

An Overview Review of Artificial Intelligence with Real-Time Face Detection Application

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Abstract- Artificial Intelligence is like as human in decision making, understanding the common language and recognizing the speech of others. This Artificial Intelligence technology is growing rapidly by developing the new algorithms with different tasks. The data science and machine learning play a major part with in the Artificial intelligence technologies. Computer vision involves the new development by creating new algorithms where it detects and delivers the perfect object in all fields. In last, 20 years major improvement where taken place in the Artificial Intelligence technology in many industries. In Artificial Intelligence applications nowadays majorly, prolog (Programming in Logic) and LISP (List processing) programming language were used. This review paper shows the overall concepts of Artificial Intelligence which used in all applications and the term data science and machine learning how it interconnected with the Artificial Intelligence and it shows the improved development with less human working effort in all fields. This paper shows the real-time face recognition using computer vision using MATLAB.

Keywords: AI, Data Science, Machine Learning, Deep Learning, Computer Vision.

1. INTRODUCTION

In the year 2025, 90 percentage of companies in INDIA going to boost their investment in the Artificial Intelligence technology. In India, the companies started to show their interest in machine learning, data science and Artificial Intelligence. Data science is to understand the business problem and the data science in there around 30 years and in the year 2015, Gil gave an evolution for the term data science. In 1966, Peter used the term data science as “Science of Data”. In 1974, Naur gave a survey regarding the methods which deals with the modern data processing in his book. In 1989, Shapero organized a workshop on first knowledge for the discovery in data base. The data mining conference was held on 1995 and it was an annual ACM conference. In 2001, in the field of statistics William published an action plan for data science. In 2002, the Icsu launched the journal in the name of data science. In 2007, the rise of “Data Scientist” which was wrote by Nathan Yau was published in that year. Data science have many terms related which is meant by overlaps. The terms are Data engineer, Big data, Business Intelligence, Business analytics, Statistics data mining, and Machine learning. In 2010, Loukides gave a definition for the data science as “Data science requires skill ranging from traditional computer science to mathematics to art”.

In 2014, V. Granvilles wrote in his book were “Data science is the intersection of computer science, statistics, operation research, machine learning and domain expertise”. According to V. Granvilles the domain expertise which is very essential for the data science such as marketing, practical physics, web and text mining, Bio informatics and genomics, image processing and computer vision. The data researcher, Data hacker called machine learning engineer and Data engineer. In this data science the newly termed called machine learning is now at the epicenter. Machine learning which relates to the data mining which improve the communication soft skills.

Machine learning is a branch of computer science and Artificial Intelligence which mainly focus on the algorithms by using the data to enable Artificial Intelligence. Machine learning works in three process namely 1. Decision process 2. Error function 3. Optimization process. The subfield of Artificial Intelligence are neural networks deep learning and machine learning. The deep learning is said to be the sub-field of neural networks and this NN is the subfield of machine learning. The areas such as computer vision, speech recognition and natural language processing which progress by the neural network and deep learning.

Machine learning methods were 1. Supervised Machine learning 2. Un supervised Machin learning and 3. Semi supervised machine learning. The train algorithms are used to classify the data from the labeled data sets called the supervised machine learning. This model tries to adjust the input data weights until it has been fitted appropriately. Th process called cross validation where it avoids the underfitting.

To analysis and to subset all the datasets the machine learning algorithms used and this is called unsupervised machine learning. The two approaches in this unsupervised singular value decomposition and principle component analysis. The medium between the unsupervised machine learning and supervised machine learning is called the semi supervised machine learning. During process pf training the data, it analysis the lesser labeled sets to classify the datasets. The algorithms commonly used for machine learning is neural networks, linear regression, logistics regression, clustering, decision tress and random forests.

