# Assignment 1

Aim: Introducation

Question 1 : What are the differences between the disciplines of artificial intelligence, machine learning and deep learning?

Artificial Intelligence is the concept of creating smart intelligent machines. Machine Learning is a subset of artificial intelligence that helps you build AI-driven applications. Deep Learning is a subset of machine learning that uses vast volumes of data and complex algorithms to train a model.
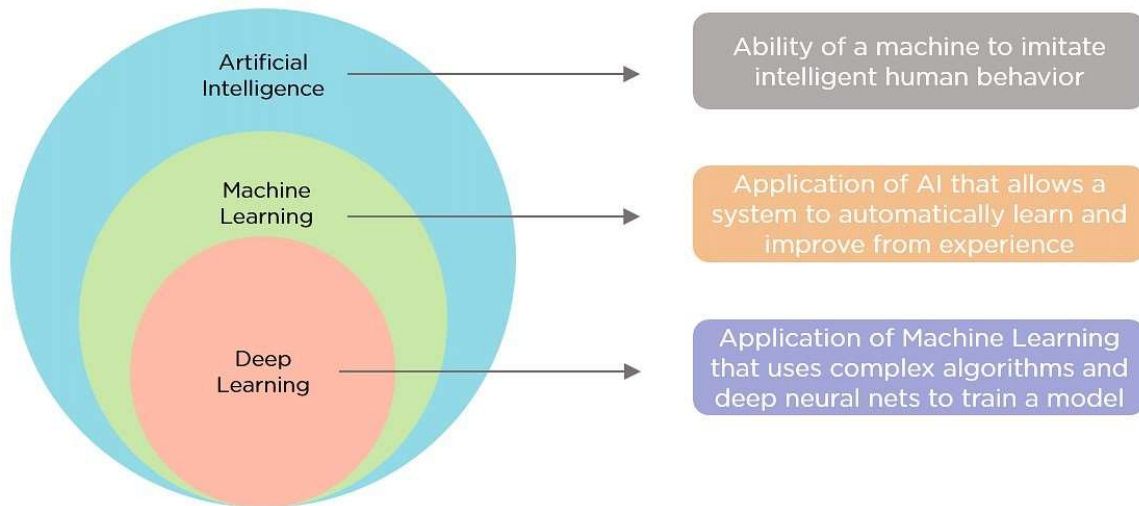
Question 2 : Different areas of Machine Learning

- Social media features: Social media platforms integrate machine learning algorithms to help deliver personalised experiences to you. Facebook notes your activities, including your comments, likes, and time spent on different types of content. The algorithm learns from your activity and makes pages and friend suggestions tailored to you.

- Virtual assistants: Apple's Siri, Amazon's Alexa, and Google Now are all popular options if you're looking for a virtual personal assistant. These voice-activated devices can search for flights, check your schedule, set alarms, and more. Machine learning is a key component of these smart devices and speakers. They collect information and

refine it each time you interact with them. The machine can then use that data to give results that best match your preferences.

- Product recommendations: Popular among e-commerce websites, product recommendations are a common machine learning application. It lets these sites track your behaviour based on your searches, previous purchases, and shopping cart history to make suggestions and recommendations about products you may be interested in.

- Image recognition: This complex technology is cropping up in various fields. You've probably seen this daily while uploading a photo to your social media platform. When you tag someone in an image, the platform recognises them. It can also be transformative for identifying potential threats or criminals, unlocking phones and mobile devices, and finding missing persons.

Question 3 : Explore and study following Python libraries in Context of Machine Learning- with its basic functions.

- Numpy
- Scipy
- Scikit-learn
- Theano
- TensorFlow
- Keras
- PyTorch
- Pandas
- Matplotlib

1. NumPy

NumPy is a fundamental library for numerical computing in Python. It provides support for arrays, matrices, and many mathematical functions to operate on these data structures.

