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Deep Learning System in Tackling Covid-19 Pandemic

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Abstract: ***Deep learning is an artificial intelligence function that simulates the working of human in data processing and creating patterns for use in decision making. Deep learning is a machine learning subset in artificial intelligence that possess a network capable of learning unsupervised from that is unstructured or unlabelled. The outbreak of a new virus named novel coronavirus-2019 in Wuhan province of china has raised alarm bell among the officials across the world as the number of people infected and the death toll raised. Recommended measures to prevent infection include the physical distance from others, the use of face mask has been recommended by health officials in public settings to minimize the risk transmission. This paper's objective is to analyse and explore the implementation of deep learning majorly, in preventing and implementing social norms prescribed by a world health organization to contain the spread of the novel coronavirus.***
Keyword: ***Deep learning, Face recognition, Thermal screening, Novel Coronavirus, Artificial intelligence, Machine learning***

I. INTRODUCTION

Artificial intelligence refers to machines with human-level or higher intelligence, capable of abstracting concepts from limited experience and transferring knowledge between domains. Machine Learning is a present-day application of Artificial Intelligence-based around the idea that we should really just be able to give machines access to data and let them learn for themselves [1]. Deep learning is a part of machine learning in artificial intelligence that possess networks capable of learning unsupervised from data that is unstructured or unlabelled. It is a function of Artificial intelligence (AI) that imitates the workings of the human brain in processing data and creating patterns for use in decision making [2]. Deep learning techniques have achieved great success in different tasks in computer vision, natural language processing, robotics and recently mitigating the novel-corona virus.

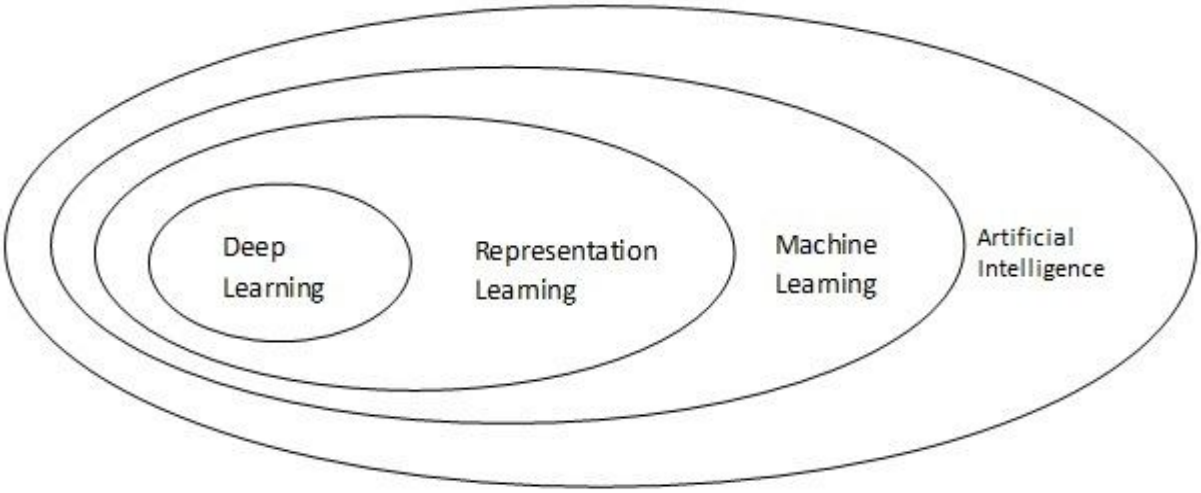

Fig. 1 Deep Learning and AI

Fig. 1 Represents Deep Learning is considered as the subset of machine learning which is an intern subset of Artificial Intelligence, a prominent field of computer science over the past decade. Learning can be supervised, semi-supervised, or unsupervised. Deep learning provides a set of algorithms and approaches that learn features and tasks directly from data. Data can be of any type, structured or unstructured, including images, text, or sound. Deep learning is often referred to as end-to-end learning because it learns directly from data. Moreover, Deep learning techniques work without human mediation and sometimes capable of producing more accurate results than a human being itself [3]. With the development of deep learning and the introduction of deep convolutional neural networks, the accuracy and speed of face recognition have made great strides.

