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The Impact of Artificial Intelligence (AI) and Machine Learning (ML) on CSR Initiatives in the Era of Covid-19: A Novel Approach

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Abstract: In recent times, the global impact of Coronavirus Disease 2019 (COVID-19), stemming from the severe acute respiratory syndrome virus 2 (SARS-CoV-2), brought widespread disruptions to various facets of human life, profoundly affecting economies worldwide. In the healthcare sector, the pandemic not only interrupted but also reversed advancements in health, leading to a decline in life expectancy, particularly in developing and underdeveloped nations. However, amidst these challenges, machine learning and artificial intelligence played a significant role in addressing the global impact of the pandemic. This paper explores the transformative role of Artificial Intelligence (AI) and Machine Learning (ML) in enhancing Corporate Social Responsibility (CSR) initiatives during the COVID-19 pandemic. The unprecedented challenges posed by the pandemic have necessitated innovative approaches in CSR, shifting from traditional philanthropic models to more technology-driven strategies. We investigate how AI and ML applications have enabled corporations to respond more effectively to societal needs during this crisis. The study employs a qualitative methodology, analysing various case studies where AI and ML have been integrated into CSR initiatives across different sectors. Key areas of focus include healthcare support, community outreach, employee welfare, and environmental sustainability. Our findings reveal that AI-driven data analysis has facilitated more targeted and efficient CSR activities, enabling better resource allocation and impact measurement. ML algorithms have played a crucial role in predicting community needs and assessing the effectiveness of CSR initiatives. This study contributes to the understanding of technology's impact on social responsibility in business, offering a framework for integrating AI and ML into CSR strategies. It highlights the potential of these technologies to revolutionize CSR approaches, making them more adaptive, impactful, and aligned with contemporary societal challenges. The paper concludes with recommendations for businesses looking to leverage AI and ML for socially responsible practices in the post-pandemic world.

Keywords: Artificial Intelligence, Companies Act 2013, Corporate Social Responsibility, Covid-19, Machine Learning.

1. Introduction

In times of crisis, there is an urgent need for resources to address the situation, whether it's economic, social, or physical in nature. Corporations are often expected to provide these essential resources. During the Covid-19 pandemic, society looked towards corporate entities for their contribution of resources. On March 23, 2020, expenditures related to Covid-19 were recognized as eligible activities under Corporate Social Responsibility (CSR). CSR is essentially a commitment by companies to integrate social and environmental concerns into their everyday operations. It's about the responsibility of companies towards society and all their stakeholders, striving to meet their needs, not merely through charity or donations, but as a response to the obligations placed upon them by society.

India marked a significant milestone on April 1, 2014, becoming the first country to legally mandate corporate social responsibility. The new provisions under Section 135

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of India's Companies Act, 2013, require companies to allocate two percent of their average net profit from the preceding three years to CSR activities. Before Covid-19, CSR activities included efforts to eradicate extreme hunger and poverty, promote education, gender equality, reduce child mortality, and improve maternal health. Following the outbreak of Covid-19, activities related to Covid-19 relief, including contributions to Central or State Disaster Relief Funds or the PM CARE fund, were also recognized as CSR activities. According to a notification by the Ministry of Corporate Affairs, resources allocated for establishing medical oxygen generation and storage plants, as well as the manufacturing and supply of oxygen concentrators, ventilators, cylinders, and other medical equipment for Covid-19, are considered CSR activities.

