.”

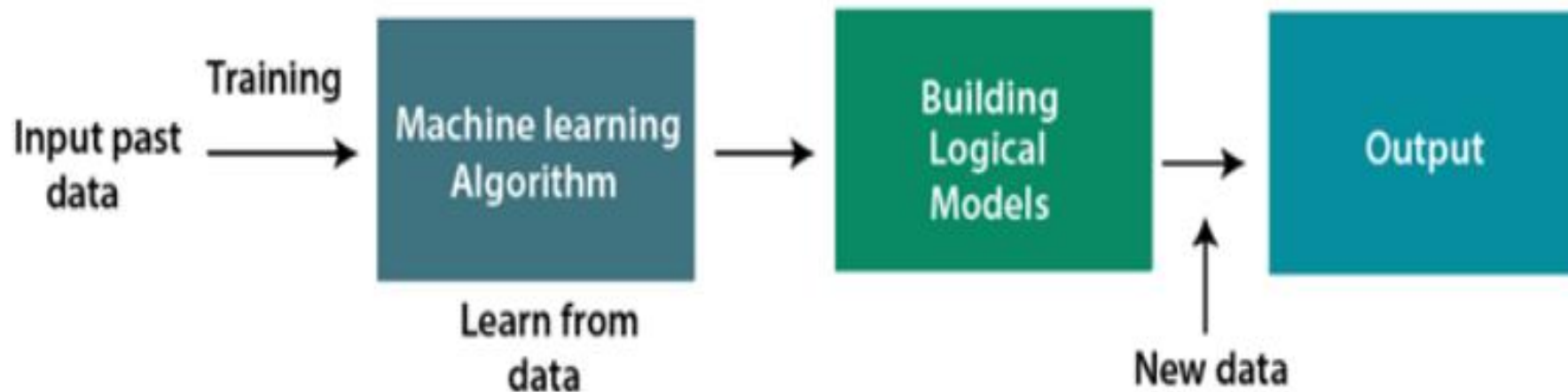
“Machine Learning is concerned with computer programs that automatically improve their performance through Herbert Simon experience.”



Turing Award 1975
Nobel Prize in Economics 1978

MACHINE LEARNING

Machine Learning is the field of study that gives computers the capability to learn without being explicitly programmed.



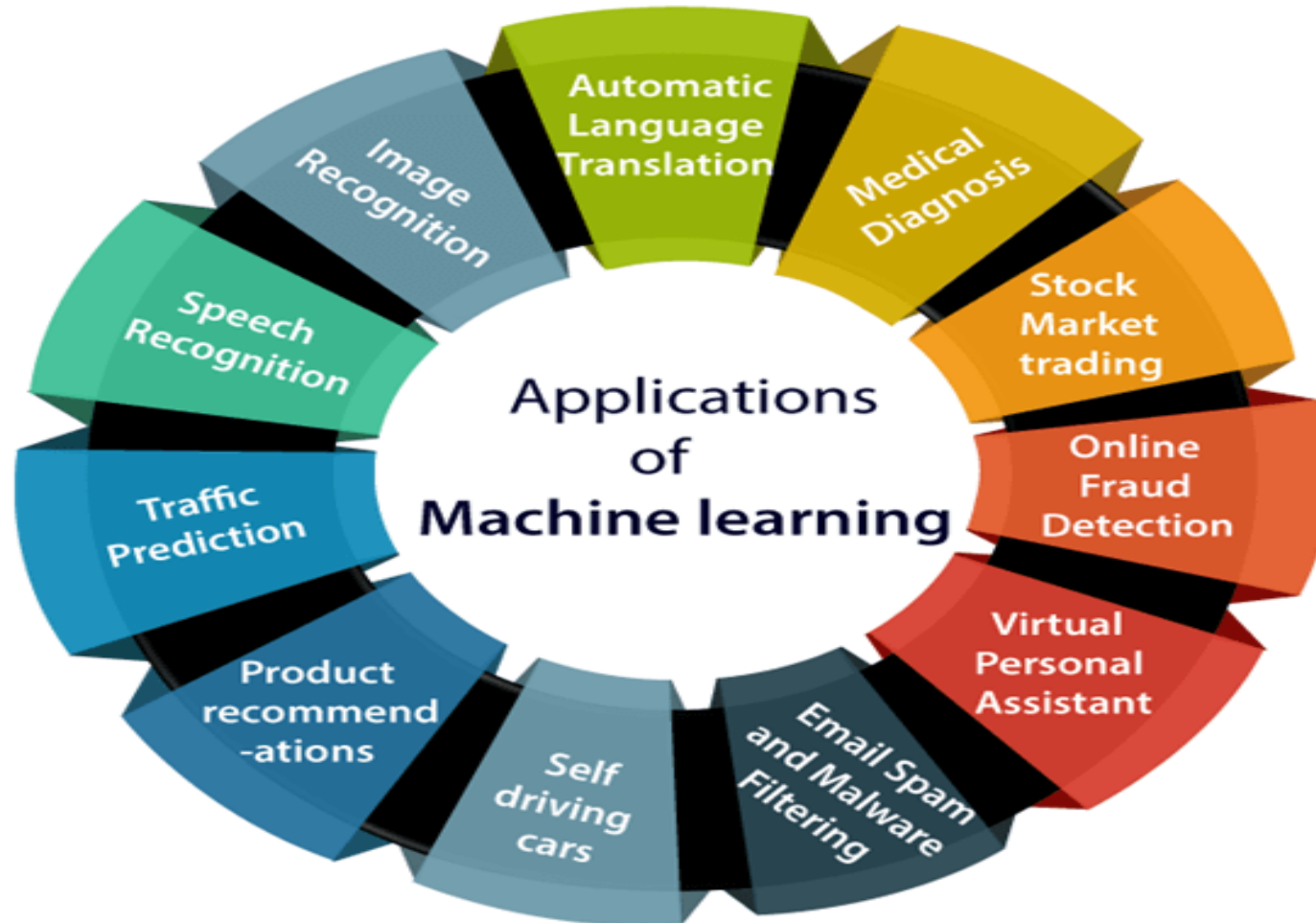
<https://static.javatpoint.com/tutorial/machine-learning/images/introduction-to-machine-learning2.png>

Pipeline of Machine Learning



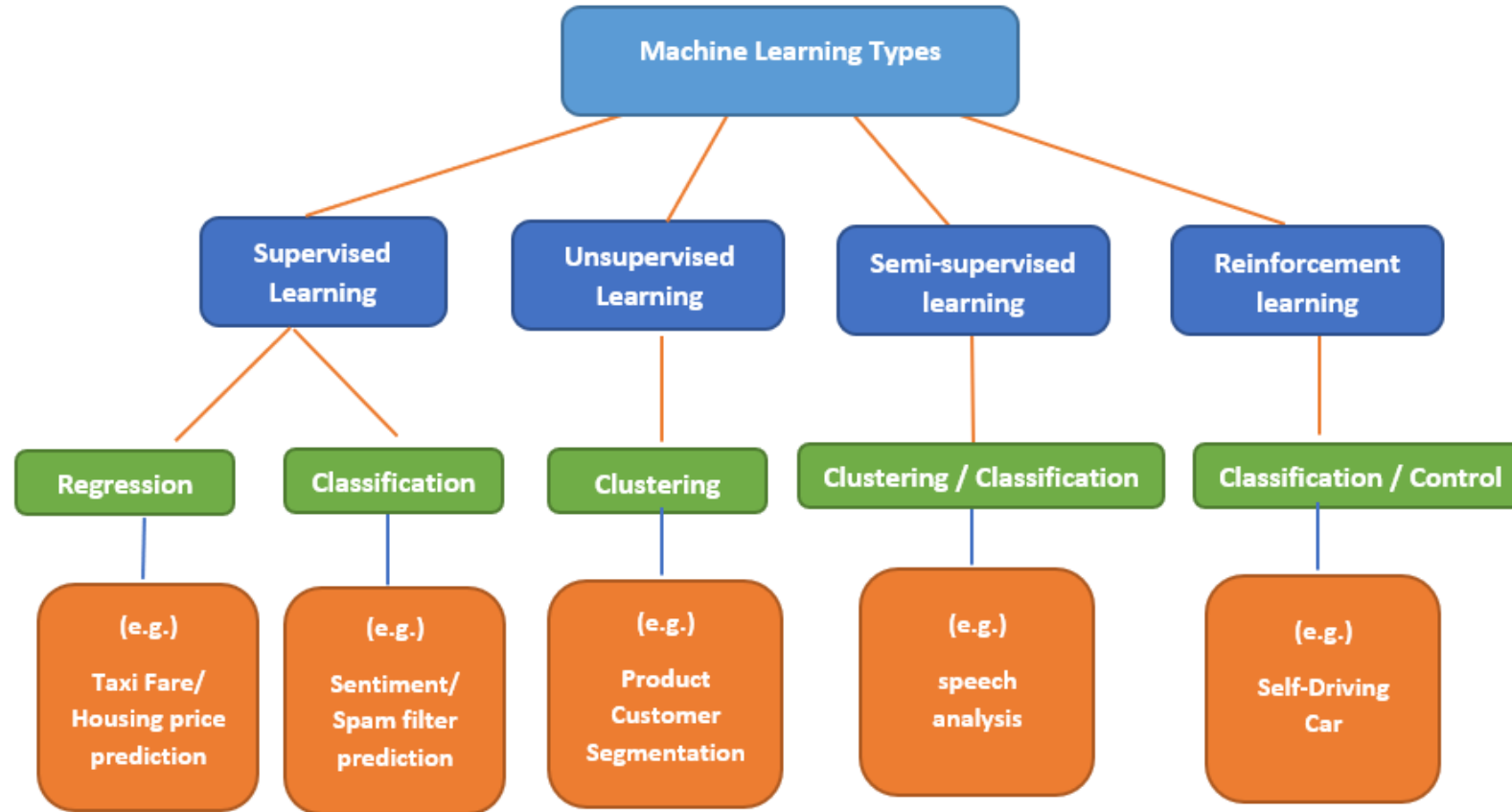
<https://www.xenonstack.com/blog/machine-learning-pipeline/>

