Balalatha's

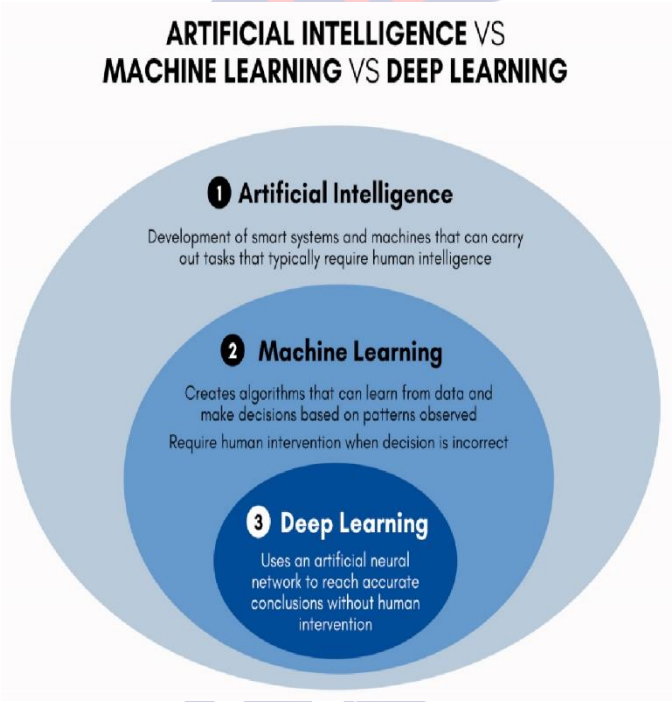
CSB IAS ACADEMY

The Road Map to Mussoorie...

Prelims EDGE – 09/10/2024

MACHINE LEARNING

Context: Machine learning pioneers win Nobel Prize in Physics.



About Machine Learning

- Machine learning is a subset of artificial intelligence that involves training algorithms to learn patterns from data and make predictions or decisions without being explicitly programmed.
- It allows computers to improve their performance on tasks through experience.

How Does Machine Learning Work?

- ***Data Collection:*** Gather large datasets relevant to the problem.
- ***Training:*** Use these datasets to train algorithms, adjusting parameters to minimize errors.
- ***Evaluation:*** Test the trained model on new data to assess its accuracy and performance.
- ***Deployment:*** Implement the model in real-world applications to make predictions or automate tasks.

Common Types of Machine Learning

- ***Supervised Learning:*** Models are trained on labeled data, meaning the input comes with the correct output.
- ***Unsupervised Learning:*** Models find patterns in data without labeled responses.
- ***Reinforcement Learning:*** Models learn by receiving rewards or penalties based on their actions.

Popular Applications of Machine Learning

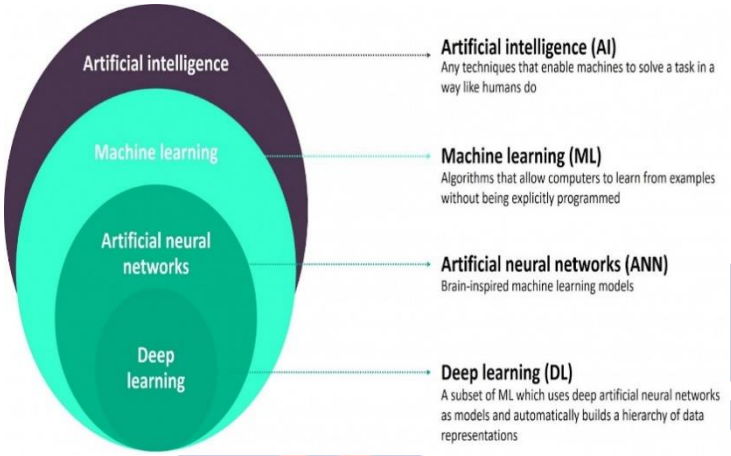
- ***Image and Speech Recognition:*** Identifying objects in images or understanding spoken language.
- ***Recommendation Systems:*** Suggesting products or content based on user behavior.
- ***Fraud Detection:*** Identifying fraudulent activities in financial transactions.
- ***Predictive Analytics:*** Forecasting future trends based on historical data.
- ***Autonomous Vehicles:*** Enabling self-driving cars to navigate and make decisions

Source : Hopfield and Hinton, machine learning pioneers, win Nobel Prize in Physics (The Hindu)

9966436875, 8374232308 csbiasacademy@gmail.com

TERMS IN NEWS

Artificial Neural Networks



- It is a vital subset of machine learning that helps computer scientists in their work on complex tasks, such as, strategizing, making predictions, and recognizing trends.
- **It is a computational model that mimics the way nerve cells work in the human brain.**
- It is designed to simulate the way the human brain analyzes and processes information.
- It is not like other machine learning algorithms that crunch numbers or organise data, it is an algorithm that learns from experience and repeated tasks performed by its users.
- It is also known as a Neural Network (NN). ANN is a computational model based on the functions and structure of biological neural networks.
- Information that runs through the network affects the structure of the artificial neural network due to the fact that a neural network learns or changes based on the input and output.
- NNs are fed massive volumes of data in the beginning phases.
- In most cases, training is done by providing input and informing the network about what should be the output.

