

# **ARTIFICIAL INTELLIGENCE**



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# **CHAPTER 1**

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## HISTORY OF ARTIFICIAL INTELLIGENCE

It's almost a century since the concept of Artificial Intelligence came into existence. Interestingly, in 1920s a Czech writer named Karel Capek wrote a science fiction play titled 'Rossum's Universal Robots(R.U.R)' and introduced the word Robot. The robots in the play were different to what they are today as they were living creatures designed to serve humans, soon they became a rebellion and threatened the human race similar to the situation that we face today even after a century. In 1945 , Vannevar Bush wrote an essay titled 'As We May Think' that was published in The Atlantic magazine under the heading 'A Scientist Looks at Tomorrow' in July 1945 and republished in September 1945 , before and after the bombings of Hiroshima and Nagasaki. He stated "Consider a future device in which an individual stores all his books, records, and communications, and which is mechanised so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory."

Five years later Alan Turing wrote a paper on the notion of machines being able to simulate human beings and the ability to do intelligent things, such as play Chess. Alan Turing was widely known for encrypting the code for communication from Germany , also gave the theory of computation. The Turing machine is an abstract machine which despite the model's simplicity can construct any algorithm's logic and build an electronic brain. After the end of World War II , Turing introduced the Turing test based on the concept a machine would be called intelligent if that machine and a

human are made to communicate through a natural language, then another human or elevator would not be able to differentiate which of the above was a machine.

John McCarthy is considered to be the father of Artificial Intelligence after he defined this field that was devoted to the development of intelligence machines in 1955 . Being a Assistant Professor of Mathematics in Dartmouth College, New Hampshire, USA John McCarthy organised a Dartmouth summer project on Artificial Intelligence in 1956 with the help of Rockefeller Foundation by sending a proposal stating

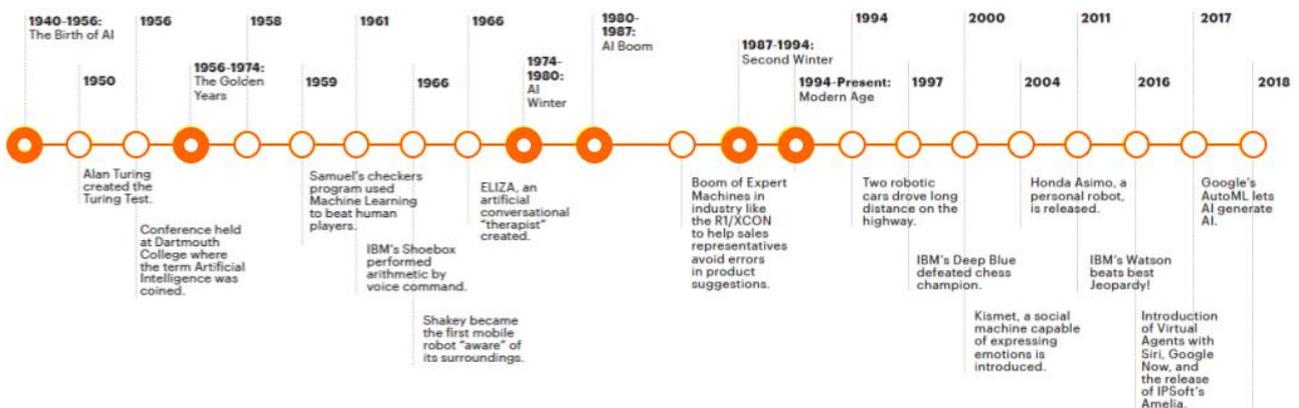
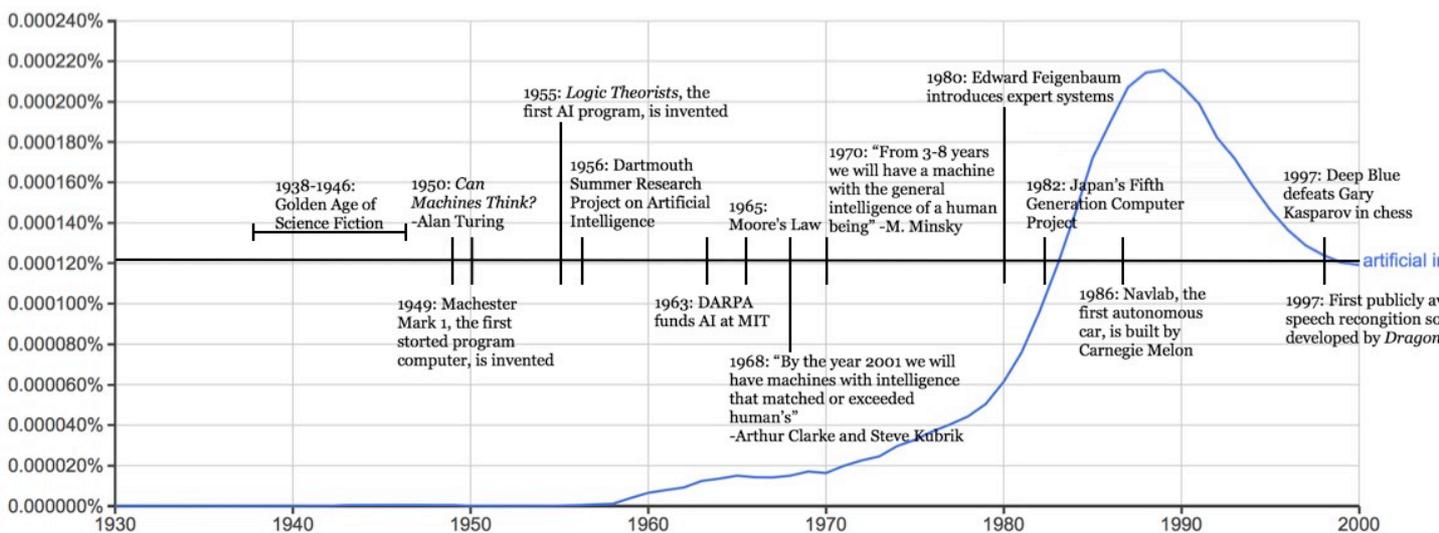
“We propose that a 2-month, 10-man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstractions and concepts, solve kinds of problems now reserved for humans, and improve themselves. We think that a significant advance can be made in one or more of these problems if a carefully selected group of scientists work on it together for a summer.”