Real time applications of ML



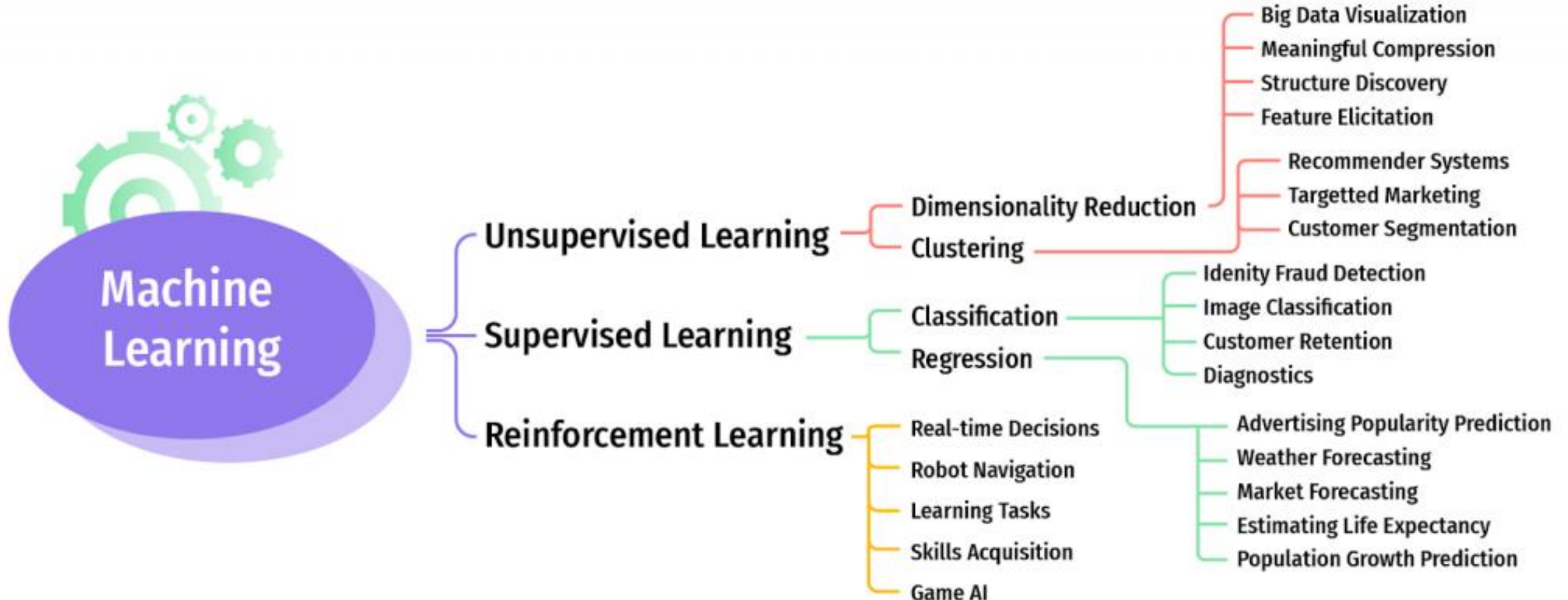
<https://www.javatpoint.com/applications-of-machine-learning>

Types of Machine Learning

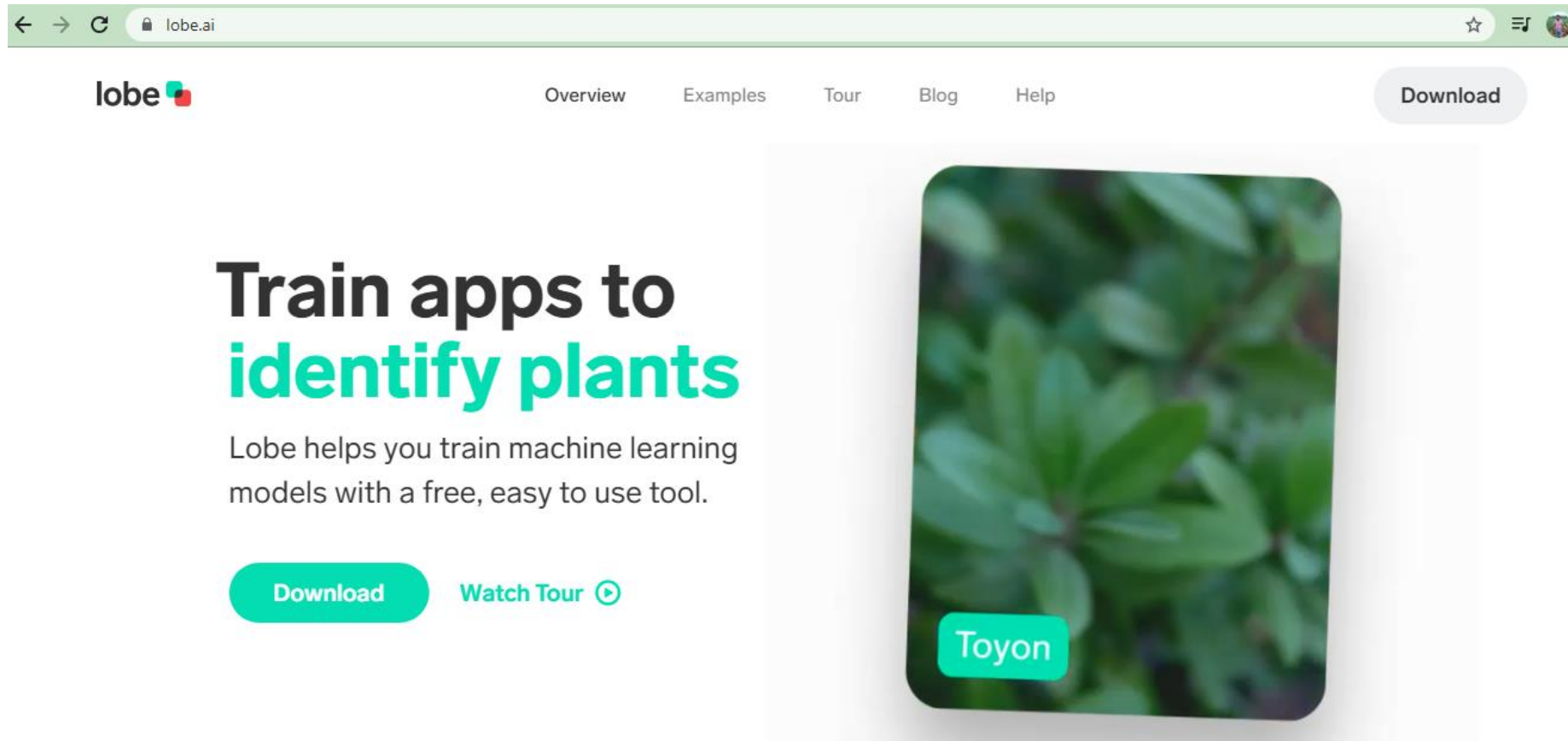


https://social.technet.microsoft.com/wiki/cfs-filessystemfile.ashx/_key/communityserver-wikis-components-files/00-00-00-00-05/7002.5_5F00_1.PNG

Types of Machine Learning



PRACTICAL : Image Recognition on Microsoft Lobe



<https://lobe.ai/>

PYTHON BASICS

What is Python?

- Python is a General-Purpose Programming language that is often applied in scripting roles.
- So, Python is programming language as well as scripting language.
- Python is an Interpreted language

Why was Python Created?

