Review of applications of Artificial Intelligence during COVID-19

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Abstract - Artificial Intelligence (AI) which emerged in 1956 has caused various technological evolutions in human medicine and healthcare and has taken over the traditional methods and models of healthcare. The deadly novel coronavirus and its rapid rate of growth and spread has taken lives of many, thus creating an immediate need to curb and control its havoc. All this led to a variety of research in the medical field which triggered a variety of applications in the Artificial Intelligence and Machine Learning that took over multitude of duties involve3d in the whole treatment of COVID infected persons thus easing the job of doctors to a little extent.

Index Terms—Artificial Intelligence (AI), COVID, Coronavirus, Pandemic, Diagnosis, Machine Learning.

I. INTRODUCTION

AI came into existence in 1950s and has proven a boon in the field of medical and healthcare by developing various sub-branches of technologies that has helped a lot to save lives that too reducing time, energy and efforts. Its applications include Machine Vision for diagnosis and surgery, Deep Learning and medical image recognition, Augmented reality and virtual reality in healthcare space, Intelligent personal health records, Robotics and Artificial powered devices, Ambient assisted living etc. When the world famous deadly acute respiratory syndrome known as novel coronavirus took the hold of entire world engulfing several lives, AI was explored to search profient technologies to tackle the problems and assist in controllong the worldwide spread of the deadly virus as COVID-19 mushroomed so steadily that it was becoming difficult to plan ahead. In context of this virus, AI aided in diagnosis of dise3ase via tests and symptom tracking, monitoring patients, indentifying severity of patients, processing COVID related imaging tests, epidemiology, pharmaceutical studies etc. The review paper aims to present the current scenario of AI during combating of COVID-19 virus by reviewing and consolidating the applications used in battling the deadly disease.

II. TREATMENT, DIAGNOSIS AND MONITORING USING AI DURING COVID TIMES

A. Treatment

One of really important applications of AI in dealing with widespread outbreak of COVID-19 pandemic is methods proposed for its treatment. These methods can be substituted to find similarities and differences between treatment plans and have also extended help to predict and direct patient's recovery by helping in making decisions to prioritize resources. SVM, Regression Model and ANN to develop intelligent systems are the three main core machine learning approaches to predict patient's recovery. These three approaches are used to design algorithms with deep learning model to predict severity of patient requiring oxygen. Also, the problem of limited ventilator systems cause hospitals to face hard decision of choosing which patient to get access to special care using multi- criteria decision analysis algorithm based on AI to prioritize patients based on health conditions using information retrieved from laboratory tests. Also, AI based decision making systems are used to select suitable plasma to prioritize patients to transfuse antibodies against novel Coronavirus into the bodies of patients from bodies of COVID-19 recovered persons.

B. Diagnosis

As suggested by World Health Organization, diagnosis is very important as testing is vital key in controlling the pandemic. The present scenario for testing is RT_PCR with DNA sequencing and identification but it has demerits like it takes much time to produce results and is expensive. AI can be used to diagnose disease without using RT_PCR or CT Scan images as severe and non-severe patients are differentiated by a few clinical features that don't comprehensively characterize the complicated pathological, physiological and immunological response to the disease. Generic Machine Learning (More accurate study), Ensemble Machine learning, Benefitting from mobile applications, Telehealth algorithms, Deep learning algorithms, Diagnosis via blood tests, Diagnosis via cough, Text processing, Combination of different types of data, Improving DNA Tests are used for diagnosis using AI.

C. Monitoring Patients

AI is used to predict recovery and mortality using Generic Machine Learning Algorithm, Ensemble Methods, Comparing the algorithm, Deep learning algorithm. Also, it is used to predict the severity of a patient using Generic Machine Learning, Blood test data, Voice signal, Clinical and Lab data, Deep Learning. It is used to monitor symptoms using combination of classic epidemiological methods, natural language processing and

Machine learning techniques. Different Machine Learning Models such as SVM, KNN, Decision Tree, Gaussian Naïve Bayesian Models are used for monitoring the patient conditions.

III.   CHEST COMPUTED TOMOGRAPHY & X-RAY IMAGE PROCESSING

A. *CT scan and Deep Neural Networks (DNN)*

A large number of Ct images are used to train deep learning algorithms. In self- supervised learning mechanism guided by a super sample decomposition is proposed for deep convolutional neural networks in processing CT scan images for COVID-19 detection.

B. *CT scan and combination of Deep Neural Networks*

Different machine learning algorithms including segmentation, data augmentation and generative adversarial network (GAN) are used to classify CT images.

C. *CT scan and Conventional Neural Networks (CNN)*

Convolutional Neural Networks are a group of deep neural networks that are currently trending in research to identify COVID-19 in CT images.

D. *CT scan using Machine learning techniques*

Classic Machine Learning algorithms are used by researchers for successful processing of images. Evolutionary algorithms, Statistical Machine Learning Improving classification, Image processing techniques, Support Vector Machines, Comapring different Machine learning algorithms, Artificial Neural networks, Ensemble of machine learning algorithms, Decentralized machine learning, Random Forests, Feature Extraction are used for processing CT scan and X-ray images.