This was attended by actual participants in short periods of time and this proposal is credited with coining of the term ‘Artificial Intelligence.’

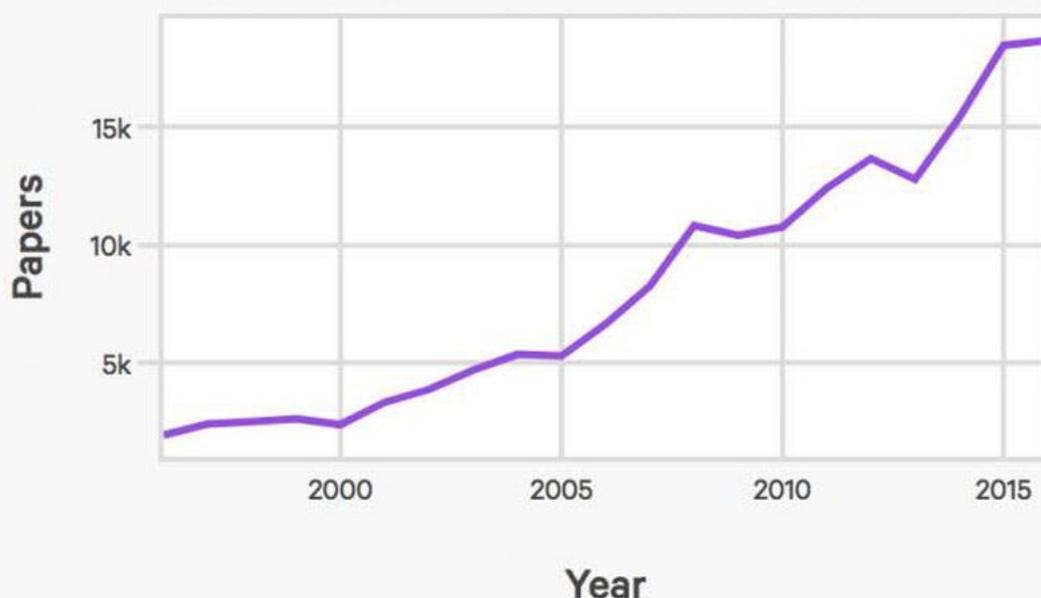
The history describes AI winters in the evolution of this science , the first being around 1974 when the British and US governments decided to cut research in the field . This was

revived by the expert systems which were based on knowledge and inference systems. This was followed by the second AI winter which came between the 80s and 90s by the introduction of desktop computers build by Apple and IBM. This led to decreased interest in expert systems and fall of hardware companies. However, on May 11, 1997 Deep Blue, a Chess computer developed by IBM defeated Gary Kasparov and led to a revival of interest in Artificial Intelligence.

ARTIFICIAL INTELLIGENCE TIMELINE



## Annually Published AI Papers



Source: Scopus.com

AIINDEX.ORG 

## INTRODUCTION

The inception of Artificial Intelligence came from the desire to create intelligent machines that would work and react like human intelligence would, that is cognitively, emotionally and socially. Respectively, the terms analytical, human-inspired and humanised intelligence came into existence with humanised intelligence consisting of all the three components. Hence, the research in Artificial Intelligence requires a multidisciplinary approach primarily focusing on psychology and computer science. Ironically, the field has also generated a mild paranoia on the dominance of machines over human civilisations. Though a report on the World Economic Forum in Forbes has been able to dispel this conception by stating that even though 75 million jobs would be displaced by the year 2022, machines

and algorithms in the workplace are expected to create 133 million new roles which means 58 million jobs in the next few years . The AI epidemic has indeed managed to represent itself in numerous interdisciplinary articles across journals and over fifteen thousand were found in Academia alone in a year.

Not only did the inception consist of the desire to simulate human intelligence but was based on the principle that every aspect of learning or any other feature of human intelligence can be so precisely described that a smart machine can be made to simulate it . So, John McCarthy in 1950s not only made an attempt to create a smart machine but also wished that learning principles of human intelligence could be precisely defined . The AI winter was long , even the contemporary works of Sokolov's Orienting Reflexes that signified human learning mechanisms and intelligence during 1950s were ignored . Unable to amalgamate the concepts , the next few decades saw an eclipsed future for Artificial and Human Intelligence until the computers began generating enormous data that needed systematic shelving and analysis . Hence , the revival saw the development of Artificial Intelligence that now basks in the glory of its achievements.

Artificial Intelligence has been defined by 'Any device that perceives its environment and takes actions that maximise its

chance of successfully achieving its goals ,’ or a ‘System’s ability to correctly interpret external data, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation’.

## **DEFINITIONS**

The English Oxford Living Dictionary gives this definition, 'The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.' Merriam-Webster defines artificial intelligence as 'A branch of computer science dealing with the simulation of intelligent behaviour in computers and 'The capability of a machine to imitate intelligent human behaviour.' Encyclopedia Britannica states, 'Artificial intelligence is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings,' while intelligent agents or beings are those that can adapt to changing circumstances. Amazon defines AI as 'the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving, and pattern recognition.' The field has been defined today for the problems it will solve and benefit the society.

Artificial Intelligence has also divided into Artificial Narrow Intelligence (ANI) , Artificial General Intelligence (AGI) , Artificial Super Intelligence (ASI) . Artificial narrow intelligence refers to a computer's ability to perform a single task extremely well, such as crawling a webpage or playing chess. Speech Recognition (can only recognise speech) while Voice Assistants such as Cortana, Alexa (only act upon voice commands which perform a certain action) are examples of Artificial Narrow Intelligence and this type of Intelligence is achieved by humanity. Artificial General Intelligence is when a computer program can perform any intellectual task that a human could but unlike ANI , it can learn and improve itself to perform various tasks such as AI-

phaGo. Artificial Super Intelligence goes a step beyond, and posits a world in which a computer's cognitive ability is superior to a human.

