Recent Advancements in Image Processing and Applications - A Review Paper

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Abstract – the ever-changing industrial world leads to neologism of technological advancements Image processing plays a vital role in all fields from door barcode scanner to till sophisticated Robotic surgery and implantation. This Articles main goal is to provide complete overview of Advancements in image processing for betterment and useful application areas. and the paper highlights most prominent recent advancements Firstly, Ongoing era Artificial intelligence(AI) Algorithms merged with imaging, Machine Learning(ML), widens the image processing application. Futuristic Textile production and quality control with Image processing. For Advanced perception and controlling of robots with Image processing makes robots involved in tedious jobs and help doctors to perform complex medical procedures.

Key Words **– Advancements in image processing, Robotic Imaging, applications of image processing, Industry 4.0**

I. INTRODUCTION

Usually, representation of picture can be two-dimensional or three dimensional. Basic Aim of Imaging can be data fetching or to enhance the image with the help of computer. In earlier days Analog image processing was in use, once Digitalization and computer integration comes in to picture, it became a part of the life [1]. Imaging rapidly changing sector that involves various fresh technologies and advanced tools. In recent days, many advancements in image processing which has gained good traction and are reshaping the industries. The recent advancements that lifts the industries as follows. Industrial Automation, robotics, part inspection and quality control, medical imaging and robotic surgery, remote sensing, security and surveillance, marine underwater application [2].machine vision incorporated with High-end models makes the decision-making task easier and smoother. Deep learning techniques revolutionized the image processing field with Convolutional Neural Network (CNN) for image segmentation, object detection. Deep learning popular nowadays which focuses on building highly accurate models with deep neural networks. This article explores about recent advancements of visioning part applied with practical implementation areas, that new researchers could utilize. The format of this article is outlined below: we will illustrate the recent advancements and technologies used in image processing such as integration of AI with image processing, submarine monitoring etc., in section 2. Review image processing practical applications in section 3. Then discuss some of the challenges and future scopes in part 4. The study is concluded in section 5.

II. RECENT ADVANCEMENTS

A. ARTIFICIAL INTELLIGENCE AND IMAGE PROCESSING

Artificial Intelligence is at higher elevation in current times AI combination greatly moves with imaging algorithms will produce a greater output. The main key research area using AI with image processing depicts image segmentation in regions that are complex in nature. deep learning has transformed vision capabilities stepping towards higher levels utilizing Convolutional Neural Network (CNN). This capability allows semantic segmentation of image. Thanks to the deep learning algorithms. Image synthesis is achieved with Generative adversarial network (GANs) and

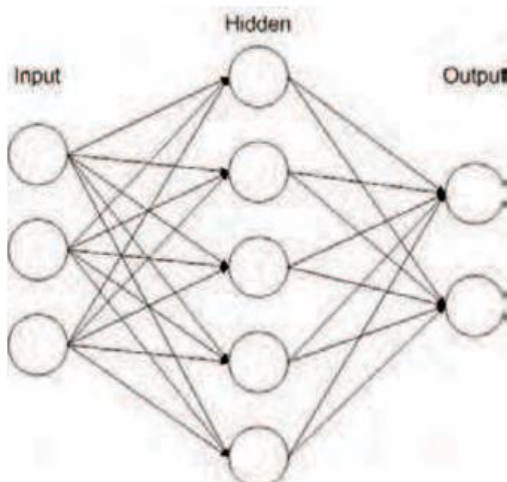VAEs. Creating lifelike images from random noise

image. AI and ML models can recognize faces and objects which enables Facial recognition, image-based searching techniques which are very essence in facial recognition-based biometrics. Artificial intelligence is vital and integration of AI with image processing gives rise to advancement in medical imaging and surveillance. Machine learning is an improving field. ML has capability to undergo training on labeled datasets referred as supervised learning. In autonomous vehicles and robotic area AI and ML plays a crucial role when it comes to visual perception and decision making tasks by analyzing sensor data it can be images from camera or by LIDAR scans to make intelligent decision for navigation and control[3].

B. NEXT GENERATION ROBOTS COMBINED WITH IMAGING

Robotic development is vigorously rising throughout the world to carry out the everyday tasks. Developing next generation robots by using robot technology (RT) middleware For RT-middleware we use a distributed framework called Distributed image analyzer. The main basic unit of framework is RT-component.. Eventually another best case for vision application is vision system used for machines. For the purpose of observing processing operation an employ must be present all the time in front of the machine to observe the screen. Person is switched with imaging then changes will be monitored by imaging capability through camera with OCR the will capture and

monitor the processing equipment. numerous data will be fetched when equipment is under process. which enhances system resilience and autonomous learning possible. single layer network are not in use it is substituted it many layers network. structure is as Shown in fig.1 Every layer is having a predefined number of artificial layers [4].