- Key Features:
    - ndarray: A powerful N-dimensional array object. o Mathematical Functions: Functions for linear algebra, random number generation, Fourier transform, etc.
    - Broadcasting: Supports element-wise operations on arrays of different shapes.

o Integration: Works well with other scientific computing and machine learning libraries.

2. SciPy

SciPy builds on NumPy and provides additional functionality for scientific and technical computing.

- Key Features:
    - o Optimization: Algorithms for function minimization (e.g., scipy.optimize).
    - o Integration: Numerical integration routines (e.g., scipy.integrate).
    - o
    - o Interpolation: Tools for interpolation and smoothing of data (e.g., scipy.interpolate).
    - o Signal Processing: Signal processing tools (e.g., scipy.signal).
    - o Linear Algebra: More advanced linear algebra operations (e.g., scipy.linalg).

3. Scikit-learn

Scikit-learn is a comprehensive library for machine learning, providing simple and efficient tools for data mining and data analysis.

- Key Features:
  - Classification: Algorithms for classification (e.g., SVM, random forest).
  - Regression: Algorithms for regression (e.g., linear regression, ridge regression).
  - Clustering: Algorithms for clustering (e.g., k-means, DBSCAN). ₒDimensionality Reduction: PCA, LDA, etc. ₒModel Selection: Tools for model selection and evaluation (e.g., cross-validation).

4. Theano

Theano is a numerical computation library that allows you to define, optimize, and evaluate mathematical expressions, particularly those with multi-dimensional arrays.

- Key Features:
  - Efficient Symbolic Differentiation: Automatic differentiation for gradients. ₒGPU Support: Can run operations on the GPU. ₒOptimization: Optimizes the use of memory and computations.

- o Integration with Deep Learning Libraries: Basis for higher-level libraries like Keras.

5. TensorFlow

TensorFlow is an open-source library for numerical computation and machine learning, developed by Google Brain.

- Key Features:
  - o Comprehensive ML Framework: Supports deep learning, traditional machine learning, and everything in between. o

  - o Tensor Operations: Core operations are performed on tensors.
  - o Graph-based Computation: Models are defined as computational graphs.
  - o Eager Execution: Allows for immediate execution of operations.
  - o Extensive Ecosystem: Includes TensorBoard for visualization, TensorFlow Lite for mobile, etc.

6. Keras

Keras is a high-level neural networks API, written in Python and capable of running on top of TensorFlow, Theano, and CNTK.

- Key Features:
    - User-Friendly API: Easy to use and fast to prototype.
    - Modularity: Modular and composable structure. o Support for Convolutional and Recurrent Networks: Easy to build complex models. oRuns Seamlessly on CPU and GPU: Efficient computation.

7. PyTorch

PyTorch is an open-source machine learning library developed by Facebook's AI Research lab. It is known for its flexibility and ease of use.

- Key Features:
    - Dynamic Computational Graphs: Changes can be made on-the-fly, allowing for more flexibility. oEasy-

to-Use API: Intuitive and easy to debug. ₒ Strong GPU Acceleration: Efficient GPU support. ₒ Autograd Module: For automatic differentiation.

8. Pandas

Pandas is a powerful data manipulation and analysis library. It provides data structures and functions needed to manipulate structured data seamlessly.

- Key Features:
    - ₒ DataFrames: 2-dimensional labeled data structures. ₒ Series: 1-dimensional labeled array.
    - ₒ Data Cleaning: Tools for handling missing data and data alignment.
    - ₒ Data Aggregation: Grouping and aggregation operations.
    - ₒ Time Series: Support for time-series data.

9. Matplotlib

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

- Key Features:

- o Versatile Plotting: Supports line plots, bar charts, histograms, scatter plots, etc.
- o Customization: Extensive customization options for plots.
- o Integration: Works well with other libraries like NumPy and Pandas.
- o Interactive Plots: Interactive plotting in Jupyter Notebooks.