So , Artificial Intelligence is basically the concept of making systems take up the workload of human beings by taking decisions and acting accordingly. This being a vast subject involves much-advanced and complex processes, hence its field of study includes many theories, methods, and technologies. The major subfields under AI are:

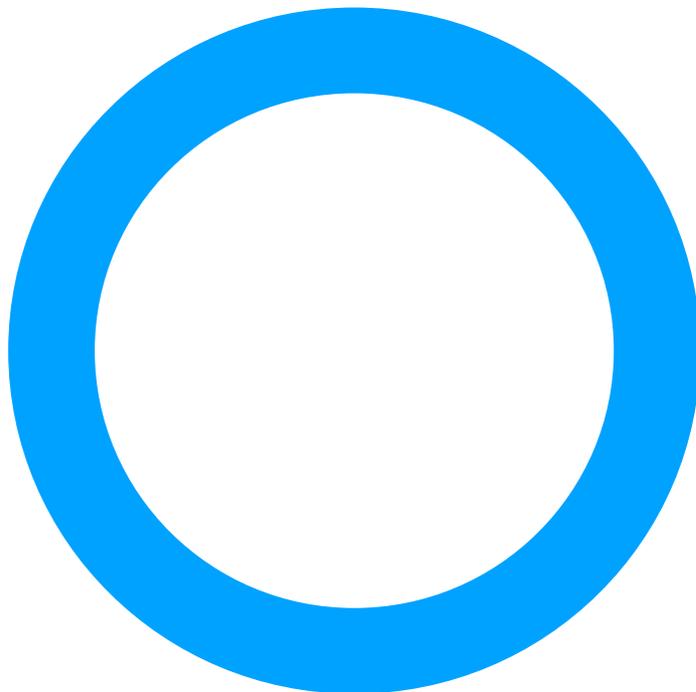
## **Machine Learning**

A technology of implementing artificial intelligence, is the science of teaching a system or computer without programming and is an iterative , recursive process requiring lots of computational power to develop complicated applications. The components of Machine Learning include programming, algorithms with statistical models and data. Though not for actual learning, it triggers the process while the program provides directions to reference data , model and algorithm to be used and locations for output . Arthur Samuel in 1959 described Machine Learning as a subfield of Computer Science that gives computers the ability to learn without being explicitly programmed . ML consists of Programs , Algorithms and Statistical Models , Data and Data Mining . The types include supervised learning, unsupervised learning and reinforcement learning .

## Supervised and Unsupervised Learning

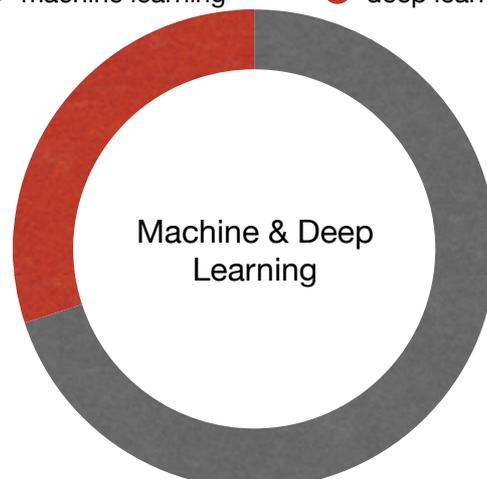
Supervised learning is when there is a labelled data with information about the data I.e. prediction of stock price and Classification of fruits , email spam detector with labelled set of already labelled emails . A label is the target, column being the features wherein one of them would be the label and rows are the ob-

● ARTIFICIAL INTELLIGENCE



servation values.

● machine learning      ● deep learning



## **Regression**

If the techniques involves the problem to be solved using continuous values , this is called Regression . Linear Regression is one of the most common techniques used in Machine Learning to predict continuous values .

## **Classification**

If the values are discrete , it is called Classification. Continuous values include a series of values such as seen in temperature or prices while discrete values are like classes with nothing in between such as apples and oranges. Machine Learning models are then structured to predict future values such as that of the weather of a place on a particular date based on the previous data that is given or the price of a house based on previous records of land deeds . The term Binary Classification is used when there are two classes to consider such as cat or dog, buy or not to buy a house. Multi-class Classification is used when there are multiple classes to consider before identification such as MNIST data for handwritten digits that range from 0 to 9.

Unsupervised learning is when the user interface has no labelled data such as classification of news while surfing on different websites.

## Deep Learning

This is a subset of Machine Learning wherein a large amount of data is analysed , the algorithm performs the data repeatedly in a attempt to improve its outcome . This includes Neural Networks also. The philosophy remaining the same , both Machine and Deep learning include Supervised and Unsupervised learning using Regression and Classification. The difference being Structured data for Machine while Large and Unstructured data for Deep Learning . Also Feature Extraction and Engineering is manual for Machine and Automatic for Deep Learning

# ALGORITHMS IN MACHINE LEARNING

- Simple Linear Classification
- Multilinear Classification
- Decision Trees
- Logistics Regression
- Naive Bayes Classification
- K Nearest Neighbours
- Support Vector Machines
- K Means Clustering

Simple Linear Regression is the equation of a straight line such as  $y=mx+c$  and one has to fit out the right values of  $m$  and  $c$  and find the straight line that fits best into the given data by using a single independent variable that can have any value, to predict the value for a dependent variable . If there is one independent variable it is called Simple Linear Regression.

Multilinear Regression has two or more independent variables that predict the value of a dependent variable and requires one to form a plane that fits best for the variables in a multidimensional space.

Decision Trees classify data and generate a series of rules . Mathematical concepts used in decision trees are entropy and information where entropy is called the measure of randomness or unpredictability of dataset and after every split the value of entropy decreases.

Naive Bayes builds frequencies and likelihood tables and are based out of Bayes Theorem.

Logistic Regression is an algorithm based out of an equation of a straight line which is used for classification and is basically a misnomer because this technique is Classification e.g. technique used to predict whether a person has diabetes or not , this is a sigmoid function carved out of a straight line.

Support Vectors are coordinates of individual observations and a Support Vector Machine is a frontier or a hyperplane that perfectly separates two classes . One has to find the minimum distance of the hyperplane from the closest support vector belonging to any class , once the distances of all hyperplanes are computed , one has to find the hyperplane with the maximum distance from the closest support vector. This black hyperplane is the farthest from the nearest support vectors.

K Nearest Neighbour or KNN classification is a supervised learning algorithm which classifies data based on how its neighbours are classified . It shows all available cases and classifies new cases based on a similarity measure. The value of K specifies how many nearest neighbours to include to classify the observations . A data point is classified by majority from its nearest neighbours based on a feature similarity and uses Euclidian distance while the distance between two closest data points or clusters is called Single Linkage.

