COMSTECH-ICYF ESSAY COMPETITION ON ARTIFICIAL INTELLIGENCE 2020-2021

Contents

Preface

The COMSTECH-ICYF Essay Competition on Artificial Intelligence (AI) aims to promote the awareness of AI as a leading technology of the contemporary era and its potential in varied areas of economy and society. It further aims to identify outstanding talent in OIC countries that has both deeper understanding as well as innovative ideas on how AI can be used to address the multitude of problems being confronted by OIC countries. Besides the physical and economic needs of societies, the challenges include the potential pitfalls, the rules, regulations and guidelines, both legal and moral, that need to be addressed to make the use of AI compatible with concerns of human privacy and dignity.

The competition was announced in October, 2020 in two separate categories *viz.* Professionals and Students, and in the three official OIC languages, namely Arabic, English, and French. (Details of the competition rules can be seen at the weblink: https://www.youtube.com/watch?v=WOawGGwdELw).The last date for the submission of essays was November 7, 2020, while the results of the competition were announced on February 15, 2021 in an online ceremony.

COMSETCH-ICYF received a good response with a total of 110 participants from 22 different countries. On the basis of their 300 -500 word Abstracts, 43 participants were shortlisted for the two categories. The shortlisted essays were judged by an international panel of four experts hailing from different countries of the OIC.

The essay themes were related to

a.   AI for Health/Education
b.   AI for Technology Frontiers
c.   AI in E – Governance,
d.   AI in Security, Justice, Crime fighting and prevention,
e.   Ethical & Regulatory Issues in Applications of AI Data privacy, digital crime fighting,

The Outline/Structure of the submitted Essays have the following indicators:

• Introduction and Background of Selected Topic • Current State of Technology • Proposed Idea and its Novelty Idea • Implementation of Idea (stakeholders, target audience etc.) • Expected Impact on Society.

Each essay was assessed by several Jury members independently and the result was determined on the basis of the average score of each participant. The three best essays in each category were selected for awards. However, for purposes of this publication the five best essays in each category have been selected for publication.

The following are the already announced winners of the 1st, 2nd, and 3rd positions in each of the two categories:

Professional category:

- 1st Prize: Beltus Nkwawir Wiysobunri of Cameroon, essay entitled "*A Deep Learning Automatic Tactile Pavement Detection System for the Visually-Impaired*".

- 2nd Prize: Mr. Ousman Touray of Gambia, essay entitled, "*Monitoring Health: Monitoring Diabetes and Hypertension Using AI*".

- 3rd Prize: Mr. Selahattin Bingol of Turkey, essay entitled "*Do Judges and Prosecutors Need to Be Worried? (AI Control on Laws)*".

Student Category

- 1st Prize: Ms. Sara Marhoon Al-Ghafri from the College of Engineering, National University of Science and Technology, Oman. Essay entitled, "*SANAD: A learning tool for the visually impaired*".

- 2nd Prize: Ms. Joanna Gomez of the School of Arts and Sciences, Division of Humanities and Social Sciences, University of the Gambia (UTG). Gambia. Essay entitled, "*Certification and Auditing as Tools for Effective Data Regulation and Oversight in Artificial Intelligence*".

- 3rd Prize: Ms. Samawia Rizwan of the National University of Science and Technology (NUST) (RCMS), Islamabad, Pakistan. Essay entitled, "*Integrated machine learning and bioinformatics approaches for the development of potential therapeutics against pandemic diseases*".

Besides the winning essays of the three prize winners in each category, the 4th, and 5th highest scoring essays in each category have also been included as follows:

Professional category

- 4th: Hinna Nayab, Pakistan, essay entitled, "*A Real-Time, Wireless Data Acquisition System for an Exsoskeleton*".

- 5th**:** Wael bin Abdur Rehman Al Theyab, Saudi Arabia, essay entitled "*Using Artificial Intelligence to create effective solutions by Standards*", (In Arabic).

Student Category

- 4th: Muhammad Fitroh Fajar Ramadhan Syarief Hidayatullah, University of Gadjah Mada, Wirobrajan Yogyakarta, Indonesia, essay entitled "*Artificial Intelligence alignment as Integrated Embedded Smart AI Pandemic, Environment, and Disaster Country Management System*".

- 5th: Abiru Memunat, Nigeria, essay entitled "*Panoptic Structures and Surveillance in Nigerian Hospitals*".

- 5th: Yassamine Lala Bouali, Skikda University, Algeria, essay entitled "*CLAIR, un pas en evant vers un air plus pur*".