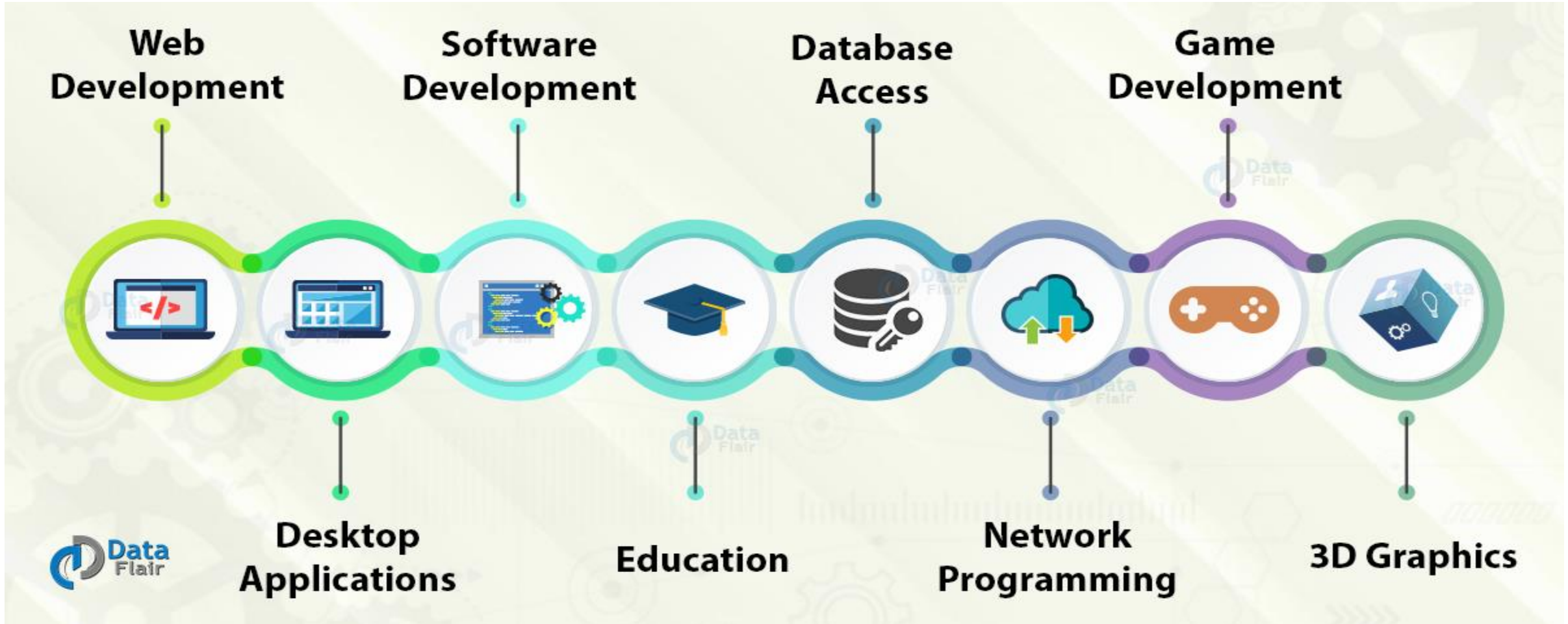
“My original motivation for creating Python was the perceived need for a Higher-level language in the Amoeba [Operating Systems] project.

I realized that the development of system administration utilities in C was taking too long. Moreover, doing these things in the Bourne shell wouldn't work for a variety of reasons.

So, there was a need for a language that would bridge the gap between C and the shell”

- Guido Van Rossum

Python - Application



Variables

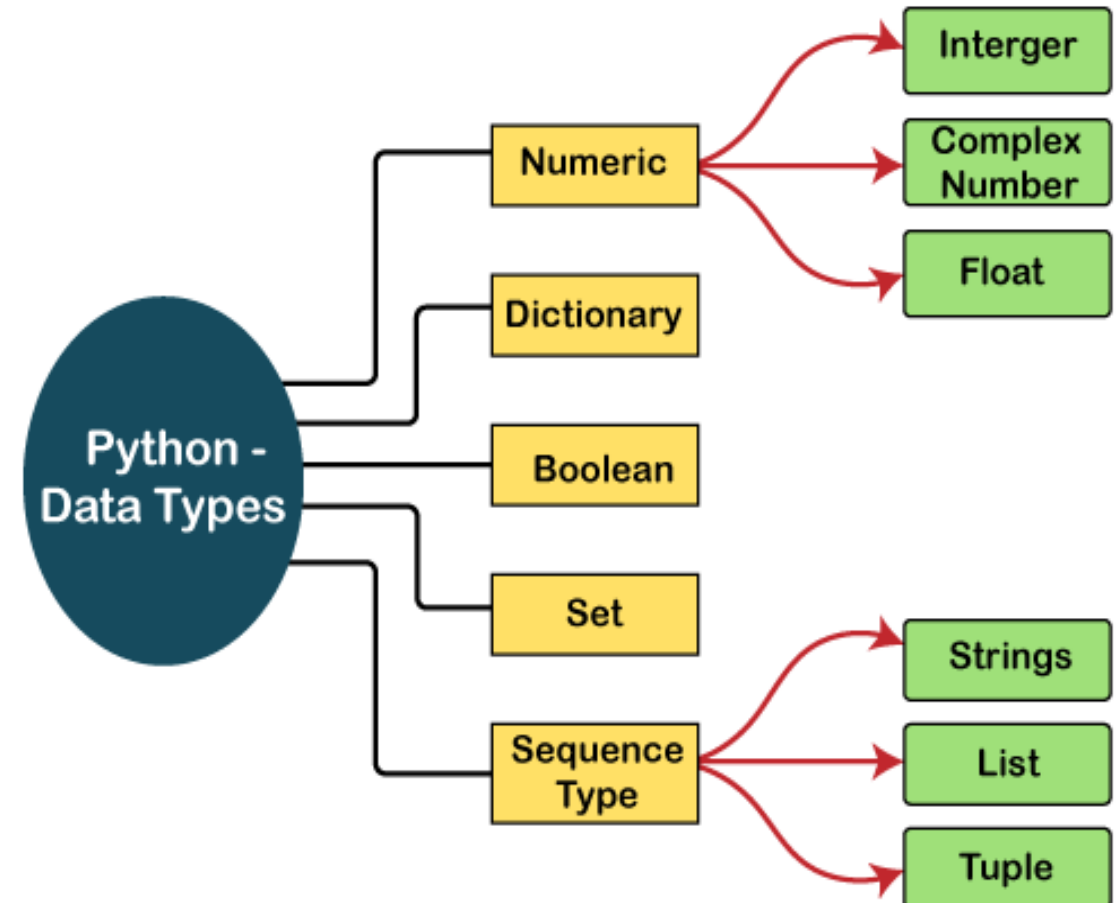
Variables are containers for storing data values

Variables and data types in python as the name suggests are the values that vary

A Variable in python is created as soon as a value is assigned to it

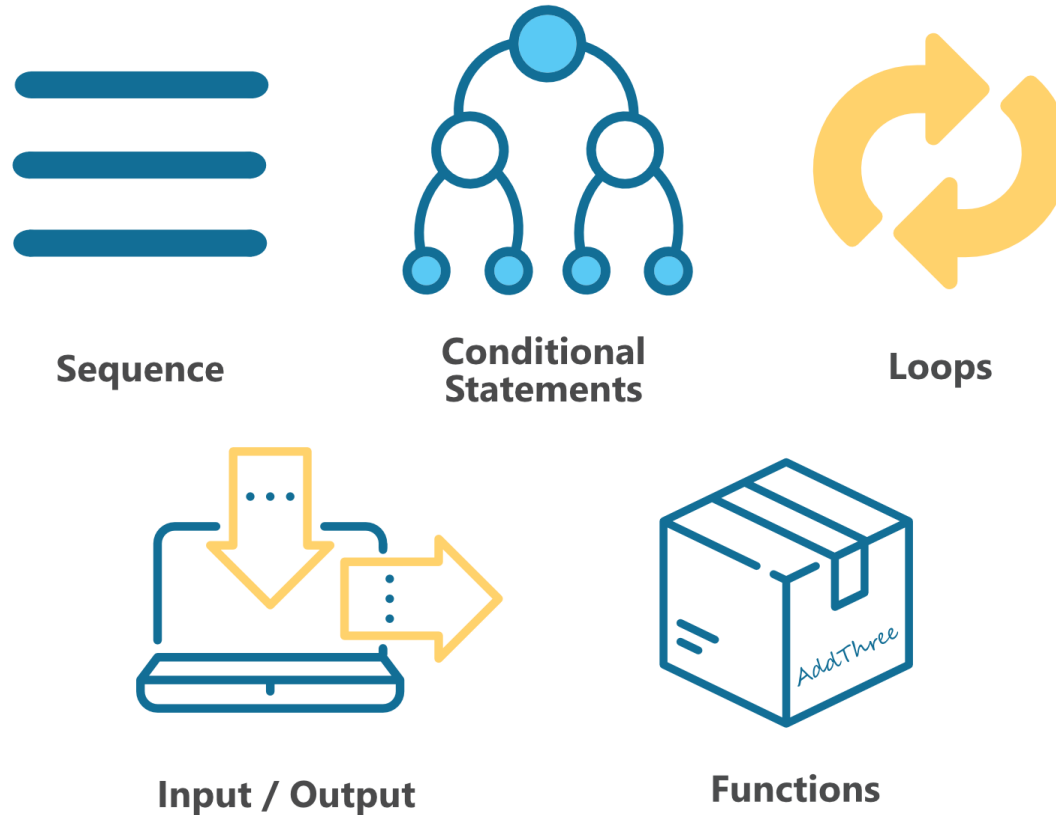
What are the Datatypes in Python?