Prior to the global recognition of the coronavirus (COVID-19) threat, artificial intelligence (AI) systems had identified an unidentified pneumonia outbreak in the People's Republic of China. AI tools and technologies played a crucial role in assisting policymakers, the medical community, and society in addressing all aspects of the crisis and its aftermath, including detection, prevention, response, recovery, and expediting research efforts. The global impact of the COVID-19 pandemic was psrofound, influencing both people's lives and economies worldwide. Artificial Intelligence (AI) constitutes a domain of algorithm-driven applications designed to empower machines in solving knowledge-related challenges, simulate human decision-making through algorithms, and enhance performance iteratively by applying inputted data to execute specific tasks. In the medical field, technologies rooted in Artificial Intelligence and machine learning (AI/ML) aim to elevate the quality of healthcare, enhance diagnostic precision, reduce potential errors, and predict outcomes by extracting valuable insights from vast datasets generated by the collective experiences of numerous patients. The utilization of artificial intelligence in addressing COVID-19 has been extensive, spanning areas such as diagnosis, public health, clinical decision-making, social control, therapeutics, vaccine development, surveillance, integration with big data, operation of essential clinical services, and the management of COVID-19 patients. To alleviate the considerable strain on limited medical resources induced by the COVID-19 pandemic, crucial measures involve swift diagnosis, precise prediction, intensified monitoring, and effective treatments to exert control over the spread of the pandemic.

2. Leveraging AI for Addressing Covid-19.

During the pandemic, the Indian government implemented AI as part of a comprehensive strategy to manage the pandemic and facilitate a strong recovery afterward. A key element of India's approach was 'CoWIN,' a digital platform that streamlined the distribution of COVID-19 vaccines nationwide, ensuring both efficiency and safety, while also serving as an effective means of communication. In March 2020, the Ministry of Health and Family Welfare, in with NITI Aayog, introduced collaboration the Telemedicine Practice Guidelines to enable remote and timely medical consultations. Additionally, Haptik, a conversational AI firm, rapidly developed the MyGov Corona Helpdesk, a sophisticated virtual assistant. Furthermore, the Government of India's Digital India Corporation, working alongside Accenture and Microsoft, created MyGov Saathi, an AI-powered chatbot. MyGov Saathi, equipped with data analytics, natural language processing, and conversational AI capabilities, can assist up to 50,000 users daily with current and reliable information about COVID-19.

In instances where RT-PCR tests were unable to identify certain COVID variants, there was a surge in people seeking CT scans and chest X-rays at diagnostic centers. To address this, the Centre of Artificial Intelligence and Robotics, under the Defence Research and Development Organisation (DRDO), created an AI-driven intelligent COVID detection software named ATMAN AI. This tool classifies chest Xray images as 'normal', 'COVID-19', or 'pneumonia', achieving an impressive 96.73% accuracy rate with digital X-rays from RT-PCR positive patients. The software is conveniently accessible on mobiles, tablets, and laptops. In a similar vein, IIT-Kharagpur introduced COVIRAP, a smartphone application for diagnosing infectious diseases. Mumbai's Qure.ai developed qXR, which utilizes deep learning for screening and diagnosing COVID-19. Additionally, scientists from IIT-Hyderabad have created COVIHOME, an AI-enabled COVID-19 self-test kit that delivers results in under an hour, suitable for both symptomatic and asymptomatic individuals.

AI is being utilized to repurpose existing medications for treating COVID-19. The Indo-German company Innoplexus leveraged its specialized AI and big data platform to analyze various factors, including expression data, molecular pathways, drug binding affinities, and information from clinical trials. This analysis was aimed at evaluating the potential of drugs like Hydroxychloroquine and Remdesivir in the treatment of COVID-19.

In India, regions such as Madurai and Telangana are employing AI technology to monitor and identify individuals not complying with mask mandates. In Hyderabad, for instance, the police are using computer vision and deep learning techniques with surveillance cameras in three Urban Police Commission rates. This system is designed to detect people who are not adhering to mask requirements in public areas. Additionally, a Punebased startup, Glimpse Analytics, is implementing AI to notify commercial establishments and office spaces about breaches in social distancing protocols within their premises. Furthermore, the Telangana government has embarked on an innovative project called 'Medicine from the Sky'. This initiative involves using drones to deliver critical healthcare supplies, such as blood, vaccines, medical samples, and organs, to 16 Primary Healthcare Centres in the Vikarabad district, showcasing a novel application of technology in healthcare logistics.