- 5th: Ansumana Darboe, School of Business and Public Administration, University of the Gambia, Banjul, The Gambia, essay entitled "*Artificial Intelligence in E-Governance*".

Foreword

H.E. Prof. Dr. M. Iqbal Choudhary
Coordinator General COMSTECH

I am pleased to see that the joint efforts of COMSTECH and ICYF in organizing an online OIC Essay competition on Artificial Intelligence are culminating in this publication of the best essays in the two categories of this competition. For COMSTECH, this competition was a continuation of our commitment to the promotion of frontiers science and technology in the OIC member states through networking, supporting collaborations, workshops, trainings, and competitions, such as the present one. Despite the continuation of the pandemic, COMSTECH has not let up these efforts. In this period, we have initiated a host of new programs, such as exhibitions, workshops, webinars, and competitions.

There is no doubt that the current COVID-19 crisis has served to once again remind OIC member states of the dire need to strengthen their scientific and technological capabilities and utilizing national talent as the base of their competence. It is in this context, we see the present essay competition as an important step in the direction of sensitizing and encouraging our member states on the potential of frontiers science and technologies to face these challenges.

Young people of today will be the leaders of tomorrow and it is vital that they are given the opportunity to reflect, analyse, and come up with ingenious solutions of technological and social problems based on intelligent, innovative and compassionate use of new technologies. Artificial Intelligence (AI), as we all are aware, is one such leading technology with the potential to transform many of our ways of living, working, and interacting socially. Indeed, it would not be an exaggeration to say that the world of tomorrow, both physical and intellectual, will have its boundaries determined by the power of AI. As such, I am pleased to inform you that AI has come to occupy a prominent position in the themes which the COMSTECH has made vigorous efforts to project, and encourage amongst member states.

The response to this particular competition and the quality and quantity of essays received by us from all over the Islamic world is a testimony to the talent and the energy that is latent in our countries. Our young people have presented very innovative ideas in a wide variety of applications, ranging from health, law, needs of special persons, environmental concerns, and data regulation, to name a few.

The successful holding of this competition has been made possible by the close coordination and understanding between the teams on the two sides, *viz.* COMSTECH and ICYF. I congratulate not only the writers but all those, from both COMSTECH and ICYF, whose efforts have made this a successful event. COMSTECH team led by my colleague Prof. Dr. Syed Khurshid Hasanain worked closely with ICFY team for the timely and efficient completion of the Essay Competition. I also appreciate very sincerely all the members of the Jury who have contributed immensely by sparing time for us out of their busy schedules. It is through their efforts that the competition has been able to maintain its standards of quality and fairness.

I look forward to many more such exciting competitions between our youth, and pray that all the participants and winners go on to make a reality of the dreams that they have described in their essays.

Foreword

H.E. Mr. Taha Ayhan
President of Islamic Cooperation Youth Forum

Artificial Intelligence (AI) refers to increasingly smart machines capable of performing tasks that typically require human intelligence and can simulate human organization, learning, and problem solving. Initiating radical changes to the systems we rely on, it might be easier to state what part of our modern society AI has not touched to show how crucial it has become to our daily lives, business operations, and society. With intelligent machines influencing nearly every facet of our lives to help improve efficiencies and augment our human capabilities, AI has become deeply intertwined in all we do; it is hard to imagine living life without it.

Today, AI is transforming societies and economies. It promises to generate greater workforce efficiency, improve well-being, and help address global challenges, such as climate change, resource scarcity, and health crises. Yet, as AI applications are adopted around the world, their use raises various ethical concerns and challenges, including bias, privacy, safety, and accountability among others.

By its present and future impact on social life and organization or by virtue of its reliance on young people to program and fine-tune AI technologies, AI is closely related to youth. Innovations in artificial intelligence are reshaping the labor market, with important implications for youth career trajectories, and requisite skills needed to thrive in this shifting occupational landscape. Considering the massive impact AI is predicted to have on our lives, it is critical that young people have a basic understanding of AI and the ethical, societal, and safety-related implications of these technologies.

A new generation of youth is coming of age as the most exciting chapter in the development of AI is written. It is critical that organizations harness the power of this younger generation to make sound decisions on how this technology will be used, developed, and in which way it will affect our lives and communities.

To this end, ICYF is dedicated to harnessing young people's transformative potentials to help prepare them for the changing future of economy, commerce, governance, and development. We acknowledge the significant value brought forth by the diverse perspectives of young people. Important steps are being made in empowering young people to voice their opinions and to play an active and decisive role in reimagining and transforming the future.