Fig-1: multi-layer perceptron neural network

C. SATELLITE REMOTE SENSING AND IMAGE PROCESSING

Remote sensing and computer vision is a significant vast research field where target detection in satellite imaging is evergreen and innovative area till today. Though the advancement in research and development is at higher altitudes with great efforts the satellite imaging offers enough complexity and challenges such as danse distribution and complex background, in order to solve these issues a structure called centralized visual processing center(CVPC) is proposed, which uses a light weight encoder to capture broad and long range objects. To increase the pictures detailed feature a pixel level learning center is employed.to recognize small objects YOLOv3 is used which combines small feature maps with larger feature maps fusion of SSD is best solution to solve the problem of complex background in remote sensing application. Centralized visual processing center will drastically enhance the detection of capability of remote sensing[5].machine learning algorithms can perform tasks without the explicit program .Machine learning combination with imaging for ISRO to carry out the processing of acquired images. firstly image need to be converted into data frames and then apply it to system application, based on the image bandwidth need to be manually stetted and identification of object with the help of convolutional neural network.by using Linear Image Self Scanning Sensor LISS-1V. it's a high end equipment[6].

D. SMART TEXTILE PRODUCTION AND QUALITY CONTROL WITH IMAGE PROCESSING

Textile designing and production as per customer need and delivered exactly incorporating machine vision camera is a trend now industry for better improvement and quality in the textile industry. once the model is finalized from the customer end its up to the image camera to take over the task.it takes four camera setup, room for clicking person picture and software will handle the measurements and followed by smart production, it will be dispatched to the customer subsequently [7].

III. APPLICATIONS

A. INDUSTRIAL OPTICAL CHARACTER RECOGNITION APPLICATION

Optical character recognition (OCR) is a vital area in automation sector for identification of part number and code written on the industrial products that will be enable human and machine to connect easily in many applications area includes artificial intelligence, computer vision. The acquired image will be segmented in the form of grid and the which portion is required will be extracted using YOLOv3 without error. The input or acquired image through optical scanner which will be useful for further processing aspects of image processing. Basic example of OCR in industry is reading part number through input vision camera [8].

B. MEDICAL APPLICATIONS

Image processing application in medical imaging and diagnosing with high quality image helps doctors and radiologists, oncologist to take better decision in planning treatment procedure leading to decrease mortality rate and saves life. Image processing is also used in magnetic resonance imaging (MRI), computer tomography (CT), etc.,[9] application areas of image processing in medical imaging is robot assisted surgery which is discussed below:

➤ Robot Assisted Surgery

The application of image processing in medial field has revolutionized the life. The deep learning-based models have changed picture by introducing image data leads to image guided robot assisted surgery (RAS). convolutional neural network goes prevalent in RAS and JIGSAWS is most utilized dataset. The RAS system combines a arm with camera Along with other mechanical arms a Docter will be controlling the system through a computer console. DL opens a smoother way to work flow analysis and gesture recognition [10].

C. UNDERWATER IMAGE RESTORATION AND ENHANCEMENT APPLICATION

Image processing in underwater is challenging due to light condition because once light enter the water medium it exponentially reduces with depth of water so under water environment is dark, less oxygen, with low contrast, blur hence underwater images require enhancement, there are filters which enhance quality and reduce noise of the image. PSM it will reduce scattering effects makes the image clear for processing. Applied to image processing for better enhancing results [2][11].

D. BIOMETRICS APPLICATION

Pattern recognition and face recognition is a difficult issue in image processing. This can be reduced by using spectral decomposition method applied to nullify face recognition problem. Below are some of biometric techniques:[12}

- Face recognition
- Iris recognition
- Fingerprint verification
- Signature recognition
- Skin spectroscopy

Following are the samples of Iris and fingerprint recognition techniques:

Fig.2 (A) Iris Recognition   (B) Fingerprint Recognition

E. AGRICULTURAL APPLICATION

INDIA a agricultural based country with comparison with other countries the innovation in agriculture sector is lagging without modern technology. The soil levels and drone involvement in seeding and spraying of chemicals into the field is not efficient. With the best incorporation of image processing techniques plant based diseases will be identified and root module diseases can be stopped. Mapping of agricultural area in India can be traced[13].

IV. CHALLENGES AND FUTURE SCOPE

imaging techniques at different conditions adaptation to light will be challenging in nature hence in order to get the desired output following are the difficulties:

- Response time
- Noise and distortion
- Variability in image quality
- Noise in the image

Image processing is a vast and evolving field recent advancements combined with futuristic research in space science and robotics which is a future of innovation. In medical imaging the futuristic development can be expected with robot integration and for diagnosing the disease in order to reduced mortality rate. Recent development in ISRO's chandrayana-3 and advancement in capturing images of moon surface by pragyan rover. NISAR between NASA and ISRO are the live examples for remote monitoring applications future lies in space research.

V. CONCLUSION

Advancements in Imaging and applications:

1. Artificial Intelligence and image processing: AI and ML with CNN accomplishes facial recognition, biometrics and by using LIDER scans control and autonomous movement happens.
2. Next generation robots and imaging: with artificial neural networks involved with image camera can replace the NC machine operator and monitor the screen.
3. Smart textile production and machine vision: textile quality and production can be monitored by using vision cameras and measurements taken accordingly for production.

By proving overview of advancements in Image Processing And exploring its application areas that will guide and help the fresh researchers. the review has effectively achieved its intended goal.

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