Table 1. Era of artificial Intelligence

Year	Beginning of Neural Network
1943	Walterpitts published the first mathematical modelling of a neural network to create algorithms

	that mimic the human thoughts process.
1950	Alan Turing introduce the Turing test opening the door by his published work computing machinery and Intelligence which is the gateway for AI.
1951	Marvin Minsky developed the ANN called SNARC using 3000 vacuum tubes to simulate the network of 40 neurons.
1952	Arthur Samuel developed the world first self-learning programs to play games.
1956	Allen wrote the logic theorist which the first AI program to perform automated reasoning.
1958	Frank developed the perceptron an early ANN that could learn from data and it became the foundation for he modern neural network.
1960	James who is the graduate student construct the Stanford cart by developing the controlling the remote vehicle using the video information.
1963	Donald developed a program called matchbox educable noughts and crosses engine which learns how to play a perfect game.
1966	Stanford research institute developed the shakey the worlds' first mobile intelligent robot that combines AI, computer vision, navigation and NLP.
1969	Marvin published perceptron's which describes the limitation od simple neural network and AI research to thrive.
1973	James released the Artificial intelligence with a general survey how the British government to significantly reduces support for he AI research.
1979	Kunihiko released the work on neocognition, multi-layered ANN used for pattern reorganization tasks.
1989	Axcelis released evolver, the first commercially available genetic algorithm software package for personal computers
1997	Sepp proposed the long short-term memory recurring neural networks which could process the entire data like video or speech.
1998	Yann team released the data set known as modified national institute of standard and technology database which adopted for the handwriting reorganization evaluation benchmark.
2002	The first open source machine learning library and

	torch was released.
2006	Geoffrey coined the term deep learning to describe algorithms that helps computer recognized different types of objects and text characteristics in pictures and videos.
2010	Anthony launched the Kaggle as a platform for the machine learning competitions.
2012	Geoffrey introduced the deep CNN architectures that wins the ImageNet challenge and triggers the explosion the deep learning and implementation.
2014	Facebook develops the deep learning facial reorganization system called DEEP FACE, which identifies the human faces in digital images with near human face accuracy.
2017	Google researchers developed the concept of transformers by inspiring the subsequent research into tools that could automatically parse unlabeled text into large language models.
2019	Microsoft launched the Turing natural language generation as generative language model with 17 billion parameters.
2021	Open AI introduces the DALL-E multimodal AI system that can generate images from text prompts.
2022	Open AI released the chatGPT in November to provide a chat-based interface to its GPT-3.5LLM
2023	Elon Musk urged a six month pause on training "AI system more powerful that the GPT-4".

Data science related to Artificial Intelligence: The combination of the computer science and statistics to extract the knowledge for data and also from valuable understandings were the multidisciplinary for data science. It mainly involves the decision- making by collecting the data, cleaning the data and analyzing the data by making the predictions. The interrelationship between the data science, Machine learning and Artificial Intelligence was shown in Figure (1.1).

To achieve the goal data scientist uses the various techniques such as machine learning, data mining, data visualization to achieve the goals. The machine learning needs large amount of data to function the system smoothly.

To create predictive models in the Artificial intelligence apps the data scientist took large data and clean it to analyze the data.

Machine learning connected with Artificial Intelligence: Artificial Intelligence and Machine learning are connected where the machine learning provides the ability to the

artificial intelligence by analyzing the large amount of data, recognizing the patterns and adapting the new information. This makes a better performed in artificial intelligence t perform the better tasks that requires for the human intelligence.

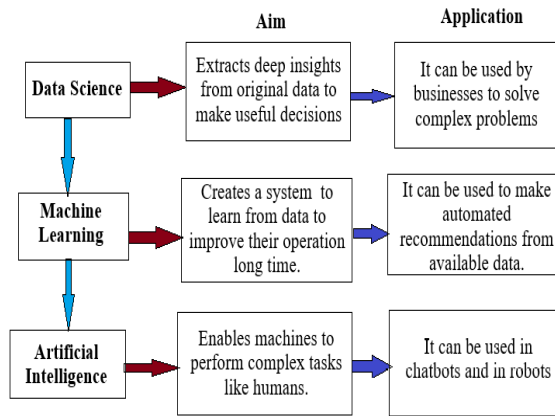


Figure 1 Relation of Data science, Machine learning and Artificial Intelligence

2. APPLICATIONS OF ARTIFICIAL INTELLIGENCE

Throughout the world especially in Industries many applications were carried out using Artificial Intelligence by this it makes the human life faster and more comfortable. Human intelligence called AI where both the engineering and science creating a great task by creating an intelligent algorithm as a machine which acts more smart than human. Nowadays humans adopted mostly in the four artificial intelligence namely personalization, predictions, Natural language programming and advanced healthcare and analysis and visualization. Overall application was shown in the “Figure 2”.