Through cooperation and shared strength, we are committed to take concrete steps towards advancing the cause of youth, who carry our hopes for a better future for the OIC regions, and humanity at large.

Acknowledgements:

The Organization of Islamic Cooperation's Standing Committee on Scientific and Technological Cooperation (COMSTECH), and the Islamic Cooperation Youth Forum (ICYF) presents their gratitude to the jury members (Scientific committee) of the COMSTECH-ICYF Essay Competition on Artificial Intelligence for evaluating the applications and selecting professionals and students' winners.

- **The Scientific Committee**:

1- Dr. Benaoumeur Mohamed Senouci: Master's and Ph.D. degrees in Computer Engineering from the National Polytechnic Institute of Grenoble-TIMA Laboratory (France), Associate Professor Graduate Engineering School ECE-Paris INSEEC-U Research Center, Algeria.

2- Dr. Mehmet Halkıdır: Ph.D., Department of Control and Automation Engineering, Istanbul Technical University, Turkey, Chief Researcher / Division Manager; Artificial Intelligence Team, TUBITAK BILGEM, Turkey.

3- Mr. Mohamed Maaz: MA, Faculty of Information and Documentation, Lebanese University, Beirut, Lebanon
Information Management; Elements of AI (University of Helsinki – Finland), Digital Security (Security First – UK). Trainer, AI/Cyber Security & Internet Policy Researcher Tech Writer MIT Technology Review Arabia. Google Policy Fellow, MENA

4- Dr. Yasar Ayaz, Ph.D. in Robotics, Tohoku University, JAPAN Chairman/Central Project Director, National Center of Artificial Intelligence (NCAI), Pakistan. Head of Department, Robotics & Artificial Intelligence, National University of Sciences and Technology, Pakistan.

- **The Organizing Committee:**

1- Dr. S. Khurshid Hasanain, Adviser at the OIC Ministerial Standing Committee on Scientific and Technological Cooperation (COMSTECH) managed the technical design of the competition and contributed to the project coordination.

2- Mr. Muhammad Haris Akram, Program Manager at the OIC Ministerial Standing Committee on Scientific and Technological Cooperation (COMSTECH) contributed to the technical design of the competition and the project coordination.

3- Mrs Amel Ouchenane, Expert at the Islamic Cooperation Youth Forum (ICYF) managed the technical design of the competition and contributed to the project coordination.

ESSAYS

- ❖ **Introductory Essay on AI**
- ❖ **Best 5 Essays (Professional Category)**
- ❖ **Best 5 Essays (Student Category)**

<u>**Introductory Essay on Artificial Intelligence:**</u>

Importance and Opportunities in Artificial Intelligence

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&
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Artificial Intelligence (AI) is fundamentally defined as the ability of machines to perform human-like cognitive tasks such as sensing, perceiving, and then formulating decisions that may also involve automation of physical processes such as manipulating objects. It is the key driving factor of the fourth industrial revolution that is setting the trend for automation in manufacturing technologies. With rapid breakthroughs in the field of AI, it has now become the most significant tool for innovation in emerging technologies, and is being implemented internationally in both government as well as private sector organizations in many fields ranging from health, education, agriculture, smart cities, transportation, communication, tourism, and various other domains. Some consider AI to be at par with what we have seen with the revolution of electricity during the 20th century.

The technology relies on the use of programmed algorithms which have evolved with the advent of big data machine learning in terms of growth and development. The paradigm shift in the field of AI shows its changing dynamics of implications in organizational setups. This digital transformation will not only redefine the methodology, but also blur industrial boundaries.

This disruptive technology will impact how people work and socialize, and how economies grow along with the wide-ranging international implications, from national security to international trade. AI is expected to lead to super intelligence that exceeds the cognitive ability of humans in virtually all fields of interest, such as machine learning, deep learning, neural network, IoT, Robotics, Blockchain, Industry 4.0, and a myriad of other applications, and be able to augment human work by helping with the decision making process. With further growth in the domains, there is a multitude of opportunities being offered by AI.

Management and governance mechanism can benefit from its application in various ways such as e-banking, judiciary, crime prevention, smart cities and national database management and successfully put in place a wide range of internal organizational structures to manage and govern AI sectors. In addition to this, it favors the democratization of data science by implementing machine learning models, and enhancing the utilization of data science by providing additional analytical tools to serve in its advancement.

