



An Overview of “DEEP LEARNING”

Prof. A. Jothi Kumar
Assistant professor
Department of Computer Science
St. Xavier's College(Autonomous)
Palayamkottai - 627002

Objectives

- Knowledge
- Intelligence
- Artificial Intelligence(Goals)
- Artificial Intelligence(Tools)
 - Neural Network
 - Deep Forwarded Neural network(Deep learning)
 - Applications
 - Example



Knowledge

Knowledge is the collection of skills and information that a living being has acquired through experience.

Knowledge Evolution

- 1) Basic Energy Particle (Ether Particle – Electron, Proton, Neutron)
- 2) Air
- 3) Fire
- 4) Water
- 5) Earth

First Sense (Skin, Touch) – Plants, Grass, Trees Etc.

Second Sense (Mouth, Taste) - Snail, Etc.

Third Sense (Nose, Smell) – Ants, Etc.

Fourth Sense (Eyes, Sight) – Crab, Fly, Bees, Snakes Etc.

Fifth Sense (Ear, Sound) – Lion, Tiger, Animals, birds Etc.,

Sixth Sense (Mind, Brain) – **Human Beings**

ஒன்றறி வதுவே உற்றறி வதுவே
இரண்டறி வதுவே அதனொடு நாவே
மூன்றறி வதுவே அவற்றொடு மூக்கே
நான்கறி வதுவே அவற்றொடு கண்ணே
ஐந்தறி வதுவே அவற்றொடு செவியே
ஆறறி வதுவே அவற்றொடு மனமே
நேரிதின் உணர்ந்தோர் நெறிப்படுத்தினரே...

Intelligence

Intelligence is the ability to apply **knowledge** to learn / understand things / to deal with new / difficult situations.

(Creativity – Human beings)

Artificial Intelligence

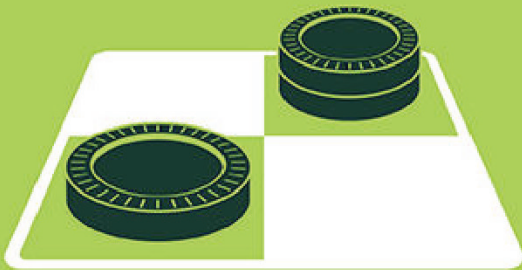
Artificial Intelligence is any technique, code or algorithm that enables machines to develop, **demonstrate and mimic human cognitive behavior or intelligence.**

John McCarthy is one of the "founding fathers" of artificial intelligence, together with Marvin Minsky, Allen Newell and Herbert A. Simon. McCarthy coined the term "Artificial intelligence" in 1955.

Artificial Intelligence

ARTIFICIAL INTELLIGENCE

Early artificial intelligence stirs excitement.



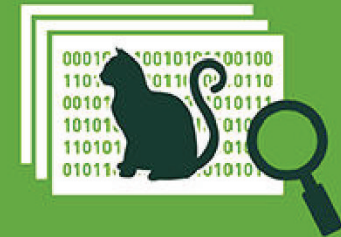
MACHINE LEARNING

Machine learning begins to flourish.



DEEP LEARNING

Deep learning breakthroughs drive AI boom.



1950's

1960's

1970's

1980's

1990's

2000's

2010's

Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

Artificial Intelligence (Goals)

- 1) Reasoning, problem solving
- 2) Knowledge representation
- 3) Planning
- 4) Learning (Machine)
- 5) Natural language processing
- 6) Perception
- 7) Motion and manipulation
- 8) Social intelligence
- 9) Creativity
- 10) General intelligence

Artificial Intelligence (Goals)

1) Reasoning, problem solving

algorithms

step-by-step reasoning

solve puzzles - rubik's Cube solution

logical deductions

problem-solving algorithms is a high priority

Artificial Intelligence (Goals)

2) Knowledge representation

Objects, properties, categories and relations between objects, situations, events, states and time, causes and effects;

(Ontology – Knowledge Graph)

Propositional Logic, Discrete Mathematics

(Always True - Eg)

Artificial Intelligence (Goals)

3) Planning

evolutionary algorithms

- Genetic Algorithm

swarm intelligence

- Ant colony optimization - suited for graph problems.
- Artificial bee colony algorithm – routing and scheduling.
- Cuckoo search - for global optimization problems.
- Particle swarm optimization – animal flocking(moving together) behavior - for numerical optimization problems.

