IoT and AI at the Core of Change

The Hyperconnected Revolution:

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AGENDA

1. Introduction
2. IoT and AI - An Overview
3. Proposition # 1 (Revitalizing Vacant Agricultural Lands with AI/IoT)
4. Proposition # 2 (AI and GPU Usage)
5. Proposition # 3 (LoRaWAN Technologies)
6. Proposition # 4 (Intensifying Technologies)
7. Conclusion

THE HYPERCONNECTED REVOLUTION:

INTRODUCTION

- AI - contain only 2 letters but has the potential to transform the whole world.
- From **Code** to **Curiosity** - The Rise of Self-Learning AI
- **AI** itself is not a **standalone**
- From Sunrise to Sleep Cycle
- AI Companions and Beyond

- ***AI, IoT, and Robotics*** *work together to make smart, automated systems that can sense, think, and act.*

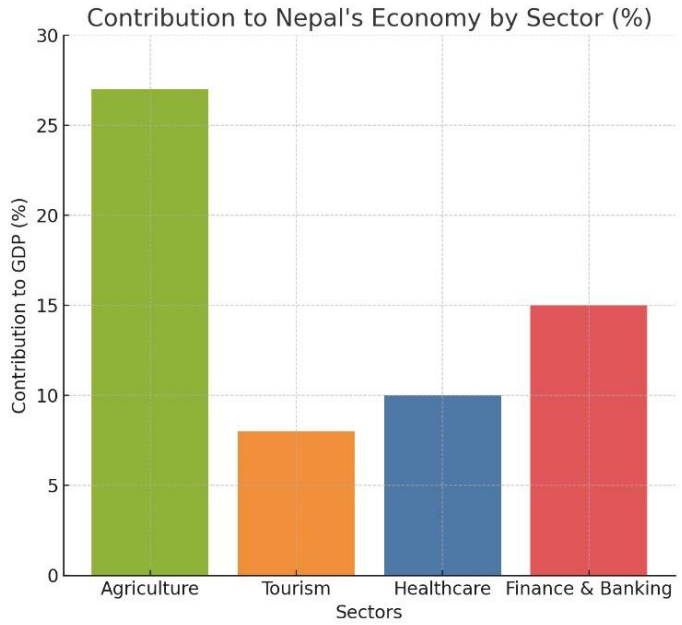
CURRENT STATE OF AI IN NEPAL'S INDUSTRIES

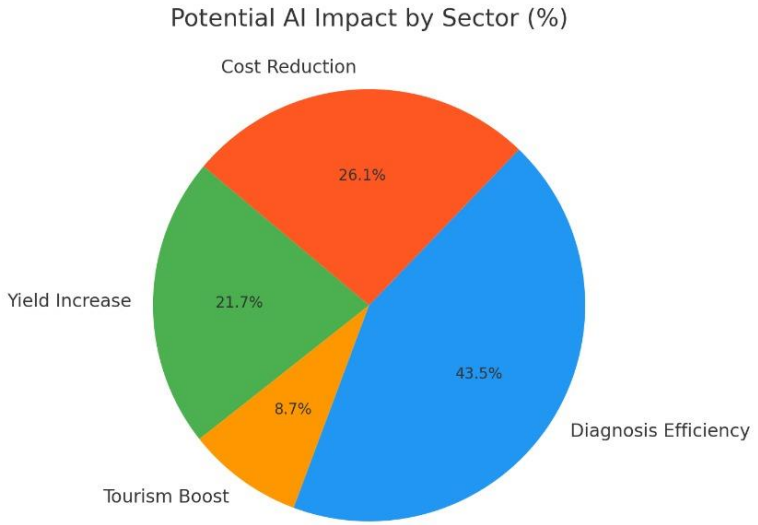
- **Statistics:**

  Only ~3-5% of Nepalese businesses are actively implementing AI (*based on findings from recent summit data*).