Another opportunistic vision of this emerging force is regarding the ongoing model amplifications in the business setup which are relying on the advancement of this emerging technology for accuracy and precision. It will in turn help in boosting sales, reinforce machine learning and manipulation while improving the production output, quality, and effectiveness of existing industry practices.

In order to address the significance of international cooperation for the realization of ambitious goals in this field, COMSTECH, the Ministerial Standing Committee on Scientific and Technological Cooperation of the OIC, is working tirelessly for the advancement of science and technology.

Based on its core mandate to strengthen the cooperation among the OIC Member States, COMSTECH has set its aim to create and nourish a scientific culture amongst the Muslim countries for socio-economic development in order to flourish and support rapid industrialization. Working in close collaboration with various Standing Committees, and other organs of the OIC, Member States of the OIC and their major Scientific and Technological Institutions are creating an effective institutional infrastructure for planning, research and development, and monitoring of scientific and technological activities at the national and global level. Its prime focus is to enhance the capabilities through training in emerging technologies, partake in follow-up actions and draw up programs as well as submit proposals catering to the progress of the Muslim countries in the field of AI.

COMSTECH has done substantial work in promoting the use of AI amongst the youth of OIC, and encourages more research and growth by organizing multiple workshops, seminars, essay competitions on AI and its related technologies.

Pakistan also has the potential to become a major global force in this technology by taking maximal benefit of its labor skill-set and knowledge, while strategizing according to the global advancement. Establishment of National Center of Artificial Intelligence (NCAI) by the Government of Pakistan is a positive step in this direction. The center is designed to become the leading hub of innovation, scientific research, knowledge transfer to the local economy, and training in the area of AI, and its closely affiliated fields. The central aim is to facilitate the researchers in the field of AI; help them establish and grow AI industry following international trends, and seek solutions to the indigenous problems through AI.

Also the PM Task Force on Knowledge Economy is currently working to transform Pakistan towards training its human resource with essential skills in IT, provide enabling environment to boost the economy, increase IT exports, and aid in creating further job opportunities.

AI implementation has already delivered a significant positive impact globally. Increasing adoption of AI into systems covering a multitude of fields and the emergence of different types of applications will only manifest further beneficial impact, nationally and internationally. Furthermore, the cumulative effect of these impacts can result in significant socio-economic gains, increased productivity, and new job creations, along with many innovative benefits envisaged to lead to new ways of orchestrating the work of humans and machines.

BEST 5 ESSAYS
PROFESSIONAL CATEGORY

A Deep Learning Automatic Tactile Pavement Detection System for the Visually-Impaired

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1. Introduction

In 2020, it was estimated by the World Health Organization (WHO) that approximately one billion suffer from near or distance vision impairment [1]. This vision impairment and blindness are mainly caused by uncorrected refractive errors and cataracts.

These visually impaired individuals struggle to navigate their environments. Therefore, they find themselves at the mercy of family, friends, or strangers. The advent of the guide canes offered some relief to these individuals as they at least could find their way around familiar environments with very little assistance.

In metropolitan cities such as Istanbul, London, etc. tactile pavements can easily be found in places such as metro stations, bus stations, parks, and highly visited places. These pavements serve as a warning and directional tool to help visually impaired individuals avoid obstructions or hazardous situations. This advancement made it easier for visually impaired individuals to maneuver their way around the city with less effort using guide canes.

However, despite all these efforts, these individuals still find it extremely difficult to walk with freedom and explore the world without assistance from people. One of the biggest problems that these individuals face is to locate tactile pavements around them.

It is impossible for them to tell if a tactile pavement is present or not in their immediate surrounding. In addition, they can't tell what type of tactile pavement it is. They have no clue in what parts of the cities they can find these pavements.

The objective of this project is to design an intelligent system that addresses these problems by harnessing the power of sophisticated state-of-the-art image processing and artificial intelligence algorithms, coupled with advanced digital smartphone technology. This system will be able to detect and classify tactile pavements. Provide navigation information through voice commands to direct the user to the detected tactile pavement. This will potentially give visually impaired individuals the ultimate independence and freedom of movement.

2. Literature Review of Current State of Technology.

The problem of visual impairment has been around for a long time and a series of researches have been conducted to develop assistive tools that can help these individuals find their way around in both indoor and outdoor environments. Wise E et al [2] developed an Infrared Data Association (IrDa) technology that functions as a detector to guide visually impaired individuals in indoor environments.

