MACHINE LEARNING (ML) WITH COMPUTER VISION (CV)

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ABSTRACT

Machine learning (ML) and computer vision (CV) are important feature of artificial inteligence scenery. Machine learning is a branch or subfield of artificial intelligence (AI) which is defined as the capability of a machine that emulates an intelligent human behaviour. The term machine learning was developed or discovered in 1959. A computer perception is also known as machine perception. In artificial intelligence (AI), Perception implicit the ability of machines to use input data from sensors such as cameras, RADAR, microphones, wireless signals, etc. Perception also use to learn about many aspects of the world. The machine learning and computer perception or vision both are part of artificial intelligence(AI). The study of machine learning (ML) and computer vision (CV) explores and analyzes the machine learning applications in computer vision and predicts future prospects.

KEYWORDS

Machine Learning (ML), Computer Vision (CV), Machine learning in computer vision(Perception), Applications

INTRODUCTION

The machine learning and computer vision or perception are two important areas of recent researches. The machine learning and computer perception both brings into the computer the human capabilities for data sensing, data understanding, and actions or activities based on past and present outcomes. The machine learning is a subfield of an artificial intelligence which focuses on building the systems that can absorb from historical data, patterns identification, and make logical decisions with little to no human intervention. It is a method of data analysis that automates the building of analytical models through using data that covers various forms of digital information including numbers, words, clicks and images.

The common defifnition of perceptual computing is a general growth and development in technology where computers are better able to sense or analyze the environment around them and respond accordingly. Perceptual computing has a lot of potential to change the end-user interfaces through which humans interact with computers. The complex human activities or actions are recognized and monitored in mulitimedia streams using machine learning and computer vision.

WHAT IS MACHINE LEARNING (ML) ?

A machine learning (ML) is the subfield of artificial intelligence (AI) which focuses on preparing the systems that can learn or improve performances based on the data they consume. Artificial intelligence is a broad term that refers to a systems or machines that follows human intelligence. The terms Machine learning and artificial intelligence are often studied together, and the terms are sometimes used interchangeably, but they doesn't mean like the same thing. An important difference is that although all machine learning is a part of an AI.

Today, machine learning is at working in every areas of industries. When we interact with banking systems, shop online, or use social media, machine learning algorithms come into the role to make our experience efficient, smooth, and secure. Machine learning and the technology around it are developing rapidly, and we're just beginning to scratch the surface of its capabilities.

Machine learning has several approaches to emphasize the training algorithm to recognize patterns in similar data environments. These approaches include :
- Supervised Learning : Under a supervised learning model, data scientists are capable to provide acceptable and secure data to ML systems. Under this model, The machine learning can understand the intended results of a given set of actions.

- Unsupervised Learning : Unsupervised learning algorithms use unstructured data sets without associated, ideal outputs to understand patterns in the data sets.
- Reinforcement Learning : This model is used to train independent machines. This application of ML is used in multiple industries, but there are significant research in this industry.
- Deep Learning & Neural Networks : Machine learning and AI systems used linear or iterative approaches to machine learning.

WHAT IS COMPUTER VISION ?

A computer vision (CV) is a subfield of artificial intelligence that instructs and allows the computer systems to understand the visual world. Computers can use digital images and deep learning models to effieciently identify and classify the objects and react to them.

Computer vision in AI is dedicated to the development of automated systems that can interpret visual data (such as photographs or motion pictures) in the same manner as people do. The plan behind computer vision is to command computers to explicate and comprehend images on a pixel-by-pixel basis. This is a base of the computer vision field. Regarding the technical side of things, computers will seek to extract visual data, manage it, and analyze the outcomes using sophisticated software programs.The amount of data that usually humans generate today is tremendous, it is nearly 2.5 quintillion bytes of data generates every single day. This growth in data has proven to be one of the driving factors behind the growth of computer vision.

In Industry two different technologies used by compter vision, which are :
- Deep Learning : Deep learning can solve complex problems. Deep learning utilizing neural networks so that they can easily train machine systems.
- Convolutional Neural Networks : CNNs adapt visual information like images and break it into pixels to create mathematical function to make predictions about the present data.