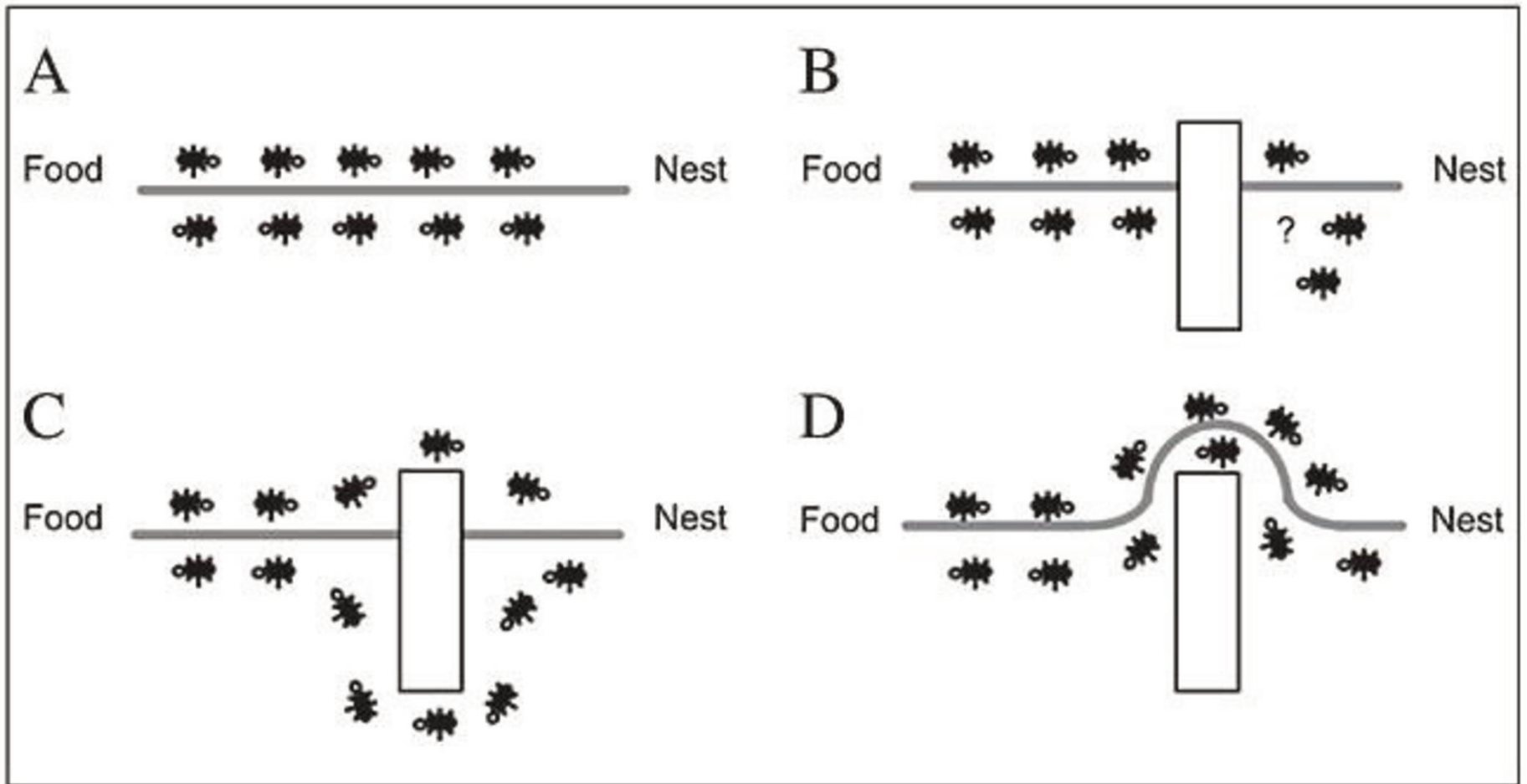
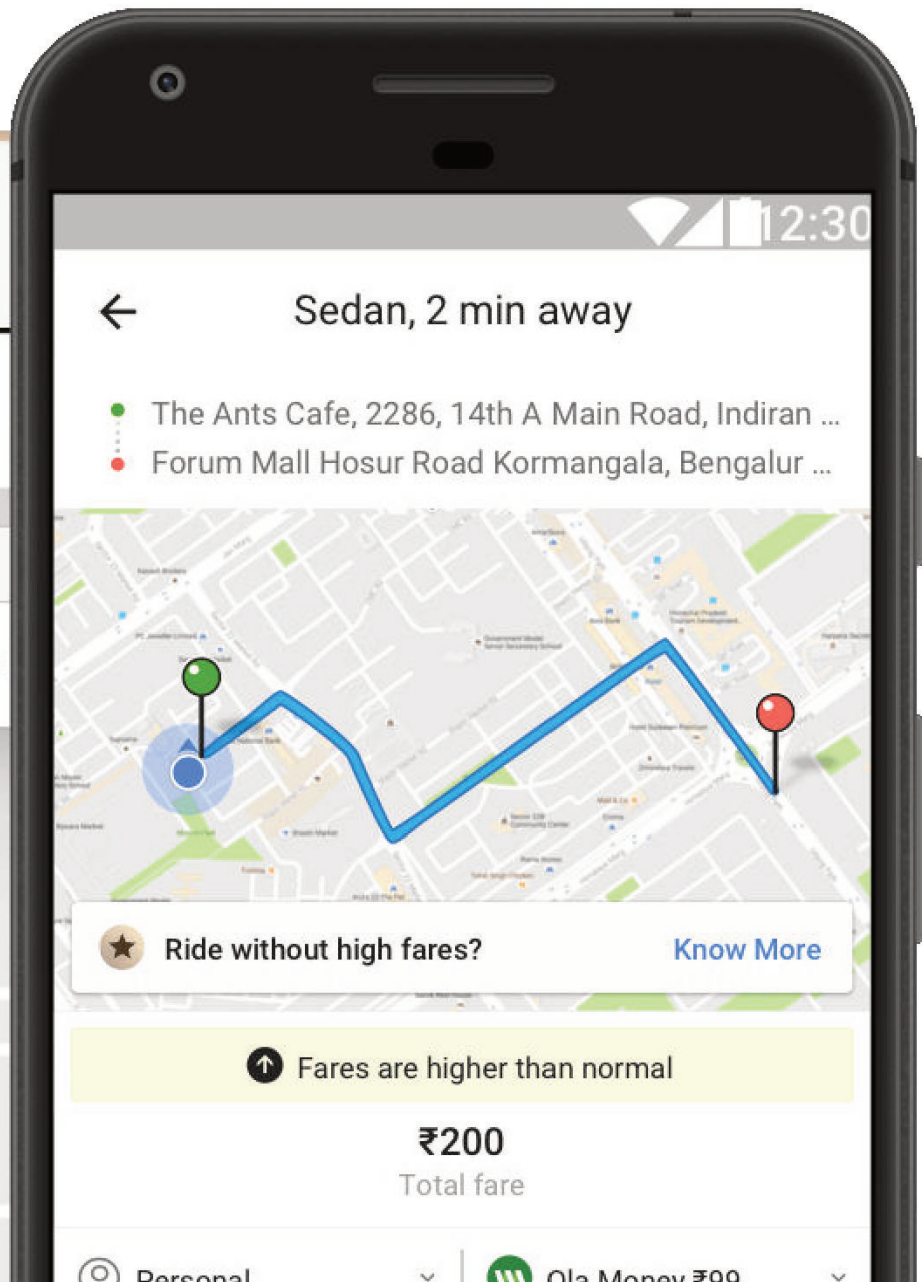