Xu Jie et al [3] developed a portable Electronic Travel Aid (ETA) technology that uses image segmentation, image edge detection, and blind sidewalk edge searching to divide the blind sidewalk from the pavement and feed the information of the blind sidewalk orientation to the user in real-time. In [4], Daniel C et al applied image processing techniques such as filtering and texture extraction to segment and identify tactile pavements.

Ito Yuki et al[5] build a system that detects Tactile pavements in images by converting these images from RGB color space to HSV. Marcelo C et al[6] proposed an approach that uses computer vision algorithms combined with decision tree algorithms to automatically detect tactile pavings. Anur Bin et al[7] developed a tactile pavement detection system that used MATLAB including the Arduino platform and speaker as guidance tools for easy navigation and guidance of visually impaired persons.

Other related work directed towards developing navigation assistive tools for the visually impaired can be found in the literature at [8][9][10][11].

3. Novelty of Tactile Pavement Detection System

Based on the research carried out in the literature, researchers have diligently worked on developing indoor and outdoor navigation assistive tools for the visually impaired. Given that the problem domain of this work focuses on designing an outdoor navigation system, I shifted my attention to analyze only the existing outdoor research done by previous researchers.

Some researchers relied on incorporating GPS technology into their systems. However, GPS suffers from the problem of accuracy. The accuracy of GPS is even made dire when used near tall buildings. This is because the error in measurement can be catastrophic as it can drive a user to the middle of the road.

Other outdoor systems that have implemented image processing algorithms acquired reasonable results. There are traditional image processing techniques such as lighting conditions, partial occlusions, etc. Some previous researchers h a v e designed navigation systems that used machine learning algorithms to detect tactile pavement. Unfortunately, these algorithms rely deeply on hand-engineered features. These features are time-consuming, brittle, and not scalable in practice.

In this research project, we design a detection system that harnesses the power of automatic extraction of low, mid, and high-level features using deep convolutional neural network algorithms to accurately detect tactile pavements on the surrounding environments of visually impaired individuals.

With the advent of state-of-the-art deep learning algorithms that are fueled by the availability of

computationally powerful CPUs and GPUs, we are capable of designing highly efficient cutting edge detection and navigation system that uses very minimal resources but yet achieves remarkable results.

By comparing several deep convolutional neural network models, we will deploy the best model into the smartphones of the visually impaired individuals that can then be used for real-time automatic detection of tactile pavements in their immediate environmental surroundings.

This project has the advantage of not requiring external independent systems for its implementation but rather leverages the already existing mobile technology.

Based on the high detection accuracy of state-of-the-art deep learning detection algorithms that are invariant to changes such as rotation, lightning, etc, there is a high probability of obtaining prediction accuracies higher than those in the literature. The project is highly scalable as it involves using only the mobile phone as the main device.

We do not aim to eliminate the use of guided canes; rather our objective is to provide a tool that can help visually impaired individuals locate any tactile pavements in their environment for which they can then find their way to their destination using their guided canes

4. Implementation of Idea.

In order to implement the novel detection navigation system to aid the visually impaired, we partition it into 3 main phases.

4.1. Dataset Acquisition and Preprocessing.

To train the models for the detection system we need to collect hundreds of training images of the tactile pavements. Figure 1 shows the different types of blister and directional pavements.

The next step is to pre-process the images using Image pre-processing techniques such as cropping, gray scaling, and filtering. This will increase the computational efficiency of the model.
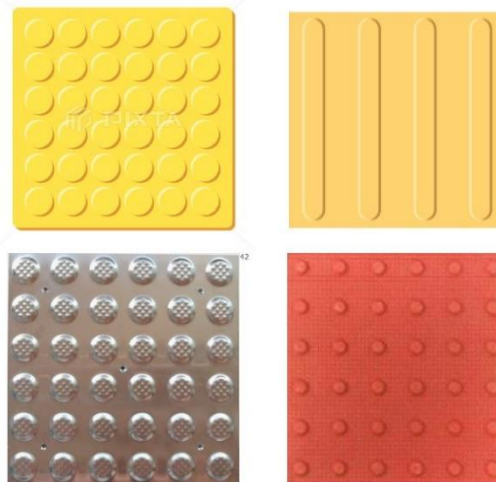
Figure: Sample of different types of tactile pavements necessary for model training.

4.2. Model Training and Tactile Pavement Detection

After pre-processing we will train the models using different state-of-the-art deep learning model architectures. Some of the model architectures to be trained include VGG-19[12], Resnet50[13], DenseNet[14], Alexnet[15], and MobileNet-V2[16].

Our choice of the best model will be based on detection accuracy and also computational efficiency. This is because the model will be deployed on mobile devices with low computational power.

