

## Competency 13

Explores new trends and future directions of ICT

### 13.1 Explores new trends and future directions in computing

Time: 4 periods

#### **Learning Outcomes**

- Describes intelligent and emotional computing.
- Explains artificial intelligences
- Appreciates man-machine coexistence

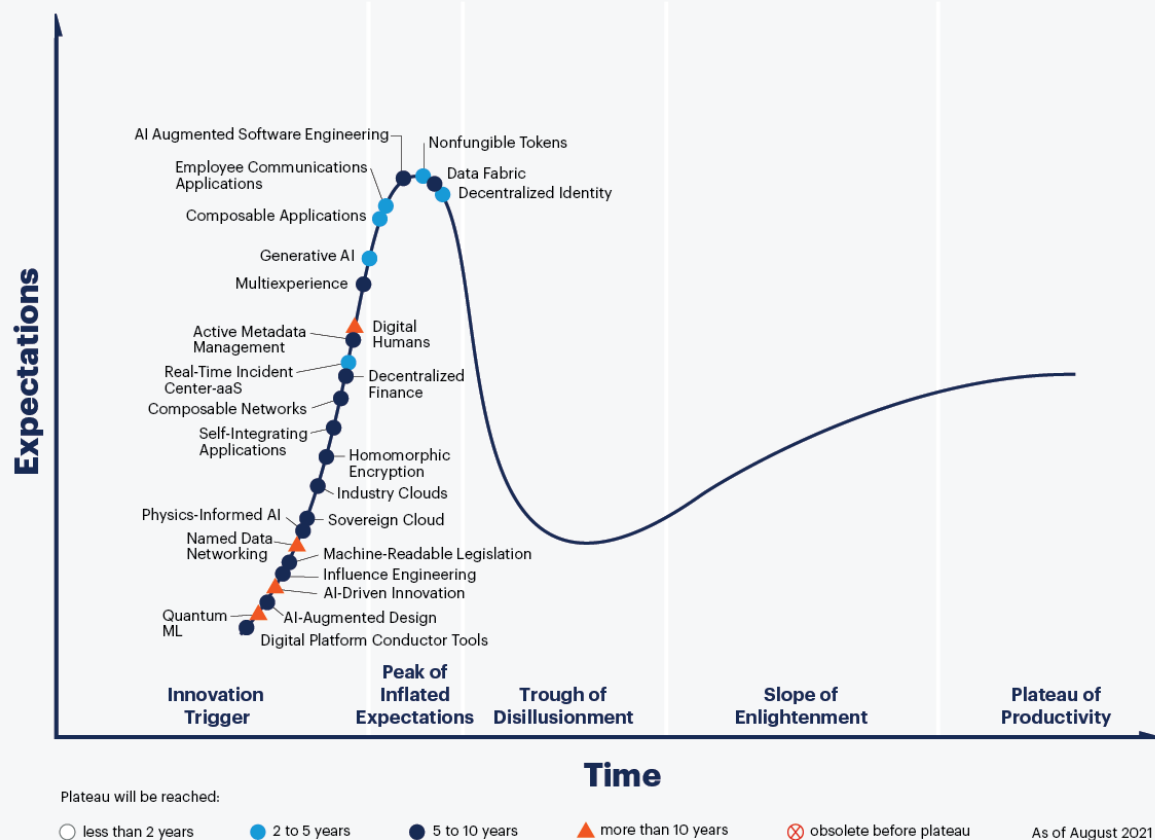
#### **New Trends and Future Directions of ICT**

Nowadays ICT is changing our lives more than ever before. We rely on ICT in many of our day to day activities to make them faster and convenient.

This heavy adoption of ICT by both individuals and markets has inspired scientists and engineers in ICT to actively research on developing new technologies as well as applications in various domains. The Gartner hype cycle – 2020 is shown below figure and it is a very useful tool to recognize top emerging technologies in the world, has five key phases that shows;

1. The inception or the trigger of a technology
2. Peak with inflated expectations
3. Trough of disillusionment with failed implementations and promises
4. The slope of enlightenment with success stories
5. Plateau of productivity with mainstream adoption

## Hype Cycle for Emerging Technologies, 2021



gartner.com

Source: Gartner  
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Gartner

### Intelligent and emotional machines

Evidence on human interest about **intelligent and emotional machines** could be found,

- Even in the ancient Greek mythology where characters such as Talos and Caucasian Eagle are sent to earth by Zeus for human protection.
- Even the modern fictions such as "2001: A Space Odyssey" by Sir Arthur C Clarke
- as well as the famous 80's tele series "Knight Rider" had machines that exhibit not only intelligent but also some emotional characteristics.