It is essential to acknowledge the contribution of the United Payments Interface (UPI) in the shift from a conventional cash-driven economy to digital payment mechanisms. In 2020, during the peak of the COVID-19 pandemic, India achieved the highest real-time payment transactions globally, reaching 25.5 billion (as reported by CLSA). This development played a crucial role in supporting social distancing measures implemented during the pandemic and facilitating the smooth operations of businesses, both small and large. Additionally, the rapid adoption of these new digital systems by the general public at an unprecedented pace can be attributed to factors such as affordable internet data, widespread smartphone usage, and the implementation of India's Unique Identity Number.

The integration of AI into India's response to the COVID-19 pandemic has not only been instrumental in combating the virus but has also played a significant role in providing access to verified information and mitigating the impact on businesses. This incorporation of AI has enhanced the country's readiness across various aspects of the pandemic response while simultaneously addressing disparities in the delivery of healthcare services.

AI technologies and resources assumed a pivotal role in all facets of responding to the COVID-19 crisis, encompassing:

- 1. Comprehending the virus and expediting medical research for drugs and treatments
- 2. Identifying and diagnosing the virus, along with forecasting its progression
- 3. Aiding in the prevention or deceleration of the virus's transmission through surveillance and contact tracing.
- 4. Addressing the health crisis via personalized information and learning
- 5. Overseeing the recovery process and refining early warning systems.

AI tools and methodologies are instrumental in aiding policymakers and the medical community in comprehending the COVID-19 virus and hastening research on potential treatments by swiftly processing vast amounts of research data. AI's capabilities in text and data mining can reveal insights into the virus's history, modes of transmission, diagnostic methods, management strategies, and lessons learned from past epidemics.

Deep learning models have the potential to identify existing and new drugs or treatments that could be effective against COVID-19. Various institutions are employing AI not only to pinpoint possible treatments but also to aid in developing prototype vaccines. For instance, DeepMind and other organizations have utilized deep learning to predict the structure of proteins linked to SARS-CoV-2, the virus responsible for COVID-19. Specialized platforms or forums are being established to consolidate and share multidisciplinary AI expertise on a global scale. For example, the U.S. government has initiated discussions with international government science leaders, focusing on employing AI to expedite the analysis of coronavirus literature, which has been made accessible through platforms like Kaggle.

Datasets in the fields of epidemiology, bioinformatics, and molecular modeling are being made accessible through initiatives such as the COVID-19 Open Research Dataset Challenge, led by the US government and partner organizations. This challenge releases more than 29,000 academic research articles related to coronavirus and COVID-19. Computing power for AI is also being provided by technology giants such as IBM, Amazon, Google, and Microsoft, as well as through individual contributions of computer processing power (e.g., Folding@home). Publicprivate collaborations, like the COVID-19 HighPerformance Computing Consortium and AI for Health, contribute to this availability of computing resources.

Various innovative approaches, including prizes, opensource collaborations, and hackathons, are playing a role in expediting research on AI-driven solutions to address the pandemic. An illustrative example is the United Kingdom's initiative called "CoronaHack – AI vs. Covid-19," which invites ideas from businesses, data scientists, and biomedical researchers on leveraging AI to control and manage the pandemic.

3. Utilizing AI for the Detection, Diagnosis, and Prevention of Coronavirus Spread is an Essential Application.

AI is currently employed in algorithms that recognize patterns and anomalies, contributing to the detection and prediction of COVID-19 transmission. Image recognition systems, powered by AI, are expediting medical diagnosis. Examples of its application include:

3.1. AI-driven early warning systems, which utilize algorithms to detect epidemiological patterns by analyzing mainstream news, online content, and various information channels in multiple languages. These systems offer early warnings that complement syndromic surveillance and other healthcare networks and data flows (e.g., WHO Early Warning System, Bluedot).

3.2. AI tools are instrumental in identifying virus transmission chains and monitoring broader economic impacts. In certain instances, AI technologies have demonstrated their ability to infer epidemiological data more rapidly than traditional health data reporting. Institutions like Johns Hopkins University and the OECD (oecd.ai) have developed interactive dashboards providing real-time data on confirmed coronavirus cases, recoveries, and deaths, tracking the virus's spread through live news.

3.3. Swift diagnosis is crucial for limiting contagion and understanding disease spread. When applied to images and symptom data, AI has the potential to rapidly diagnose COVID-19 cases. It is imperative to ensure the collection of representative data from the entire population to guarantee scalability and accuracy.