Internet: News feed provides the continuous information to the users with the updated fillings. Machine learning plays a major role in this Internet facilities to determine the which posts should show toward the searcher in web browsers. Various types of social medias like twitter, LinkedIn, Facebook are also using the machine learning technology.

Virtual Subordinates: Open Artificial Intelligence were using the natural language program to understand the user’s natural language quires to import the command again to the users in the same language. Nowadays, Alex by amazon, Siri by Apple’s and recently 2023 chatGPT using this NLP.

Real time Face recognition: The data base stored in the cloud which helps for the facial recognition technology which has capable of matching the faces by capturing in the form of digital frames. It gives 98% accuracy and, in all mobiles, human where using as face lock or unlock.

Agriculture: The predictive analysis where mainly using the machine learning to analysis the predictive models for certain applications. In agriculture artificial Intelligence plays a major

role and identifying the defects and producing the solution for the defects to the farmers. Farmers are getting more support through the Artificial Intelligence in the form of increasing the yields by improving the pesticides handlings. The agronomist uses the artificial intelligence for their research fields and also to improve the quality of crops.

Crop Monitoring and Soil monitoring: Machine learning plays a major role to monitor the crops as well as to monitor the soil. It mainly helps check the moisture in the soil and to detect the pests and also to predict what kind of disease affected the crops in the farms. Artificial Intelligence technology improves the monitor section work in the time.

Education: Artificial Intelligence gives a scope for the administration and students in education fields. Many courses through online is now utilized by the educators as well as students to gaining more understandable knowledge. Artificial Intelligence supports to the management by sending the automated message and circulars for the student and parents regarding their report on their subjects and extracurricular activities. It crests many attractive puzzles and games such that kids can learn in their own way and this makes the kids brain to engaged with the concept orient critical thinking.

Healthcare monitoring: In early days Artificial Intelligence plays a major role where this technology itself detect and diagnose the disease especially in cancer treatment. Artificial neural network supports in the medical field by storing the data of the patients in various aspects like persons specific information in though the Electronic Medical Record for their medical diagnose.

Remote Healthcare system: Artificial Intelligence supports for medical field by remote monitoring and reporting to the nearby hospital regarding the critical patient health. Patients who are under risk of their health in hospital or home this Artificial intelligence technology supports them with first aid.



Figure 2. Overall applications of AI

Manufacturing unit: Nowadays, every automated technology works with sensor as an input such that Artificial Intelligence helpful for the home appliance like monitoring the water quality and this works with the combination of digital instrument called spectrometry which separates and also measures the spectral components. In gas and oil companies the Artificial intelligence technology widely used to check the equipment problems and to increase the output of the gas and oil.

AI cars: For self-driving cars the artificial intelligence acts as a brain. In the self-driving drives many sensors were present and this makes the drive smoothly by deciding the stopping or turning the vehicles. In many vehicles the artificial intelligence technology controls automatically, the speed of the vehicles while driving in the highway and this helps to prevent the accidents.

Data Security: Artificial Intelligence plays a major role in data security works like a detective agent. The big piles of data watching if any stranger takes place in the form of theft the details from the online and it gives alert to the owner in the form of Anomaly recognition.

III Artificial Intelligence tools: The software application which use the algorithm of AI to perform the reputed tasks and to solve the problems. AI tools was used in health care, education, to analyze the data and used for decision making. Artificial Intelligence tools works by the machine learning algorithms to analyze the raw data and perform the decision making based on the trends and patterns of the data.

Machine Learning Models in MATLAB: The machine learning models basically classified in two ways in terms of set of classes and continuous process. 1. ML classification 2. ML Regression.