Clustering divides data points into a fixed number of clusters . Types of Clustering include Partitional and Hierarchical types . Partitional includes K Means Clustering and Fuzzy C Means while Hierarchical include Agglomerative and Divisive types. K Means Clustering includes division of data points into clusters wherein each data point belongs to a cluster . Initially centroids are assigned randomly , then Euclidian distance is used to find out the centroid which is closest to each data point which are

then assigned to centroids correspondingly while the data points get reallocated to a different cluster based on the proximity to the new centroid and this keeps repeating until the centroids become static. Elbow Point is the point where we see a small change in the value of WSS or Within Sum of Squares which are the sum of squared distances between every point of cluster and its centroids. The number of clusters at elbow or points is chosen as the value of  $k$ .

## **DEVELOPMENT OF ARTIFICIAL INTELLIGENCE IN INDIA**

The first program on AI in India was conducted by Professor H . N. Mahabala in 1965 when he initiated the first computer program in IIT Kanpur later in 1985 when he designed Very Large Scale Integrated (VLSI) computer chip circuits . The actual research began in 1986 when the government of India initiated a program called Knowledge Based Computing Systems (KBCS) with United Nations Development Program . India ranked third biggest AI-focused start up hub among the G 20 countries in 2016 , with an exponential growth in the market 86% higher than the global average and an investment of US \$529.52 million in Applied technology sector and AI , Machine Learning and Data Science being the major domains and sub-domains. Despite these figures out of the 22,000 PhD educated researchers worldwide in Artificial Intelligence (AI), only 386 are in India with serious research work limited to less than 50 researchers with concentration mostly in institutes such as the IITs, IIITs and IIS-c. Therefore, it is the need of the hour to generate a nation wide awareness in this field so that researchers from both medical and technological domains can contribute to the revolution in Artificial Intelligence and Healthcare. Solved in India (or more accurately, solved by Indian IT companies) could be the model going forward for Artificial Intelligence as a Service (AlaaS). AI combined with robotics and Internet of Medical Things (IoMT) could potentially be the new nervous system for healthcare in India. Most of the research on AI in USA is by the private sectors . However, in India companies such as TCS , Wipro and Infosys which provide cutting edge technology solutions have between 2001 to 2016 contributed to only 14% of research publications while 86% is provided by the universities and almost 70% of these industry publications have been limited to Indian subsidiaries of International companies with only TCS being in the top ten though it is encouraging to note that

the number of papers has jumped almost ten fold in a decade from 2006 from 331 papers to 3301 in 2016.

Factors that led to an impediment to the growth in Artificial Intelligence are :

- Lack of expertise as only 4% of AI professionals have worked on technologies such as neural networks.
- Lack of awareness , as even today most government and public enterprises find the technology unreliable, hence refrain from adopting it for businesses.
- Inaccessibility of computing , quality and cloud infrastructure
- Lack of open source platforms to incorporate industry specific data for newer startups.

Pitching India as a “ Garage for the developing and emerging technologies” NITI Aayog has formulated a few guidelines to overcome these impediments.

- Opting for a multi-stakeholder marketplace
- Facilitating the creation of Annotated Datasets through an Open Government Data Platform.
- Encouraging Partnerships and Collaborations
- Spreading awareness on the benefits of Artificial Intelligence initiatives program transparent for the general public with live demonstrations to explain benefits to augment business growth.
- Establishing incubation hubs to assist and support in setting a standard startup ecosystem.

ICON , CROSS , CASTLE and CETIT are the few strategies being incorporated to promote AI in India . ICON being International Centres for New Knowledge , CROSS being Center on Research for Sub Systems , CASTLE being Center for Advanced Studies , Translational research and Leadership and CETIT being Centre for Excellence in Technology Innovation

and Transfer. Both ICON and CROSS are now being collectively included in COREs which is Centres of Research Excellence in Artificial Intelligence while CASTLE and CETIT being included under ICTAI which is International Centre for Transformational Artificial Intelligence. To address issues such as financial , social sustainability and global competitiveness organisations such as Centres for Studies on Technological Sustainability known as CSTS are being established in lines on CREATE or Campus for Research Excellence and Technological Enterprise based on Singapore Program or Innovate UK.

Presently, we also need to step out of the “Black Box Phenomenon” in Artificial intelligence described as very little or no understanding of what happens within the parameters of algorithms and only the input data and results are the known factors. This occurs due to the desire to improve the performance as defined by a narrow set of parameters with the developers emphasis being less on how algorithms are achieving the desired success. Incidentally, most models are now being developed for decision making and it would become inherently imperative to explain the factors that are leading to the desired output, that would slowly help to obliterate this phenomenon.

## CHAPTER 2

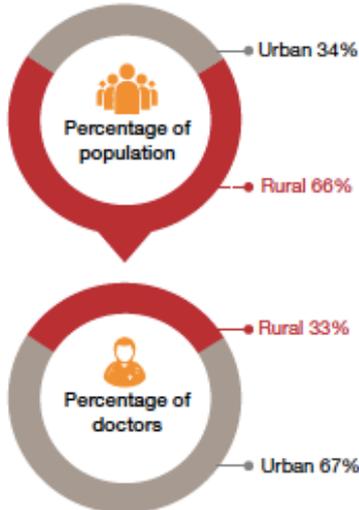
### Role of Artificial Intelligence in Healthcare

Dendral designed for organic chemistry was developed by researchers in Stanford University in 1965 and is considered the first program in Artificial Intelligence that provided the basis for other programs such as MYCIN , one of the earliest significantly used program of artificial intelligence in Medicine . Dendral was developed using LISP or LISt Processor , a favourite language for Artificial Intelligence, developed by John McCarthy at MIT. MYCIN in 1970 was developed to identify bacteria as in bacteraemia, meningitis and the use of antibiotics . The clinicians were given a set of simple yes or no questions and in the end the program provided the list of culprit bacteria from a high to a low probability based on certainty factors. The program never came into clinical use due to ethical , legal issues and lack of system integration. Later due to development of computing systems over the decades , internet connectivity , increased availability of healthcare related data , growth of genome sequences databases , electronic health record systems , revival of artificial intelligence in healthcare has been seen. It has been predicted that by 2020 medical data will be doubling every 73 days and there will not be sufficient medical personnel to handle this flow of data. Even a standard 5% increase in the number of radiologists will not be able to report upto 29% increase in medical CT , MRI images unless

