ARTIFICIAL INTELLIGENCE FOR ENGINEERING

UNIT : 5 . Applications

Lecture - 23

Content : Image and face Recognition

Course Outcomes : Students will be able to learn the applications of Artificial Intelligence.

Image Recognition

- Image recognition refers to technologies that identify places, logos, people, objects, buildings, and several other variables in digital images.

- A common example of image recognition is optical character recognition (OCR). A scanner can identify the characters in the image to convert the texts in an image to a text files. With the same process, OCR can be applied to recognize the text of a license plate in an image.

- Image recognition, in the context of machine vision, is the ability of software to identify objects, places, people, writing and actions in images.

- Computers can use machine vision technologies in combination with a camera and artificial intelligence software to achieve image recognition

- Image recognition is used to perform a large number of machine based visual tasks, such as performing image content search and guiding autonomous robots, self driving cars and accident avoidance systems.

How does image Recognition work?

Modeling Step-1: Extract pixel features from an image

Modeling Step-2: Prepare labeled images to train the model.

Modeling Step-3: Train the model to be able to categorize images.

Modeling Step-4: Recognize (Predict) a new image to be one of the categories.

Face Recognition

- Face recognition is a methods of identifying or verifying the identity of an individual using their face.

- Face recognition systems can be used to identify people in photos, video, or an real-time.

- Face recognition systems use computer algorithms to pick out specific, distinctive details about a person's face.

- These details, such as distance between the eyes or shape of the chin, are then converted into mathematical representation and compared to data on other faces collected in a face recognition database.

- Face recognition systems vary in their ability to identify people under challenging conditions such as poor lighting, low quality image resolution, and suboptimal angle of view.

In facial recognition there are two types of comparisons-

- **Verification** - the system compares the given individual with who they say they are and gives a yes or no decision.

- **Identification** - the system compares the given individual to all the other individuals in the database and gives a ranked list of matches.

How Face Recognition works

1. The face detection process is an essential step as it detects and locates human faces in images and videos.

2. The face capture process transforms analog information (a face) into a set of digital information (data) based on the person's facial features.

3. The face match process verifies if two faces belong to the same person.

Here are some nodal points that are measured by the software.

1. Distance between the eyes
2. Width of the nose
3. Depth of the eye socket
4. Cheek bones
5. Jaw line
6. Chin

Applications

- ## Security / counter terrorism.
  Access control, comparing surveillance images to know terrorist.

- ## Day Care :
  verify identity of individuals picking up the children.

- ## Residential Security
  Alert homeowners of approaching personnel.

- ## Voter verification
  where eligible politicians are required to verify their identity during a voting process.

- ## Banking using ATM
  The software is able to quickly verify a customer's face.

UNIT-5 : Applications
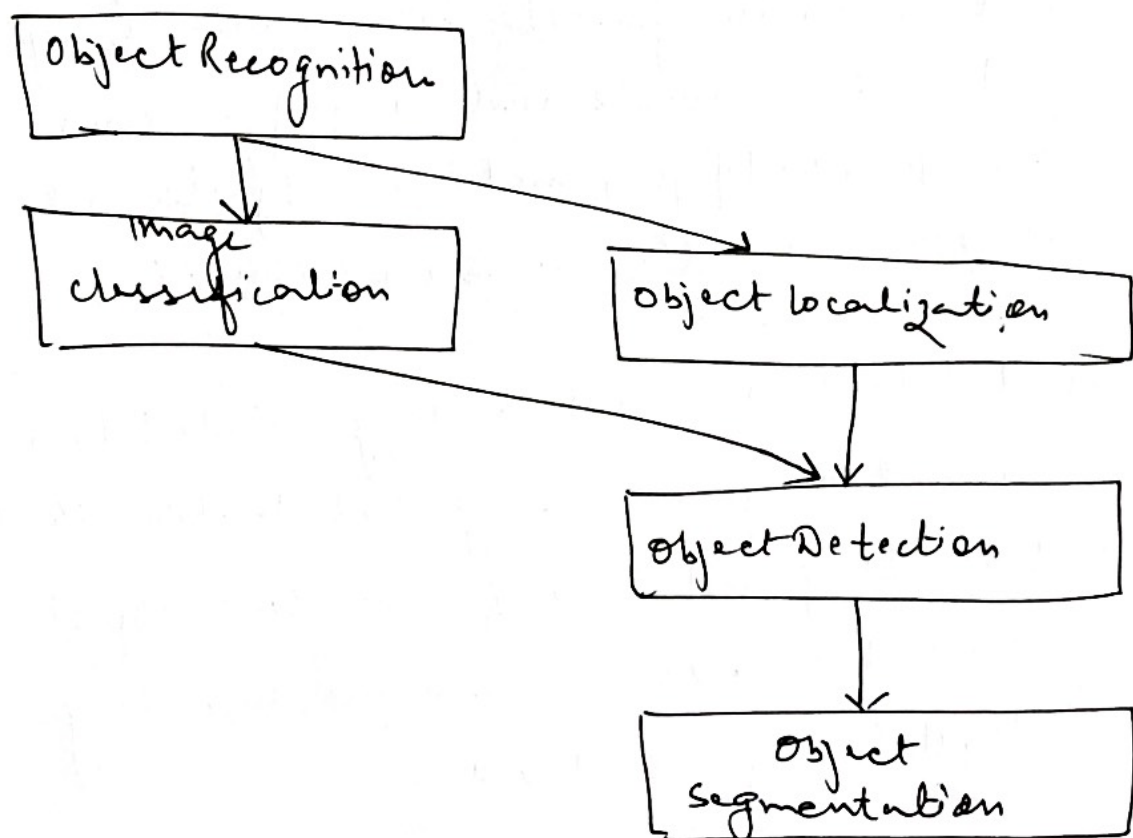
LECTURE-24

Content : Object Recognition

Lecture Outcomes : Student will be able to know the object recognition appliation.

