Artificial Intelligence (AI) Chips

For Prelims: Artificial Intelligence, Active Neural Network, Machine Learning

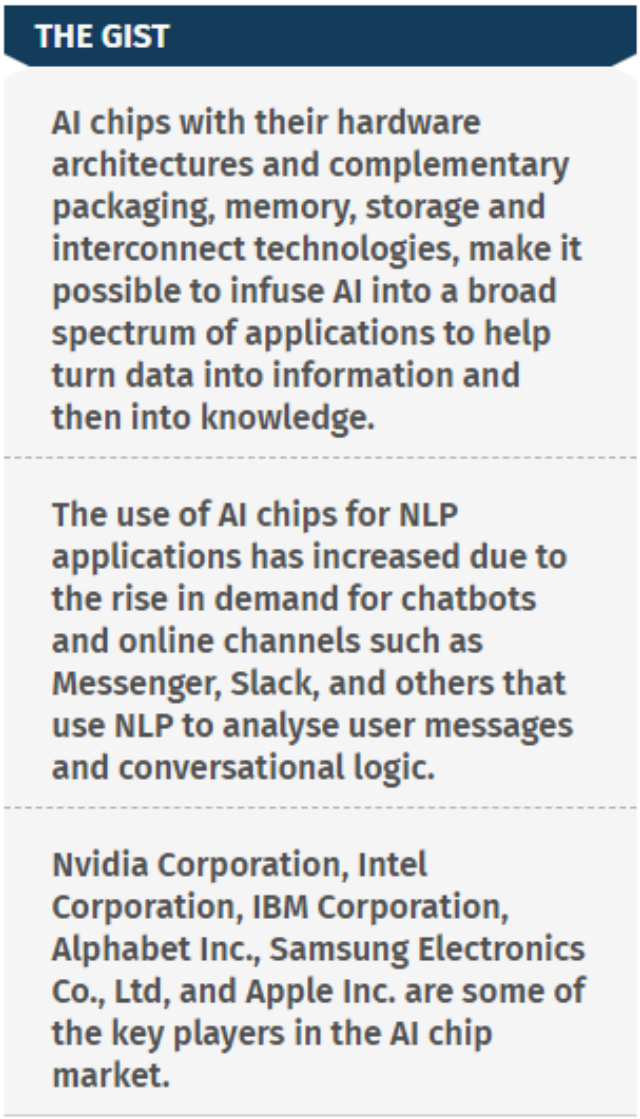
For Mains: IT & Computers

Why in News?

The adoption of Artificial Intelligence (AI) **chips** have risen in recent times with chipmakers designing different types of these chips to power AI applications.

What are AI chips?

- **About:**
  - AI chips are **built with specific architecture and have integrated AI acceleration to support deep learning-based applications.**
    - **Deep learning,** more commonly known as **Active Neural Network (ANN) or Deep Neural Network (DNN)**, is a subset of **machine learning** and comes under the broader umbrella of AI.
- **Functions:**
  - It **combines a series of computer commands or algorithms** that stimulate activity and brain structure.
  - DNNs **go through a training phase, learning new capabilities from existing data.**
    - DNNs can then **inference, by applying these capabilities learned during deep learning training** to make predictions against previously unseen data.
    - Deep learning can make the process of collecting, analysing, and interpreting enormous amounts of data faster and easier.
  - Chips like these, with **their hardware architectures, complementary packaging, memory, storage, and interconnect solutions,** make it possible for AI to be integrated into applications across a wide spectrum to turn data into information and then into knowledge. //



- **Types of AI Chips Designed for Diverse AI Applications:**
  - Application-Specific Integrated Circuits (ASICs), Field-Programmable Gate Arrays (FPGAs), Central Processing Units (CPUs) and GPUs.
- **Applications:**
  - AI applications include **Natural Language Processing (NLP), computer vision**, robotics, and network security across a wide variety of sectors, including **automotive, IT, healthcare, and retail.**
- **Reasons for the Rise:**
  - The increasing adoption of **AI chips in data centres** is one of the major factors driving the growth of the market.
  - Additionally, the **rise in the need for smart homes and cities**, and the surge in investments in AI start-ups are expected to drive the growth of the global AI chip market.
    - The Worldwide AI chip industry **accounted for approx. USD 8 billion in 2020** and is expected to **reach USD 195 billion by 2030,** growing at a **Compound Annual Growth Rate (CAGR)** of **37.4% from 2021 to 2030.**

What is the Significance of AI Chips over using General Purpose Hardware?

- **Faster Computation:**
  - Artificial intelligence **applications typically require parallel computational capabilities** in order to run sophisticated training models and algorithms.
  - **AI hardware provides more parallel processing capability** that is estimated to have up to 10 times more competing power in ANN applications compared to traditional semiconductor devices at similar price points.

- **High Bandwidth Memory:**
    - Specialized AI hardware is **estimated to allocate 4-5 times more bandwidth** than traditional chips.
        - This is necessary **because due to the need for parallel processing,** AI applications require significantly more bandwidth between processors for efficient performance.

UPSC Civil Services Examination, Previous Year Questions

Q. With the present state of development, Artificial Intelligence can effectively do which of the following? (2020)

1. Bring down electricity consumption in industrial units
2. Create meaningful short stories and songs
3. Disease diagnosis
4. Text-to-Speech Conversion
5. Wireless transmission of electrical energy

Select the correct answer using the code given below:

(a) 1, 2, 3 and 5 only
(b) 1, 3 and 4 only
(c) 2, 4 and 5 only
(d) 1, 2, 3, 4 and 5

Ans: (b)

Exp:

- Google is using the Internet of Things (IoT) and Artificial Intelligence (AI) from its DeepMind acquisition to **reduce energy consumption in its data centres** by as much as 30%. Hence, 1 is correct.
- Using AI as a tool to make music or aid musicians has been in practice for quite some time. In the 1990s, David Bowie helped develop the Verbasizer, which took literary source material and randomly reordered the words to create new combinations that could be used as lyrics. However, as **AI works in programmed ecosystem and does not have emotions** so it would be hard for an AI to create meaningful short stories and songs. Hence, 2 is not correct.
- AI combined with robotics and the Internet of Medical Things (IoMT) could potentially be the new nervous system for healthcare, presenting solutions to address healthcare problems. Integration of AI technology in cancer care could improve the accuracy and speed of diagnosis, aid clinical decision-making, and lead to better health outcomes. Hence, 3 is correct.
- Speech synthesis is the artificial production of human speech. It is a way to convert language to human voice (or speech). For example, Google’s Assistant, Amazon’s Echo, Apple’s Siri, etc. Hence, 4 is correct.
- Potential cases of AI’s use in the energy sector include energy system modelling and forecasting to decrease unpredictability and increase efficiency in power balancing and usage. However, it cannot be used for transmission of electrical energy. Hence, 5 is not correct. Therefore, option (b) is the correct answer.

Source: TH