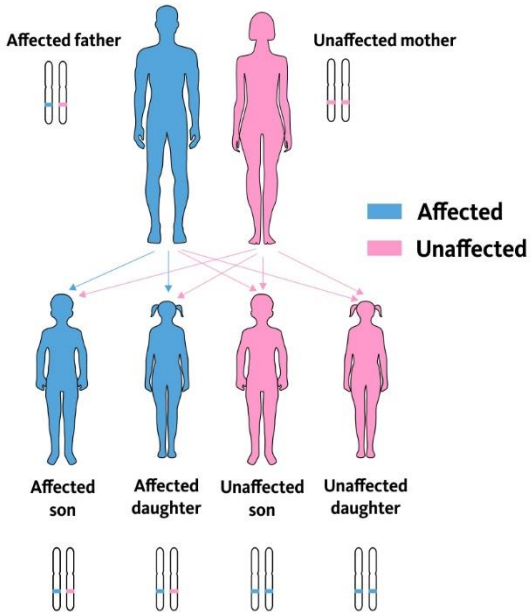
Marburg Virus

- Marburg hemorrhagic fever is a rare but severe hemorrhagic fever that affects both people and non-human primates.
- It is caused by the Marburg virus, a genetically unique zoonotic (animal-borne) RNA virus. Marburg and Ebola viruses are both members of the Filoviridae family (filovirus).
- The reservoir host of the Marburg virus is the African fruit bat
- The virus can be transmitted from bats to primates, including humans, and then spread through direct contact with blood or other body fluids from infected individuals.
- The average MVD case fatality rate is around 50%. Case fatality rates have varied from 24% to 88% in past outbreaks depending on virus strain and case management.

9966436875, 8374232308 csbiasacademy@gmail.com

- There is no treatment or vaccine for Marburg disease.
- Supportive therapy, such as intravenous fluids, electrolyte replacement, supplemental oxygen, as well as blood and blood products replacement, improves survival.

Hereditary cancers



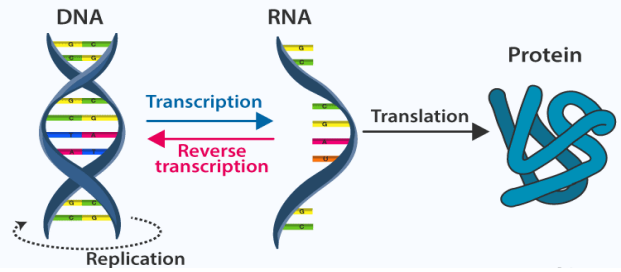
- Hereditary cancers are those caused by inherited genetic mutations passed from parent to child.
- These mutations increase an individual's predisposition to developing certain types of cancer.
- Hereditary cancer syndromes are most often inherited in an autosomal dominant manner, meaning that an individual only needs one copy of the mutated gene from either parent to have an increased risk of cancer.
- Around **10% of all cancer cases** are believed to result from inherited mutations. The prevalence is higher for certain cancers, such as ovarian (20%) and breast, colorectal, lung, and prostate cancers (10%).
- Mutations in **BRCA1 and BRCA2** are linked to a higher risk of breast and ovarian cancers.
- In men, BRCA mutations increase the risk of prostate and male breast cancer.
- They can also lead to other cancers like pancreatic, colorectal, and uterine cancers.
- Therapies such as **PARP inhibitors** are specifically designed for cancers with BRCA mutations, as they disrupt DNA repair mechanisms that these cancers rely on.
- New therapies continue to emerge based on further genetic research.
- **CRISPR screens** allow researchers to create specific mutations in genes like BRCA to study their effects on DNA repair and cancer progression. These tools also help identify resistance to therapies.

Transcription

- Genes do not directly produce protein, but they provide information to build proteins.
- Protein production is completed in two ways: transcription and translation.
- Both the transcription and translation keep the information in DNA and then use it for protein production
- The process following which DNA is copied to RNA is known as transcription, and the process by which RNA is used for producing protein is known as translation
- The first step of gene expression is known as transcription.