- Numeric
- Sequence Type
- Boolean
- Set
- Dictionary



<http://www.javatpoint.com/python-data-types>

Controls Structures in python?



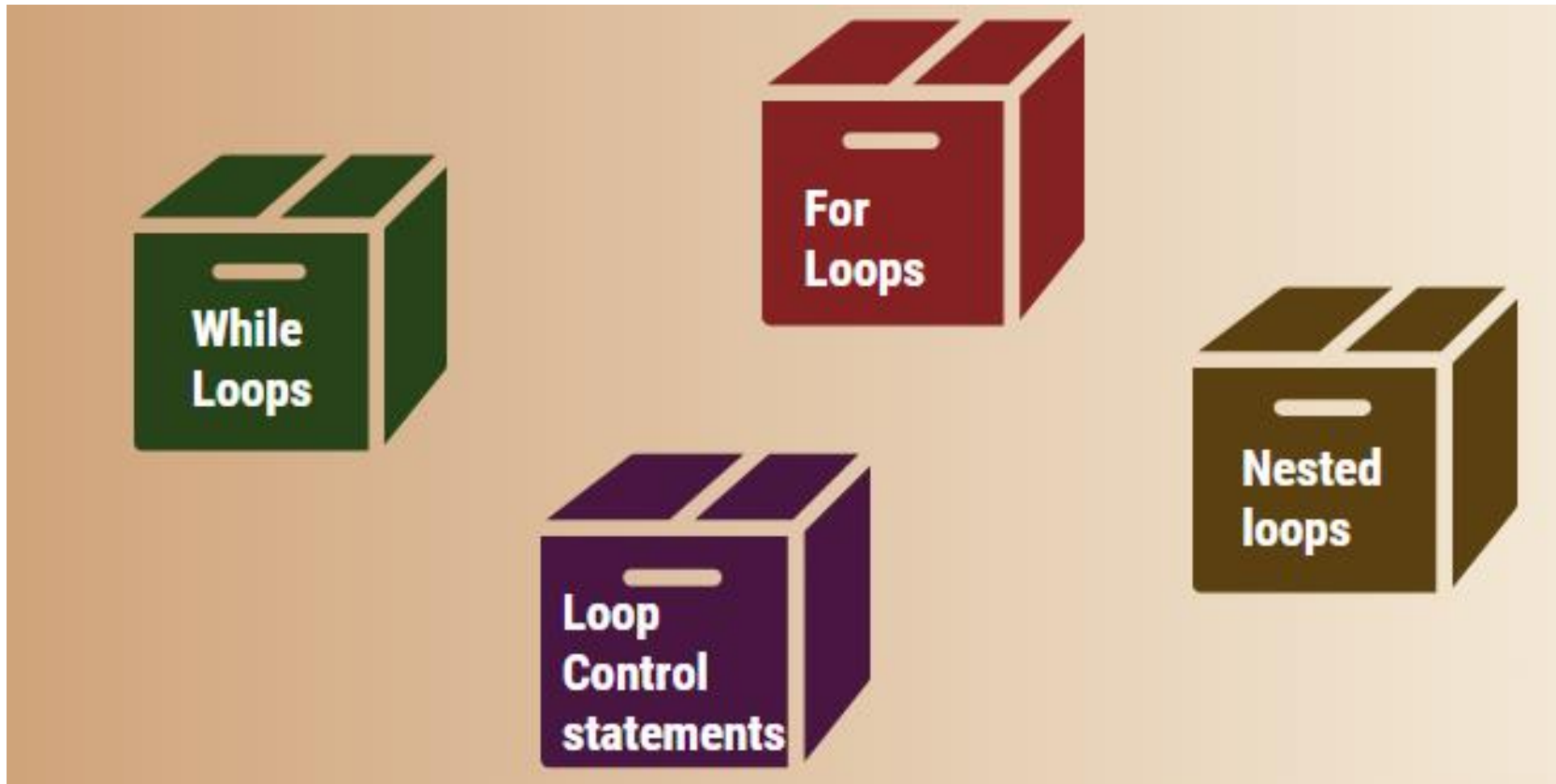
https://microbit-challenges.readthedocs.io/en/latest/_images/control_structures_diagram.png

Decision Making Statements in Python?



<https://techvidvan.com/tutorials/wp-content/uploads/sites/2/2019/12/Decision-Making-in-Python.jpg>

Loops in Python?



<https://techvidvan.com/tutorials/wp-content/uploads/sites/2/2019/12/Decision-Making-in-Python.jpg>

Loops Controls in Python?



<https://techvidvan.com/tutorials/wp-content/uploads/sites/2/2020/01/loop-control-statement-in-python.jpg>

Python Libraries

- Python Libraries are a set of useful functions that eliminate the need for writing codes from scratch
- There are over 137,000 python libraries present today
- Python libraries play a vital role in developing machine learning, data science, data visualization, image and data manipulation applications and more

Machine and Deep Learning libraries in Python



<https://towardsdatascience.com/best-python-libraries-for-machine-learning-and-deep-learning-b0bd40c7e8c>

NUMPY LIBRARY

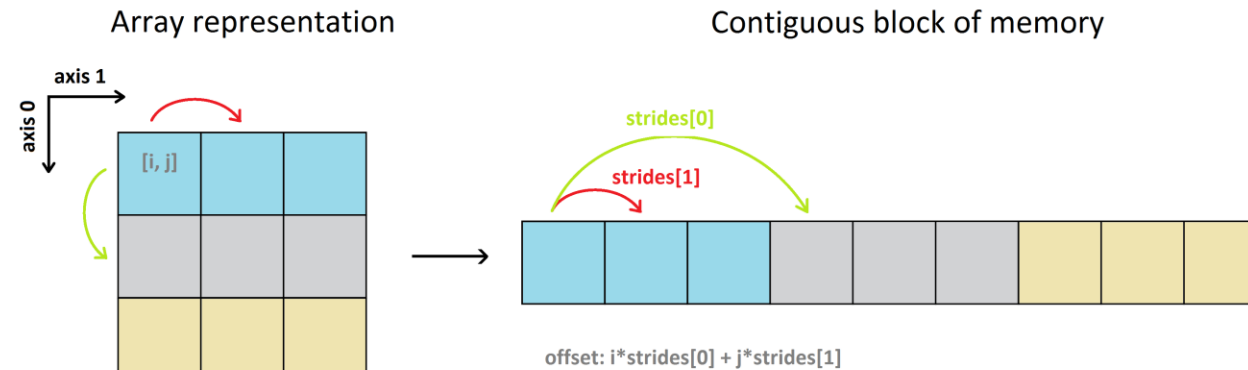


Introduction

- NumPy is an open-source Python library used for working with arrays
- It also has functions for working in domain of linear algebra, fourier transform, and matrices
- NumPy stands for Numerical Python
- The NumPy array is a data structure that efficiently stores and accesses multidimensional arrays
- It consists of a pointer to memory, along with metadata used to interpret the data stored there, notably 'data type', 'shape' and 'strides'
- NumPy is a Python library and is written partially in Python, but most of the parts that require fast computation are written in C or C++

Why NumPy?

- NumPy aims to provide an array object that is up to 50x faster than traditional Python lists
- Numpy array is a contiguous block of memory used to store the same type of data. When the type of data you store is determined, your memory stride is determined. Its essence is an array, so you can only store elements of the same type.
- Strides are necessary to interpret computer memory, which stores elements linearly, as multidimensional arrays. They describe the number of bytes to move forward in memory to jump from row to row, column to column, and so forth.



<https://i.stack.imgur.com/oQQVI.png>

Installing Numpy Module

- You may use Command Prompt/Terminal
- You need pip/conda to install various libraries

`pip install numpy`

`conda install numpy`

Note: It is pre-installed if Anaconda Software is used

Practicals on Numpy

- Creating Numpy Array of different dimensions (Scalars vs Vectors vs Matrices)
- Random Generator Number
- Importance of Random Seed
- Matrix Multiplication in Numpy
- Descriptive Statistics using Numpy
- Interquartile Range
- Broadcasting in Numpy
- How to sort Numpy Arrays?