MACHINE LEARNING IN A COMPUTER VISION

AI is like an umbrella of these two terms, machine learning is a subfield of an AI, wherein computer vision is also the subset of machine learning. However, computer vision is directly considered as a direct subset of an AI. Machine learning and computer vision are the two terms of AI that are become closely related to each other. Machine learning has improved techniques such as recognition and tracking with computer vision. It offers effective and successive methods for acquisition, image processing, and object focus which are mostly used in computer vision. In turn, computer vision has created a broad scope of machine learning. It involves a digital type image or video, a sensor device, an interpreting device, and the stage of interpretation. Machine learning is used in computer vision in the interpreting device and clarification stage. Relatively, machine learning is the broader field, and this is evident in the algorithms that can be applied to other fields. An example is the analysis of a digital recording, which is done with the use of machine learning principles. Computer vision, on the other hand, basically deals with digital types images and videos. Also, it has relationships in the fields of information engineering, physics, neurobiology, and signal processing.

Computer vision includes image denoising, image inpainting, image segmentation, image classification, object detection, object identification and other tasks. Where on the other side, Machine learning includes supervised and unsupervised learning related to classification and clustering tasks. Both computer vision and machine learning are fundamental and essential techniques for intelligent systems and applications, such as through face recognition, fingerprint recognition, fire monitor, and medical and biological information analysis systems. The aim of computer vision technologies in machine learning and artificial intelligence is that to build a system that can be work without involvement of human.
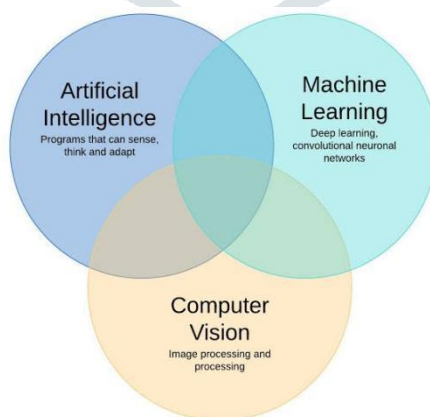

Fig 1 : Machine Learning with Computer Vision

KEY DIFFERENCES BETWEEN MACHINE LEARNING & COMPUTER VISION

Technical Differences

In simple terms, computer vision is a technology that attempts to train computers to recognize patterns in visual data in a similar way as humans do. On the other side, machine learning is a process that enables computer systems to learn how to process and react to data inputs based on prior set by previous actions. In short, machine learning is more general and does not necessarily involve visual data.

Main Differences

In both computer vision and machine learning, the aim is for computer systems to learn how to process and react to data in a specific situation. However, computer vision is widely focused on imaginary and visual data while machine learning focuses on other types of data and aims at tackling image classification, object detection, object segmentation, object tracking in videos. In both cases the outcome is the same, however, the type of input data determines which learning process would work best. The key outcome is that the computer system should be able to learn from previous data.

APPLICATIONS OF COMPUTER VISION USED IN MACHINE LEARNING

The application of recognition capability of machine learning with computer vision has altered the technological world's scenery. It is amazing to see how a simple application of machine learning - within computer vision systems can have important implications.

Via the overlap of machine learning and computer vision competencies, artificial intelligence-based image processing is accomplished whereby data images are manipulated or altered to enhance the original image's quality or extract new and relevant information from the original image.

This important application of machine learning within computer vision is used in nearly every digital visual industry:

1) Business analytics and market research,

2) 3D data image mapping,

3) Agriculture: and specifically the online and real-time monitoring of crops and produce for disease identification and prevention,

4) Security: visual digital facial recognition for security systems and specifically used within airports, and

5) Entertainment.

These are the examples that shows the overlap of computer vision and machine learning applications in the real world.

SCREENSHOTS OF SURVEY
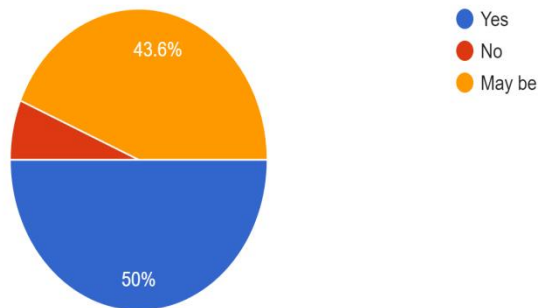
1. Do you know about ML ?
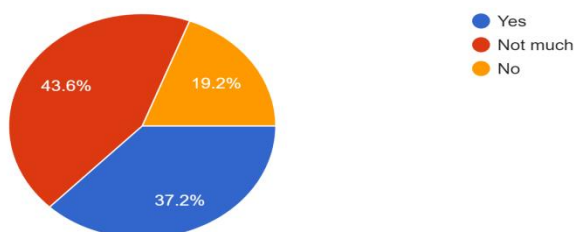
2. Is machine learning (ML) is a part of an artificial intelligence (AI) ?