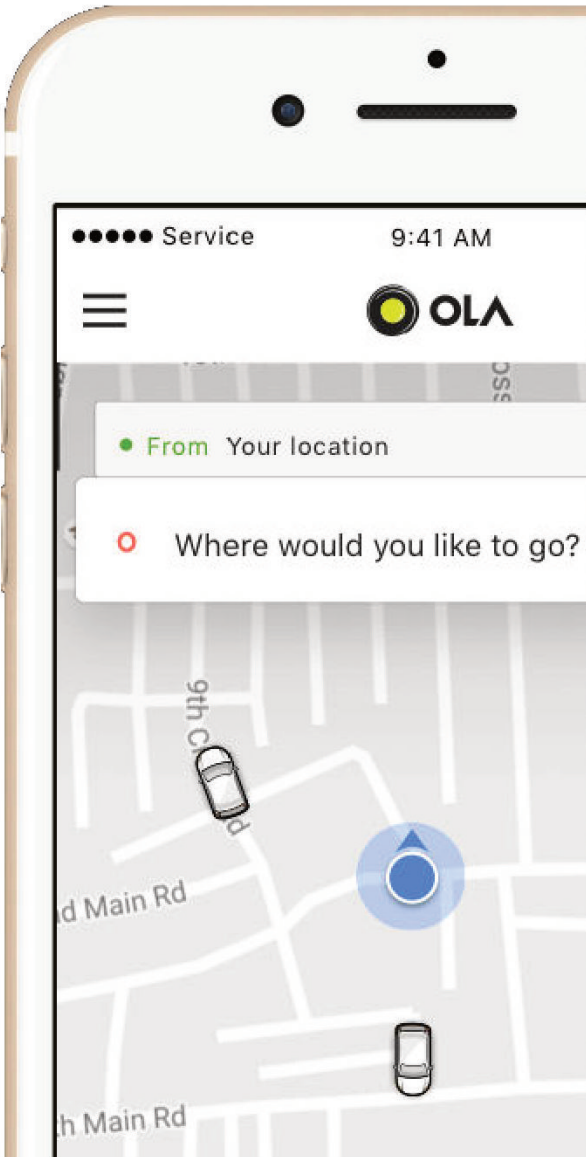