- ✓ For example, KITT, the **intelligent** car in Knight Rider, engages in several conversations with its master Michael Knight that shows some **emotions**.
- On the other hand, humans, throughout history, have attempted to build self-operating machines or machines of control mechanism designed to automatically follow a predetermined sequence of operations, or respond to predetermined instructions. Those machines are known as **automatons**.
- However, the growth of such attempts to build truly intelligent machines had been very slow until the discipline of **artificial intelligence was formally begun in the mid-20th century**.
- Following figure shows the famous Maillardet's automaton found in Franklin Institute's museum.



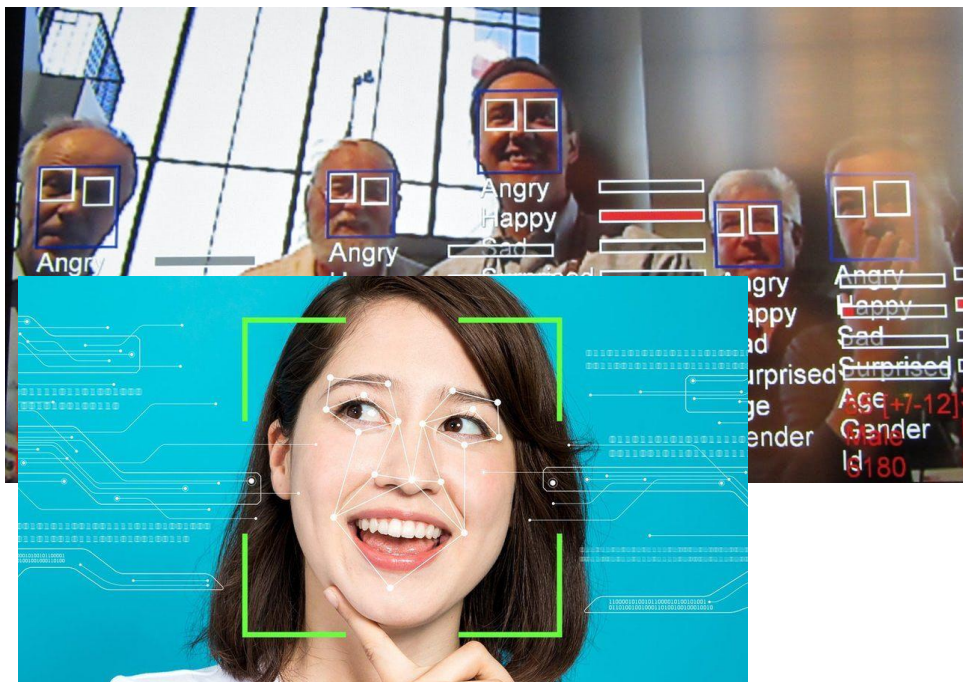
## Emotional Computing, What and Why?

- ✓ People talking back to a computer/smart-phone is common enough usually in a moment of frustration.
- ✓ Getting the computer to respond in kind is a far different task
- ✓ The challenge is not of inventing new software or hardware, but to have ethics involved.
- ✓ If computers are to have emotional components, what role would they play in everyday life?
- ✓ Do human beings really want an emotional relationship with a mechanical mind?