NumPy Statistical Functions

- `np.amin()`- Minimum value of the element along a specified axis.
- `np.amax()`- Maximum value of the element along a specified axis.
- `np.mean()`- Mean value of the data set.
- `np.median()`- Median value of the data set.
- `np.ptp()`- Range of values along an axis(peak to peak).
- `np.std()`- Standard deviation
- `np.var()` – Variance.
- `np.average()`- Weighted average
- `np.percentile()`- nth percentile of data along the specified axis.

Statistics – Mean, Median and Range

- Mean - Compute the arithmetic mean along the specified axis.

```
np.mean([1,2,3,4,5])
```

- Median - Compute the median along the specified axis.

```
np.median([1,5,2,3,4])
```

- Range - Compute the median along the specified axis.

```
np.ptp([1,5,2,3,4])
```

*Ptp – Point to Point

Statistics – Standard Deviation and Variance

1. Standard deviation is the square root of the average of squared deviations from mean. The function used for this is `np.std()`.

The formula for standard deviation is as follows –

`std = sqrt(mean(abs(x - x.mean())2))`**

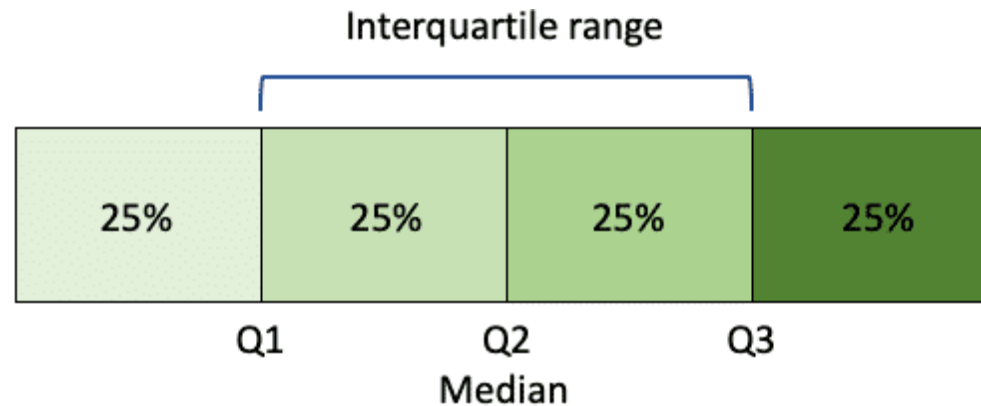
`np.std([1,2,3,4])`

2. Variance is the average of squared deviations, i.e., **`mean(abs(x - x.mean())**2)`**.

Or, standard deviation is the square root of variance.

`np.var([1,2,3,4])`

Statistics – Interquartile Range



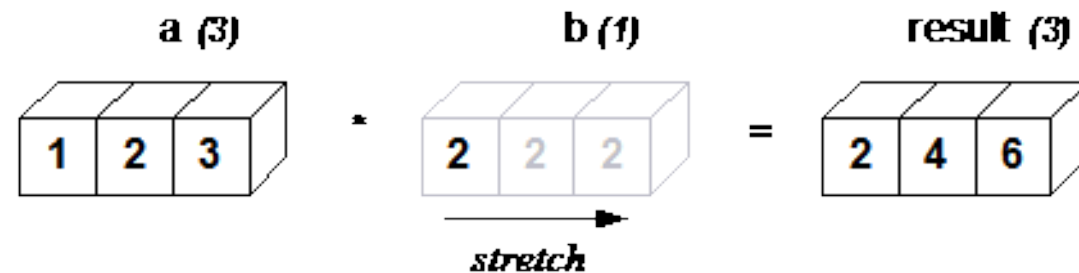
The **first quartile (Q1)**, is defined as the middle number between the smallest number and the median of the data set, the **second quartile (Q2)** – **median** of the given data set while the **third quartile (Q3)**, is the middle number between the median and the largest value of the data set.

In numpy, use `np.percentile()`

https://cdn.scribbr.com/wp-content/uploads/2020/09/iqr_quartiles.png

Broadcasting of an Array

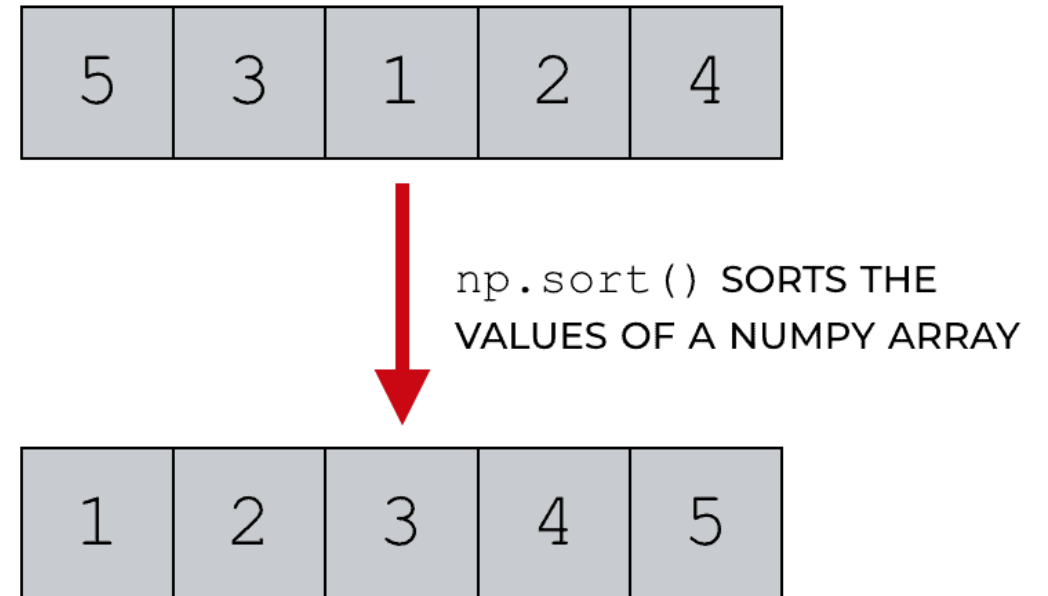
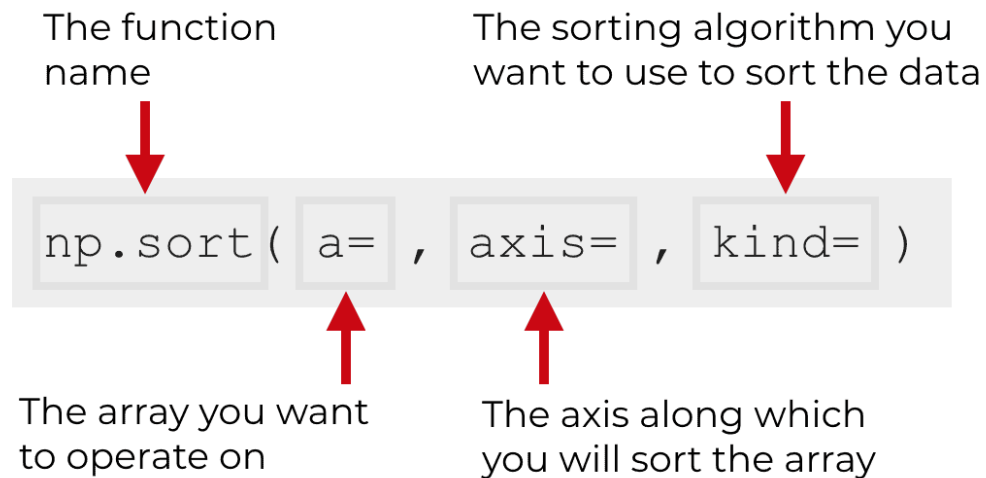
- Broadcasting describes how numpy treats arrays with different shapes during arithmetic operations.
- The smaller array is “broadcast” across the larger array so that they have compatible shapes.



https://numpy.org/doc/stable/_images/theory.broadcast_1.gif

Sorting an Array

- Return a sorted copy of an array.



<https://vrzkj25a871bpq7t1ugcgmn9-wpengine.netdna-ssl.com/wp-content/uploads/2019/05/numpy-sort-simple-example.png>

Data Visualization

The way of Reading Data in a Visual form



What is Data Visualization?