Figure 2. A. Ants in a pheromone trail between nest and food; B. an obstacle interrupts the trail; C. ants find two paths to go around the obstacle; D. a new pheromone trail is formed along the shorter path.

pheromones

Shortest path Algorithms – OLA, Uber



Artificial Intelligence (Goals)

4) Learning (Machine Learning)

is the study of computer algorithms that improve automatically through experience.

Supervised Learning

Unsupervised Learning

Artificial Intelligence (Goals)

4) Learning (Machine Learning)

Supervised Learning

- classification and numerical regression.
- Classification determine what category something belongs in a number of examples of several categories.
- Regression produce a function that describes the relationship between inputs and outputs and predicts how the outputs should change as the inputs change.

Unsupervised Learning

task of a function to describe hidden structure from "unlabeled" data (a classification or categorization is not included in the observations).

Artificial Intelligence (Goals)

4) Learning (Machine Learning)

Supervised Learning



Unsupervised Learning



dataaspirant.wordpress.com

TRADITIONAL MACHINE LEARNING



Input



Feature extraction



Classification



Output

Artificial Intelligence (Goals)

5) Natural language processing

- ability to read and understand human language
- Knowledge from human-written sources
- information retrieval
- text mining, question answering
- machine translation

Artificial Intelligence (Goals)

6) Perception (Machine Perception/Vision)

- Use input from sensors (such as cameras, microphones, tactile sensors, sonar and others) to deduce aspects of the world.
- Ability to analyze visual input.
- Speech recognition,
- Facial recognition and object recognition.
(Facebook tag)

Artificial Intelligence (Goals)

7) Motion and manipulation (Robotics)

Robotics is an interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others.

to handle tasks such as object manipulation, navigation, with sub-problems such as localization, mapping, and motion planning.



Artificial Intelligence (Goals)

8) Social intelligence (Affective computing)

- Affective computing is the study and development of systems that can recognize, interpret, process, and simulate human affects.
- It is an interdisciplinary field spanning **computer sciences, psychology, and cognitive science.**

Artificial Intelligence (Goals)

9) Creativity

Computational creativity (also known as artificial creativity, mechanical creativity, creative computing or creative computation) is a multidisciplinary endeavour that is the intersection of the fields of **artificial intelligence, cognitive psychology, philosophy, and the arts.**

Artificial Intelligence (Goals)

10) General intelligence

- combining all the skills mentioned above

- artificial consciousness

philosophy of artificial intelligence through questions about **mind, consciousness, and mental states**

- artificial brain (Blue Brain)

Artificial Intelligence (Tools)

- 1) Search and optimization
- 2) Logic
- 3) Probabilistic methods for uncertain reasoning
- 4) Classifiers and statistical learning methods
- 5) Neural networks**
- 6) Deep feed forward neural networks**
- 7) Deep recurrent neural networks**
- 8) Control theory
- 9) Languages
- 10) Evaluating progress