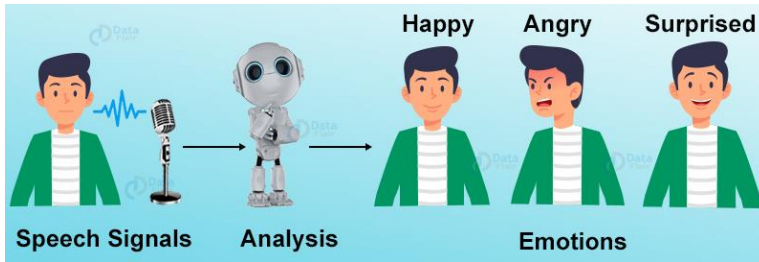
This field is called **Affective Technology**

## Face Recognition and Application

Today, machine prototypes exist that measure human emotional expression through physiological signals such as facial expressions and voice changes and allow a human-like response.



## Voice Recognition and Applications



## Artificial intelligence

**What is intelligence?** Hard to define unless you list some important characteristics, such as Abstract concepts, mathematics, language, problem solving, memory, logical reasoning, planning ahead, emotions, morality, ability to learn/adapt etc..

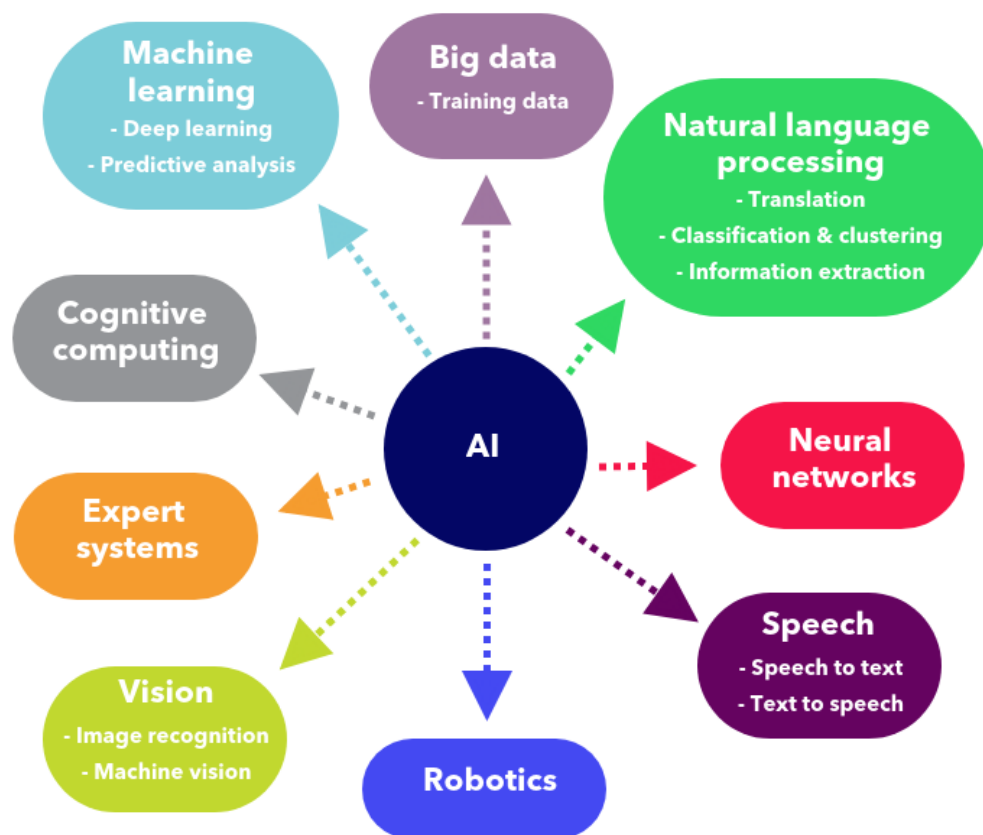
## Machine intelligence

- ✓ Computer which follows problem solving processes something like that in humans.
- ✓ Intelligent systems display machine-level intelligence, reasoning, often learning, and self-adapting.