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A. Deep Learning Architecture

The advancement in the field of deep learning architecture in the last two decades offers significant opportunities for applying it in various fields and its applications. This paper presents the three most popular deep learning architectures - Deep Belief Network, Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs).

1) Deep belief network (DBN) is a typical unsupervised network architecture that provides a unique training algorithm.Fig.2 The DBN is multilayer network contains many hidden layers in which each pair of connected layer is made up with a restricted Boltzmann machine(RBM).

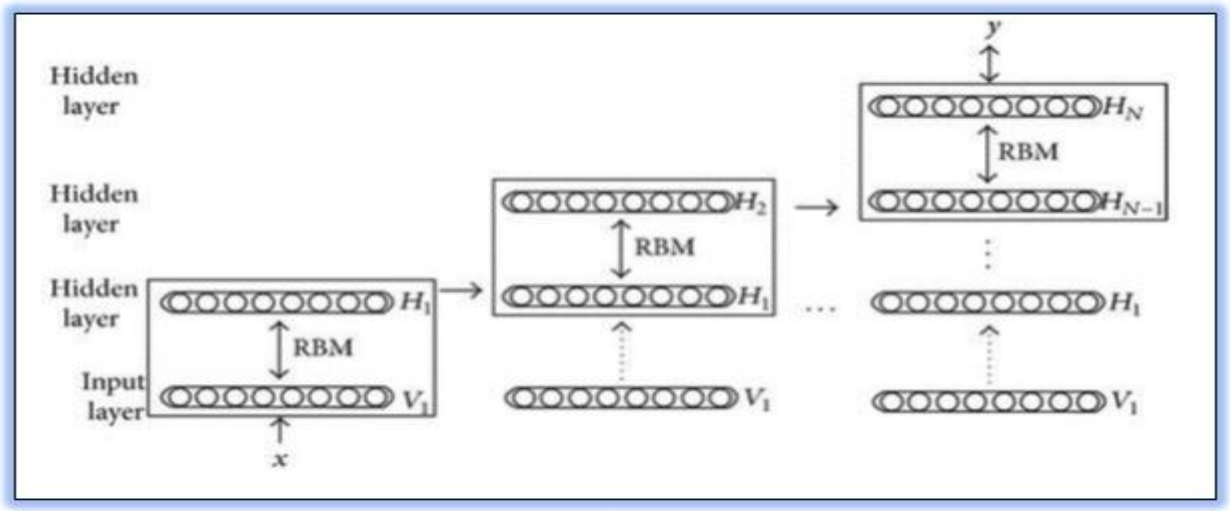

Fig. 2 A General Architecture of Deep Belief Network

2) Recurrent neural network (RNN) is one of the first algorithms that remembers its input, as it consists of internal memory, and therefore most suitable for solving machine learning problems that involve sequential data, such as speech and language.

3) A Convolutional Neural Network (CNN) is derived from the neurobiological process of the visual cortex, CNN is most appropriate for the data sets that requires a large number of nodes and parameters to be processed. [5]

II. DEEP LEARNING FOR FACE RECOGNITION

Deep learning gives the power to build recognition biometric software that is capable of uniquely identifying or verifying a person. All this because deep learning methods are able to leverage very large datasets of faces and learn rich and compact representations of faces, allowing modern models to first perform as-well and later to outperform the face recognition capabilities of humans. [6]
Initially, everyone believed a neural network cannot achieve near-human-level performance. Everything, however, changed in 2014. The scientists decided to check it out by means of the two best networks at the moment - AlexNet and the network developed by Matthew D. Zeiler and Rob Fergus.Apart from AlexNet and Zeiler network important development in deep learning for face recognition, there are also other milestone systems like DeepFace, the DeepID series of systems, VGGFace, and FaceNet.

1) DeepFace is a facial recognition system based on deep convolutional neural networks created by a group of researchers at Facebook in 2014. It identifies human faces in digital images. With an accuracy of 97%, it was a major leap forward using deep learning for face recognition.

