ATAL CENTRE FOR ARTIFICIAL INTELLIGENCE

Established under the aegis of New Education Policy 2020

(Approved by Executive Council held on 08.12.2020
Resolution No. 6.02, Subclause 6.02.6)

at

महात्मा ज्योतिबा फुले
रुहेलखण्ड विश्वविद्यालय, बरेली

Mahatma Jyotiba Phule Rohilkhand University
Bareilly, Uttar Pradesh, India

Contents

Vision

Atal Center for Artificial Intelligence will foster artificial intelligence based interdisciplinary research and development by bringing together academia, industries, and government for societal and national benefits.

Mission

- To facilitate collaboration among researchers from the disciplines of computer science, agriculture, electronic engineering, mechanical engineering, medical science, and education, etc. from academia and industries for providing artificial intelligence based solutions to difficult societal problems.

- To promote ethical and genuine research inclusive of artificial intelligence through unique interdisciplinary partnerships targeting real world problems.

- To develop skills and technology to enhance human capacity for social

Message from Honourable Vice Chancellor

It gives me immense pleasure that Atal Center for Artificial Intelligence (ACAI) is established at MJP Rohilkhand University, Bareilly under the aegis of new education policy 2020. Artificial intelligence has the capabilities to drive true transformation in human lives. The advanced research in artificial intelligence requires collaboration among different fields of science and engineering. The ACAI is a foresight initiative to facilitate multi-disciplinary research for the betterment of the society, environment, and mankind. It also intends to cultivate the collaborations with industry to motivate and nurture the research and development towards real applications. I look forward ACAI to become an asset for the nation in Rohilkhand region.

Team and Collaborators

Dr. Brajesh Kumar
Coordinator
Associate Professor,
Department of Computer Sc. & IT
MJP Rohilkhand University, Bareilly
Email : bkumar@mjpru.ac.in

Dr. S. S. Bedi
Co-Coordinator
Professor,
Department of Computer Sc. & IT
MJP Rohilkhand University,
Bareilly
Email: bedi@mjpru.ac.in

Dr. Yograj Singh
Co-Coordinator
Associate Professor,
Department of Electronics & Instrumentation
MJP Rohilkhand University,
Bareilly
Email: ysdaksh.ei@mjpru.ac.in

Prof. Swahiko Shimada
Research Collaborator
Professor,
Dept. of Bioproduction and Environment Engineering
Tokyo University of Agriculture, Tokyo, Japan
Email : shema123@nodai.ac.jp

Dr. Rama Rao Nidamanuri
Research Collaborator
Professor,
Dept. of Earth and Space Engineering
Indian Institute of Space Science & Technology
Thiruvananthapuram, India. Email : rao@list.ac.in

Dr. Divyesh Varade
Research Collaborator
Assistant Professor,
Dept. of Civil Engineering
Indian Institute of Technology Jammu
Jammu, India. Email : divyesh.varade@iitjammu.ac.in

1. Preamble

Mahatma Jyotiba Phule Rohilkhand University (MJPRU) Bareilly is a conglomeration of constituent departments and affiliated colleges/institutes spread in the region of Rohilkhand, which covers nine districts namely, Bareilly, Moradabad, Sambhal, Rampur, Bijnore, Amroha, Budaun, Pilibhit and Shahjahanpur, which lies on the upper Ganges alluvial plain and is bounded by the Ganges Doab to the South and West, Uttarakhand to the North, Nepal to the East, and the Awadh region to the southeast. This university enjoys the status of largest University in terms of area in Uttar Pradesh and possess Forty- five yearscommitment to excellence, encompasses around 548 colleges and institutions imparting quality education in almost all the disciplines.

MJPRU system is entering into the phase of implementation and execution of National Education Policy 2020 (NEP 2020) and we have to ensure that every student must enjoy a safe and stimulating learning environment, availing a wide range of learning experiences and good physical infrastructure. Our goal will be not only to attain these qualities but also to strengthen, integrate and coordinate across institutions and industries within the country and abroad.

The National Education Policy (NEP 2020) advocatesthe complete overhaul and re-energising of higher education, especially in deprived areas and region, by establishing large multidisciplinary universities. Here it is to emphasize that in our Uttar Pradesh, in every region (Bundelkhand, Kanpur, NOIDA/Greater NOIDA, Lucknow, Allahabad, and Banaras, etc.), we have either central universities or institutes of central government to cater the need of leading academic institutions of higher education, but Rohilkhand region (largest area encompassing 9 districts) is lacking in terms of leading academic institutions and MJP Rohilkhand university the only leading university in this region which may cater the area as a Research Intensive University.

MJP Rohilkhand University is potentially a multidisciplinary university of higher learning, and is ready to move ahead. The NEP2020 envisions the use of technology and integration, and stress upon new technologies like Artificial intelligence (AI), machine learning, block chain, smart boards, hand held smart computing devices etc. The term Artificial intelligence is used to define machines or computers that mimic the functions of the human mind such as learning and problem-solving. Natural language processing, computer vision, and decision making are a few of the functions expected of an advanced AI program.