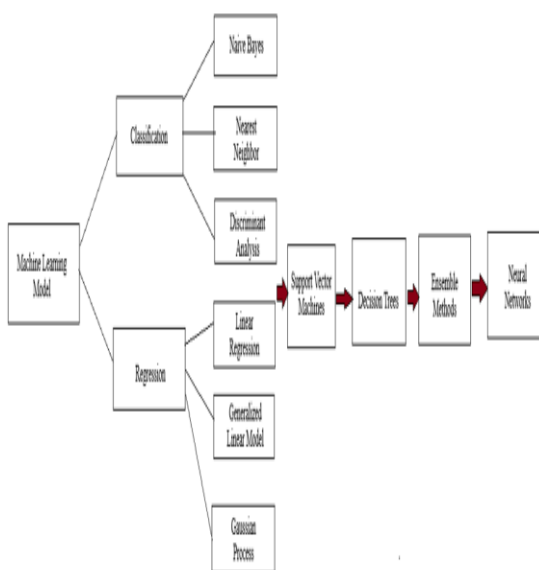


Figure 3. Machine learning model

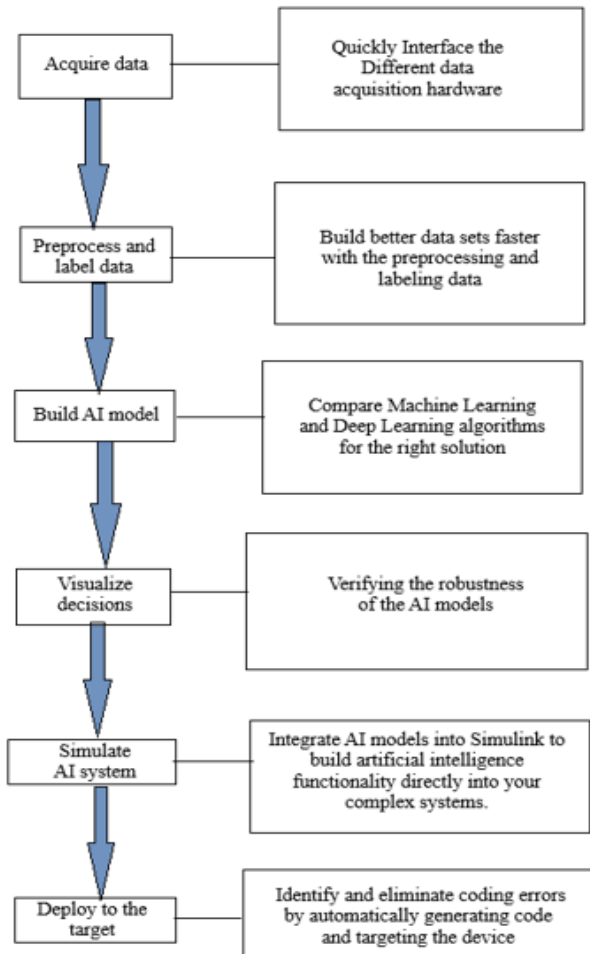


Figure 4. Work flow of the artificial intelligence technology using the machine learning and Deep learning process

The above “Figure 4” show the work flow of the artificial intelligence technology using the machine learning and Deep learning process using MATLAB. In all applications this process helps to reach the right solution and give good accuracy. In the below section the face recognition using MATLAB was carried out using the computer vision tool box and its an application which can be used for the industries and educational purpose.

3. OVERVIEW ON ALGORITHMS USED FOR ARTIFICIAL INTELLIGENCE TECHNOLOGY

Artificial Intelligence algorithm can apply for the computer science and mathematics and it is a set of instructions that are followed in calculation or other operations. So, the algorithm of AI shows how the system to learn and operate by tis own like human. AI algorithm works by taking the training data and it majorly helps the algorithm m to study.

Linear Regression: Linear Regression is mainly used to forecast and to predict the values within the continuous range and this is said to be supervised algorithm.

Decision -making: It can handle a complex data and also it is ease and simple. This algorithm is popular in machine learning it identifies the decision and gather the information finally it gives the alternative resolutions.

Random forest: The random forest algorithm is not a single tree to decide the solution it is a numerous tree which takes data from the training dataset and individually trained with various random samples. Overfitting is the common issue occur in the random forest algorithm.

Support Vector Machine: In Machine Learning very most important algorithm is a SVM algorithm because it has capable for nonlinear and linear classification and outlier recognition. This SVM algorithm can be used as classification and regression difficulties. It was capable to give better results even if there was a less data.

