



Artificial Intelligence Applications

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As can be seen from the definition and objectives of AI, there are quite a large number and variety of applications across the industries as well as in our daily life. Given below are some examples of such applications:

1. Expert Systems (first generation AI)

A "knowledge engineer" interviews experts in a certain domain and tries to embody their knowledge in a computer program for carrying out some tasks. How well this works depended on whether the intellectual mechanisms required for the task were within the present state of AI. When this turned out not to be so, there were many disappointing results. One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. Its ontology included bacteria, symptoms, and treatments, but did not include patients, doctors, hospitals, death, recovery and events occurring in time. Its interactions depended on a single patient being considered. Since the experts consulted by the knowledge engineers knew about patients, doctors, death, recovery, etc., it was clear that the knowledge engineers forced what the experts told them into a predetermined framework. In the present state of AI, this has to be true. The usefulness of current expert systems depends on their users having common sense.

2. Recommendation Systems/Engines

The success of the e-commerce business model is mostly attributed to

recommendation engines that help upsell and cross-sell, reducing the need for promotions. Based on user profile and past purchase history, the system recommends what other products he/she may be interested in. Amazon pioneered this, and it is now common in every e-commerce site. The level of sophistication of these engines is ever increasing to make them even more effective. Movie recommendations is another popular application.

3. Computer Vision (image processing, object recognition, video analytics)

Computer vision is an interdisciplinary field that deals with how computers can be made to gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to automate tasks that the human visual system can do. Computer vision is concerned with the automatic extraction, analysis and understanding of useful information from a single image or a sequence of images. The image data can take many forms, such as video sequences, views from multiple cameras, or multi-dimensional data from a medical scanner. As a technological discipline, computer vision seeks to apply its theories and models for the construction of computer vision systems such as:

- Medical image (ECG, CT Scan, MRI etc.) processing to detect diseases
- Security surveillance systems
- Facial recognition to enable entry into restricted areas, e.g. office premises or to classify the emotional state of a person
- Visual product discovery at e-commerce sites

- Image-based searches
- Optical Character Recognition from images (scan of old printed material/books)

4. Speech Recognition (Virtual Assistants)

Human interface to the machines/computers has so far been the keyboard. With Speech Recognition technologies, this interface is being changed to voice, similar to how humans communicate with one another. Virtual Assistants from Apple (Siri), Amazon (Alexa), Google Assistant, and Microsoft (Cortana) are examples of these applications. United Airlines deployed this technology to replace call center agents for ticket booking, customer support etc.

Smart speakers have been developed by using these virtual assistants. Amazon Echo, Google Home and Apple HomePod are examples of smart speakers.

5. Machine Translation

Conversion of text/documents from one language to other language without manual intervention is now possible. It is mostly from English to most of European and Arabian languages as of now. Google Translate now covers most of the Indian Languages as well.

6. Natural Language Processing (NLP)

Machines are now able to read, understand, interpret and act on the text input provided to them. With the arrival of the Internet and growth of e-commerce, the demand for online chats with agents for customer support increased dramatically. With

improved NLP, these human agents are being replaced by software agents. Following are some such applications:

- Chatbots for customer support
- Spam/non-spam segregation of e-mails
- Automatic filtering of web site content that is gibberish, profane etc.
- Text Analytics/Sentiment Analysis
- Grammar correction in documents

NLP is a very broad field, and sometimes Speech Recognition (speech to text), Speech Synthesis (text to speech), Machine Translation (one language to other) are also classified under NLP. There are many sub fields such as Natural Language Understanding (NLU), Natural Language Generation (NLG), Named Entity Recognition (NER), Relationship Extraction (RE), Question & Answer (Q&A) application etc.

7. Robotics

This is a branch of technology that deals with the design, construction, operation, and application of robots.

7.1 Soft Robotics

Non-rigid robots constructed with soft and deformable materials that can manipulate items of varying size, shape and weight with a single device. A good example is Soft Robotics Inc. grippers that can adaptively pick up soft foods like baked goods or tomatoes without damaging them.

7.2 Swarm robotics

Co-ordinated multi-robot systems, often involving large numbers of mostly physical robots.

7.3 Tactile/touch robotics

Robotic body parts (often biologically

inspired hands) with capability to sense, touch, exhibit dexterity, and perform a variety of tasks.

7.4 Serpentine Robots

Serpentine looking robots with many internal degrees of freedom to thread through tightly packed spaces.

7.5 Humanoid Robots

Serpentine looking robots with many internal degrees of freedom to thread through tightly packed spaces.

8. Robotic/Cognitive Process Automation (RPA/CPA)

This is a class of software “robots” that replicate the actions of a human interacting with the user interfaces of other software systems. RPA enables the automation of many “back-office” (e.g. finance, human resources) workflows without requiring expensive IT integration. This deals with mostly structured data available in enterprise applications such as SAP, Oracle, or custom developed applications like e-commerce.

RPA typically automates manual data entry operations (currently BPO activity) as in invoice, purchase order and other forms related processes. This does not have any intelligence built into it, hence, strictly speaking it should not fall under AI.

An extension of RPA is called Intelligent or Cognitive Process Automation (CPA). While RPA mimics human actions, CPA mimics human judgment (perception). Cognitive Automation deals with unstructured data such as images, video, text (documents) etc.,

recognizes objects/patterns in image/text and invokes RPA to update enterprise database.

CPA will play a critical role in transforming IT architecture that enables the future Intelligent Enterprise. All enterprise applications will also be transformed into smarter applications with human judgment capability.

9. Autonomous Vehicles

Autonomous vehicles are those that can operate without human driver/pilot. These include the following:

9.1 Autonomous Cars and Trucks

In July 2016, Tesla reported that its cars had driven over 130 million miles while on “Autopilot”. In December 2016, Rio Tinto had a fleet of 73 driverless trucks hauling iron ore 24 hours/day in mines in Western Australia. Google, Uber and all the leading automobile companies are investing a lot to develop these technologies further to make wheeled vehicles capable of operating without a human driver viable on our roads!

9.2 Unmanned Aerial Vehicles

Flying vehicles capable of operating without a human pilot. The unmanned General Atomics Predator XP UAV, with roughly half the wingspan of Boeing 737, can fly autonomously for up to 35 hours from takeoff to landing. Amazon is investing a lot in developing drones that are self-driven for logistics purposes. If they succeed, aerial rentals, similar to car rentals of today, can soon be a possibility!

9.3 Autonomous Planning and Scheduling of Spacecrafts

NASA's remote agent program became the first on-board autonomous planning program to control the scheduling of operations for a spacecraft. Remote agents could generate plans from high-level goals specified from the ground, and monitor the execution of those plans – detecting, diagnosing, and recovering from problems as they occurred.

9.4 Logistics Planning

During the Persian Gulf crisis of 1991, US forces deployed a Dynamic Analysis and Re-planning Tool (DART), for automated logistics planning and scheduling of transportation. This involved up to 50,000 vehicles, cargo, and people at a time, and had to account for starting points, destinations, routes, and conflict resolution among all parameters.