Therefore, MJP Rohilkhand University has established "**Atal Center for Artificial Intelligence (ACAI)**" in its campus at Bareilly to create and apply AI-based innovations and solutions to a broad range of societal domains including healthcare, agriculture, education, infrastructure, and financial inclusion. The ultimate aim of ACAI is to work with government functionaries, social sector organisations, innovators, and all other relevant stakeholders to transform the lives of underserved people in Rohilkhand and the rest of the nation and world.

2. Our Goals

- **To Create Expert Systems**– which exhibit intelligent behaviour, learn, demonstrate, explain, and advice its users.

- **To Implement Human Intelligence in Machines**– Creating systems that understand, think, learn, and behave like humans.

- **To Enhance Research Opportunities**– Enabling interaction between academicians, scholars, students, and industry to enhance research activities for knowledge creation, problem solving, and academic excellence.

3. Artificial Intelligence

During the last few decades humans were being transformed into machines and for next few decades machines will be transformed into human. This goal looks to be achievable with the arrival of a new branch of computer science i.e. AI, which is "The science and engineering of making intelligent machines, especially intelligent computer programs" according to father of AI John McCarthy. AI is a way of **making a computer, a computer-controlled robot, or a software think intelligently**, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a
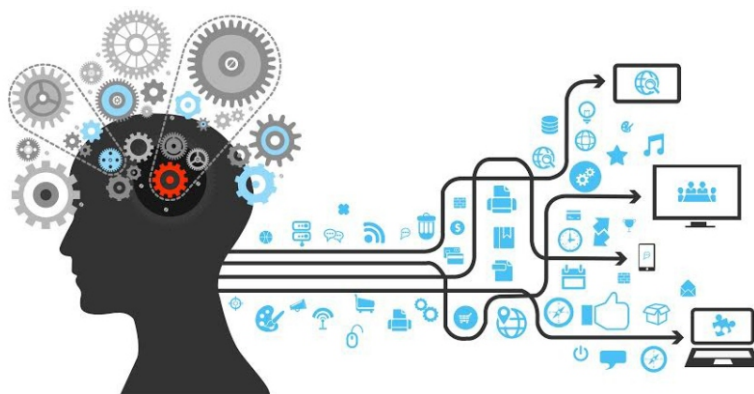

Figure 1: Resemblance of artificial intelligence with human intelligence

problem, and then using the outcomes of this study as a basis of developing intelligent software and systems. While exploiting the power of the computer systems, the curiosity of human, lead him to wonder, "Can a machine think and behave like humans do?" Thus, the development of AI started with the intention of creating similar intelligence in machines that we find and regard high in humans. This includes a variety of cognitive tasks such as sensing, processing language, learning, and making decisions, etc. Intelligent systems use a combination of big data analytics, cloud computing, machine-to-machine communication and the Internet of Things (IoT) to operate and learn.

AI is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering. A major thrust of AI is in the development of computer functions associated with human intelligence, such as reasoning, learning, and problem solving.

Out of the areas, one or multiple areas can contribute to build an intelligent system and thus AI deals in creation of Gaming, natural language processing, expert systems, vision systems, speech recognition, handwriting recognition, image processing, intelligent robots, augmented and virtual reality, data mining, web crawler etc.
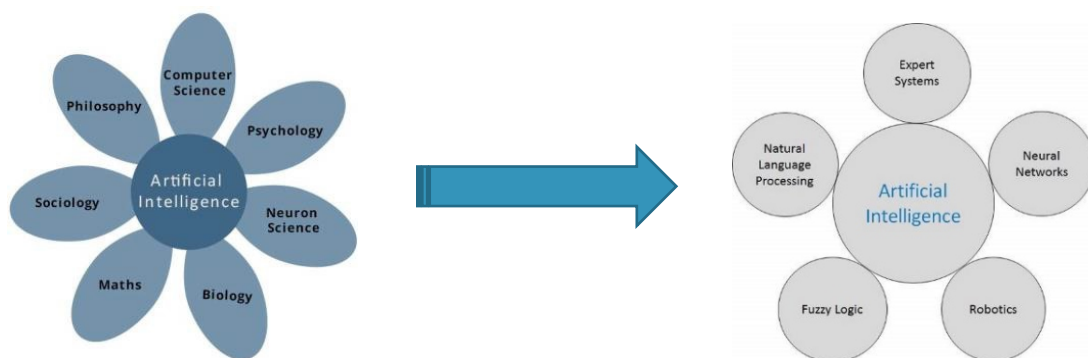

Figure 1: Applications of Artificial Intelligence

4. Applications of Artificial Intelligence

The evolution of AI technologies are transforming both industrial, societal, and defence activities in everyday scenarios ranging from chatbots to security. The major potential application areas of AI include agriculture, business automation,

healthcare, education, natural language processing, robotics, image processing, and remote sensing, etc. According to NITI Ayog (2018), there are five majorly focused areas for AI applications in India: precision agriculture, healthcare, education, smart cities, and smart mobility and transportation.