IV.   APPLICATIONS OF AI IN PANDEMIC CONTROL

1. Contact Tracing- It is used to automatically record the interactions between people and offer self-assessment tool for monitoring the symptopms.
2. Identifying COVID-19 cases- In order to control the increasing number of COVID cases, inspection of society is very important. AI based approach for optimized mobilization strategy for mobile assessment agents for the epidemics is proposed for proper monitoring of people with symptoms to track and control the spread of infection.
3. Testing for infection- As per World Health Organization (WHO) reports, COVID testing is very important parameter in controlling the effects of pandemic. AI plays a key role in determining the correlation between number of swab tests and confirmed cases of infection. Various authors have also presented the correlation between swab tests, daily positive cases, mild cases admitted to hospitals, ICU cases and even death rates.
4. Risk Assessment- AI based tools are used to assess the risks involved in urban areas due to worse pandemic conditions. Using algorithms and data, AI assess the risks and develop community level strategies to minimize the risk involved.
5. Social Distancing- The role of social distancing is very crucial in combating the Coronavirus. Due to negligence and lack of awareness, people are not following appropriate social distancing norms in public places. AI approaches based on deep learning are proposed to keep a check on people disobeying distancing rules and those showing symptoms and becoming part of social gatherings.
6. Understanding the pandemic- Research has shown that understanding the outbreak of previous pandemics will help us understand the behavior of COVID-19 and thus, enabling us to plan better to understand and reduce the infections caused.
7. Battling against disinformation- Social media plays an important role in creating awareness among the public regarding global news and happenings but at the same time the false information and existence fabricated news cause people panic and social fatigue. Machine learning algorithm is proposed by researchers to detect conspiracy theories. Such models can be constituted to provide real multimodal information and to predict news credibility.
8. Policy suggestion- To suggest policy, machine learning algorithm can be used to identify structural breaks in detected positive cases dynamics with territorial level panel data. Algorithm based on neural networks can be used to model the behavior of pandemic with Government policies. Then, optimization algorithm finds the optimal decision.

V.   ROLE IN MANAGING THE EFFECTS OF PANDEMIC

A. *Ultility Service sand Organizations*

Artificial intelligence and Neural Networks have helped determine the difference in patterns of consumption of power and fuel by predicting the effects of pandemic. Also, different organizations are using various AI approaches such as Language Processing and Machine Learning to enhance the predictability of resource usage, problem prediction and fraud detection.

B. *Helping researchers and Educational System*

AI tools and algorithms have provided a boost in biomedical research in times of pandemic and has helped in development of new virtual platforms in education and employment to work from home by joining online and working virtually.

C. *Oil market*

Machine learning based algorithms and approaches are used to analyse the changes and relationships between consumption and

prices. US has deployed such models to determine gasoline consumption.

D. Psychological Effects

The coronavirus outbreak has caused various psychological effects such as depression, unemployment, isolation, fears and hopelessness which can be successfully analysed through Machine learning which is nowadays used to study negative effects of pandemic on mental health as it can cause increased stress.

E. Sport

Nowadays machine learning approaches are used to predict the impact of various factors on performance of players in sports.

F. Managing economical impacts

Even the consequences of COVID-19 outbreak on economy is predicted using deep learning in different parts of the world.

G. Smart Cities and Hospitals

The applications of AI has shown huge evidence in proper control of pandemic and to reduce its outbreak in smart cities using predictive tools like neural networks. Moreover AI based algorithms were used in hospitals in decision making and risk analysis to do or delay operations or transplants in patients to reduce risk of exposure to coronavirus based on various attributes.

VI. ROLE IN PHARMACEUTICAL STUDIES

- Drug Repurposing – Combination of different drugs suitable for treatment are found using Machine Learning.
- Potential Drug Discovery- AI based approaches are used to find successful medicines that have worked well for a disease.
- Immune System Study- Artificial intelligence has assisted a lot in conducting research for antibodies that could be injected to boost immunity against coronavirus.
- Herbal Drugs- The effects of herbal medicine on 3D structure of virus can be studied using multiple algorithms.
- Drug molecule structure study- Machine Learning approaches can be used to study molecule structures acting as potential inhibitors against virus.
- Existing Drugs study- AI helps in determining the potential existing drugs for successful infection control.
- Drug Discovery Technique- AI is used in developing new drugs as per needs of treatment.
- Molecule design- AI based models can be used to create drug molecules that could work against COVID-19.
- Text Processing- NLP can be used to determine the success of drugs against virus.

- Drug side effect study- Side effects can be studied using predictive networks.
- Virus sequence study- It concludes the relation between viral and antiviral molecules.
- Infection mechanism study- Machine learning can be employed to study effects on patients with special conditions such as pregnancy.
- Vaccine study- Vaccine research has used various AI approaches for generating vaccines through mutation and behavioural analysis of virus.

VII. CONCLUSION

AI approaches can be widely employed for detection as well as treatment of Coronavirus but machine learning algorithms require a lot of test data in order to operate to provide accurate results. The use of Body Area Network devices like smart watches can be used to investigate the body parameters that can impact the results and are indicative of presence of virus infections. Moreover, constant monitoring of body temperature, pulse etc can actually alarm the persons before spread of infection. One important concern in this respect is implementation of research in the field of AI as many areas of AI are still to be explored and its potential is yet to be recognized.

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