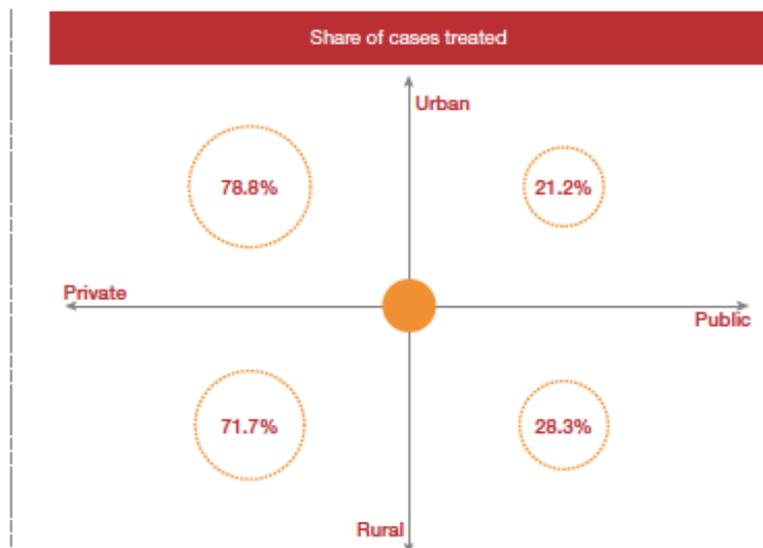
they report at the rate of about four seconds to an image thereby directly affecting diagnostic accuracy.

Even today the urban and rural divide has been a major deterrent to an efficiency healthcare delivery system. Lack of implementation of consistent healthcare policies and an effectively monitoring system has delayed the targets as desired by World Health Organisation. WHO has labelled 1 doctor and 2.5 nurses for 1000 population while there are only 0.76 doctors and 2.09 nurses today. Similarly, we have 1.3 hospital beds compared to 3.5 hospital beds required by WHO policy.

Split of population and doctors



Share of cases treated



The Government of India has launched interventions to improve quality of healthcare, most significant of them being

Ayushman Bharat and Health Wellness Centres . Over 1.5 lakh Health Wellness Centres are being opened across the country while Ayushman Bharat scheme is now being utilised by patients in private hospitals . Though the initiative of covering each family with 5 lakhs medical insurance is indeed a welcome step, long term outcomes will justify the benefits of these interventions as to whether the dissipation of government funds to private sectors in a non-conformational manual feedback system could indeed be beneficial. Hence, there is a potential need for an automated overseer that checks and sets alarms for discrepancies emanating from a human interface . Certain machine learning algorithms can be created to assist feedback systems in data acquisition. About 1200 crores is being allocated to the development of Health Wellness Centres providing 12 basic healthcare services with the key component of screening five non communicable diseases such as hypertension , diabetes and three cancers namely oral , breast and cervical with chronic obstructive pulmonary disease being on the addition list with each HWC equipped with staff to provide services to a population of 5000 people.

With less than 2% of the hospital being accredited and most being individual driven rather than run by institutions, most patients are left to self-judgement and awareness towards the progression or treatment of their diseases . Certain studies have depicted travel distance of up to 1800 km for cancer treatment in some cases. India sees an incidence of more than 1 million new cases of cancer every year, and early detection and management can be crucial in an optimum cancer treatment regimen across the country. Prevention and early detection reduces disease burden, ensures long term follow up and management of symptomatic pa-

tients. Of the total number of pathologists in India about 2000 are barely experienced in oncology and only 500 of these can be considered to be oncopathologists. The ' Digital Pathologist ' could be the next change healthcare systems would realise when machine learning algorithms would be able to assist a general pathologist in reaching a diagnosis. SigTuple analyses blood slides and generates a report without assistance from a pathologist and is cost effective compared to what it would cost if reported by a pathologist for remote areas.

Telemedicine is a fast growing industry that bridges the gap between the developed and remote areas in the country. Artificial Intelligence in a descriptive and predictive way facilitates providing, timely and efficiently, specialist consultation and other clinical services remotely via secure audio and video connections. Using telemedicine and mobile health services the government of India had launched National eHealth Authority (NeHA). This was proposed by the Ministry of Health and Family Welfare in 2015 as an authority to be responsible for the development of an integrated health information system in India , a nodal authority that would develop an integrated health information. LiveHealth, a Pune-based start-up also works as a management information system (MIS) for healthcare providers. It collects samples, manages patient records, diagnoses them and generates reports. MUrgency, a Mumbai-based healthcare mobile application helps people connect in need of medical emergency responses with qualified medical, safety, rescue and assistance professionals. Portea, a Bengaluru-based start-up offers home visits from doctors, nurses, physiotherapists and technicians for patients. Patients who are unable to visit hospitals can receive assistance from doctors and medical

professionals using remote diagnostics and monitoring equipments, point-of-care devices.

Radiomics is an emerging field for Imaging Biobank in cancer detection and prognosis achieved by a comprehensive quantification of tumour phenotypes by the application of large number of quantitative imaging features using Artificial Intelligence. This is based on studies which have shown that certain image based features may correlate to molecular and clinical features like known mutations, receptor status, prognostic power, intra-tumor heterogeneity and gene expression patterns . Also an association between radiographic imaging phenotypes and tumor stage , metabolism , hypoxia, angiogenesis and underlying gene and protein expression profiles. The use of Artificial Intelligence facilitates the correlation between these features to reach a clinical diagnosis. Norma, a Bengaluru-based start-up founded in the year 2016, is using AI for pain-free breast cancer screening.

Augmented reading aids are being used to support clinicians using pre analysed information with visual annotations such as introduced by AI-Rad Companion Chest CT4 , a radiological assistant launched by Siemen's Healthineers. This highlights, quantify, measure defined anatomies and abnormalities and report findings in a structured table. Similarly, Companion 5 provides the patient's status in a clinical pathway. Philips Innovation Campus (PIC) in Bengaluru is developing solutions for Tuberculosis detection from chest x-rays, and a software solution (Mobile Obstetrics Monitoring) to identify and manage high-risk pregnancies. It has also partnered with Fortis Escorts Heart Institute, Delhi to set up Philips IntelliSpace Consultative Critical Care, where

hospitals can now monitor multiple intensive care units (ICUs) from a central command centre that may be located in a geographically-separated area.