4.1. Precision Agriculture: Precision agriculture is a modern approach of farm management that makes use of information technology to fulfil the needs of crops and soil to ensure the good health, sustainability, productivity, and environment protection. The precision agriculture was introduced in early 1990s with the use of global positioning system (GPS) guidance for tractors. The GPS connected controller automatically steers the equipment based on the field coordinates to avoid any overlaps reducing the wastage of seed, water, fuel, and fertilizers, etc. GPS is also helpful in soil sampling that helps to measure the nutrient level, pH level, water level, and other data for analysing productivity differences within the field. It helps the farmers to formulate a plan for optimizing seeding and fertilizer. Later, other technologies such as remote sensing, image processing, sensors, photogrammetry, and machine learning, etc. were also introduced to enable the practices of precision agriculture. Modern precision agriculture use GPS, geographic information system (GIS), grid sampling, remote sensors, and variable rate technology (VRT) with equipment such as tractors, sprayers, diggers, combines, and planters, etc.
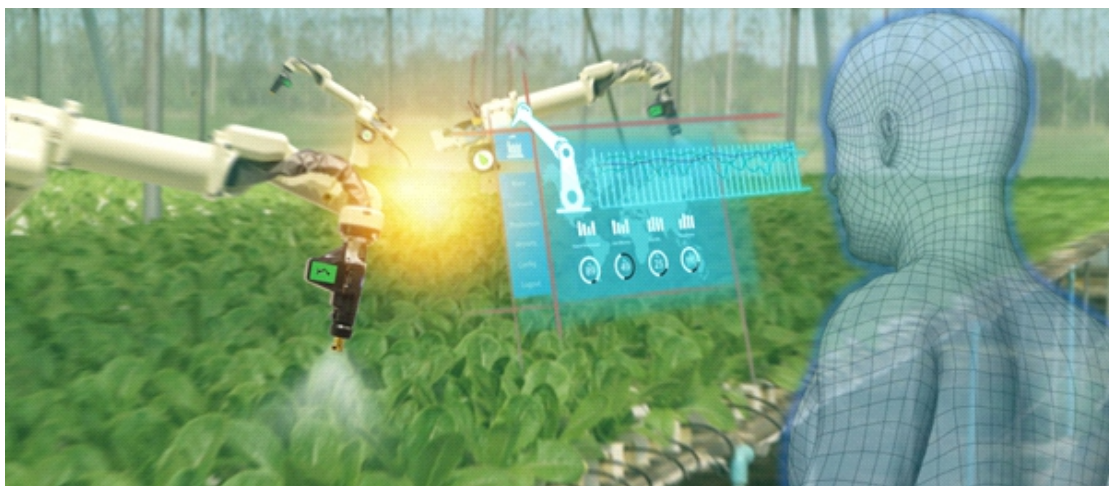

Figure 3: Artificial intelligence in agriculture

According to the report of Food and Agriculture Organisation (FAO) of the United Nations, world population is expected to increase 10 billion by 2050 resulting the need to increase agricultural production by at least 70 % to feed the people. We

are cultivating the entire available land and making use of large quantities of synthetic fertilizers and pesticides. In addition, the agriculture is facing increasing pressure from climate change, dwindling water supply, reducing agriculture land, and increasing production cost. Besides, the recent COVID-19 pandemic has reduced the overall farm workforce. All these factors are posing great challenges to the sustainability of food supply system. The AI in precision agriculture could be a viable solution to all these challenges in agriculture.

The traditional farming treats the fields homogeneously and use fertilizers, irrigation water, and pesticides, etc. at the uniform rate everywhere in the field. However, there exists significant spatial variability at the field creating different demands at different locations. Therefore, uniform application of the inputs results in the yield loss and higher production cost. Precision agriculture uses the variable rates of irrigation, agrochemicals, and other inputs according the needs of the different locations for better yield and quality. The AI based techniques help to improve efficiency and manage the challenges in the agricultural sector like the crop yield, irrigation, soil content sensing, crop monitoring, weeding, and crop establishment. AI has the potential to deliver much-needed solution.

4.2. Health Care: Despite the different settings of the health services in different parts of the world, there are several worldwide health challenges including acute health workforce shortages and weak public health surveillance systems, undermine global progress towards achieving the health-related sustainable development goals. In India, there are 0.76 doctors and 2.09 nurses per 1,000 population. Non-uniform accessibility to healthcare across the country continuing to be the major barrier. AI driven health technologies could be used to address many of these challenges. For example, AI driven interventions have supplemented clinical decision making towards reducing the workload of health workers. AI can be used to identify disease outbreaks earlier than traditional approaches, thereby supporting timely programme planning and policy making. AI based techniques along with signal processing and image processing help to automate the diagnosis of communicable diseases such as tuberculosis, pneumonia, and malaria, etc. AI driven interventions also focused on the diagnosis of non-communicable diseases for disease detection, including cervical cancer and pre-cervical cancer. Morbidity and mortality risk assessment is another area for which artificial intelligence driven interventions have been assessed in the global health context. These interventions are based largely on machine learning classification tools and typically compare

multiple machine learning approaches with the aim of identifying the optimal approach to characterise risk. This approach has also been used at health facilities to predict disease severity in patients with dengue fever and malaria, and children with acute infections. Machine learning classification tools were also used to estimate the risk of non-infectious disease health outcomes.