Data visualization is the process of translating data into a chart, graph, or other visual component

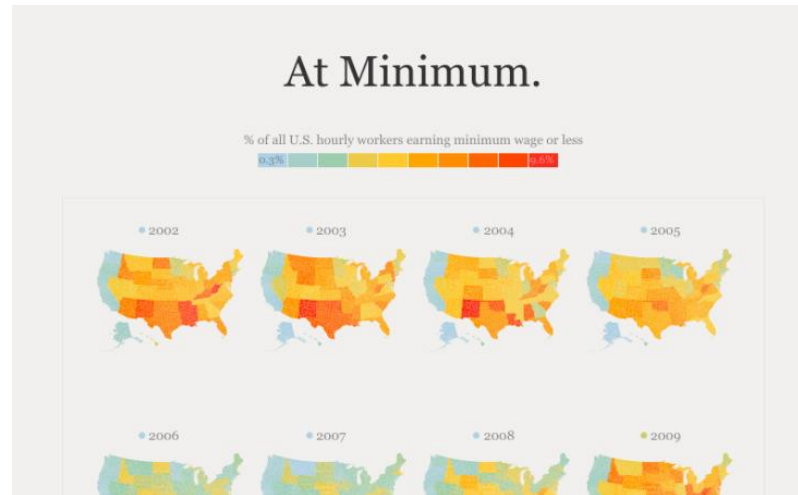


<https://taskassistants.com.ng/product/data-entry/>

Families of Visualizations



Chart



Geovisualization

	1234	678
	368	8034
	2620	2559
	971	322

Tables

<https://www.tableau.com/learn/articles/data-visualization/glossary>

Plotting and Visualization

Plotting is a chart or map showing the movements or progress of an object.

Popular plotting libraries:

matplotlib



plotly



 pandas

seaborn

Matplotlib



Matplotlib is a comprehensive library for creating static, animated, and interactive visualizations in Python.

Matplotlib installation

Using
pip

- *pip install matplotlib*

Using
conda

- *Conda install matplotlib*

Graph plot using Matplotlib

matplotlib

```
Import matplotlib.pyplot as plt
```

```
// Import matplotlib
```

```
X = [1,2,3]
```

```
//x-axis coordinates
```

```
Y= [3,4,5]
```

```
//y-axis coordinates
```

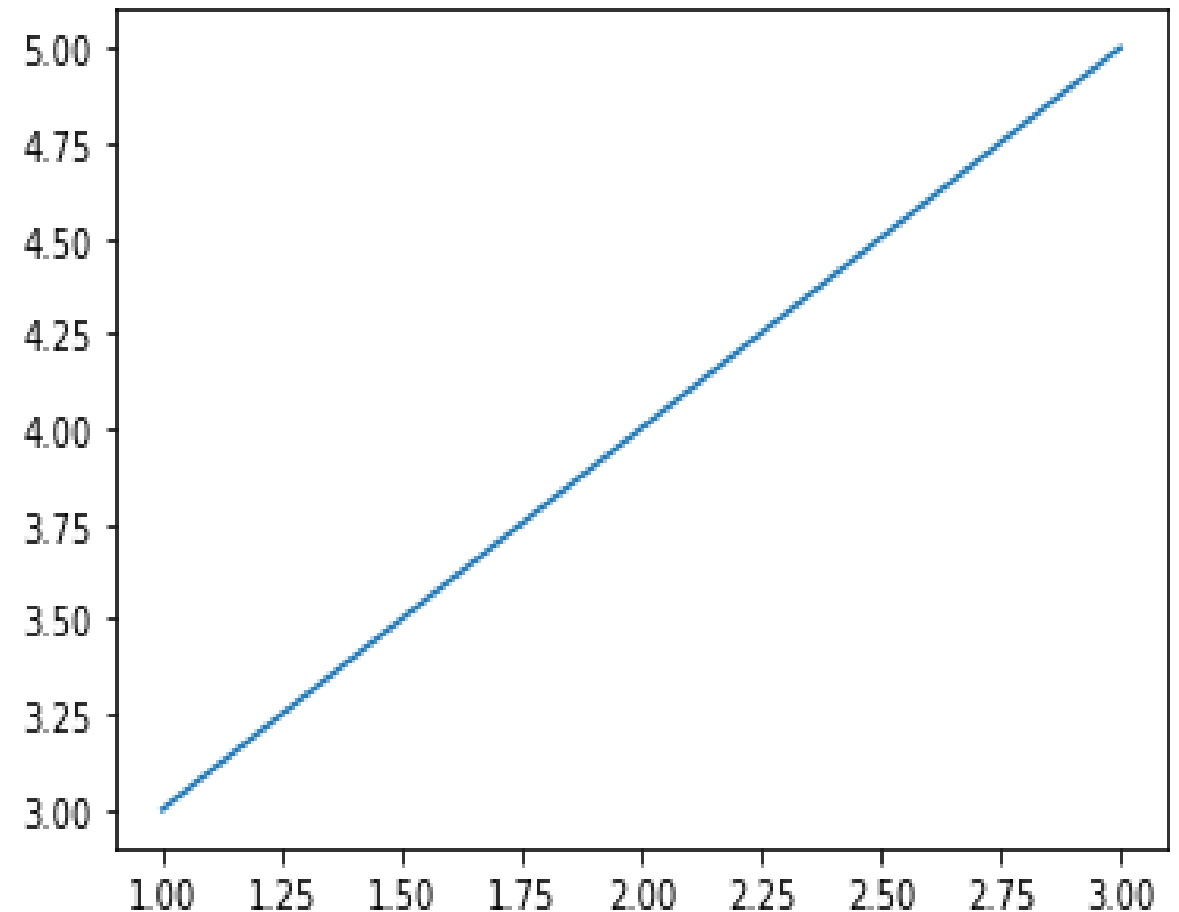
```
plt.plot(x,y)
```

```
// call plot function to draw plot
```

```
plt.show()
```

```
//call show function to show plot on output
```

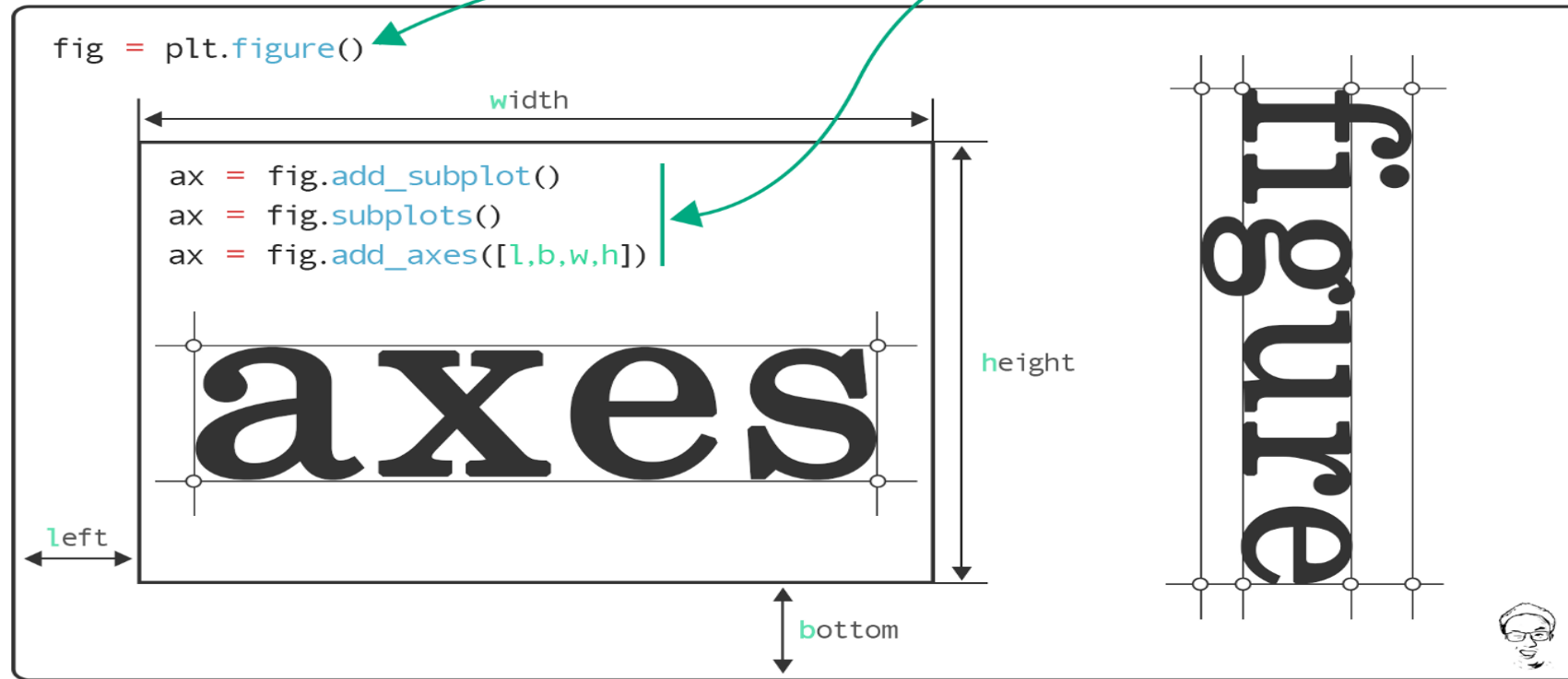
Output



Figures and subplot in Matplotlib

matplotlib

```
fig, ax = plt.subplots()
ax = plt.subplot()
ax = plt.axes([l,b,w,h])
```