Controlling the spread of the contagion is a top priority worldwide, and AI applications are playing a significant role in preventing the virus's spread. In several countries, population surveillance is being utilized to monitor COVID-19 cases. For instance, in Korea, algorithms are employed to trace coronavirus patients using data from geolocation, surveillance-camera footage, and credit card records. In China, individuals are assigned a risk level indicated by a color code (red, yellow, or green) through cell phone software, assessing their contagion risk. Machine learning models are using travel, payment, and communication data to forecast the next outbreak's location. This information assists in border checks and informs search engines and social media platforms, which also contribute to real-time disease tracking. Many countries, including Austria, China, Israel, Poland, Singapore, and Korea, have implemented contact-tracing systems to identify possible infection routes. In Israel, for example, geolocation data is used to detect individuals who have come into close contact with known virus carriers, sending them text messages to immediately self-isolate. Semi-autonomous robots and drones are being employed in hospitals for urgent needs. These include delivering food, medications, cleaning, and sterilization tasks, assisting doctors and nurses, and transporting equipment.

4. Companies integrating Artificial Intelligence in CSR Initiatives

During the COVID-19 pandemic, several companies across various sectors utilized AI in their Corporate Social Responsibility (CSR) initiatives. Here's a list of some notable examples:

4.1. Microsoft: Microsoft used its AI for Health initiative to provide support for COVID-19 response efforts, including data analysis, research, and resource allocation. On January 29, 2020, Microsoft introduced AI for Health, an initiative designed to enhance the well-being of individuals and communities globally. This five-year commitment aims to equip nonprofits, researchers, and organizations with AI and data science tools. The primary focus of the AI for Health initiative is to support remote education, empower students globally, facilitate remote work for businesses, ensure the availability of essential medical supplies, and assist local communities. Microsoft has outlined key areas of concentration in its efforts to combat COVID-19, including data and insights, treatment and diagnostics, resource allocation, dissemination of accurate information, and scientific research. The company has established significant partnerships worldwide, such as the COVID-19 High Performance Computing Consortium, The Institute for Health Metrics and Evaluation (IHME), The Washington State Department of Health, Folding@home, The Sepsis Center of Research Excellence (SCORE-UW), and Take, each contributing their unique capabilities to support COVID-19 relief and the AI for Health initiative.

4.2. IBM: Through the IBM Watson platform, the company offered AI-powered tools to help healthcare organizations, researchers, and governments in understanding and responding to COVID-19. IBM is aiding various government bodies, healthcare entities, and academic institutions globally by utilizing AI to deliver reliable data and information to their citizens. As citizens flood these organizations with inquiries, response times in many regions can surpass two hours. To address this, IBM offers the Watson Assistant for Citizens on the IBM public cloud at no cost for a minimum of 90 days. This service integrates Watson Assistant, advanced Natural Language Processing from IBM Research, and cutting-edge AI search capabilities through Watson Discovery. It is designed to understand and respond to frequent questions about COVID-19. IBM is providing the Watson Assistant for Citizens without charge for at least 90 days, including assistance with the initial setup, which is typically completed within a few days. Initially available in English, the solution is also being adapted to include Indian languages such as Hindi. The service comes with 15 pre-trained COVID-19-related "intents" or queries. These "intents" refer to the objectives or aims expressed in a user's query. Watson Assistant leverages this understanding to determine the most appropriate dialogue flow for each response.

4.3. Google: Google's DeepMind division used AI for understanding the protein structure of the coronavirus, which was crucial for vaccine and treatment development. Google's DeepMind has harnessed artificial intelligence to successfully tackle a significant challenge in biological sciences, unraveling the mystery of how proteins transform from linear chains of amino acids into intricate 3D structures. These structural configurations are crucial for carrying out essential life processes, and deciphering their functions is paramount. The renowned structural biologists and organizers of the biennial protein-folding competition, Critical Assessment of Protein Structure Prediction (CASP), have acknowledged DeepMind's AI system, AlphaFold, as a breakthrough in addressing this longstanding 50-year challenge. This achievement holds profound implications, potentially expediting the development of new medications. Notably, in the current context, it could significantly accelerate research efforts in creating a COVID-19 vaccine.

