

# Application of Artificial Intelligence in Applied Biology and Health Sciences

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**Abstract** - In modern world, artificial intelligence will substitute or magnify human competency in Applied Biology and Health Sciences. AI is the cognitive brilliance manifested by machines or software. AI is growing as an outstanding field in information technology as it enriched the mankind in many circumstances. The application of AI across different disciplines promises an alternative sustainable solution for all human problems. AI is developed in last 10 years as a life changer; when it stated solving human problems easily. This includes solving protein architecture, drug discovery and design, drug recycling, drug safety, diagnose patients, to choose a suitable crop, to determine when to fertilize crops, to avoid adulteration of seeds, to diagnose the crop infections, for proper application of pesticides and herbicides, to identify and removal of weeds, to identify natural ripening of fruits, for the detection of food nutrient value, agri-products for the health and weather forecasting.

**Keywords:** Artificial Intelligence, Protein Architecture, Drug Discovery, Drug Recycling, Drug Safety, Nutrient Value, Weather Forecasting

## I. INTRODUCTION

Artificial intelligence deals with the study and developments of intelligent machines and software that can reason, learn, gather knowledge, communicate, manipulate, and perceive the objects. AI technologies have advanced to the level in offering real practical benefits in many of their applications. Major AI areas are Expert Systems, Natural Language Processing, Speech Understanding, Robotics and Sensory Systems, Computer Vision and Scene Recognition, Intelligent Computer- Aided Instruction, Neural Computing. These Expert Systems are fast developing technology which is having a huge impact on various fields of life. The various techniques applied in artificial intelligence are Neural Network, Fuzzy Logic, Evolutionary Computing, and Hybrid Artificial Intelligence. AI has the advantages over the natural intelligence as it is more persistent, logical, inexpensive, reproducible, and documentable which can carry out certain tasks much faster and better than the human beings [1].

## II. APPLICATION OF ARTIFICIAL INTELLIGENCE IN BIOTECHNOLOGY

AI-driven biological information discovery and assembly was possible by certain techniques like text mining [2], semantic analysis [3] and missing link prediction [4] in a

multilevel approach. The next generation search engines can lead biological research by collecting all known and missing knowledge to answer a research question. But researchers can't rely upon AI tools to perform applied science research fully independent from human supervision and control. Behavioral ecology research questions are analyzed by AI using several modalities to understand how genetics affect bird's social behavior and migration [5].

Foraging of large herbivores was analyzed by integrating AI in hierarchical decision-making models of behavior [6]. AI technology use heterogeneous biological data (DNA Sequence data, Phylogenetics information and environmental data) and gene expression data (gene function) to elucidate and test hypothesis about the role of genes that shape phenotypes. Cell imaging, genomics, epigenomics, proteomics, metabolomics and metagenomics in soils can reveal the cellular decision making or phenotypic changes that influence on the crop productivity [7].

Due to the advancement of AI, biotechnology startup businesses were started by a few organizations. The uses of AI in Biotechnology were medication discovery and clinical trials, diagnostics, radiotherapy and radiology, customized medicine, quality control, electronic health record (EHR) and medication management. Sensyne Health is at the cutting edge combining with AI for understanding information and empowers the delineation of patients for clinical preliminaries. Agilent Technologies using AI improved the quality and standardization of tissue diagnostics. Gilead Sciences on applying AI establish medication for nonalcoholic steatohepatitis (NASH).

Genentech used AI for storing cancer patient medical record data for applying in algorithm models to predict novel targets for cancer therapy. The Reverse Engineering and Forward Simulation (GNS REFS) uses Machine Learning and simulation to find novel cancer therapies. Biogen using AI created a search engine to customers for queries related with the company's portfolio of products. Vertex Pharmaceuticals used human genetics with AI to enhance target discovery of precision medicine and to understand clinical impact of mutations and patient stratification in diseases with unmet need [8].

### **III. APPLICATION OF ARTIFICIAL INTELLIGENCE IN MICROBIOLOGY**

Microorganisms are omnipresent and connected with everyone's daily life. Biologist was interested in microorganisms, since they are discovered in the 19th century. Earlier the biologist studied about microorganisms by cultivation, though it is expensive and time consuming. But sequencing technology has increased the speed of microbiology research. Microorganisms evolved with the surrounding environment and other organisms and involved in many life activities. It has role in human health, agriculture, stock raising, ecological management, production of chemical and foodstuffs production. Next generation sequencing technology paved the way to generate big data of microbial species. Therefore, AI driven methods have been gradually applied to microbial studies and microbial analyses.