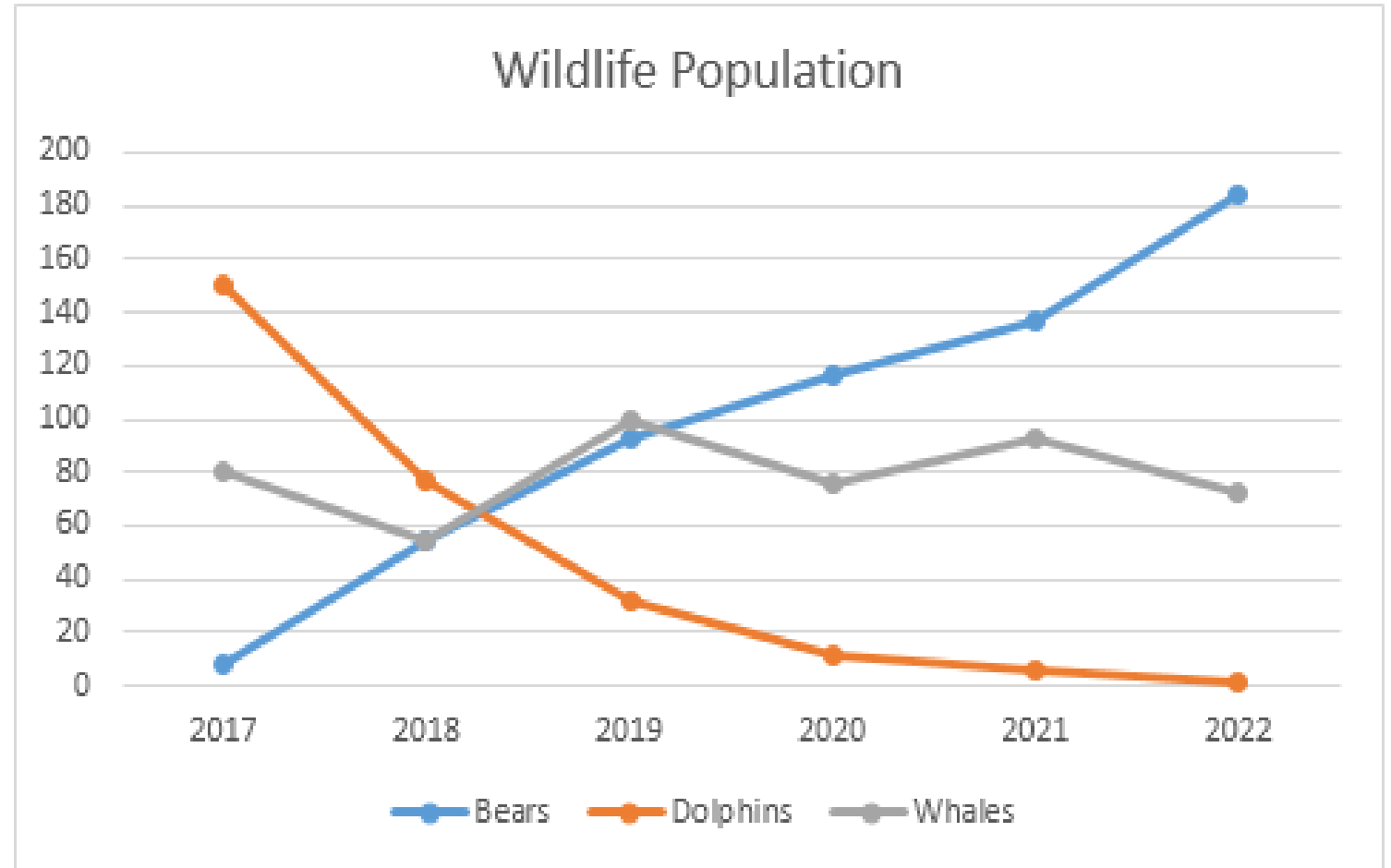
<https://towardsdatascience.com/the-many-ways-to-call-axes-in-matplotlib-2667a7b06e06>

Line Plot

According to the wiki,

“A line chart or line plot or line graph is a type of chart which displays information as a series of data points called ‘markers’ connected by straight line segments. It is a basic type of chart common in many fields”

<https://medium.com/@patrickbfuller/line-plot-7b4068a3a9fc>



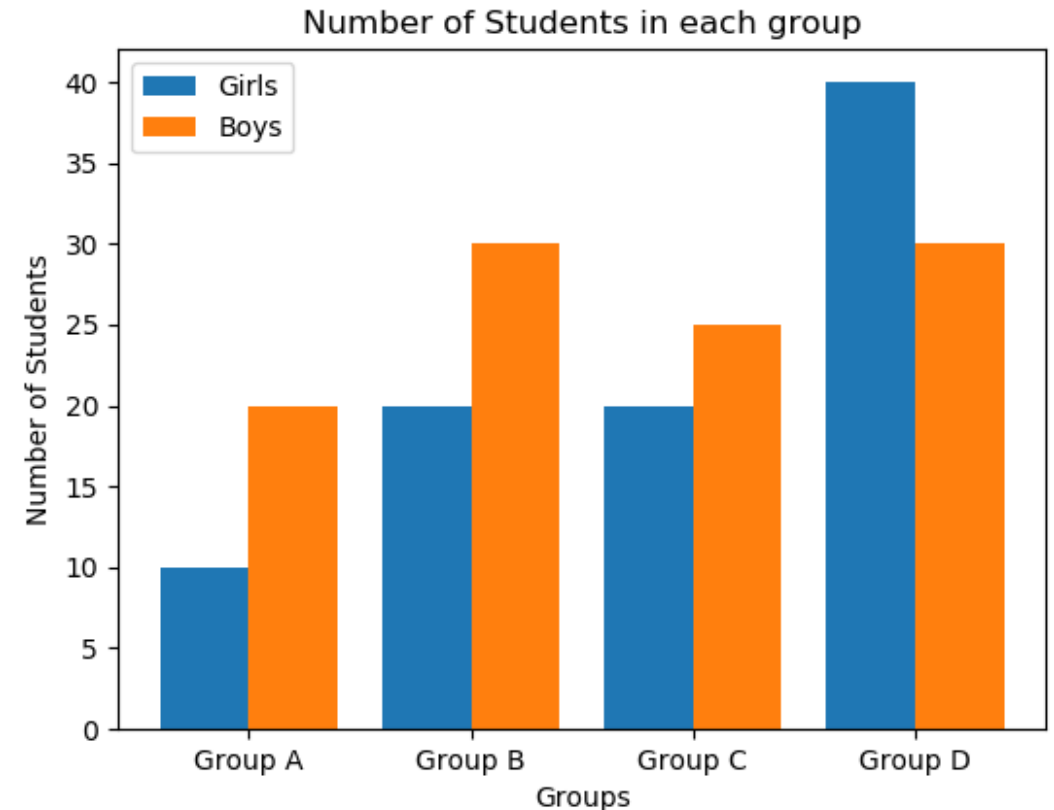
Bar Plot

A bar chart or bar graph is a chart or graph that presents categorical data with rectangular bars with heights or lengths proportional to the values that they represent. The bars can be plotted vertically or horizontally.

Syntax:

ax.bar(x, height, width, bottom, align)

plt.bar(x,y)