Figure 4: Artificial intelligence in healthcare

4.3 Education: An effective education system has the ability to transform the country through development of efficient human resources. In India, currently over half the population of the country is below the age of 25. An improved education and teaching is important for a youth population. AI has impacted the education like other sectors. According to Microsoft and McKinsey's recent report of over 2,000 students and 2,000 teachers from Canada, Singapore, the UK, and America shows that artificial intelligence is providing teachers and schools with innovative ways to understand how their students are progressing, as well as allowing for a fast, personalised, targeted creation of content.

AI can help to customise learning according to the strengths and weaknesses of the individual students. Teachers don't only teach, they also spend hours grading papers, and preparing upcoming lessons. However, certain tasks, such as marking papers, could be done by robots, giving teachers a lighter workload and more flexibility to focus on other things. AI makes comprehensive information available to

teachers any time of day. They can use this information to continue educating themselves in things such as learning foreign languages or mastering complex programming techniques. It can be connected to different classrooms all over the world, fostering greater cooperation, communication, and collaboration among schools and nations.
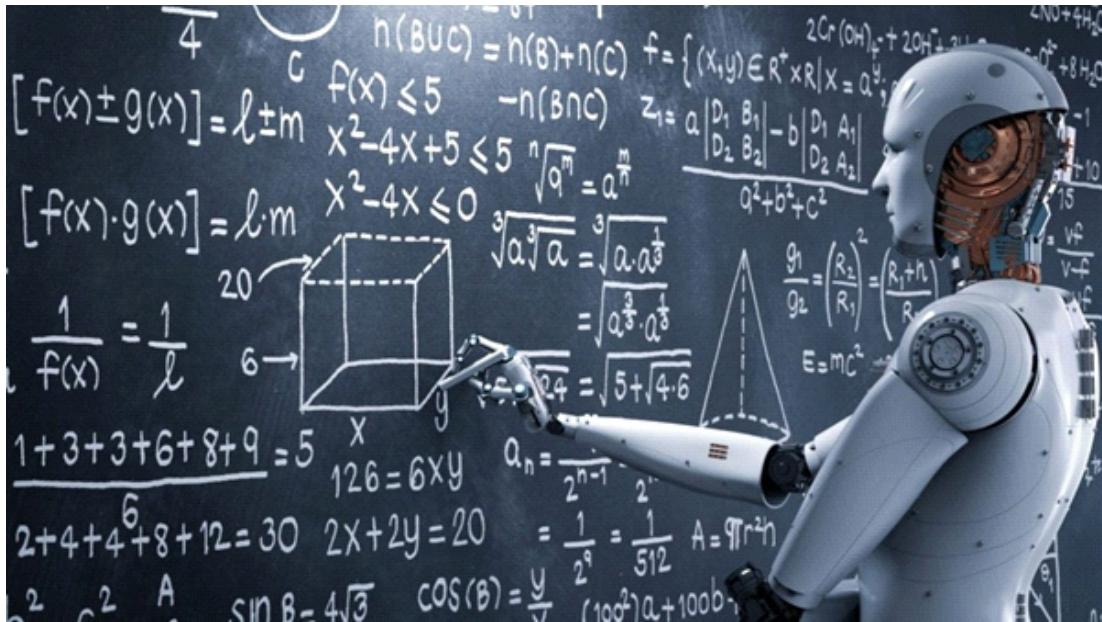

Figure 5: Artificial intelligence in education

4.4 Smart Cities: In India, urbanisation is increasing for some years. In 2011, 31% population was living urban areas, while it was 45% in 2018. It is expected to rise up to 60% by 2050. Unplanned urbanisation presents challenges such as congestion, over pollution, high crime rates, poor living standards, and can potentially put a huge burden on the infrastructure and administrative needs of existing Indian cities. To tackle these challenges, the Government of India has embarked on an ambitious initiative to set up Smart Cities across India, aimed at driving economic growth and improving the quality of life, by harnessing IT solutions. As part of the Smart Cities Mission, 99 cities have been selected with expected investment of INR 2.04 lakh crores.

Artificial intelligence can be life changing if rightly implemented in smart cities by improving the efficiency of the overall system. The AI enabled CCTV cameras and sensors can be used for vigilance to enhance the security level in the city. These

cameras can monitor the movement of registered vehicles and can monitor the crowd and cleanliness of the public places. The most of the people in the cities have their own vehicles. AI can be used to manage the parking and traffic of vehicles. It helps the drivers to save their time as well as smooth movement. The face recognition technology is capable of detecting people from their faces. The security cameras can be used trace, identify, and authenticate people entering the city and societies. Smart waste and disposal management is another area, where AI could be helpful in a smart city to keep it clean and maintain hygiene level. AI is also very helpful for better urban planning by mapping land use with the help of aerial view images.