- **Challenges Faced:** Limited local data sources, shortage of AI-trained professionals, infrastructure gaps.
- **Opportunity Areas:** Agriculture, healthcare, tourism, finance, and manufacturing where AI can solve persistent issues.

IMPACT OF AI – THE PRESENT SCENARIO



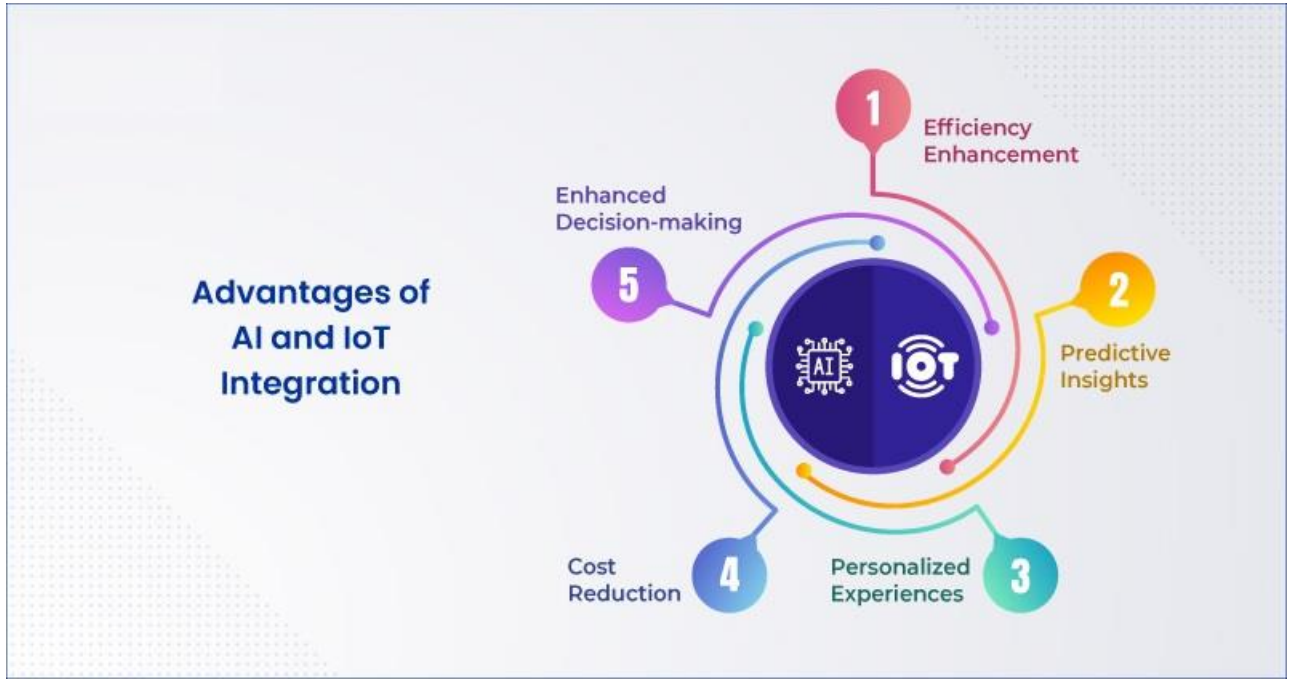


- **Bar Chart:** Shows the approximate contribution of each sector (Agriculture, Tourism, Healthcare, Finance) to Nepal's GDP
  Pie Chart (Right): Illustrates AI's potential impact by sector, such as yield increases (उत्पादन वृद्धि) in agriculture, boosted tourism, improved diagnosis efficiency in healthcare, and cost reduction in finance.

DEFINITIONS!!!

- **Hyperconnectivity** refers to the interconnectedness of devices, systems, and people through the internet.
- **AI instances** are basically **applications or systems that use Artificial Intelligence (AI)** to perform tasks. Each instance represents a device, software, or system running AI algorithms to make decisions, solve problems, or automate tasks.
    - For example:
    - A **voice assistant** like Alexa or Siri is an AI instance.
    - A **self-driving car** that uses AI to navigate the road is also an instance.
- **Edge infrastructure** refers to **computers and devices that process data right where it's created, instead of sending it to a faraway cloud server**.
    - For example:
    - A **security camera** that detects movement and alerts you in real-time processes data locally. That's "edge."

