* **Neural network:** *information processing paradigm inspired by biological nervous systems, such as our brain*
* **A Neural Network** is a system composed of many simple processing elements operating in parallel which can acquire, store, and utilize experiential knowledge.
* **Structure:** large number of highly interconnected processing elements (*neurons*) working.

**ANN Applications:**

1. ***Classification:*** the aim is to predict the class of an input vector
2. ***Pattern matching:*** the aim is to produce a pattern best associated with a given input vector
3. ***Pattern completion:*** the aim is to complete the missing parts of a given input vector
4. ***Optimization:*** the aim is to find the optimal values of parameters in an optimization problem
5. ***Control:*** an appropriate action is suggested based on given input vectors
6. ***Data mining:*** with the aim of discovering hidden patterns from data (knowledge discovery)
7. ***Noise Reduction:*** removing the non-significant features

* ANNs incorporate the two fundamental components of biological neural networks:
  1. Neurons (nodes)
  2. Synapses (weights)

**Network Layers:**

* **Input Layer**: The activity of the input units represents the raw information that is fed into the network.
* **Hidden Layer** - The activity of each hidden unit is determined by:
  + The activities of the input units and
  + The weights on the connections between the input and the hidden units.
* **Output Layer** - The behavior of the output units depends on:
  + The activity of the hidden units and
  + The weights between the hidden and output units.
* **Phases:**
  + Learning (training)
    - Training can be done using **Back-propagation** technique (will be seen later).
    - Training is done using a big part of known (labeled) data.

– The dataset contains both inputs and their corresponding output(s).

* + - This phase is *time consuming*
  + Testing
    - Testing is done using the **Feed-forward** technique.
    - A small part of the known data is used in this phase.
  + Execution
    - The **Feed-forward** technique is used.
    - New unlabeled data (inputs with unknown outputs) are fed to the NN.
* **Labeled Data:**
  + Data is usually given in one or more consistent dataset(s)
  + Data is divided into two parts:
    - One part for the training/learning phase
    - Another part for the testing phase