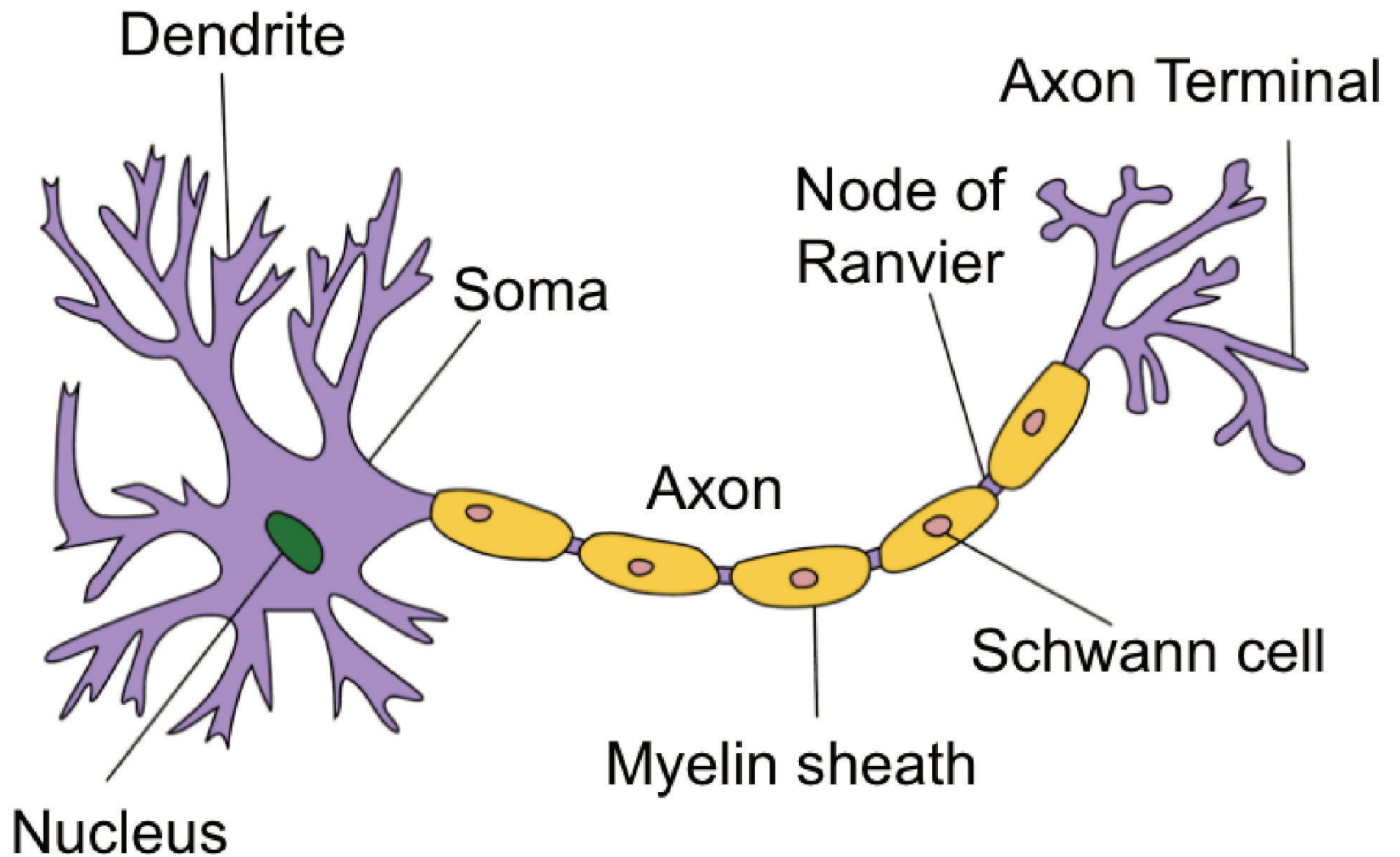
Artificial Intelligence (Tools)

Neural networks

Neural networks are modeled after the neurons in the human brain, where a trained algorithm determines an output response for input signals.