Based on preliminary research that I have conducted, mobileNetV2 seems to be the best candidate model to consider due to its small model size and high accuracy.
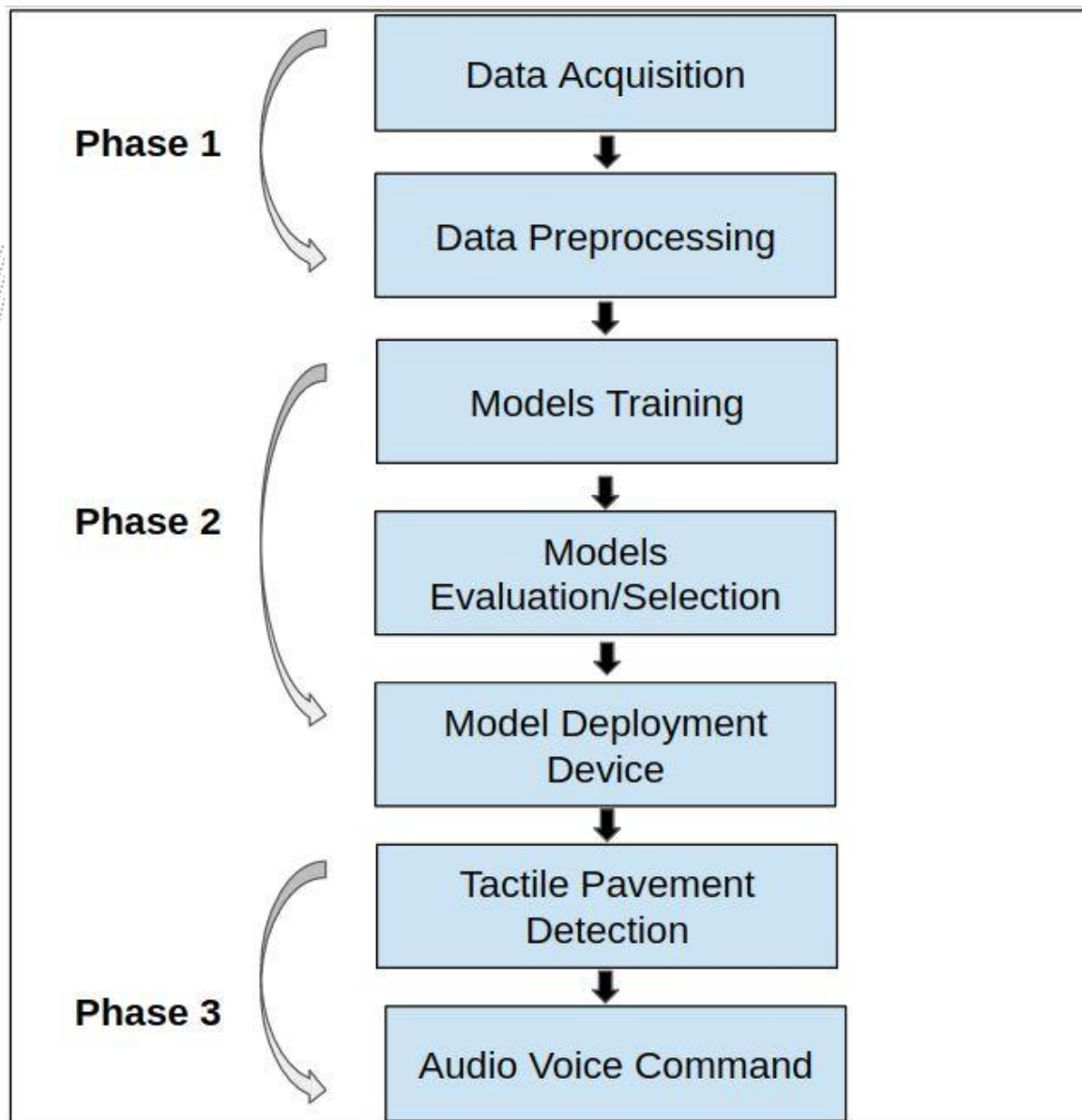
Figure 2: Flow Chart Design of the Deep Learning Automatic Tactile Pavement Detection System

4.3. Direction and Voice command.

This module of the detection system will play a vital in the functioning of the detection system. When a tactile pavement is detected we need a technique to communicate this information back to the user. The information communicated to the user includes the type of tactile pavement detected and the distance between the user and the tactile pavement. Finally, by leveraging the GPS guiding system of the mobile phone, we can guide the visually impaired individual towards the detected pavement with high precision. This will be accomplished by developing an independent mobile application that runs the model and also converts the detections to voice commands that can then be used to direct the individual.