Figure 6: Artificial intelligence for smart cities

4.5 Smart Mobility & Transportation: In modern economy, the mobility and transportation form the backbone both for domestic and international trades. The need of high mobility gives rise to the requirements of safe and efficient transport as well as it must be sensitive to the environment. In India, as of 2007-2008, 87% of the total freight traffic carried through roads and railways. As of 2011-2012, it accounted to almost 90% of the total traffic. Therefore, mobility and transportation management poses a challenging problem. Although, India has a large transport network, the congestion and its associated costs are continuously rising. According to the Ministry of Road Transport and Highways, 501423 road accidents were reported in the country during 2015 resulting 146,133 fatalities. AI has some major applications in traffic mobility and transportation management to reduce these problems.
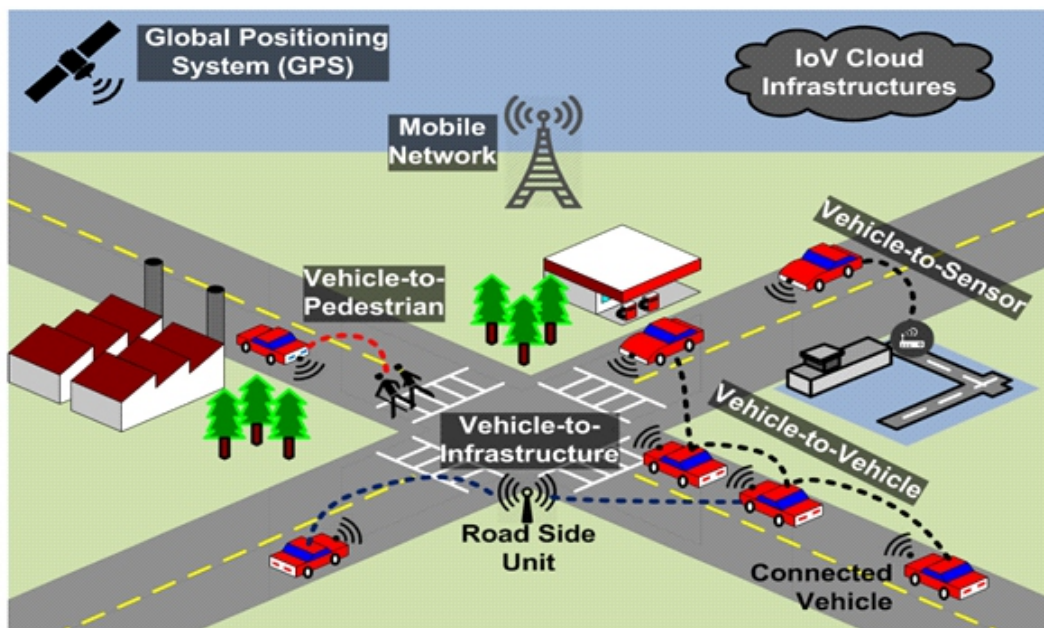
Figure 7: Artificial intelligence in transportation

With the help of CCTV cameras, sensors, automatic number plate recognition, speed detection cameras, and lane violation detection system, etc., AI can be used to make real time decisions on rule violation, toll pricing, smart ticketing, access to exit, and allocating right of way to public transport vehicles, etc. AI can also be helpful to design smart traffic control system to facilitate services such as automatic vehicle detection, optimise signal timings, etc. It can also be used to make human like decisions on route selection.

In addition to above mentioned applications, there are a number of other important application areas, where AI could be make differences. Such important applications include natural language processing (NPL) that deals with interaction of human with computers using natural language. The common applications of NPL are language translation, interactive voice response, personal assistant applications, and automatic learning, etc. NPL has a great potential for analysing and understanding the peoples sentiments using text, audio, and video data over social media data and other such platforms.

4.6 Data Centre Park

Experts have found that building data centres will go a long way in further pushing the AI technology sector in the states and country, and the state and central

governments are also keen to set up such Data Centre Parks (DCP) throughout the country with a laudable move. This effort will gain many start-up heroes to make a mark when India is embracing technology at various levels and taking big leads. Experts believe that enabling the institutional, public and private sector initiatives to build DCP throughout the country would not only help in the on-demand access to ICT infrastructure but will also cater to Indian regulatory requirements and will also drive scalability for businesses in India. A DCP at MJP Rohilkhand university at Bareilly is self justified as the host university enjoy the well rounded existence of important departments of computer science, IT, CT and other assisting departmental entities including a well established educational hub of agriculture, health, CST, IT, humanities, veterinary sciences etc in entire Rohilkhand region.

Figure 8: Artificial intelligence for data center

5. MJP Rohilkhand University: A potential HEI

Rohilkhand University established in 1975 as an affiliating University, upgraded to affiliating-cum-residential university in 1985, and further renamed as "Mahatma Jyotiba Phule Rohilkhand University" in the month of August in 1987. The University has taken an overall perspective of development plan and thereby modified University status by including new Faculties of Engineering and Technology, Management, Sciences, Education, Applied Sciences etc and now encompasses faculty of Advanced Social Sciences, Science, Education, Agriculture, Education, Applied Sciences, Arts, Commerce, Dental Sciences, Engineering & Technology, Law, Management, Pharmacy and Medical Sciences etc. In tune with the goals of the

University, different constituent departments located within the campus have framed their objectives for keeping pace with the national and international educational scenario and hence creating well rounded, highly skilled, motivated and cultured human resource for the society.