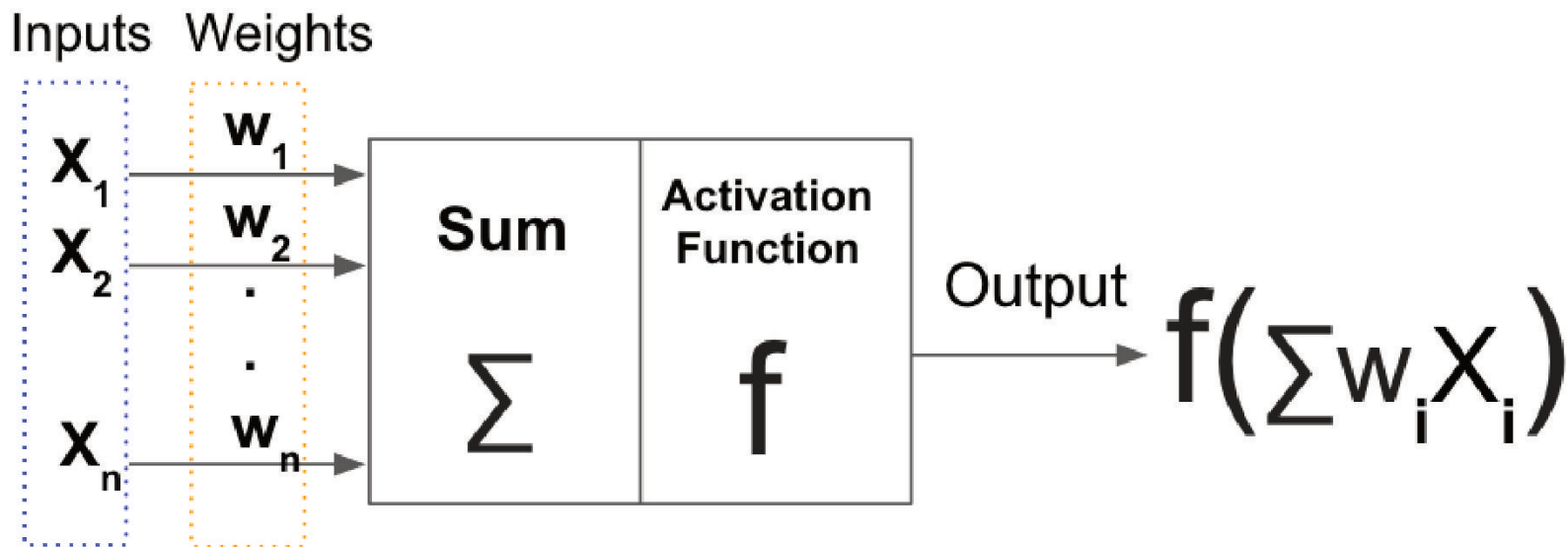
**Human Brain – 86 billion Neurons
(8,600 Crores)**

**** Einstein used only 13% (Lucy)**



Structure of a typical neuron

(source: Wikipedia)