THE CONVERGENCE OF IOT AND AI



IoT devices generate vast amounts of data, and AI helps analyze and make sense of this data in real-time. This convergence is driving innovation across various sectors.

1.Smart factories use AI to analyze data from IoT devices to optimize production lines and reduce downtime.

2. AI can analyze the data from IoT sensors in a car to predict when a part might fail, allowing for proactive maintenance.

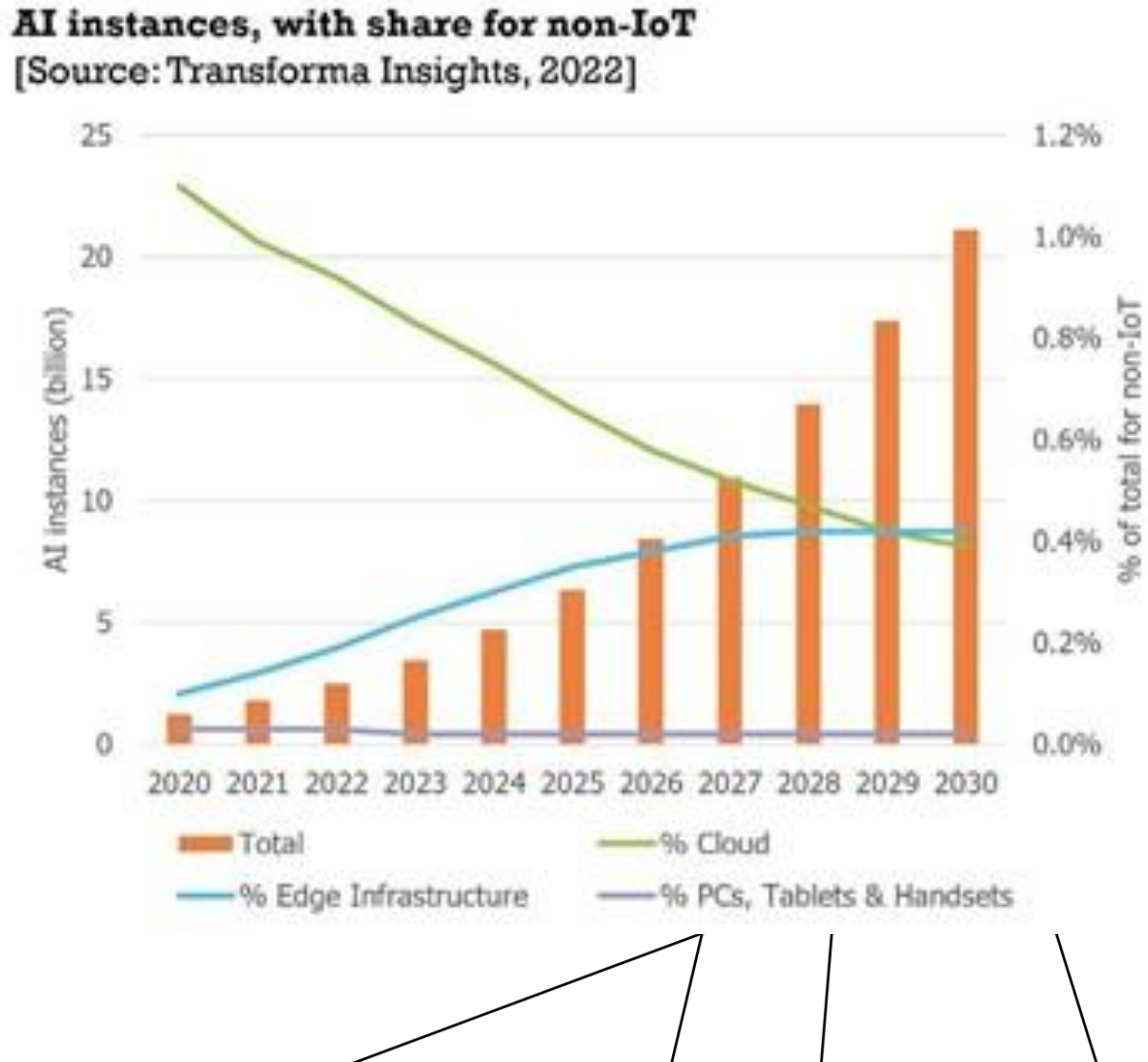
3. A smart thermostat learns your preferences and adjusts the temperature automatically to suit your comfort.