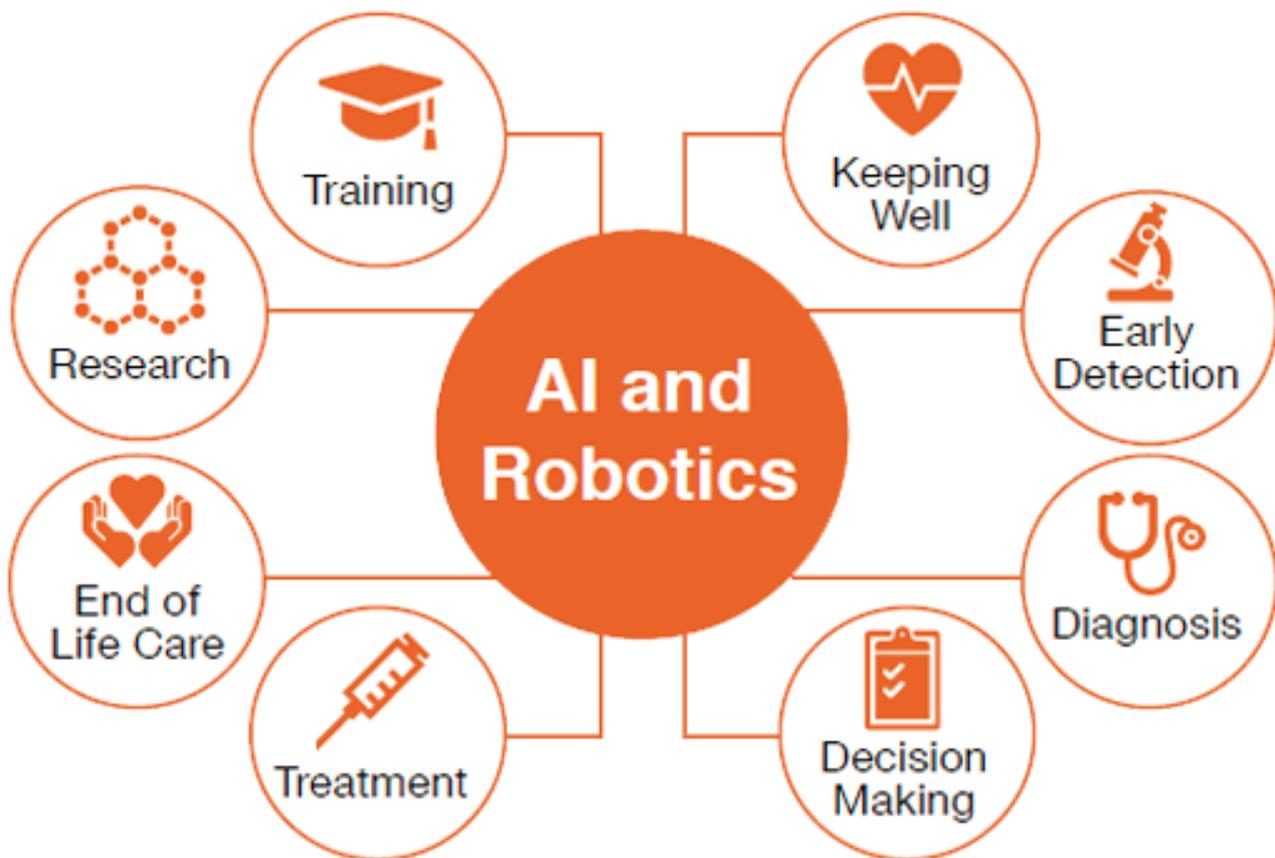
3Nethra, a project by Forus Healthcare is a project used in screening of eyes for Diabetic Retinopathy. This portable device integrates Artificial Intelligence using Microsoft retinal Imaging APIs and is being used in eye checkup camps even with nil or limited cloud connectivity. Microsoft has also teamed up with the Government of Telangana to use cloud-based analytics for the Rashtriya Bal Swasthya Karyakram program by adopting MINE (Microsoft Intelligent Network for Eyecare), an AI platform to reduce avoidable blindness in children. AddressHealth, a Bengaluru-based start-up provides primary pediatric healthcare services to school children where they are screened for hearing, vision, dental health, anthropometry, alongside a medical competition.

StethoMe Smart Stethoscope revolutionising remote medicine . In this ready to use at homes , this AI enabled device is paired with a smartphone app that tells the user where to place the stethoscope which then collects audio from the procedure, the respiratory and heart sounds are then decoded by AI algorithms and the data transferred to the physician which literally feels as if the stethoscope has been placed on the chest by the doctor that has helped in diagnosing asthma in children , COPD, cystic fibrosis beside others.

Human Vaccine has been created by Artificial Intelligence. Flinders University in Australia have claimed to have devel-

oped enhanced influenza vaccine using SAM , Search Algorithm for Ligands which is an Artificial Intelligence program.