2) The DeepID, or “Deep hidden IDentity features,” is an array of systems (e.g. DeepID, DeepID2, etc.), initially described by Yi Sun, et al. Their system was first described alike DeepFace, even though was expanded in subsequent publications to support both identification and verification tasks by training via contrastive loss.

3) The VGGFace was developed by Omkar Parkhi, et al. from the Visual Geometry Group. In addition to a better-tuned model, the focal point of their work was on how to collect a massive training dataset and use this to train a very deep Convolutional Neural Network (CNN) model for face recognition that allowed them to achieve then state-of-the-art results on standard datasets.

4) FaceNet is a facial recognition system developed by a group of Google researchers in the year 2015 that achieved then state-of-the-art results on a range of face recognition datasets benchmark. The FaceNet system can be used widely thanks to multiple third-party open-source implementations of the model and the availability of pre-trained models.

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Various Study conducted by WHO and other governmental agency like A study by a team of researchers led by a Texas A&M University professor has found that not wearing a facial mask exponentially increases a person's chances of being infected by the coronavirus. their results clearly show that airborne transmission via respiratory aerosols represents the dominant route for the spread of COVID-19.

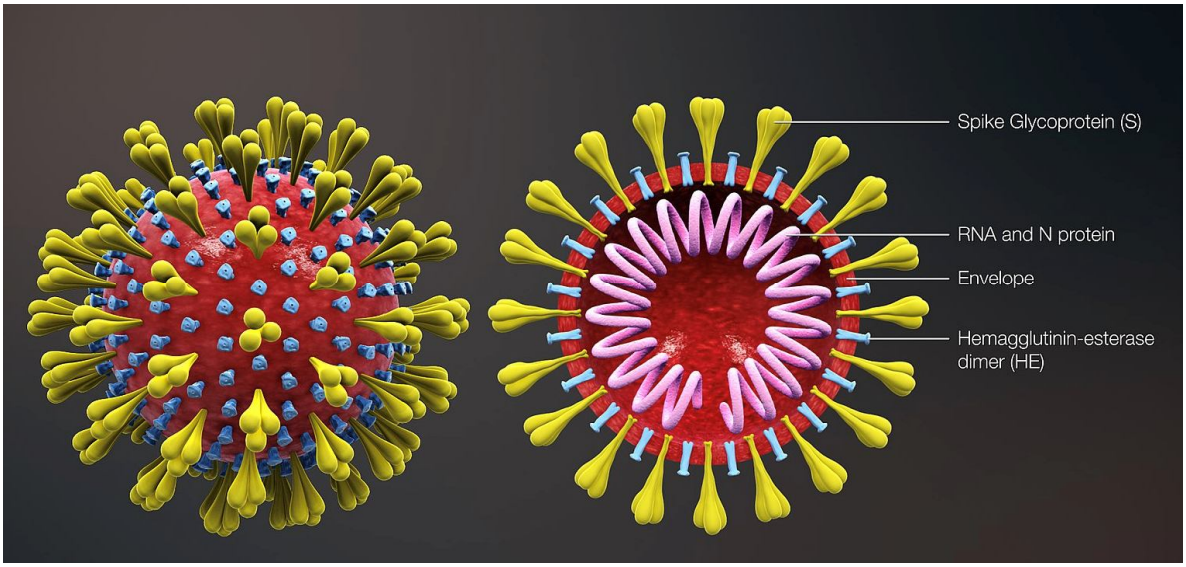

Fig. 3 Schematic of a coronavirus

The infection rate of people can be brought down to .5% if a person wears a facial mask. In order to monitor and implement the preventive techniques suggested by WHO in public places and social gathering, the deep learning architecture combines facial recognition technology with thermal screening emerged as a saviour. It detects human with higher temperature through thermal screening and also detects people wears a mask with facial recognition technology.