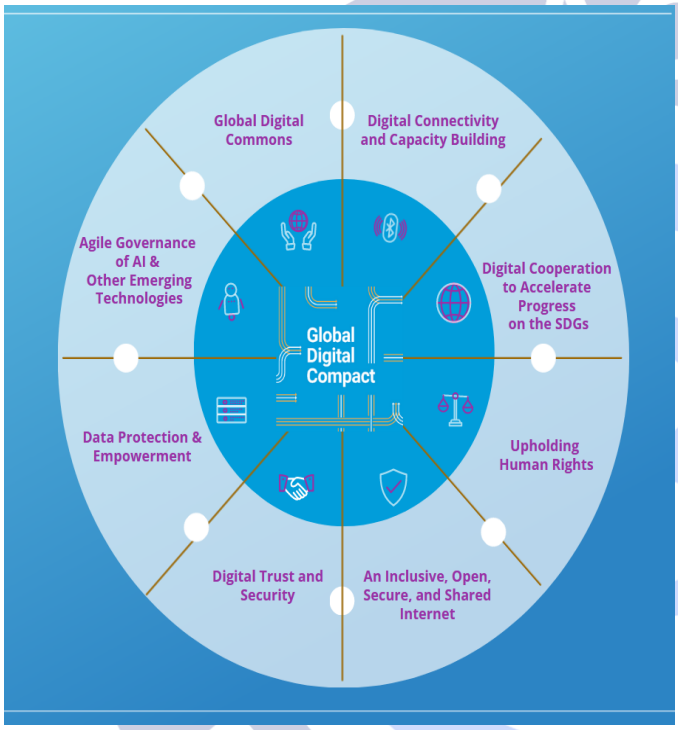
9966436875, 8374232308 csbiasacademy@gmail.com

- In the ***transcription process, the sequence of DNA of a gene is copied into RNA.***



- It uses one of the two exposed DNA strands like a template, and this strand is known as the template strand.
- The product of RNA is complementary to the template strand, and it is fully similar to other DNA strands, known as a nontemplate strand.

The Global Digital Compact



- The Global Digital Compact is a comprehensive framework for global governance of digital technology and artificial intelligence
- Adopted during the UN's 'Summit of the Future,' focuses on harnessing digital technologies for the common good while promoting sustainable development and responsible data governance.
- It aims to address challenges like the digital divide, data privacy, and ethical AI use.
- It is a non-binding diplomatic instrument aiming to guide governments, institutions, and stakeholders in digital technology use and governance.
- Over time, its guidelines could evolve into soft laws.

Global Framework on Chemicals

- The Global Framework on Chemicals (GFC) is an international initiative designed to address the **safe management of chemicals and hazardous substances on a global scale.**
- It was adopted in September 2023 during the fifth International Conference on Chemicals Management (ICCM5), the Framework provides a roadmap to address the environmental and health impacts of chemicals and waste.
- The framework aims to mitigate the risks associated with chemicals throughout their lifecycle, from production to disposal, to protect human health and the environment.
- The GFC outlines five strategic objectives and sets 28 targets to help countries and stakeholders manage chemicals throughout their entire lifecycle, including products and waste management.

9966436875, 8374232308 csbiasacademy@gmail.com

- **The Rotterdam Convention** is a global treaty that aims to protect human health and the environment by helping countries make informed decisions about trading hazardous chemicals
- **The Stockholm Convention** on Persistent Organic Pollutants (POPs) is a global treaty that aims to protect human health and the environment from the harmful effects of POPs
- **The Minamata Convention** on Mercury is a global agreement that aims to protect the environment and human health from mercury pollution.

PRACTICE QUESTIONS

Q1: How many of the following are applications of Machine Learning?

1. Image and Speech Recognition
2. Recommendation Systems
3. Fraud Detection
4. Predictive Analytics
5. Autonomous Vehicles

Select the correct option

a) Only Two
b) Only Three
c) Only Four
d) All of the above

Q2: Consider the following statements regarding Artificial Neural Networks

1. It is a vital subset of machine learning that helps computer scientists in their work on complex tasks, such as, strategizing, making predictions, and recognizing trends.
2. It is a computational model that mimics the way nerve cells work in the human brain.
3. It is designed to simulate the way the human brain analyzes and processes information

How many of the above statements are correct?

a) Only One
b) Only Two
c) All of the above
d) None of the above

Q3: Consider the following statements

1. The process following which DNA is copied to RNA is known as translation
2. The process by which RNA is used for producing protein is known as transcription

How many of the above statements are correct?

a) Statement 1
b) Statement 2
c) Both the statements
d) None of the above

Q4: It is global treaty that aims to protect human health and the environment by helping countries make informed decisions about trading hazardous chemicals. Identify the correct option from the following

9966436875, 8374232308 csbiasacademy@gmail.com

a) Stockholm Convention

b) Minamata Convention

c) Rotterdam Convention

d) Beijing Declaration

Q5: Consider the following statements regarding Hereditary Cancers.

1. Hereditary cancers are those caused by inherited genetic mutations passed from parent to child.
2. Around 60% of all cancer cases are believed to result from inherited mutations
3. CRISPR screens allow researchers to create specific mutations in genes like BRCA to study their effects on DNA repair and cancer progression.

How many of the above statements are correct?

a) Only One

b) Only Two

c) All of the above

d) None of the above

Answers

1. **D**
2. **C**
3. **D**
4. **C**
5. **B**

9966436875, 8374232308 csbiasacademy@gmail.com