The system design schematic is shown in Figure 2 above.

5. Expected Impact on Society.

The one billion people in the world that suffer from vision impairment according to WHO, represent a clear picture of the earth-shattering impact this simple yet sophisticated deep learning-based tactile pavement detection system technology can have on the lives of these individuals.

This system will permit visually impaired individuals, especially in the big metropolitan cities where tactile pavements are present, to easily detect tactile pavements around them. Therefore, they would be able to walk with more freedom and confidence.

This system will uplift the burden that these individuals have on their families and on society as a whole. They will not require assistance from anyone to find tactile pavements in their immediate surroundings.

The core of the system is mobile devices that are widely available. Hence, the model can be easily deployed to serve millions of people around the world. It is highly scalable.

Its simplicity will mean that it will require very little training time for visually impaired individuals to learn and start using the system. This is contrary to other existing assistive tools such as Braille that require a long training time for new visually impaired individuals to get familiar with.

This system is versatile and highly adaptable. It can be modified easily for use in indoor scenarios to help these individuals locate other items in their homes using only their mobile phones.

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Monitoring Diabetes and Hypertension Using AI

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1. INTRODUCTION AND BACKGROUND

Artificial intelligence (AI) in healthcare refers to the use of complex algorithms designed to perform certain tasks in an automated fashion. When researchers, doctors and scientists inject data into computers, the newly built algorithms can review, interpret and even suggest solutions to complex medical problems[1]. Although AI is gaining recognition over the traditional system in some advanced countries in Europe, America and Asia, but it will be completely new to most Gambians. The use of sophisticated technology in the assessment and diagnosis of patients makes the works of laboratory scientists, physicians, nurses and other healthcare workers simpler. Monitoring the health of patients living with NCDs (Diabetes and Hypertension) using AI will be the core concept of this idea, therefore this discourse will particularly focus on AI in monitoring Diabetes and Hypertension. The pre-AI age has posed lots of challenges to the health system and patients; some of these challenges are cognitive overload, inaccurate data recording and limited access to healthcare information and services among others. With the above background, let me introduce SparoNCD.AI: This is a health monitoring web-based portal that will transform healthcare needs and services from dependence to independence, from limited access to unlimited access, from provider-controlled to user-controlled appointments, from disease focused to patient focused interventions with accurate data generation and efficient data protection. In order to actualize this, SparoNCD.AI has sections for Health Care Data, Diagnostics, Medical Management and Patient Education Programs.

2. CURRENT STATE OF TECHNOLOGY

In the advanced world, radiology, pathology and laboratory medicine which were traditionally technical fields have now been digitalised. Healthcare as we know is going through a massive change from being driven by limited data to 360-degree, multimodal personal-public-population physical-cyber-social big data driven[2]. This transmutation is evident in diverse areas of healthcare. For instance, Buoy Health, an intelligent symptom and cure checker located in Boston, Massachusetts, uses algorithms to diagnose and treat illness; Enlitic, an AI deep learning tool for actionable insights, located in San Francisco, California, developed deep

learning medical tools to streamline radiology diagnosis; and Deep Genomics, located in Toronto, Canada, which helps researchers find candidates for developmental drugs related to neuromuscular and neurodegenerative disorders[3]. Despite these advancements, the current state of technology in The Gambia regarding AI is deeply below standard. Almost in all healthcare institutions, there are still record clerks whose duties are to manually record patients' health information on every visit. This information is later analysed manually to generate hospital statistics. In the area of radiology, there are some radiologists who still present handwritten reports to patients. Nevertheless, there is still hope for AI in the health system of The Gambia. Almost every household in the urban centres has at least one smart phone or portable electronic device; this avails an opportunity to make a start. Every change for a better world comes with its pitfalls; however, the current state of technology will gradually ameliorate. There are an increasing number of people studying Computer Science and every University of The Gambia's program has Introduction to Information Technology as a general requirement course, and this is a positive development for AI.

3. PROPOSED IDEA AND ITS NOVELTY

Every big success story started small, and SparoNCD.AI will not be an exception to this phenomenon. SparoNCD.AI stands for Sparo's Non-Communicable Diseases, Artificial Intelligence. It is a proposed web-based healthcare portal to be focused on the monitoring, managing and psychosocially supporting people living with diabetes and hypertension. As a start, SparoNCD.AI will subscribe 50 participants. Each service user will have a private portal and login details for access to personal data and healthcare. The structural build-up of the will be explained in details.