Logistics Regression: Logistics regression algorithm used for the classification task as well as regression but this algorithm is widely used for the classification tasks. The true or false value is identified by the separation of line in the S-shape.

Naive Bayes: Naive Bayes algorithm always follows the Bayes theorem. This algorithm before going into the decision steps it takes the previous probability sets of the classes of the target instead of skipping into directly into the data.

K- Nearest neighbors: KNN algorithm can be used for the predictive and classification modelling. It classifies the output by its closeness with the other output present in the graph. KNN algorithm is used for estimate tasks.

Natural Language Programming: NLP mainly deals with the interaction between computers and human language. NLP techniques mainly include the three techniques namely 1. Sentiment investigation 2. Entity reform and 3. Machine conversion. This technique permits the machine to understand and generate the human linguistic in spoken or textual forms.

Computer Vision: Computer vision plays a major role in Artificial Intelligence technology to analyze and recognize the various images as well as videos. Computer vision supports for the industrial application by recognizing the face, barcode scanning and detecting and object detection.

Gradient Boosting: If one use plenty of data to produce high prediction power in terms of prediction this boosting algorithm supports for the perfect resolutions. To build a strong predictor by the combination of average and weak predictors. In data science this gradient boosting algorithm is used to improve the models.

Learning vector quantization: Artificial neural network algorithm plays major role that allows the engineer to choose how many training data to suspend onto and learns exactly with the data what that occurrence should look like. It helps to reduce the memory requirement by loading the entire data for the KNN algorithm.

Linear Discriminant Analysis: The Linear Discriminant Analysis algorithm of Artificial Intelligence technology is the straight forward approach to predict the modelling and for data classification. The mean value and the total variance for all classes for the data was calculated in statistical method in this algorithm.

Dimensionally Reduction: It works under the principle of component analysis. This algorithm helps to compress the data results in less storage space in the system. It speeds up the control of the system and also removes the noise and redundant structures.

4. REAL-TIME FACE MONITORING USIGN COMPUTER VISION ALGORITHM.

In Industries and medical field, the face detection is the major role to predict the worker and patient face and also it is the need to monitor the surroundings of the campus. Mainly the face detection and reorganization also been used for many applications like for security and authentication in government related documents. Computer vision algorithm-based face detection was carried out in this work. Face detection helps for industries to easily capture the workers faces to maintain the attendance and also it automatically detects the human face through the picture or videos. The Artificial Intelligence technology where the computer vision automatically extracts the data, analysis the data, classifies the data and understanding it in the form of single images, three-dimensional data and in video sequences.

Algorithm to detect the human face: Viola- Jones algorithm used for the work to detect the single an multiple human face. This algorithm shows the interaction between the image processing and computer science. This algorithm works with the gray scale video or picture image and it looks at many minor subregions and tries to find the human face for exact features like nose, eye and mouth in each subregion. “Figure 5” shows the main steps for the Viola- Jones algorithm.

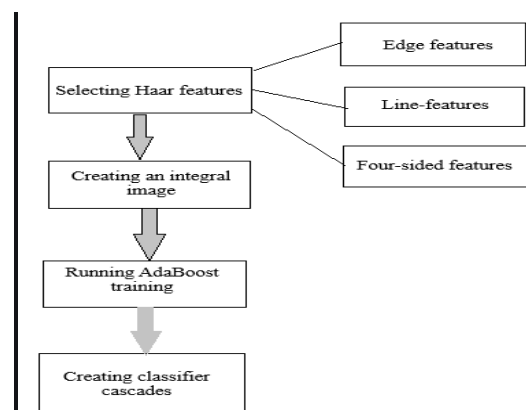


Figure 5. Viola-jones algorithm

To detect the face the cascaded object detector uses the Viola-Jones algorithm in the form of detecting the eyes, mouth, nose and upper body. The computer vision tool box in MATLAB

gives the train cascaded object detector function to train the client classifier. The positive images (Human faces) and negative image (Trees, bicycle and buildings) is stored in the data base and the trained cascaded object detector trains the positive and negative images as a function f_x . The cascade classifier classifies the data in three stages 1. when the positive image is classified the output will be true positive 2. When the negative image is mistakenly classified as positive then the output will be false positive and finally 3. When the positive image is mistakenly classified as negative image the output will be false negative. For each stage it should have low rate of false negative such that true images (human face) well defined by this detector.