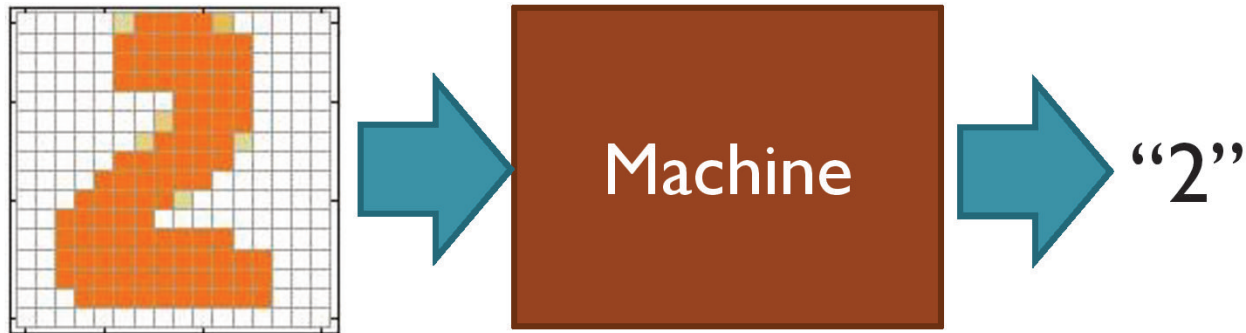


Structure of artificial neuron

Neural networks

Example

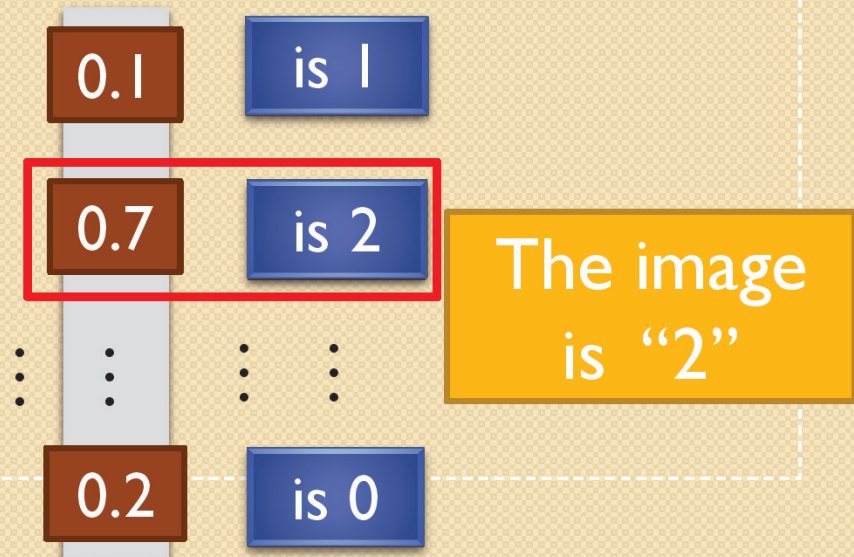
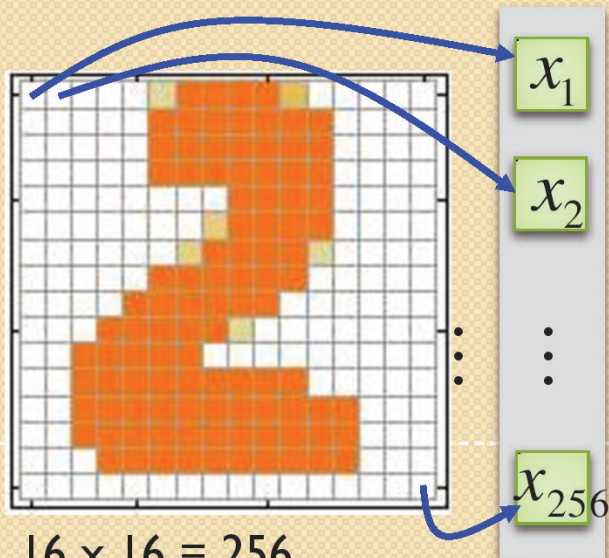
- Handwriting Digit Recognition



Neural networks

Input

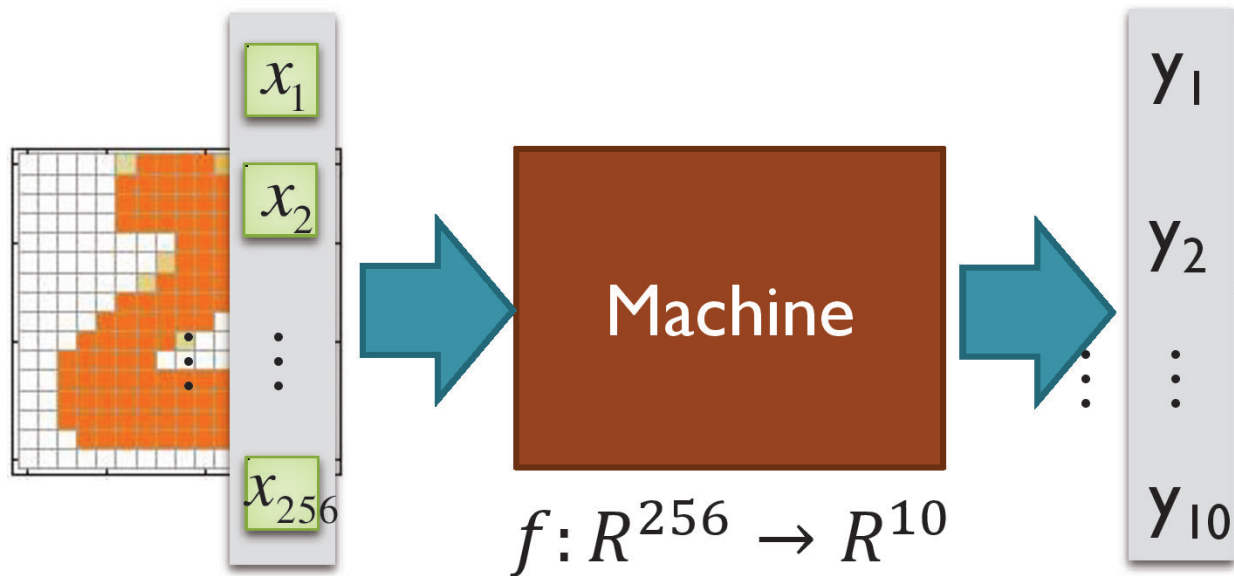
Output



Each dimension represents the confidence of a digit.