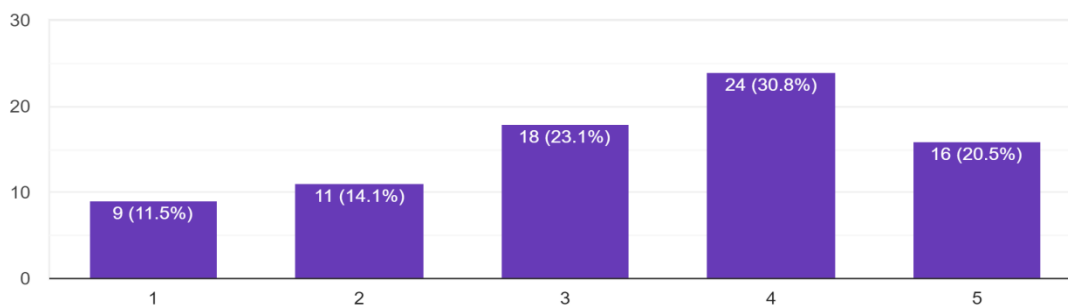Is ML is part of an AI?
78 responses

- Yes
- No
- May be

43.6%

50%

3. Do you think machine learning (ML) is beneficial for industrial automation ?

Do you think ML is beneficial for industrial automation?
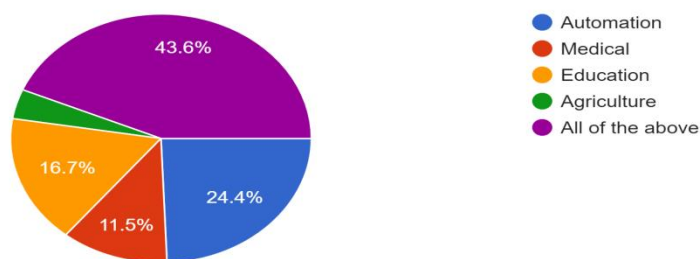78 responses

9 (11.5%)   11 (14.1%)   18 (23.1%)   24 (30.8%)   16 (20.5%)

4. What do you think in which sector ML is most useful ?

what do you think in which sector ML is most useful?
78 responses

- Automation
- Medical
- Education
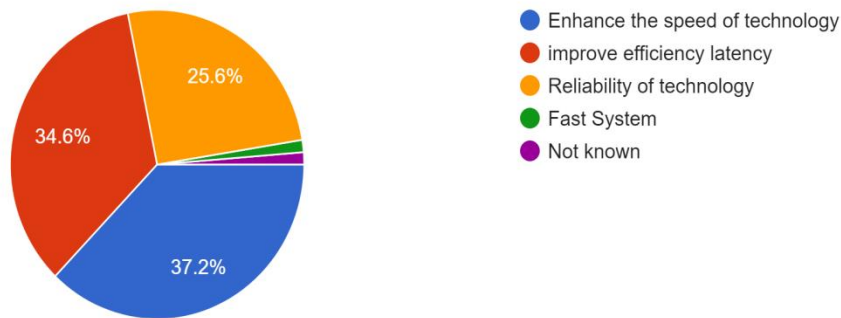- Agriculture
- All of the above

43.6%

16.7%

11.5%

24.4%

5. What is the impact ML in industry (Data Analytics) ?

What is the impact of ML in industry (Data Analytics) ?
78 responses

- Enhance the speed of technology
- improve efficiency latency
- Reliability of technology
- Fast System
- Not known