4. In agriculture, IoT sensors monitor soil conditions, and AI suggests the exact amount of water or fertilizer needed, reducing costs.

5. AI can process data from wearable devices to assist doctors in diagnosing and treating patients more effectively.

WHY IS THIS RELEVANT TODAY?

- The integration of IoT and AI is crucial today as it enhances efficiency, reduces costs, and unlocks new opportunities. It's transforming industries like healthcare, manufacturing, and smart cities.



HOW ARE IOT AND AI RESHAPING DAILY LIFE?

An example:

1. Coffee Brewing machine, before you arrive at home

2. A thermostat, that you make it hot, before you arrive at home.

3. Smart Parking

CHALLENGES FACED IN IOT ADOPTION

FOR NEPALESE INDUSTRIES

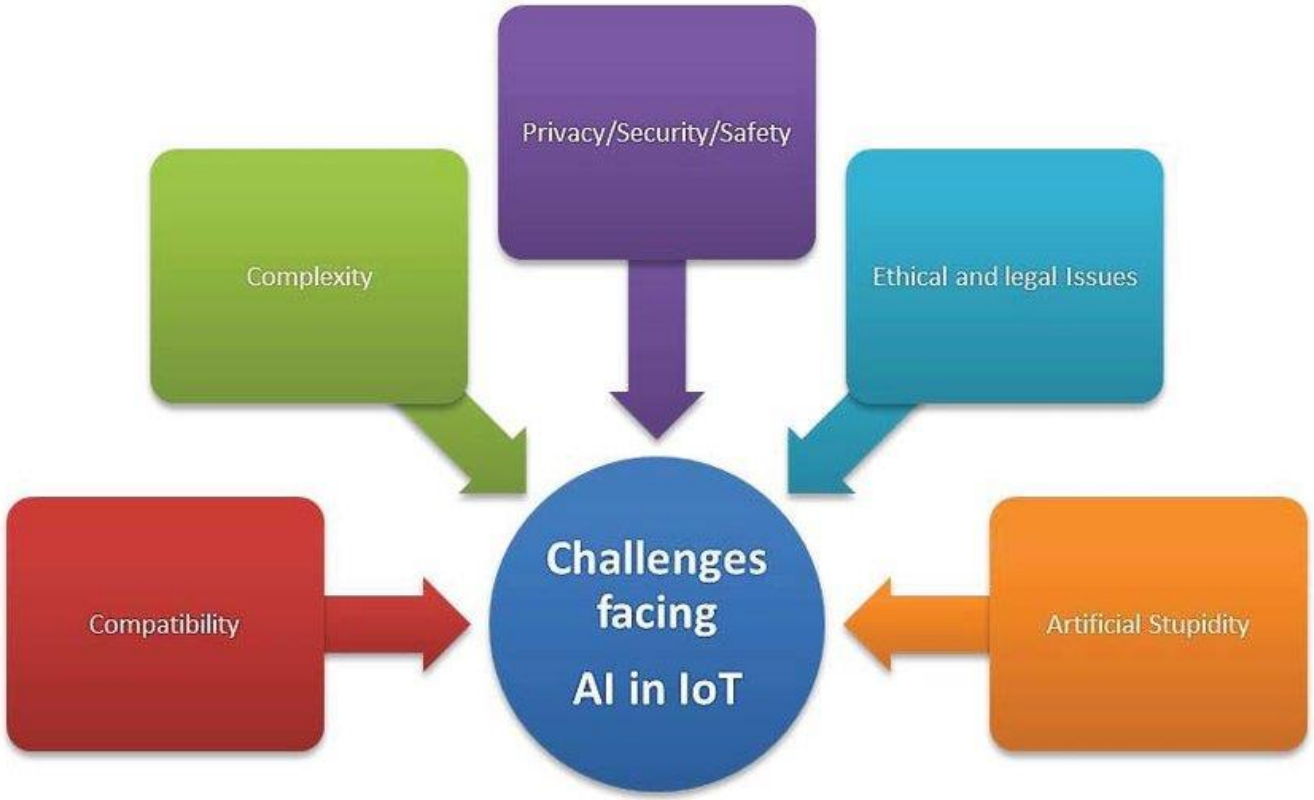
- **Internet Penetration:** Only around 65% of the population has internet access, with disparities between urban (85%) and rural (30%) areas.
- **Energy Disruptions:** Frequent power outages, especially in remote areas, affect the functionality of AI-IoT systems, which need reliable power sources.
- **Cost of Imports:** IoT device import costs are approximately 30% higher due to taxes and shipping fees, making adoption expensive.
- **Data Vulnerability:** 60% of Nepalese companies report limited cybersecurity measures, making IoT deployments prone to data breaches.