Neural networks

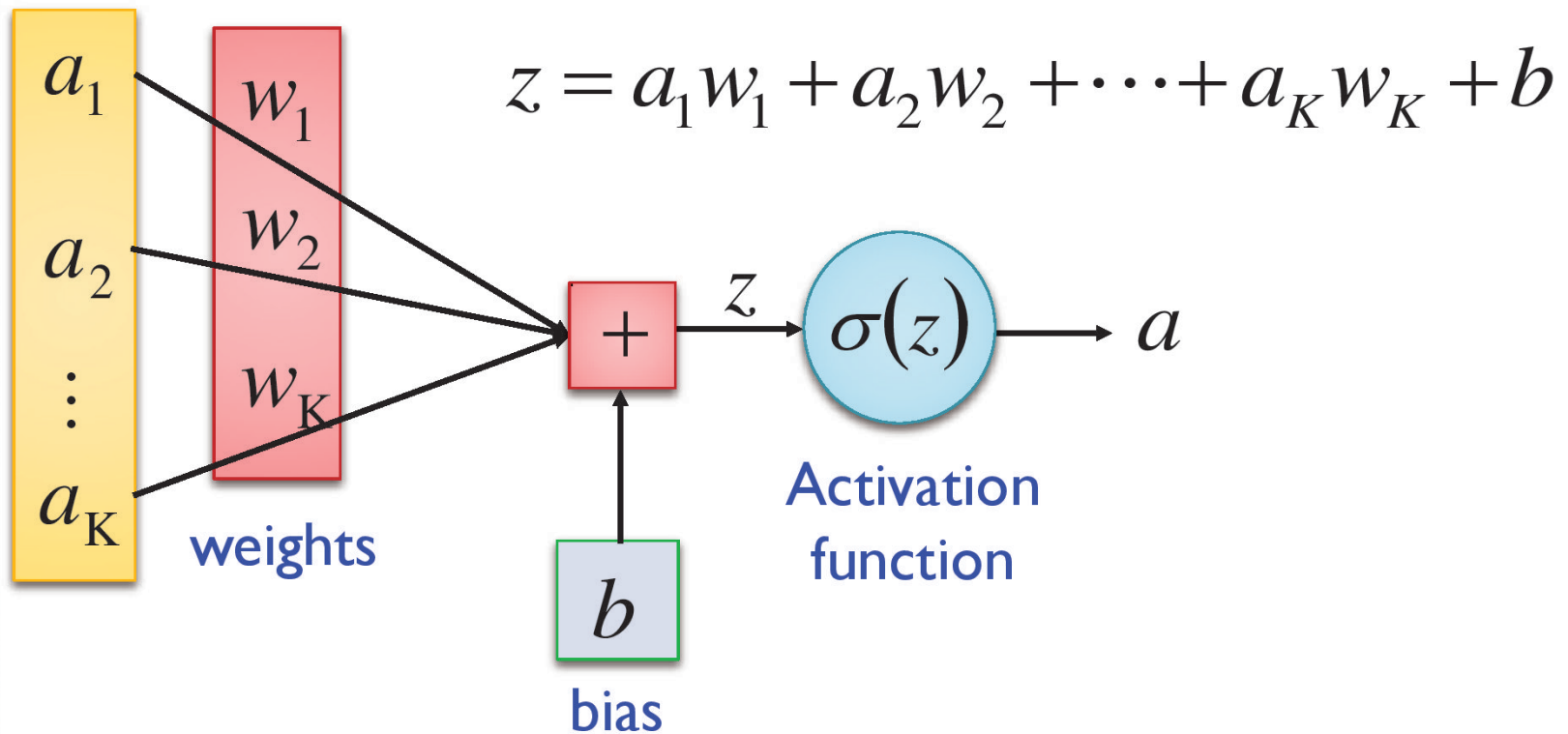
- Handwriting Digit Recognition



In deep learning, the function f is represented by neural network

Element of Neural Network

Neuron $f: R^K \rightarrow R$



Neural Network