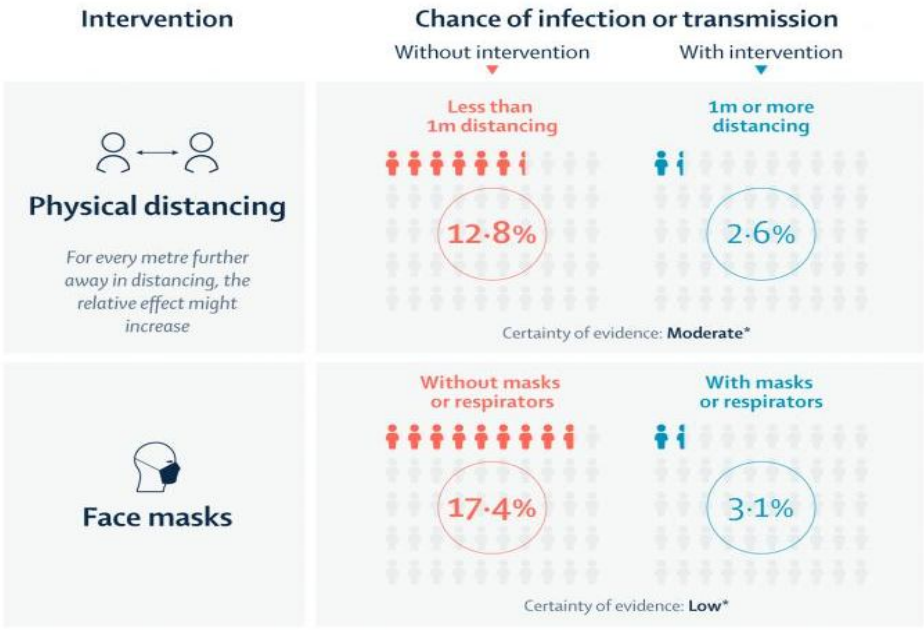

Fig 4. Preventive measures for Covid-19 Pandemic

In this pandemic, deep learning with facial recognition helps to detect the person a wearing protective mask which is a preventive measure to contain this spread of the novel-corona virus.

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III.DEEP LEARNING ON THERMAL DETECTION

Deep learning has achieved unprecedented results in many image analysis tasks. a case study is performed where the goal is to detect persons in infrared images using deep learning. Consider a surveillance scenario where cameras are stationed around an object of interest. Traditionally this requires an operator to monitor the feed from all these cameras for suspicious activity. The use of deep learning for these types of image related analysis tasks has had huge success in recent years. The use of deep learning for these types of image related analysis tasks has had huge success in recent years. This makes deep learning extremely attractive, as it moves one step closer to providing end-to-end learning agents requiring minimal human intervention. [8].

It may be an amplification to say that COVID-19 created the need for temperature detection kiosks, it certainly fostered the fastest demand for temperature detection in combination with biometric identity verification as organizations scramble for ways to protect guests and employees from airborne pathogens and bacteria.

Businesses, schools, airports, institutions, and government facilities are anxious to resume operations following more than two months of lockdown, but they need to enforce social distancing and identify people with high temperatures. In response, technology companies have developed an automated identity and temperature monitoring tool that allow locations to check temperatures. [9]

Fig. 5 Covid-19 Screening Kiosk

Companies that responded to requests for information provided their own art and are listed in alphabetical order.

A. AAEON electronics
B. ARVI technology
C. CSA LLC and SZZT electronics co.ltd
D. Digital media vending international LLC
E. Diversified
F. Frank mayer associates
G. Howard industries
H. Intra edge and pyramid computer
I. JNL technologies Inc
J. Kogniz

Deep learning combines facial recognition, thermal screening to implement the required preventive measures adopted by governments across the world. The Kiosks are designed to detect people whether wears a mask and their body temperature. The deep learning algorithm is designed in a manner that allows people who wear masks and the temperature is normal.

Also, there are kiosks that embed with the attendance system of the organizations so as to ensure the employees are adhering to the measures that are allowed. The screen flashes green for the acceptable temperature and red for a high temperature.

This is gaining momentum and many products are showing up in the market. The products are designed to caters to various needs arising due to the Covid-19 pandemic. These systems are implemented in public places like malls, airports, etc. The Covid-19 has changed the socials norms across the globe. The deep learning has a vast implementation in the recent scenario.