25.6%
34.6%
37.2%

6. Rate the impact of ML on industry ?

Rate the impact of ML on industry ?
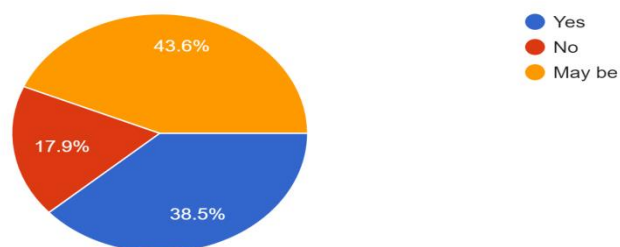78 responses

10 (12.8%)　9 (11.5%)　18 (23.1%)　23 (29.5%)　18 (23.1%)
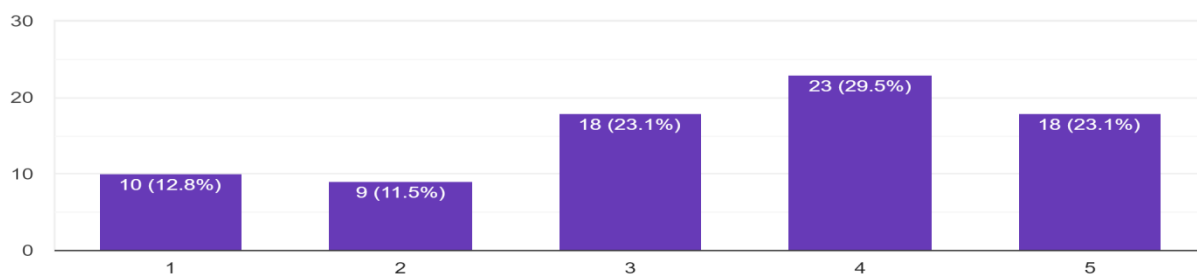
7. Have you ever used any machine learning application ?

Have you ever use any machine learning application ?
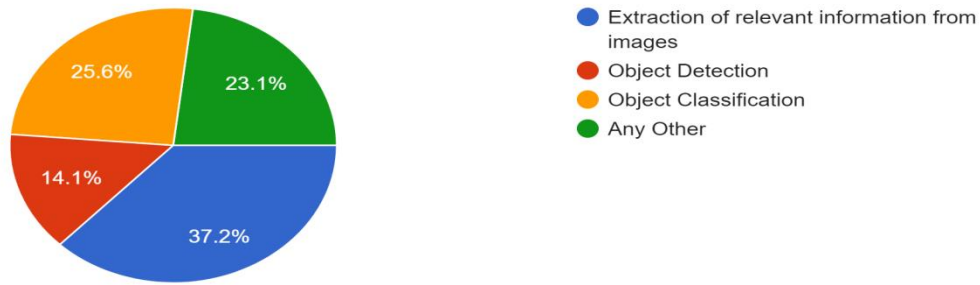78 responses

- Yes
- No
- May be

43.6%
17.9%
38.5%

8. What are the applications of machine learning models in computer vision ?

What are the applications of machine learning models in computer vision?
78 responses

Legend:
- Extraction of relevant information from images (blue): 37.2%
- Object Detection (red): 14.1%
- Object Classification (orange): 25.6%
- Any Other (green): 23.1%

9. Will machine learning merge with computer perception ?

Will Machine Learning merge with Computer Perception?
78 responses

Legend:
- Yes, Definitely (blue): 48.7%
- No (red): 19.2%
- May be (orange): 32.1%
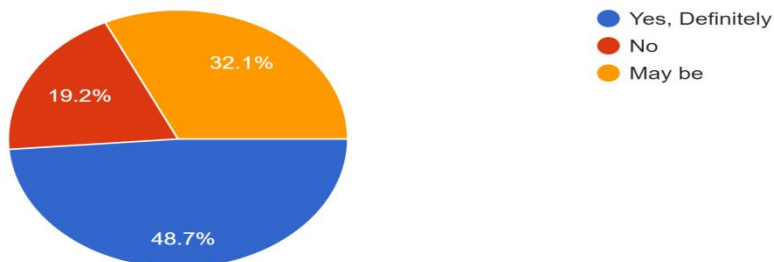
DESCRIPTIVE STATISTICS

Discriptive statistics is a means of describing features from a data set by generating summaries about data samples.