AI was applied in prediction of microbial species, prediction of environmental and host phenotypes, to predict diseases, to find the interaction between microorganisms and analysis of the microbial-disease associations [9]. AI integrated machines are used for growing and diverse epidemic data [10, 11]. The AI integrated machines were used in infectious diseases diagnostics, particularly for the control and management of COVID-19 outbreak. The AI driven prediction of microbial species was possible by certain tools like IDTAXA [12], MetagenomicDC [13], MARVEL [14], VirSorter [15] and VirFinder [16].

### **IV. APPLICATION OF ARTIFICIAL INTELLIGENCE IN BIOINFORMATICS**

Bioinformatics deals with the acquisition, inventorying, handling, dissemination, analysis, and translation of DNA/RNA/PROTEIN data by software engineering and science devices to understand the usefulness of information. The data was abundantly found in different biological databanks. The data accumulated consist of big bits of knowledge [17]. AI integrated next generation DNA/RNA/PROTEIN sequencing was used to characterize the molecular information and analyze these sequence data for recognizing the areas of qualities.

### **V. APPLICATION OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE**

The economics of agriculture rely upon agro-climatic elements such as seed quality, soil quality, water availability and food preservation strategies. The Department of Agricultural and Farmers Welfare under Government of India developed agriculture reform activities like documenting seasonal database and applying it with AI algorithms to train farmers for selecting a proper crop. ML algorithms along with Internet of Things (IoT) are used to diagnose pest attack, fungal infections and identification and removal of weeds. So now Department of Agricultural and Farmers Welfare are using AI driven drone technology

for targeted spraying of insecticides and pesticides in big plantations and agricultural field lands [18].

Recently farmers or cultivators from Kerala are committed suicide due to several pest infestations in their cultivation like Eriophyid mite in coconut tree, Borers in Cardamom plant, Giant African Snails in Jack fruits tree and mango tree. Low yield seeds, low efficient fertilizers, pesticides, and herbicides sold in the market are also reducing the profit of farmers. So, in order to develop the agricultural sector of India, smart AI algorithms are needed to avoid adulteration of seeds and for proper application of fertilizers, pesticides, and herbicides. The high demand of fresh fruits in summer triggers the suppliers to do artificial ripening in fruits by ethylene, acetylene and calcium carbide which harm nervous system, cause memory loss and even cancer in humans. Therefore, it is very urgent to develop an AI driven algorithm to identify chemical ripening of fruits, for the detection of nutrient value in foods and agri-products for the health and well-being of human beings [19].

### **VI. APPLICATION OF ARTIFICIAL INTELLIGENCE IN PHARMACEUTICALS**

Pfizer is at the cutting-edge position to improve the effort in functional precision medicine using AI and real-world data (RWD). They believed that RWD has amazing power to formulate new medicines and precise treatment options to enhance patient conditions for tumors and hematologic malignancies. Janssen Pharmaceutica developed an AI-powered drug design system and in-silico system based on neural network models. They invented new potent chemical molecules during drug discovery process. Sanofi by using AI document processing solution reviews scientific articles for gathering scientific information which may help in drug discovery in pharma business.

Novartis AI exploration lab uses AI in order to rectify the computational difficulties begin with generative chemistry, image segmentation and analysis for smart and personalized deliveries of therapies and optimization of cell and gene therapies. Bayer with AI collaboration triggered their steps ahead towards shorten their duration to launch a drug in the market. DeepChem, DeepTox, DeepNeuralNetQSAR, Organic, PotentialNet, Neural graph fingerprint and AlphaFold were real examples of AI tools used in drug discovery [20, 21, 22, 23, 24].

### **VII. APPLICATION OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE**

Healthcare industry use AI, to imitate human intelligence in the medical test, demonstration and apprehension of complicated medical records and management [25]. Health-driven AI applications are used to compare the medical test and the hospitalized person outcomes. AI applications are useful in medical investigation, medication protocol development, drug development, precision medicine, patient tracking and medical care management.