## Artificial Intelligence

- ✓ Artificial Intelligence (AI) is usually defined as the science of making computers do things that require intelligence when done by humans.
- ✓ Some important AI Techniques are: Neural Network, Genetic Algorithm, and Expert Systems

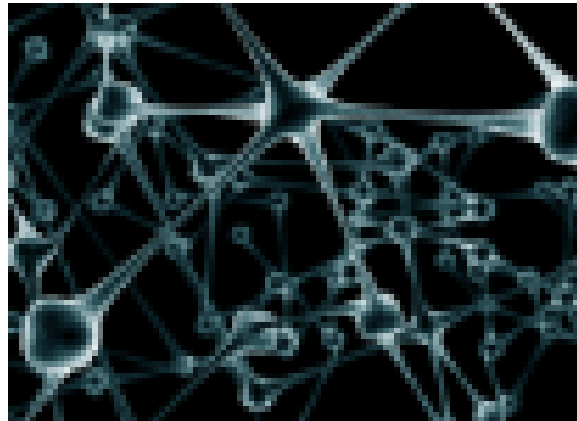
## THE BRANCHES OF ARTIFICIAL INTELLIGENCE



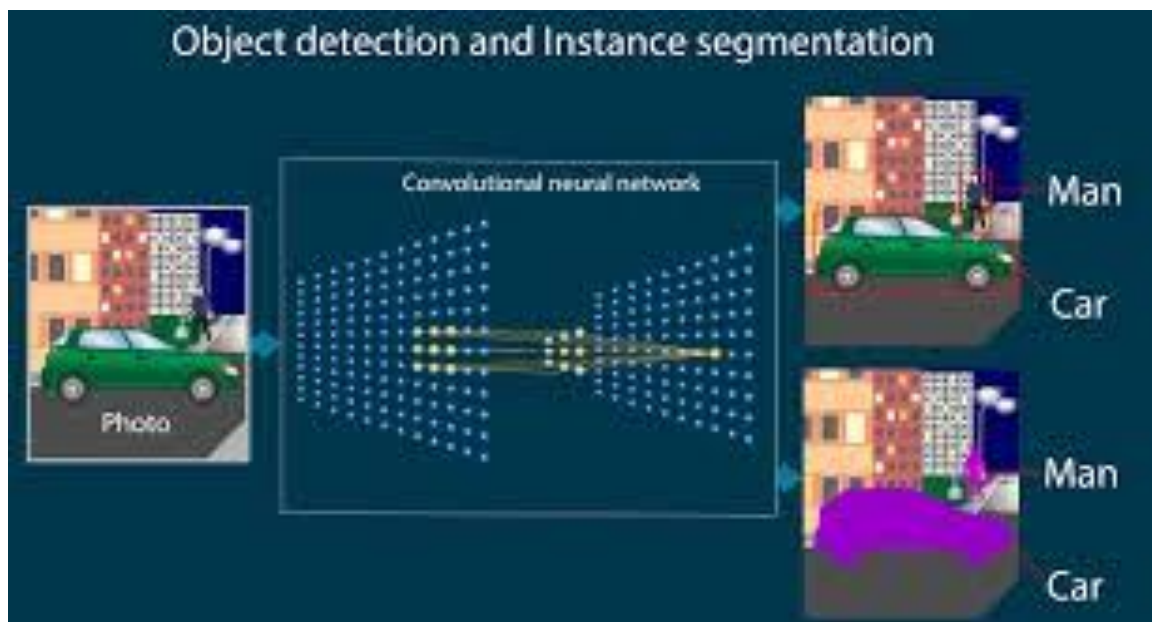


## Neural Network

Neural Network are computational models inspired by an animal's central nervous systems (in particular the brain) which is capable of machine learning as well as pattern recognition.



- ✓ Artificial neural networks are generally presented as systems of interconnected "neurons" which can compute values from inputs.
- ✓ Applications are in
  - Finger Print Recognition
  - Pattern Identification
  - Speech Recognition
  - Character Recognition
  - Signature Verification Application
  - Human Face Recognition
  - Object detections etc.