4.4. Alibaba Group: Alibaba Cloud developed an AIpowered diagnosis system to help in the quick and accurate diagnosis of COVID-19, enhancing medical response capabilities. Alibaba's DAMO demonstrated its commitment by expediting the diagnosis of suspected coronavirus cases, providing much-needed relief. Additionally, in collaboration with Aliyun, DAMO Academy supports doctors by utilizing an algorithm that considers patients' symptoms, medical histories, and test results for diagnosis. The COVID-19 pandemic has put Alibaba's advanced technological capabilities to the test, showcasing the results of years of dedicated work.

4.5. Facebook: The Company utilized AI to combat misinformation about COVID-19 on its platform and supported research through its Data for Good program. Facebook is actively assisting the global public health community in ensuring the safety and awareness of individuals during the ongoing coronavirus public health crisis. Additionally, efforts are being made to tackle the long-term repercussions by providing support to industries in need and facilitating easier access for people to both seek and offer help within their communities. The company has been at the forefront of implementing various artificial intelligence techniques to monitor content across its social networks. In addition to combating misinformation related to COVID-19, Facebook has deployed new A.I. algorithms to enforce its policy prohibiting ads that attempt to profit from the pandemic by selling items like face masks and hand sanitizer.

4.6. Amazon: Through AWS Diagnostic Development Initiative, Amazon supported projects developing rapid and accurate diagnostic solutions using cloud computing and AI. In response to the global challenge of expanding COVID-19 testing, Amazon introduced the Amazon Web Services (AWS) Diagnostic Development Initiative. This initiative aims to assist organizations worldwide in leveraging cloud technology to expedite research and development in diagnostics. As part of this effort, AWS has allocated \$20 million in computing credits and specialized support from the AWS Professional Services team to aid customers utilizing AWS for advancing diagnostic solutions. AWS has collaborated with 87 organizations in 17 countries, spanning non-profits, research institutions, start-ups, and large businesses. A total of \$8 million has been granted to support various diagnostic projects, encompassing molecular tests for antibodies, antigens, and nucleic acids, diagnostic imaging, wearables, and data analytics tools employing artificial intelligence and machine learning for virus detection.

4.7. NVIDIA: NVIDIA provided AI computing resources to researchers working on COVID-19 through its COVID-19 High Performance Computing Consortium. NVIDIA's team of computer scientists has become part of the COVID-19 High Performance Computing Consortium. This collaborative effort unites leaders from the U.S. government, the private sector, and academic circles to expedite research using some of the most potent highperformance computing (HPC) resources available worldwide. The goal of the consortium is to fast-track the development of effective strategies for detecting, containing, and treating the coronavirus. To aid researchers, the consortium provides access to 30 supercomputers, boasting over 400 petaflops of computational capacity. NVIDIA's team, led by Ian Buck, the Vice President and General Manager of Accelerated Computing, brings a wealth of knowledge in critical areas. This includes AI, supercomputing, drug discovery, molecular dynamics, genomics, medical imaging, and data analytics.

4.8. Baidu: Leveraged its AI capabilities to develop an opensource tool to predict the spread of the virus and provided AI-powered conversational bots for healthcare inquiries. Baidu has promptly utilized its proficiency in artificial intelligence (AI) and related technologies and products to aid frontline initiatives in preventing and managing the pandemic. The company's swift response to the current health crisis is made possible by its sustained investment in advanced research and development. Baidu's extensive AI patent portfolio attests to the excellence and scope of its research and development endeavors. As illustrated in the instances below, Baidu takes pride in applying these patented AI technologies to contribute to meeting the pressing requirements of society in the ongoing battle against COVID-19.