5.1 Need of Artificial Intelligence Center at MJPRU

MJP Rohilkhand University is the only leading university in the Rohilkhand region providing higher education in different disciplines ranging from literature and arts to engineering and medical science. The university has the potential to emerge as one of the premier center of artificial intelligence that can expand and increase development in the region in several ways. AI can dramatically speed up the economic and societal transformations. The multi-disciplinary environment of the MJPRU has potential to provide breeding ground for artificial intelligence. USA and China are the two leading countries in the AI development. China has a well-supported commitment to AI and it is expected to lead the world by 2030. Lately, India has adopted an strategy to promote the artificial intelligence for economic development. The government think tank NITI Ayog has plans to put resources into artificial intelligence research to amplify economic development and Indian-made intelligence to compete with the leading countries. However, we are still a long way to go to stand with the world pioneers.

It is important to promote the organizations like MJP Rohilkhand University to fulfill the goals of the Indian government to place India along with the leading countries. It can play a fundamental role in advancing AI research. AI holds immense potential for increasing productivity, most obviously by helping firms and people use resources more efficiently, and by streamlining the way we interact with large sets of data. It can help to improve the Gross Domestic Product (GDP).

5.2 Potential Areas of Application in Rohilkhand Region

There are various potential areas, where MJP Rohilkhand University can promote the application of AI research. Agriculture is mainstay of the Rohilkhand region. It has very productive land for growing rice, sugarcane, wheat, and pulses, etc. AI has immense potential for increasing agricultural efficiency. India is short of medical workers and so the Rohilkhand region. AI can fill up this gap. Recently artificial intelligence applications have been developed that substitute and complement the expensive experts. At MJPRU, we have both engineering and

medical faculties that can collaborate to develop the customize solution for the region. Quality education is a key development challenge for many developing countries. There is a shortage of skilled teachers. The engineering and education departments at MJPRU can collaborate to develop the AI based customized teaching and automated assessment solutions. Bareilly is figured amongst the PM Narendra Modi's ambitious 100 smart city list. With our AI research facility, we can contribute to the smart city project. In addition, the proposed facility can contribute in the areas natural language processing, and robotics, etc.

6. Infrastructure and Facilities Creation in Future

ACAI aims to promote research and development involving AI in different application areas including agriculture, healthcare, natural language processing, and smart cities, etc. Therefore, a variety of computational devices, networking and communication infrastructure, and building infrastructure are required to fulfil all kind of needs.

6.1 Artificial Accelerators

AI techniques usually involve a large number of computations that are often carried out on a tremendous amount of data elements, which requires a large memory capacity, high bandwidths, and cache coherency within the overall system. The general purpose computer systems are not suitable for performing such types of computations. Therefore, some special facilities would be created to meet the desired
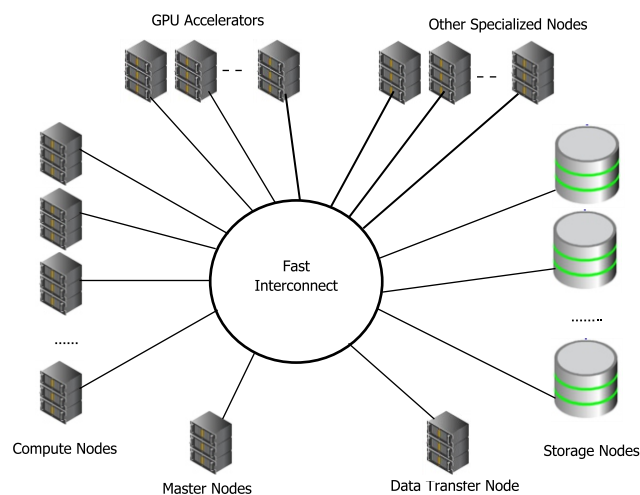

Figure 9: Layout of the proposed HPC architecture

goals. AI accelerator is a kind of specialised computer system created to accelerate artificial intelligence applications, particularly machine learning, robotics, artificial neural networks, machine vision, deep learning, and other data-intensive tasks. Artificial intelligence accelerator have novel designs and typically focus on low-precision arithmetic, novel data flow architectures, and in-memory computing capability. These specialized hardware units are designed to speed up the tasks related to various applications. The accelerators have many advantages including high computing speed and high throughput. The primary advantage of artificial accelerator is high speed that significantly reduces the amount of time required to train and execute artificial intelligence models. There are many artificial intelligence based tasks that cannot be executed on CPU. A number of specialized hardware components are used to accelerate the processing in such applications including graphics processing unit (GPU), tensor processing unit (TPU), vision processing unit (VPU), field programmable gate arrays (FPGA), application specific integrated circuits (ASIC), and heterogeneous computing.