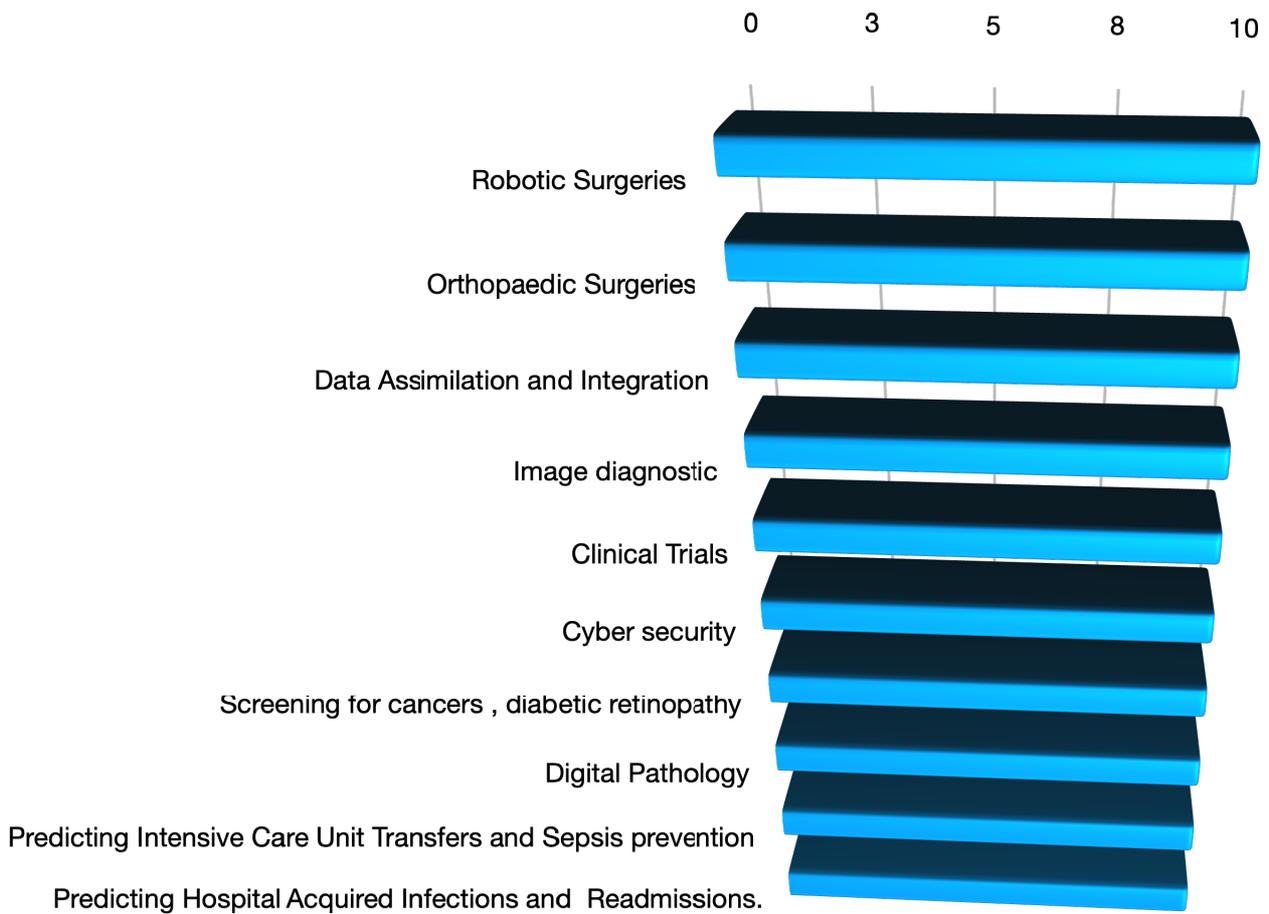
Artificial Intelligence has also been used in finding Brain Activity in Clinically Unresponsive Patients in cognitive motor dissociation and predicting likelihood of non-cancer deaths from chest images years in advance. Convolutional neural networks in deep learning algorithms (CXR-risk) using parameters such as aortic calcification or enlarged heart can detect subtle changes in chest xrays that predict mortality unto 12 years in advance.



Healthcare market is expected to reach a US\$6.6billion by 2021 compared to US\$600million in 2014. AI combined with robotics and Internet of Medical Things (IoMT) could potentially be the new nervous system for healthcare, presenting solutions to address healthcare problems and helping the government in meeting the above objectives. There are reports to suggest that AI could potentially add USD 957 billion (or 15% of current gross value added) to the Indian economy by 2035. The integration of AI in healthcare in India has been seen as a key technology towards improving the efficiency, quality, cost, and reach of healthcare and is being promoted by stakeholders like FICCI and the Office of the Prime Minister.

# USES OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

1. Helps in simulating and improving Robotic Surgeries and saving billions in losses from complication of procedures.
2. In Orthopaedic Surgeries there has been a reduction of up to five times in complications when Artificial Intelligence has been used in real time during surgeries and a 21% reduction in post surgery hospital stay.
3. Data Assimilation and Integration
4. Image diagnostic for reporting radiological images.
5. Clinical Trials
6. Cyber security to protect health data and Claims fraud detection, Claims Denial Management , Likelihood of Medicaid Eligibility.
7. Screening for cancers , diabetic retinopathy
8. Digital Pathology
9. Predicting Intensive Care Unit Transfers and Sepsis prevention
10. Predicting Hospital Acquired Infections and Readmissions.



## Ethical , Legal and Cultural issues in Artificial Intelligence

Data privacy, consent, data integrity, algorithmic accountability and culture are some of the factors that play a vital role in social acceptance of artificial intelligence as an alternative to a medical practitioner with a doctor-patient relationship.

The very essence of data acquisition for an open data system to be used for creating models and machine learning algorithms is subject to a public and private interface systems that are ac-

cessible to startups such as the Open Data Portal from the Health Management Information System (HMIS). The data available on the website is public sector data, however almost 70% of healthcare is limited to the private sector thereby unable to justify the accuracy of overall healthcare management in both public and private sectors. However, UK differs in this regard as the National Health Services works with private entities to provide machine-readable open data and formulate organisational policies. The UK NIH Clinical Centre recently released over 100,000 anonymized chest x-ray images and their corresponding data from more than 30,000 patients to the scientific community. All patients were partners in research and voluntarily enrolled to participate in clinical trials. Though this fringe benefits approach was not always without criticism as in case of Google DeepMind's work with the Royal Free Hospital London which led to concerns that users were not properly informed about how and what data would be shared with Google.

With prior government approval and if the startups can provide proof of use, the Israeli government releases digitised health records to startups. Even a non government body such as the American Cancer Society in USA releases data for free use by anyone along with interactive tools to work in their own projects. NITI Aayog has also taken initiatives to facilitate the creation of Annotated Datasets through an Open Government Data Platform which would be beneficial for startups to pursue their goals.

Informed consent is another issue that requires consideration especially when direct impact of a doctor-patient relationship and the opinions of knowledgeable medical professional influences and overweighs the benefits of using Artificial Intelligence.

Text for website(punch line for front page)

“ The amalgamation of two vectors of our existence , human and artificial intelligence would be one of the most significant accomplishments of our times . Nothing would interest more than to connect a human brain with a machine interface in an interactive real time analysis and to create an output that predicts the next moment . In a attempt to achieve this we begin

with simple approach to artificial intelligence and healthcare by giving the first direct open base web approach to predicting X-Rays and lung disease in an application that can be accessible from primary to tertiary care hospitals”

Team ( Photos and Bio Data )

Vishal Sharma

Dr. Piush Choudhry

Bharat Singh

DR PIUSH CHOUDHRY

M.B.B.S. M.S. ( General Surgeon)

current positions :

Consultant General Surgeon

## Max Hospital , Dehradun

Dr Piush Choudhry did his MBBS from King George's Medical College Lucknow in 1993 and completed his internship training at Civil Hospital , Lucknow . Then worked on a project 'Desynchronisation of Alpha Rhythm in Brain Waves' in 1995-96 at Computational Brain Facility Centre, Cognitive Neuroscience Unit, Westmead Hospital , Sydney, Australia. After completion he began post graduation in Master of Surgery at M.S.Ramaiah Medical and Teaching Hospital in 1997 , Bengaluru and completed the surgical training in 2000. He joined Batra Hospital and Medical Research Centre , New Delhi in 2001. In 2003 he was a visiting surgeon to university of Erlangen-Nurnberg ,Germany and a member of European Association of Endoscopic Surgeons. He also worked in Indraprastha Apollo Hospital , Indian Spinal Injuries Centre , was a Surgical Trainee at All India Institute of Medical Sciences and was attached to other hospitals in New Delhi . Then he worked in his hospital in Shahjahanpur till 2010.