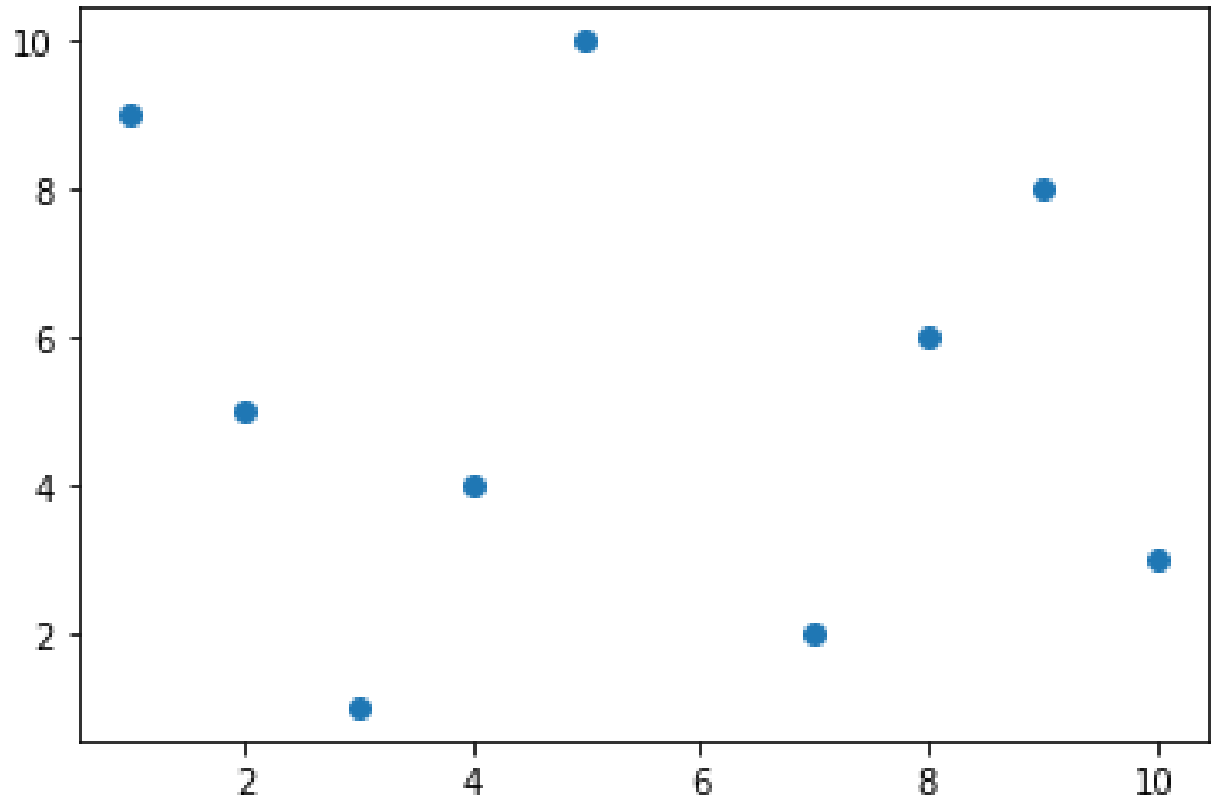
Scatter Plot

A scatter plot is a diagram where each value in the data set is represented by a dot.

Use the **scatter()** method to draw a scatter plot diagram:

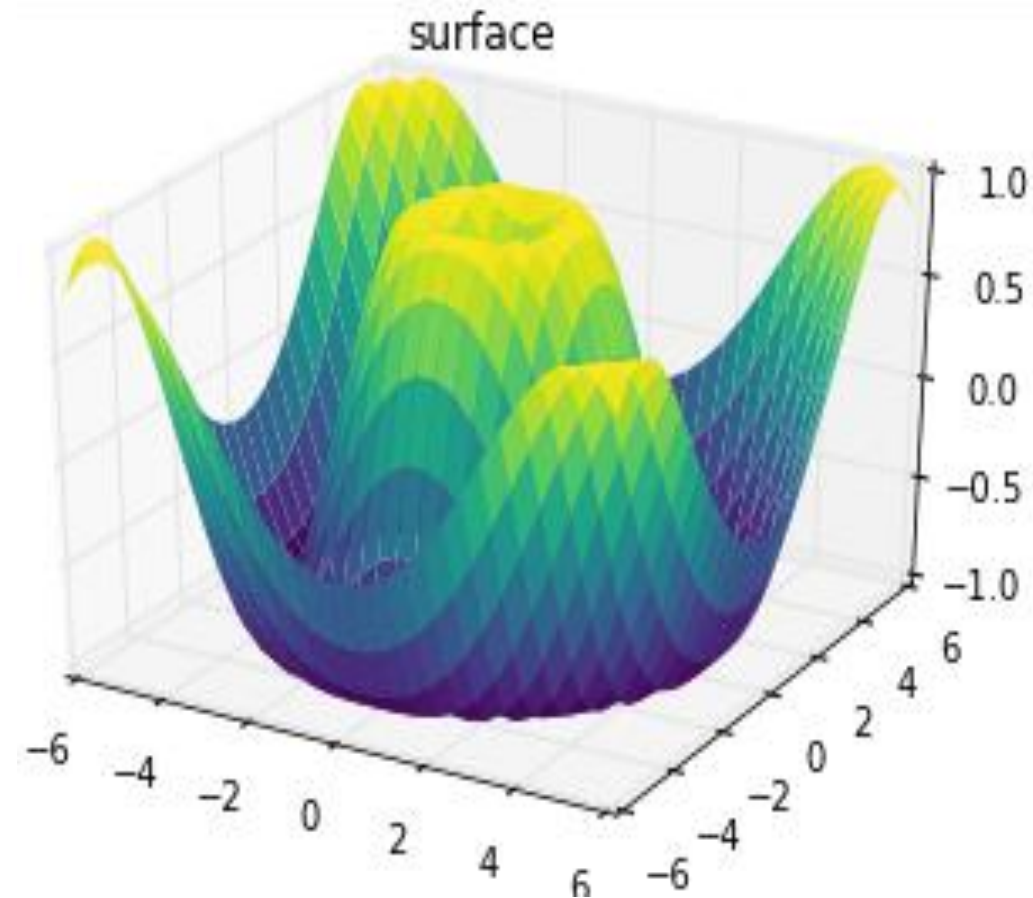
Syntax:

plt.scatter(x, y)



3-D Plotting in Matplotlib

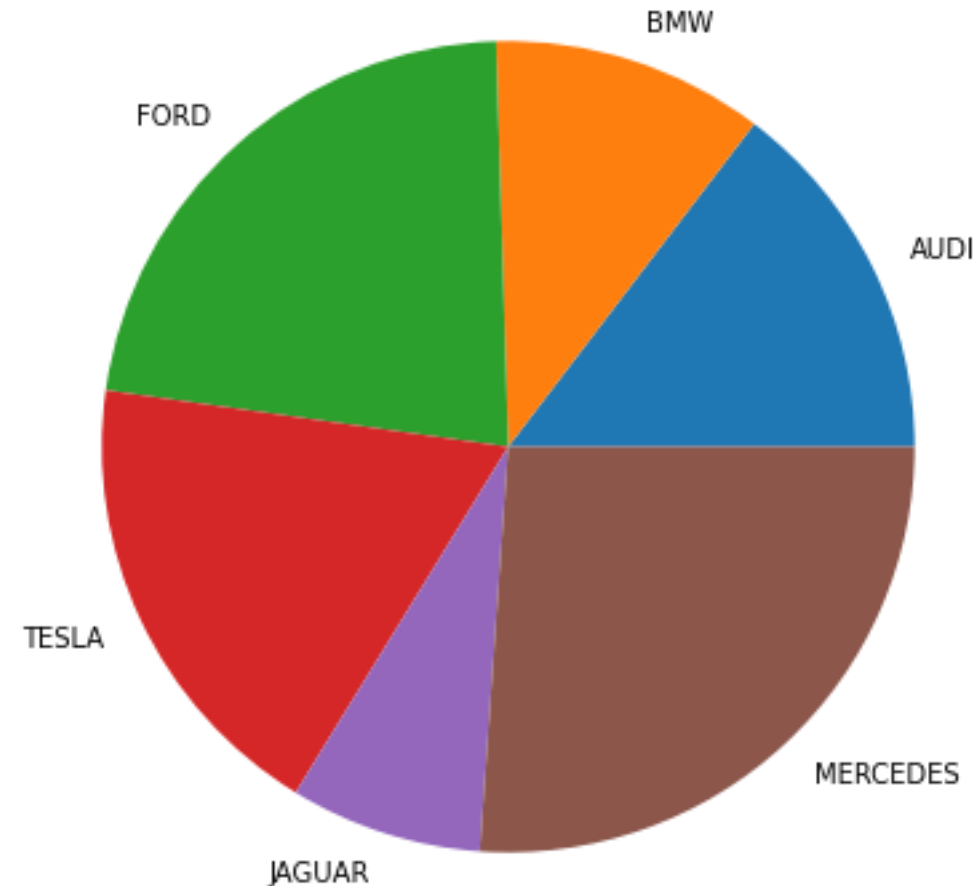
- Three-dimensional plots are enabled by importing the **mplot3d** toolkit, included with the main Matplotlib installation:
- **from mpl_toolkits import mplot3d**
- Syntax:
plt.plot3D()



<https://jakevdp.github.io/PythonDataScienceHandbook/04.12-three-dimensional-plotting.html>

Pie Chart

- Matplotlib API has **pie()** function in its pyplot module which create a pie chart representing the data in an array.
- Syntax:
plt.pie(data)



<https://www.geeksforgeeks.org/plot-a-pie-chart-in-python-using-matplotlib/>

REFERENCES

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3. <https://www.weforum.org/agenda/2018/09/artificial-intelligence-shaking-up-job-market/>
4. https://en.wikiversity.org/wiki/Artificial_intelligence/Introduction
5. <https://techvidvan.com/tutorials/artificial-intelligence-applications/>
6. <https://www.xenonstack.com/blog/machine-learning-pipeline/>
7. <https://docs.microsoft.com/en-us/azure/architecture/data-guide/big-data/ai-overview>
8. <https://www.javatpoint.com/history-of-artificial-intelligence>

THANK YOU