AI-based physical robots are used in hospitals for pre-set activity like lifting, relocating, and carting of materials. In USA (2000) the surgical robots get approved and helped the surgeons to improve their vision, create precise and minimally invasive incisions and stitch wounds [26]. AI-based wearables, iPhone and web-based technologies are used to monitor inpatients and outpatient's cardiac data points [27]. AI are used for the assessment of maxillo-facial surgery, cleft palate therapy as for facial attractiveness and age appearance [28,29]. AI-based Endoscopic diagnostics like Oesophagogastroduodenoscopy (OGD) and colonoscopy helped clinicians to identify gastric cancer [30].

AI-based investigation of meningitis, blood poisoning, tuberculosis and forecasting medication difficulties in

hepatitis B and hepatitis C patients are also possible. AI-based support-vector machines are used to identify antimicrobial resistance (AMR), blood smear analysis for diagnosing malaria and better point-of-care testing of Lyme borreliosis [31]. AI is applied in diagnosis, molecular characterization, risk stage analysis and drug discovery of cancer. AI algorithms are used in identifying prostate cancer and breast cancer [34,35]. AI-based pathological and histological diagnosis was possible in hepatitis B, gastric cancer and colorectal cancer [36]. AI-driven detection of Metastatic Cancer was done by applying cancer genotypic and phenotypic data [37]. AI-based medical imaging and AI in nucleology lessen the doses of radiation applied by traditional Medical Science [38,39,40].

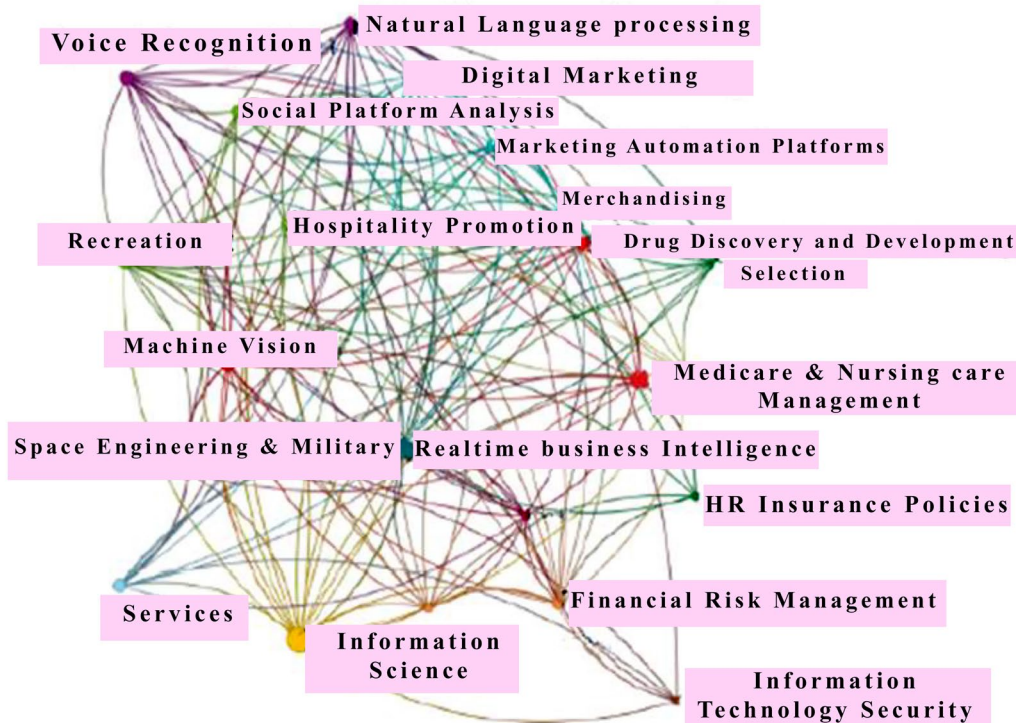


Fig. 1 Application areas of AI

## VIII. CONCLUSION

Artificial Intelligence is a cutting-edge research field which aids the human being to apply the extra-intelligence of machines to contribute couple of discoveries in the Modern World. It is a next generation technology, where humans have to accept like a co-worker in their workspace. This review conclude that the application of AI has created a direct impact to the future of Applied Biology and Health Sciences.

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