Object Recognition

- Humans can easily detect and identify objects present in an image. The human visual system is fast and accurate and can perform complex tasks like identifying multiple objects and detect obstacles with little conscious thought.

- Object detection is a technology related to a computer vision and image processing that deals with detecting and locating instances of semantics object of a certain class (such as humans, buildings, or cars) in digital images and videos.

- object-recognition is a computer vision technique for identifying objects in images or videos.

How it works ?

- Image classification involves predicting the class of one object in an image.

- Object localization refers to identifying the location of one or more objects in an image and drawing abounding box around their extent.

- Object detection combines these two tasks and localizes and classifies one or more objects in an image.

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│  Object Recognition  │
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     │            │
     ▼            ▼
┌──────────┐   ┌──────────────────────┐
│  Image   │   │  Object localization │
│classification│ └──────────────────────┘
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                └─▶│   Object Detection   │
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                   │        Object        │
                   │     Segmentation     │
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Applications

- Computational photography
- Assisted driving — Pedestrian & car detection
  - Lane detection.
- Image search

Challenges

- Viewpoint variation
- Illumination variation
- Occlusion
- Scale
- Deformation
- Intraclass variation

ARTIFICIAL INTELLIGENCE FOR ENGINEERING

UNIT-5 : Applications

LECTURE-25

Content : Robotics

Lecture Outcomes : Students will be able to learn the basic concept of Robots.

Robotics

→ **Robot** - Mechanical device that performs human tasks, either automatically or by remote control.

→ **Robotics** - Study and application of robot technology.

• Robotics is science of designing or building an application of robots. Simply, Robotics may be defined as, "the study of robots", the aim of robotics is to design an efficient robot.

→ **Tele robotics** - Robot that is operated remotely.

- Robots are, infact, defined as man-made mechanical devices that can move by themselves, whose motion must be modeled, planned, sensed, actuated and controlled, and whose motion behaviour can be influenced by 'Programming'.

Essential Characterstics of Robots

- <u>Sensing</u> - First of all your robot would have to be able to sense its surroundings. Giving your robot sensors: light sensors (eyes), touch and pressure sensors (hands), chemical sensors (nose), hearing and sonar sensors (ears) and taste sensors (tongue) will give your robot awareness of its environment.

- <u>Movement</u> - A robot needs to be able to move around its environment. Wheather rolling on wheels, walking on legs or propelling by pushers a robot needs to be able to move.

- <u>Energy</u> - A robot needs to be able to power itself. A robot might be solar powered, electrically powered, battery powered.

✓ <u>Intelligence</u>- A robot needs some kind of "smarts".
This is where programming enters the pictures.
A programmer is the person who gives the robot its
smarts.

Advantages

- Going to far away planets.
- Going far down into the unknown waters and mines
  where humans would be crushed.
- working at places 27*7 without any salary
  and food
- They can perform tasks faster than humans
  and much more consistently and accuratly.

Disadvantages

- People can lose jobs in factories
- It needs a supply of power
- It needs maintenance to keep it running
- It costs money to make or buy a robot.

Types of robots

- **Industrial Robots**
  - Materials handling
  - Welding
  - Inspection
  - Improve productivity

- **Mobile Robots**
  - Robots that move around on legs, tracks or wheels.

- **Educational Robots**
  - Robotic kits are used extensively in education.

- **Domestic Robots**
  - Two types those designed to perform household tasks and modern toys which are programmed to do things like talking, walking & dancing etc.

Robot Components

1. __Manipulator or Rover__ — Main body of robot

2. __End Effector__ — the part that is concerned to the last joint of a manipulator.

3. __Actuators__ — Muscles of the manipulators.

4. __Sensors__ — To collect information about the internal state of the robot or to communicate with the outside environment.

5. __Controller__ — Similar to cerebellum. It controls and coordinates the motion of the actuators.

6. __Processors__ — the brain of the robot. It calculates the motions and the velocity of the robots joints etc.

7. __Softwares__ — operating system, robotic software and the collection of routines.

Robotic Applications

→ Exploration
- space Missions
- Robots in the Antarctic
- Exploring volcanoes
- Underwater exploration

→ Medical Science
- surgical assistant

→ Assembly
- factory part handling
- Assembly
- Painting
- Surveillance
- security
- Home help

ARTIFICIAL INTELLIGENCE FOR ENGINEERING

UNIT-5: Applications

Lecture-26

Content - Applications

Lecture outcomes - Students will be able to know the different applications of AI.

Applications of AI

There are different applications of AI.

1. Astronomy
2. Health care
3. Transport
4. Agriculture
5. Education
6. E-Commerce
7. Entertainment
8. Robotics
9. Automative
10. Social media

11. Data Security
12. Finance
13. Gamming
14.