5. MATLAB RESULTS AND DISCUSSION

In computer vision application the face detection and tracking are very important which included automotive safety, reorganization and surveillances. In this work three steps were used to detect the single and multiple face in the image. “Figure 6” shows the flow chart for the work which was carried out to detect the face from the live or stored videos.

Step 1: Created the cascaded object detector.

Step 2: Stored video file or live video reader reads the file using video reader.

Step 3: Read frame reads the live video or stored video.

Step 4: bbox computes the bounding box values by creating rectangle shape in the face present in the image.

Step 5: Imshow which shows only the captured rectangle shaped- faces from the image.

Flow work to detect the face:

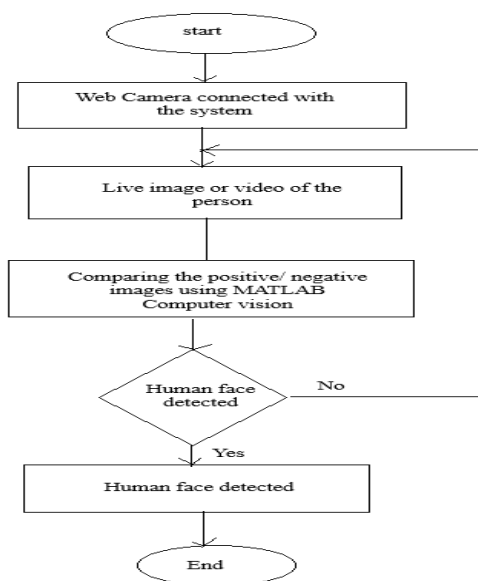


Figure 6. Flow chart for the prosed work

“Figure 7” shows the single face captured with the presence of many objects around in the video and in Figure 8” shows the two faces captured only the positive image and the program which framed is not captured the negative image like plants, clothes and buildings in the live video taken for the work. Finally, the figure 1.9 shows multiple humans were sitting and only three of the face was captured and remaining they turned their face above the camera, finally this shows only the absolute face was detected using the computer vision algorithm.

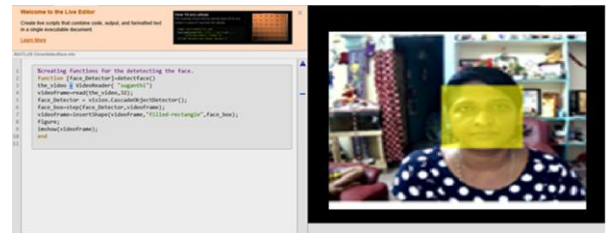


Figure 7. Single face detected

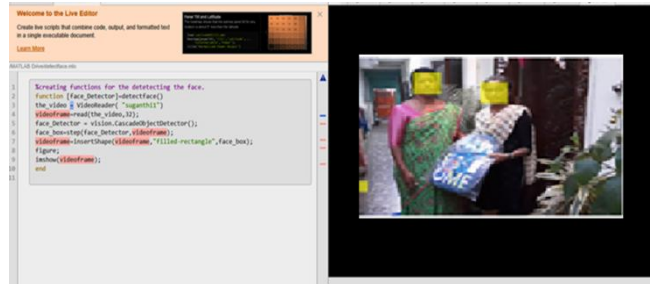


Figure 8. Two face detected



Figure 9. Multiple face detected

6. CONCLUSION

In this paper overview review of Artificial intelligence was worked out and this gives a better understanding about the AI and how it was reshaping the human life and how the algorithms used for the various applications. Especially the application of the Artificial Intelligence becoming more transformative in day today life in a thoughtful way. The work which carried out by detecting the human face with the help

of the MATLAB which will be useful for the industries as well as for residential applications. In future to improve the computational effectiveness, processing time and perfect resolution can try for the KLT algorithm and Eigen faces algorithm to detect the faces and also in medical sector using the face reorganization method one can easily check the previous medical data of the patients by analyzing patients face itself.

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