GPUs are the specialized chip used for the rapid manipulation of images and calculation of image properties. The neural networks and image processing involve manipulation of the large number of matrices. The GPUs provide a parallel processing environment to accelerate all sort of tasks that make them an essential part of modern computing to drive advances in gaming, graphics, and image processing. Their extremely parallel structure gives advantages over general-purpose CPUs process huge blocks of data in parallel. Multiple GPUs are installed on workstations to expedite processing huge images, multiple videos at once, and 3D rendering.

TPUs are a specialised circuit launched by Google that implements all the necessary control and arithmetic logic necessary to execute machine learning algorithms especially for training artificial neural networks, deep learning models, and random forest. Unlike GPUs, the TPUs are custom-designed to handle operations on multi-dimensional arrays and matrices in neural network training.

VPUs are custom-designed to handle machine vision tasks and algorithms. They are specially suitable for capturing visual data from cameras and parallel processing of the captured data. VPUs are good for implementing convolutional neural networks (CNN), Scale-invariant feature transform (SIFT), and other similar techniques. They have a greater emphasis on on-chip data flow between many parallel execution units. Other speciality of VPUs include growing adoption for smartphones, edge artificial intelligence, and advanced computing capacities for computer vision.

FPGAs are integrated circuits that can be configured by a customer or a designer after manufacturing. FPGAs include a range of programmable logic blocks and reconfigurable interconnects that allows the blocks to be inter-wired in various configurations. FPGA provides interface flexibility and allows the integration of programmable logic with CPUs and standard peripherals. They have big resources of logic gates and RAM blocks for implementing complex data computations. The programmable properties of the FPGAs make them suitable for various applications and can be used to accelerate the workload. ASIC are based one entirely different approach than FPGA. They employ optimized memory and application specific strategies to accelerate calculation and increase the throughput of computation. Heterogeneous computing makes use of multiple and different kind of processors or cores incorporating specialized processing capabilities to deal with the particular tasks. It provides the interfacing for different kind of devices and include various kind of hardware accelerators such as GPUs, TPUs, VPUs, cryptographic co-processors, and encoders/decoders.

6.2. High Performance Computing Cluster

The high performance computing (HPC) cluster is a major computing facility that provides different kind of services and computation environment to the users and researchers. A layout depicting the architecture of HPC cluster is shown in the Figure 9. HPC cluster consists of a good number of compute nodes, large memory compute nodes, AI accelerators, storage nodes among other nodes. Apart from the HPC cluster, some other application specific devices are required. The computing environment is controlled by temperature and humidity. It is important to maintain appropriate temperature and humidity level to ensure both performance and operational integrity. Therefore, a standard cooling facility would be created for the proper functioning of the entire system. Computer room air conditioning (CRAC) units are replacing air-conditioning units for computing centers. CRAC setup has been successful in the process of cooling air. The cold air flows through the racks where it picks up heat before exiting from the rear of the racks. An independent building infrastructure is needed to host the HPC and other devices. The building would consists of laboratories, power supply room, machine rooms, seminar hall, video conferencing room, staff offices, and cooling facility, etc. In addition, academic, technical, and non-technical staff would also be required for proper functioning and maintenance of the facility.

6.3 Unmanned Aerial Vehicles

Remote sensing is widely used in many research areas including precision agriculture, defence, urban planning, and monitoring, etc. Recently, small UAVs have

evolved to provide cost effective remote sensing options. The UAVs can be mounted with different types of sensors on board to record optical, laser, and other type of data. The typical platforms used for this purpose are multi-rotor, fixed-wing, and single-rotor UAVs. The multi-rotor UAVs are the most economical option for high spatial resolution and temporal aerial photography with a lightweight camera payload. However, multi-rotors have small flight time as they require a lot of energy to remain in air due to gravity and battery gets exhausted within 20-30 minutes(Australian UAV, 2020). Therefore, multi-rotors are not suitable for large scale phenotyping due to their limited speed and endurance. The fixed-wing UAVs use wings like an aeroplane that provide them a lift against gravity and they need energy only to move forward. The fixed-wings UAVs are able to travel longer and monitor larger areas with better efficiency. But fixed-wing aircrafts are costly and unable to hover at one place and their launching and landing is a lot trickier. Another consideration of fixed-wing is that the captured imagery needs a lot preprocessing before it could be used for a particular application. A single-rotor UAV is like a helicopter, which is able to carry heavy payload. It operates on gas and has the ability to hover with long endurance. However, the higher cost and risk of larger blades are major concern with application of fixed wingaircraft. The choice of a particular type of UAV depends both on UAV features and sensortype.

6.4 Robotics

Robotics is an interdisciplinary field that integrates computer science and various disciplines of engineering. Robotics involves design, construction, operation, and use of robots. The goal of robotics is to design machines that can help and assist humans. Robotics integrates fields of mechanical engineering, electrical engineering, information engineering, mechatronics, electronics, bioengineering, computer engineering, control engineering, software engineering, among others.

Robotics develops machines that can substitute for humans and replicate human actions. Robots can be used in many situations and for many purposes, but today many are used in dangerous environments (including inspection of radioactive materials, bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, underwater, in high heat, and clean up and containment of hazardous materials and radiation). Robots can take on any form but some are made to resemble humans in appearance. This is said to help in the acceptance of a robot in certain replicative behaviors usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, or any other human activity. Many of today's robots are inspired by nature, contributing to the field of bio-inspired robotics.