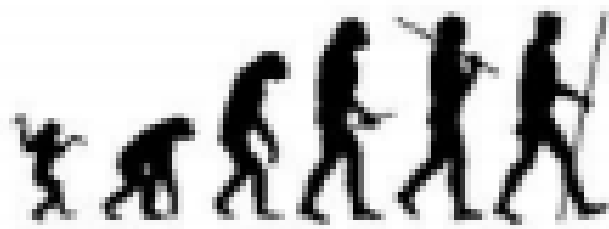


For more applications refer the following website - <https://www.ideamotive.co/blog/business-applications-of-neural-network>

## Genetic Algorithm

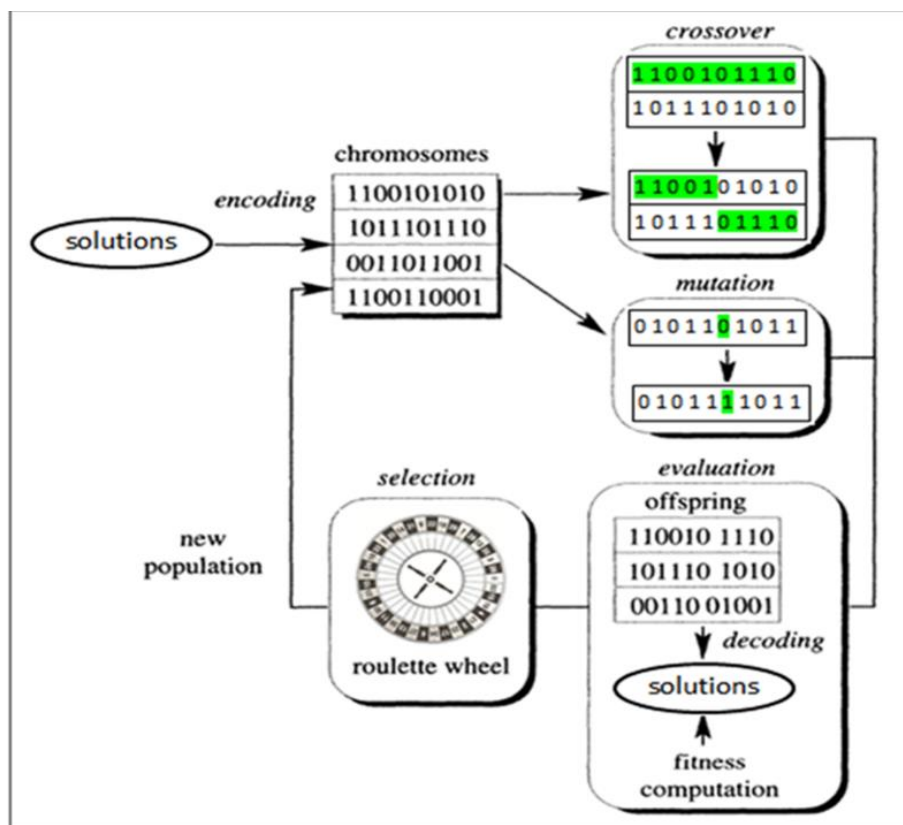
Genetic Algorithms (GAs) are adaptive heuristic search algorithm premised on the evolutionary ideas of natural selection and genetic.

The basic concept of GAs is designed to simulate processes in natural system necessary for evolution, specifically those that follow the principles first laid down by Charles Darwin of survival of the fittest.



In GA, combining two good solutions to create better solutions in the next generation.

Father and mother contribute good features to create better children.



Applications are

Circuit/car design ([http://rednuht.org/genetic\\_cars\\_2/](http://rednuht.org/genetic_cars_2/)), traffic controlling, path finding, etc