LIMITATIONS IN IOT DEPLOYMENTS:

- **Limited internet coverage had seriously affected in remote areas:**
  - Affecting real-time data collection and processing.
  - Low-speed internet increases latency, making real-time monitoring challenging.
  - Power supply issues impacting IoT system reliability.

- **Cost and Accessibility:**
  - Limited availability of affordable, **high-quality IoT devices** compatible with Nepalese industrial standards
  - **Absence of proper data management infrastructure** for handling large IoT datasets.
- Limited awareness of global data protection regulations like **GDPR** that may impact international partnerships
- **Most existing industrial machinery are not IoT-compatible**, requiring retrofitting or complete replacement.
- Challenges in **connecting new IoT technology with old systems in traditional Nepalese industries.**

CHALLENGES FACING AI IN IOT



PROPOSITION # 1

Revitalizing Vacant Agricultural Lands with AI, IoT and Robotics

HOW?

1. Increasingly vacant cultivable land in Nepal's hills and rural areas.
   - Many cultivable lands are left unattended due to many reasons,
   - ***one major reason being labor shortages.***
2. Even in areas where agricultural practices are in place, traditional methods are still widely used.
   - **As a traditionally agriculture-driven nation, unused land represents a loss of potential for food production and economy.**

SOLUTION:

- Lease unused lands and deploy robotic and AI/IoT-driven farming solutions.
- Use automation and AI to turn unused lands into productive farming areas.

PROPOSITION # 2

AI and GPU Usage

AI AND GPU USAGE

- AI models require strong GPUs to process data quickly.
- **Challenge:** GPUs are expensive and can slow down AI progress.
- **Energy Use:** Training large AI models uses a lot of electricity, often from non-renewable sources, which raises environmental concerns.
- **Heat Production:** GPUs produce a lot of heat during AI processing.
- **Issue:** Too much heat can cause system failures, needing extra cooling to prevent problems

SUSTAINABILITY CONCERNS WITH AI AND GPUS

- The high energy use of AI leads to carbon emissions and affects the environment.
- **Need:** The tech industry must focus on sustainable practices to reduce this impact.

KEY POINTS:

- Nepal has vast hydropower resources.
- Hydropower can significantly reduce data center energy costs.
- Himalayan climate is ideal for cooling data centers.
- If Government wills to provide incentives, then it can boost the data center industry.