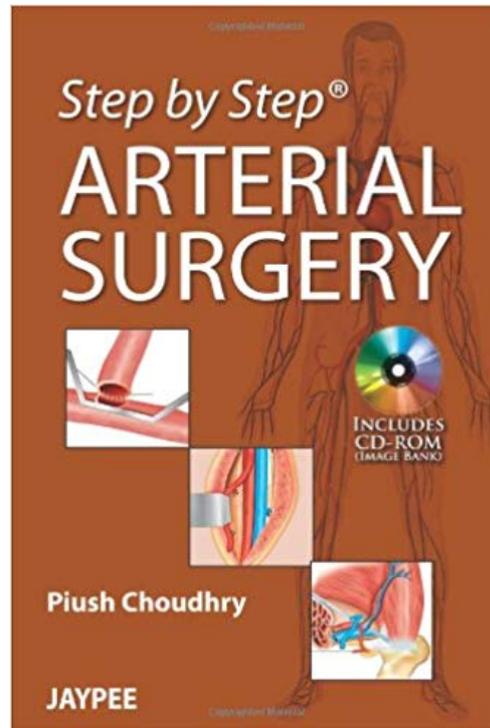
His publications include a book on vascular surgery , 'Step by Step Arterial Surgery' published by Jaypee Brothers Medical Publishers , New Delhi in 2013 . The book is also available in digital format , along with illustrations on approach to arteries in human body . Other publications include 'Alpha waves , Intelligence and Orienting Reflex, A Review' in Indian Journal of Neurosciences and subsequently ' The Intelligence Reflex' in the same journal in 2017 . Besides publication on Thoracoscopic Splanchnicectomy in Journal of Minimal Access Surgery, health articles on Gallstones and others have been published in local magazines. He has also completed a Post Graduate program in Artificial Intelligence and Deep Learning from Manipal Academy of Higher Sciences.

## PUBLICATIONS

1. Step by Step Arterial Surgery book. Jaypee Brothers Medical Publishers, New Delhi 2013.
2. Thoracoscopic Splanchectomy as palliative procedure in carcinoma pancreas Minimal Access Surg. 2009 Apr-Jun; 5(2): 37-39.
3. The Intelligence Reflex. Indian Journal of Neurosciences, October-December, 2017;3(4):147-149.

4. Alpha Waves , Intelligence and the Orienting Reflex. A Review.  
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5.



## **BELIEFS**

### **GENERAL BELIEF**

We are from disciplines of software engineering and medicine who believe that healthcare can be immensely benefited by the use of artificial intelligence . This can be achieved by a systematic approach to awareness in the uses of Artificial Intelligence in healthcare . Hence , to begin with, we have not only included an application that predicts whether an Xray has a lung disease just at the click of a button but also provided chapters that explain Artificial Intelligence , history and its role in Healthcare . India has experienced an exponential rise in Artificial Intelligence recently and this trend is predicted to continue over the years . We intend to step beyond this lung model and create a map model for every organ system to facilitate correct diagnosis and an easy approach for large scale sector hospitals with an application that segregates data in moments to adjudge which of the patients would require a further consultation with a doctor besides an AI opinion for anyone who wishes to know whether there is a further consultation required for the symptoms.

## **CORE BELIEF**

Artificial Intelligence has revolutionised the way we think , work and behave . It has taken a over a century to achieve

and required firm perspectives and beliefs that stood the test of time and winters . Human intelligence has also fascinated scientists over the centuries . Upto nine types of Intelligence have been described in general , such as Naturalist (nature smart) , Musical (sound smart) , Logical-mathematical (number/reasoning smart) , Existential (life smart) , Interpersonal (people smart) , Bodily-kinesthetic (body smart), Linguistic (word smart), Intra-personal (self smart) and Spatial (picture smart). Numerous attempts have been used to calculate Intelligence of Humans since early nineteenth century such as 1913 when William Stern devised the term Intelligent Quotient . Since then numerous Intelligence Quotient (IQ) scores have been described to assess children and adults. Similarly, much work has been performed in the field of cognition , brain reflexes and neuroscientific approach to human intelligences with contemporary works of Sokolov(1956) such as Orienting Reflex, with the development of Artificial Intelligence by John McCarthy (1956) , in the last century . However, it is yet an unexplored territory when both these fields can be amalgamated to create and human-machine interface that analyses intelligence in a real time and is shown as a reflex and not a static value or score. Though , not too distant this dream is, definitive and productive steps need to be taken to create awareness and the importance of such a sphere of existence within the scientific community that can create such models that would speak a language of the future .

## **BOOK ON ARTIFICIAL INTELLIGENCE AND HEALTHCARE**

### **1. HISTORY OF ARTIFICIAL INTELLIGENCE**

2. INTRODUCTION
3. DEFINITIONS
  - A. MACHINE LEARNING
  - B. SUPERVISED AND UNSUPERVISED LEARNING
  - C. REGRESSION
  - D. CLASSIFICATION
  - E. DEEP LEARNING
4. ALGORITHMS IN MACHINE LEARNING
5. DEVELOPMENT OF ARTIFICIAL INTELLIGENCE IN INDIA
6. ROLE OF ARTIFICIAL INTELLIGENCE IN INDIA
7. ETHICAL , LEGAL AND CULTURAL ISSUES IN ARTIFICIAL INTELLIGENCE
8. COMPREHENSIVE APPROACH TO ARTIFICIAL INTELLIGENCE (VISHAL)

Then the book can start

HOW TO USE THE APPLICATION (BHARAT)

DISCLAIMER NOTE

Contact Us

intelhealth@gmail.com

Careers/Investors ( u both decide )

TEAM	BELIEF	BOOK	HOW TO USE APP	BLOG	PUBLICATIONS	CONTACT US	INVESTORS

## REFERENCES

NITI Aayog Discussion Paper . National Strategy for Artificial Intelligence . June 2018.