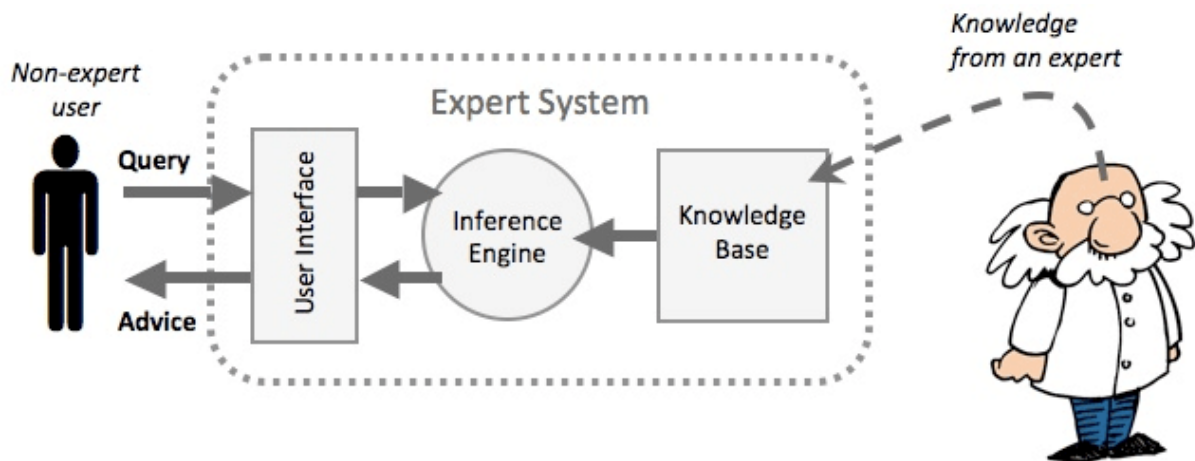


## Expert Systems

An expert system is computer software that attempts to act like a human expert on a particular subject area.

An expert system is made up of three parts:

- ✓ **A user interface** - This is the system that allows a non-expert user to query (question) the expert system, and to receive advice.
- ✓ **A knowledge base** - This is a collection of facts and rules. The knowledge base is created from information provided by human experts
- ✓ **An inference engine** - This acts rather like a search engine, examining the knowledge base for information that matches the user's query



- ✓ Applications are

Medical diagnosis, financial advice, discover locations to drill for water, vacation advisor (<http://www.exsys.com/demomain.html>) etc.

## **Artificial Intelligence Software vs. Conventional Software**

- Conventional computer software follow a logical series of steps to reach a conclusion. Computer programmers originally designed software that accomplished tasks by completing algorithms.
- AI software uses the techniques of search and pattern matching. Programmers design AI software to give the computer only the problem, not the steps necessary to solve it.

## **Artificial Intelligence (Pros)**

- Ability to simulate human behavior and cognitive processes
- (Intuition, Common sense, Judgment, Creativity, Beliefs etc)
- Capture and preserve human expertise
- Fast Response.
- The ability to understand large amounts of data quickly.

## **Artificial Intelligence (Cons)**

- No common sense
- Cannot easily deal with mixed knowledge
- May have high development costs
- Raise legal and ethical concerns

Technique	Description
Searching	Searching for a goal state in state space. For example, finding the winning state in a board game with a human player
Expert Systems	Rule-based systems that capture knowledge as If-Then rules and help humans in reasoning and advising
Natural Language Processing	Recognizing and even understanding human languages
Speech recognition	Recognizing words and understanding short voice sentences
Computer vision and scene recognition	Interpreting contents of pictures captured by cameras
Machine learning	Learning patterns in data. For example, predicting whether a new customer will default a loan or not by exploring the past data of all customers who obtained a loan
Neural networks	A notable technique in the domain of machine learning based on a massively parallel architecture of information processing. A significant development in the area could be seen with the emergence of deep neural networks
Genetic algorithms	Solving optimization problems based on the natural selection process in biological evolution where a significant optimal solution is obtaining by evolving a population of candidate solutions
Fuzzy logic	Making decisions with fuzzy linguistic statements. For example, if the room temperature is 'hot', turn the fan 'fast'. Here hot and fast are fuzzy statements that cannot be represented as True or False

Table 5.1: Intelligent Techniques

## **Man-Machine Coexistence**

### **What does coexistence mean?**

The word coexistence can be broken into two parts, co- and -exists.

The prefix co- means together and -exist means to be or to live.

- Therefore coexistence means being or living together
- Coexistence also has another connotation - peaceful coexistence.
- It means more than being in the same place at the same time, getting along with each other
- For example, the Honda Research's humanoid robot Asimo was developed to assist humans in workplaces without disturbing humans.
- Asimo has also demonstrated its ability to work with multiple other Asimos which is an example of the concept of machine-machine coexistence.



### References

[https://www.tutorialspoint.com/artificial\\_neural\\_network/artificial\\_neural\\_network\\_applications.htm](https://www.tutorialspoint.com/artificial_neural_network/artificial_neural_network_applications.htm)

### Teachers' Guide

<https://portalwrite.wordpress.com/man-machine-coexistence/>