4. 9. Siemens: Used AI-based analytics and simulations to optimize hospital operations and healthcare logistics during the pandemic. To address the current worldwide health emergency resulting from the COVID-19 virus, Siemens is offering access to its Additive Manufacturing (AM) Network and 3D printers to the global medical community. This initiative aims to expedite the design and production of medical components. The AM Network serves as a platform connecting users, designers, and 3D-print service providers, streamlining the production of spare parts for critical machines such as ventilators. Siemens' AM network is accessible on a global scale and encompasses the entire value chain—from uploading and simulating designs to verifying the design and managing the printing process, along with associated services.

4. 10. Pfizer: Utilized AI to expedite the research and development process for its COVID-19 vaccine. Pfizer effectively utilized AI to conduct vaccine trials and streamline the distribution process. In their approach, AI played a crucial role throughout the development of the COVID-19 vaccine, ensuring it catered effectively to the needs of individuals. Even before the pandemic, Pfizer had started to automate its research and development processes, integrating artificial intelligence into its operational framework. During the vaccine trials, which involved about 44,000 participants, the company employed AI algorithms to discern relevant patterns and insights from millions of data points. The pharmaceutical industry incorporated AI in various stages of vaccine development and trial processes. Notably, after achieving the necessary efficacy case counts, the data were processed and made available in roughly 22 hours, thanks to the use of a Machine Learning (ML) tool known as Smart Data Query (SDQ). This ML approach throughout the study ensured high data quality with minimal need for human intervention.

5. Suggestions

5.1. Foster collaboration across disciplines and stakeholders, both domestically and internationally. This includes the AI community, medical professionals, developers, and policymakers, to define problems, pinpoint relevant data and accessible datasets, exchange tools, and develop training models.

5. 2. Investment in AI and ML Technologies: Corporations should allocate resources for the development and integration of AI and ML in their CSR strategies. This includes investing in research and development, and in acquiring or collaborating with technology providers.

5.3. Skill Development and Training: Companies should focus on upskilling their workforce in AI and ML providing training and educational resources will ensure that employees are equipped to implement and manage AI-driven CSR initiatives effectively.

5.4. Data-Driven Decision Making: Encourage the use of data analytics in understanding and responding to community needs. AI and ML can process vast amounts of data to identify key areas where CSR efforts can be most effective, especially in times of crisis like the COVID-19 pandemic.

5.5. Collaboration with Tech Companies and Start-ups: Establish partnerships with tech companies and start-ups specializing in AI and ML. These collaborations can lead to innovative CSR solutions that are more effective and scalable.

6. Conclusion

The COVID-19 pandemic has presented unparalleled challenges and repercussions globally, impacting AI research and application as well. Advancements in AI for managing epidemics will also be beneficial in handling other significant, unpredictable events, often referred to as "gray rhino" and "black swan" events. The aim is for AI to foster ethical, human rights-oriented approaches and to mitigate the differential impacts that might arise from pandemics like COVID-19 and from flawed policies and practices. This holistic view of AI's role in pandemic management highlights both its challenges and its vast potential for positive impact. In the era of COVID-19, the impact of Artificial Intelligence (AI) and Machine Learning (ML) on Corporate Social Responsibility (CSR) initiatives has been transformative, marking a novel approach in how businesses address social and environmental challenges. The integration of these advanced technologies has not only accelerated the response to the pandemic but has also redefined the scope and effectiveness of CSR activities. AI and ML have enabled companies to respond swiftly and more efficiently to the urgent needs arising from the pandemic. From enhancing healthcare responses through predictive analytics to aiding in the development and distribution of vaccines, these technologies have played a pivotal role. The pandemic has also highlighted the importance of data-driven decision-making in CSR. AI and ML have empowered organizations to analyze vast amounts of data to identify critical areas of need, measure the impact of their CSR efforts, and adjust strategies in real time for greater effectiveness. This has led to more targeted, impactful, and sustainable CSR initiatives. The COVID-19 pandemic has acted as a catalyst, accelerating the adoption of AI and ML in CSR initiatives. It has opened new avenues for innovative, effective, and efficient responses to societal challenges, setting a new standard for how businesses can and should contribute to the greater good in an increasingly complex and interconnected world.

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Conflicts of interest

The authors declare no conflicts of interest.