ACTION PLAN:

- Invest in Nepal's data center infrastructure.
- Support policies that promote sustainable data centers.
- **Collaborate to make Nepal a global data center hub.**
- **Economic Benefits:** Job creation, foreign investment, and technological advancement.

NORWAY’S DATA CENTER IN ARCTIC REGION

PROPOSITION # 3

LoRaWAN Technologies

- LoRaWAN, -> **L**ong **R**ange **W**ide **A**rea **N**etwork,
- A technology designed for low-power, long-distance communication between devices.
  - Small gadgets talking to each other over long distances without using a lot of battery power. LoRaWAN does just that!
  - It connects devices (like weather stations or smart meters) to the internet through special gateways. These gateways can receive signals from devices located several kilometers away.

- Low Power: Devices using LoRaWAN can run on small batteries for years
- Long Range: While Wi-Fi might only work well within a building, LoRaWAN can send signals over several kilometers.
- **In short:** LoRaWAN supports low-power, wide-area communication for IoT devices.

DISASTER MANAGEMENT USING LORA AND LORAWAN

- **Problem:** Recent floods in Kathmandu and surrounding areas underscore the **need for early-warning systems** to prevent casualties.
- **Solution:** LoRa and LoRaWAN for real-time flood and environmental monitoring in vulnerable zones.
- **How It Works:** Sensors collect rainfall, river levels, and pressure data, transmitting it across LoRa networks to alert systems in real time.
- **Impact:** Potential for **30-50% reduction** in flood-related casualties by enhancing evacuation response times.

AGRICULTURE – PRECISION FARMING WITH AI AND LORAWAN

- **Challenges:** Crop yield impacted by unpredictable weather, resource use, and pest management.
- **AI and LoRaWAN:** IoT sensors using LoRaWAN for soil health, moisture, and weather monitoring.
- **Results: Crop productivity improvements up to 15%,** with **pesticide reduction of 20% in pilot programs**.
- **Case Study:** Terai region – predictive farming led to timely harvesting, avoiding losses from early rains.

LIKEWISE:

Manufacturing – Predictive Maintenance and Smart Factories:

- **IoT Monitoring with LoRaWAN:** Real-time machine data transmission, reducing unplanned downtime by 20%.
- **Case Study:** Textile factories in Nepal saw a 25% improvement in machine uptime.

PROPOSITION # 4

Intensify the Technologies

SMALL LANGUAGE MODELS

- **Small Language Models:** Small language models are like smaller, simpler versions of big AI systems that understand and generate human-like text. They need less data and power, making them easy to use on smaller devices.
- **Benefits**:
  - **Efficiency**: They use less power, so they run faster and cost less.
  - **Accessibility**: You can find them in chatbots on websites and personal assistants on smartphones.
  - **Privacy**: They can work directly on your device, keeping your data safe without needing to send it to the cloud.

TINYML:

- Machine learning models to run on very small devices, like sensors or microcontrollers.
- It allows for real-time **decision-making in small devices**, making applications possible in areas like smart homes (for detecting motion), healthcare (monitoring vital signs), and agriculture (analyzing soil conditions).
- In short:
  TinyML are smart processing done on tiny devices, enabling real-time actions with low power consumption.

ENSEMBLE LEARNING IN AI (RESEARCH PERSPECTIVES)