Do you know about ML ?	
Mean	1.756410256
Standard Error	0.085952959
Median	2
Mode	1
Standard Deviation	0.759115983
Sample Variance	0.576257076
Kurtosis	-1.128848835
Skewness	0.443420932
Range	2
Minimum	1
Maximum	3
Sum	137
Count	78

Is ML is a part of an AI ?	
Mean	1.615384615
Standard Error	0.077915674
Median	1.5
Mode	1
Standard Deviation	0.688132599
Sample Variance	0.473526474
Kurtosis	-0.657996891
Skewness	0.675291662
Range	2
Minimum	1
Maximum	3
Sum	126
Count	78

Do you think ML is beneficial for industrial automation ?	
Mean	3.347615385
Standard Error	0.14464227
Median	4
Mode	4
Standard Deviation	1.277445941
Sample Variance	1.631868132
Kurtosis	-0.836861063
Skewness	-0.413822317
Range	4
Minimum	1
Maximum	5
Sum	261
Count	78

What do you think in which sector ML is most useful ?	
Mean	2.076923077
Standard Error	0.135048777
Median	2
Mode	1
Standard Deviation	1.192718501
Sample Variance	1.422577423
Kurtosis	-0.364375982
Skewness	0.838079928
Range	4
Minimum	1
Maximum	5
Sum	162
Count	78

What is the impact ML in industry (Data Analytics) ?	
Mean	1.948717949
Standard Error	0.101434
Median	2
Mode	1
Standard Deviation	0.895840835
Sample Variance	0.802530803
Kurtosis	0.199650127
Skewness	0.658474808
Range	4
Minimum	1
Maximum	5
Sum	152
Count	78

Rate the impact of ML on industry ?	
Mean	3.384615385
Standard Error	0.148508815
Median	4
Mode	4
Standard Deviation	1.311594343
Sample Variance	1.72027972
Kurtosis	-0.830574712
Skewness	-0.46832242
Range	4
Minimum	1
Maximum	5
Sum	264
Count	78

Have you ever used any machine learning application ?	
Mean	1.743589744
Standard Error	0.084457638
Median	2
Mode	1
Standard Deviation	0.746174615
Sample Variance	0.556776557
Kurtosis	-1.063918077
Skewness	0.4585632
Range	2
Minimum	1
Maximum	3
Sum	136
Count	78

What are the applications of machine learning models in computer vision ?	
Mean	2.141025641
Standard Error	0.122037807
Median	2
Mode	1
Standard Deviation	1.077808731
Sample Variance	1.161671662
Kurtosis	-1.140377833
Skewness	0.414508762
Range	3
Minimum	1
Maximum	4
Sum	167
Count	78

Will machine learning merge with computer perception ?	
Mean	1.705128205
Standard Error	0.087722837
Median	2
Mode	1
Standard Deviation	0.77474712
Sample Variance	0.6002331
Kurtosis	-1.103792895
Skewness	0.569947362
Range	2
Minimum	1
Maximum	3
Sum	133
Count	78

CONCLUSION

The research on computer vision and machine learning growing in the sense of new techniques, models, processes and algorithms. Machine learning is able to address many issues of features extraction and processing in computer vision. Complex problems getting easier to understand by the use of machine learning and computer vision. The study includes the analysis, classification, recognition and discussion with the use of machine learning with computer vision. This research has identified the successful implementation of applications of machine learning in computer vision for weather forecasting, biological science, reading of expressions, species classification, games, monitoring the flows of traffic and predictive maintenance in industries. The biological science, human activity, interpretation, traffic managemnet, and professional sports are the emerging areas in industry. The object detection, object classification, and prediction are the most frequent terms of machine learning used in computer vision. Career oportunities are build in the industry with the help of machine learing. Processes like image processing, image acquisition, feature enhancement and object extraction are getting clear and completed by computer vision with using machine learning algorithms. This research paper will give the importance of machine learning (ML). This survey will provide details about the types of tools, applications, datasets and techniques. Techniques of computer vision has improved by machine learning algorithms.

FUTURE SCOPE

Machine learning and computer vision are two technical fields of artificial intelligence which are closely connected. Computer vision (CV) and machine learning (ML), both are fundamentals technologies of intelligent systems and applications. In the future, CV and ML will create wide platform for career in artificial intelligence. Machine learning and computer vision will provide technical segments such as creative AI, autonomous systems, distributed enterprise managemnet and cyber security. VR applications can be developed with the use of ML and CV.

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