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IV. CONCLUSIONS

Necessity, according to the proverb, is the mother of invention. This work has been an investigation into how deep learning can be implemented in dealing Pandemic like situations by the task of detecting body temperature and peoples who wear masks. Deep learning models possess an ability to conduct appropriate results without human intervention and it makes them promising for solving real-time issues like Covid-19 crisis. Moreover, real-time products based on deep learning also discussed. In the future, this can be extended to contact tracing and predicting the possible affected people by analysing the various data feed into deep learning models.

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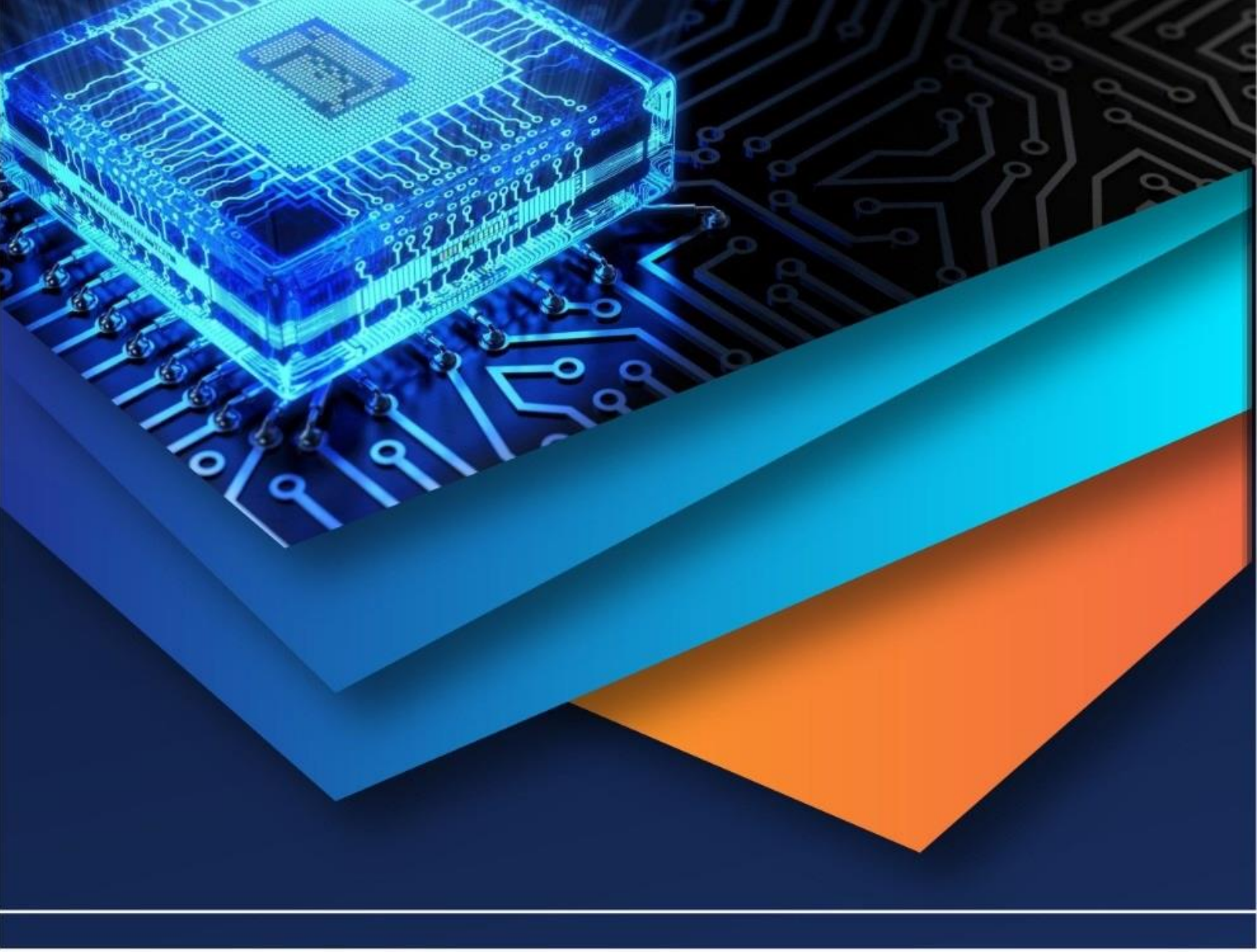

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