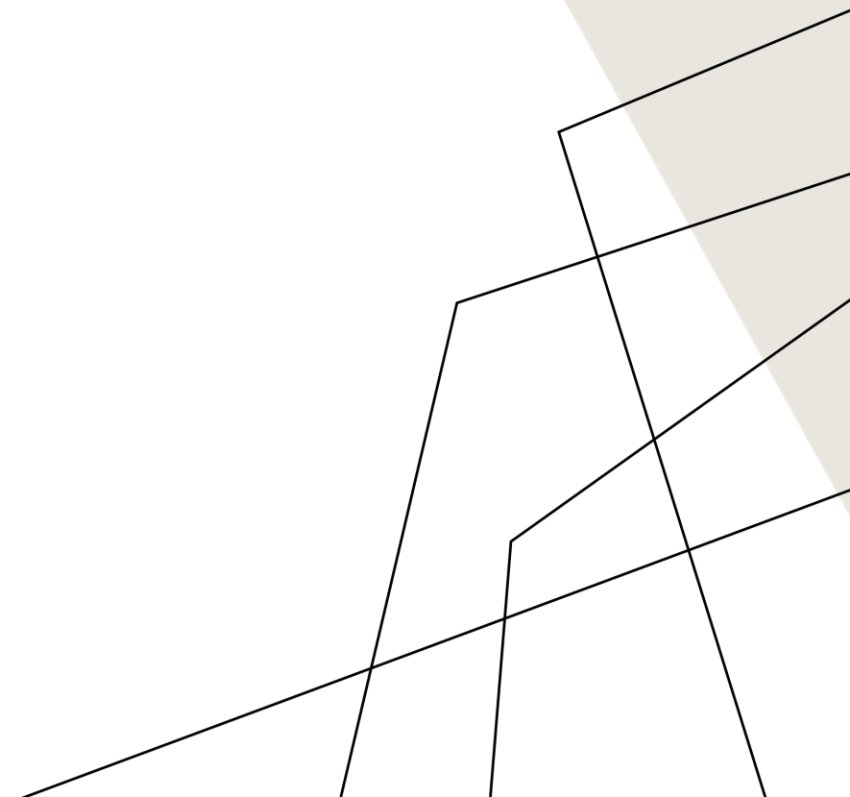
- **YOLO Algorithms**
  - Real-time processing: YOLO excels at processing images and videos in real-time. This makes it ideal for applications where fast detection and response are crucial.
  - Some examples:
  - *Self-driving cars:* To detect pedestrians, vehicles, and other obstacles on the road, allowing the car to react quickly and safely.
  - *Video surveillance:* To analyze live video feeds to detect suspicious activity or identify wanted individuals.
  - *Augmented reality:* To overlay information or graphics onto a live video stream, such as identifying landmarks or highlighting objects of interest.

ENSEMBLE LEARNING IN AI (RESEARCH PERSPECTIVES)
(CONTINUED)

- ***Faster R-CNN:*** Like YOLO, it spots objects in videos and pictures, but takes a bit longer to double-check and make sure (useful for high-accuracy tasks).
    - Example: Imagine a cautious detective who confirms details before identifying a suspect.
- ***Mask R-CNN:*** This detective doesn't just identify the suspect, but also sketches their outline for better identification (useful for tasks needing precise object shapes).
- ***Generative Adversarial Networks (GANs):*** Imagine two artists in a competition – one creates new paintings, the other tries to spot fakes. Through this competition, both get better, with the first artist creating increasingly realistic art.
- ***Transformers:*** This is like a super translator who understands the flow and meaning of words in different languages, not just the individual words (useful for machine translation or summarizing text).
- ***Long Short-Term Memory (LSTM):*** Think of a detective with an amazing memory who can recall details from long and complex cases (useful for tasks involving long sequences, like speech recognition).

DIGITAL TWINS

- A digital twin is a virtual copy of a physical object or system that allows for real-time monitoring and analysis.
- Think of it like having a digital version of something in the real world, such as a machine, building, or even an entire city.



SMART GRIDS AND ENERGY MANAGEMENT SYSTEMS

- Pay as you go model
- End users are credited with “points”
- Industries can be benefitted.
- Real time monitoring and control
- 2-way communication (between utility provider ar consumers)
- Integration of Renewal Energy

INTEL’S “QUARK” PROCESSORS

- **Disaster Management with Distributed Sensors**
- In flood-prone areas, multiple Quark-powered sensors can keep an eye on water levels, flow rates. These sensors share information instantly, helping authorities send out timely flood warnings.
- **Why It Matters:** Quark processors use very little power, allowing them to monitor large areas reliably—even during power outages.

THANK YOU

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