7. Benefits to Rohilkhand Region

ACAI has the potential to provide the opportunity for the researchers of different disciplines to carry out research for the benefit of the society in Rohilkhand region as well as for the nation. It will serve as platform for the research of different disciplines to collaborate with each other to do interdisciplinary research for the societal and industrial welfare. There are various applications areas where ACAI could contribute. Some of them are discussed here.

Agriculture is a conventional sector that provides employment to a large number of people in the Rohilkhand region. Considering the need of the growing population of the country, the agriculture production needs to be increased significantly. AI can provide the advance solutions for the assessment of crop traits including disease detection, growth monitoring, irrigation monitoring, and production assessment, etc. MJPRU have the agriculture and engineering faculties that can collaborate to aid the agriculture research at ACAI.

Bareilly is the part of smart city project of the government of India. It is figured out in the list of proposed smart cities. A smart city is an urban area that uses different types of electronic methods and sensors to collect data. Insights gained from that data are used to manage assets, resources and services efficiently; in return, that data is used to improve the operations across the city. This includes data collected from citizens, devices, buildings and assets that is then processed and analyzed to monitor and manage traffic and transportation systems, power plants, utilities, water supply networks, waste, crime detection, information systems, schools, libraries, hospitals, and other community services. The smart city concept integrates information and communication technology (ICT), and various physical devices connected to the IoT network to optimize the efficiency of city operations and services and connect to citizens. The proposed research facilities at ACAI can contribute to the smart city project.

Considering the existance of engineering and medical colleges in the region, the ACAI can help to create AI based healthcare solutions. The primary aim of health-related AI applications is to analyze relationships between prevention or treatment techniques and patient outcomes. AI programs are applied to practices such as diagnosis processes, treatment protocol development, drug development, personalized medicine, and patient monitoring and care. AI algorithms can also be used to analyze large amounts of data through electronic health records for disease

prevention and diagnosis. Medical institutions such as The Mayo Clinic, Memorial Sloan Kettering Cancer Center, and the British National Health Service have developed AI algorithms for their departments. Large technology companies such as IBM and Googlehave also developed AI algorithms for healthcare. Additionally, hospitals are looking to AI software to support operational initiatives that increase cost saving, improve patient satisfaction, and satisfy their staffing and workforce needs. Currently, the United States government is investing billions of dollars to progress the development of AI in healthcare. Companies are developing technologies that help healthcare managers improve business operations through increasing utilization, decreasing patient boarding, reducing length of stay and optimizing staffing levels.

Education is another important area where ACAI can contribute for the benefit of the region. Global adoption of technology in education is transforming the way we teach and learn. AI is one of the disruptive techniques to customize the experience of different learning groups, teachers, and tutors. AI helps find out what a student does and does not know, building a personalized study schedule for each learner considering the knowledge gaps. In such a way, AI tailors studies according to student's specific needs, increasing their efficiency. Digital learning interfaces with customization options, digital textbooks, study guides, bite-sized lessons, and much more can be generated with the help of AI. New ways of perceiving information, such as visualization, simulation, web-based study environments, can be powered by AI.

8. Structure of ACAI

The office bearer of ACAI will designated as Coordinator, Co-coordinator, Professor, Associate Professor, and Assistant Professor. The office bearers will be supported by technicians and staff members. The coordinator and Co-coordinator of the ACAI will be appointed by Honorable Vice Chancellor of MJPRU, Bareilly and can be changed by the Honorable Vice Chancellor any time. The other office bearers, technicians, and staff will be appointed as per university norms and rules.

9. Summary

AI is an interdisciplinary science that intends to build smart machines capable of performing tasks that typically require human intelligence. AI can be applied for social good meanigfully improving the people's lives. The Rohilkhand region

comprises nine district of Uttar Pradesh and there is no premier research institue in the region to address the local needs or issues with the innovative use of modern technologies. MJP Rohilkhand University with its multi-disciplinary structure has the potential to fill up the gap. It can play a crucial role in the development of the region. The research center named as ACAI aims at promoting AI research and development that could provide customized solution for different areas such as agriculture, smart city project, education, and healthcare, etc. The ACAI will play an important role in the knowledge-driven growth of the region based on innovation. ACAI will play an important role in the knowledge-driven growth of the region based on innovation. ACAI will serve as an international/national resource on matters related to AI encompassing the following solutions.

1. Performance and risk assessment stakeholder mapping and analysis.

2. Implementation of short term and long term training and mentoring programmes.

3. Contributing to the innovation programmes of corporates and industrial sectors through facilitation of technology exchange and assisting in orientation of plocies to promote security and development.

4. Convening of expert meetings, national and international conferences/ workshops/orientation programmes/internship/policy makes awareness-raising workshops.

5. Starting of need based certificates, diploma, degree/vocational degree programmes in PPP modes with industrial and IT sectors.

6. Promoting research and development activities for providing efficient solutions to real world problems.