3.1 BIO-DATA

This section of the portal will be provided at the time of subscription. It will contain the following: Full Name, Preferred Name, Age, Sex, Address, Religion, Ethnicity, Highest Education Level, Occupation, Preferred Languages, Marital Status, Next-Of-Kin, Contacts (Email and Cell Phone Number), and Contact Number of Next-Of- Kin.

3.2 MEDICAL-SURGICAL HISTORY

In this section, the following data will be provided: Family Medical History, Current Diagnosis, Previous Surgeries, Most Recent Admission, Current Treatment, Medications and Allergies.

3.3 BASIC VITAL SIGNS

In this part, we will have the following Data: Temperature, Pulse, Respiration, and Blood Pressure.

3.4 COMPREHENSIVE CLINICAL ASSESSMENTS

This part of the portal will give opportunity to the patients to tick their prevailing signs and symptoms.

3.4.1 INTEGUMENTARY SYSTEM

Laceration, abrasions, puncture, abscess, rashes, blisters, burns, ringworms, athletes foot, cellulite, pimple, edema, erythema, fissure, jaundice, keloid, macule, pallor, papule, petechia, pruritus, pustule, ulcer, urticaria, vesicle, wheal, tumours, oral thrush, stomatitis and other.

3.4.2 RESPIRATORY SYSTEM AND CARDIOVASCULAR SYSTEM

Respiratory: difficulty in breathing, fast breathing, painful breathing, nasal congestion, cough, sneezing, runny nose, sore throat, body aches, fatigue, dizziness, loss of consciousness and other.

Circulatory: chest (pain, tightness, pressure, discomfort), legs and arms (pain, numbness, weakness, coldness), racing heartbeat, slow heartbeat, shortness of breath, light-headedness, dizziness, fainting, cyanosis, bleeding and other.

3.4.3 URINARY AND REPRODUCTIVE

Frequent urination, painful urination, cloudy urine, urine with odour, lower abdominal pain and fullness, confusion, agitations, blood in urine, discharges, dysmenorrhea, menorrhagia, dyspareunia, lower back pain, infertility, multiple miscarriages.

3.4.4 NERVOUS SYSTEM

Headache, loss of sensation, memory, muscle strength and sight, tingling, blurred vision, double vision, impaired mental ability, muscle rigidity, tremors, seizures, back pain, slurred speech and other.

3.4.5 SKELETAL SYSTEM AND MUSCULAR SYSTEM

Weakness, stiffness, joint friction, decreased range of motion, inflammation (pain, warmth, swelling, tenderness, impaired function, redness of skin, deformity), fracture, spasm, twitching, cramping and other.

3.4.6 DIGESTIVE SYSTEM AND ENDOCRINE SYSTEM

Bloating, constipation, diarrhoea, heartburns, incontinence, nausea, vomiting, dysphagia, odynophagia, weight gain, weight loss, loss of appetite, melena, hematochezia, weakness fatigue and other

3.5 DIAGNOSTICS

This section of the portal will have patients test results such as Haematology reports, Ultrasonography results, Chest X-rays, CT scans, Comprehensive Metabolic Panel, Plasma Glucose, HBA_{1C}, Urine Analysis, Echocardiography, Electrocardiography, Sputum Analysis, Hepatitis B and C, HIV and AIDS status, and test requests links.

3.6 MEDICAL TREATMENTS

In this part, the previous prescriptions and the button for new prescriptions will be available.

3.7 VIDEO BLOG AND GALLERY

The video blog and gallery will have standard health tip, posters and self-care videos in English other local languages. It will also have a tutorial on how to make use of the portal as a service user.

These different categories of data will be used to program algorithms that will analyse information and make suggestive diagnosis and treatments.

4. IMPLEMENTATION OF IDEA

SparoNCD.AI will be implemented by using developed algorithms. It will be technologically operated with occasional copresent healthcare delivery by a multidisciplinary healthcare team when it is absolutely needed. As aforementioned, the focus of this project will be on people living with hypertension and diabetes. Therefore, the communities of these patients will be equipped with facilities for this initiative to be sustainable. These facilities include, community health service stations, which will be responsible for assessing the vital signs and basic haematology test for patients and report on their portals; community pharmacies, which will be responsible for dispensing medications using the codes of the patients and the prescription obtained from prescriber on the web; and ambulance services at strategic locations for efficient movement of patients in life threatening conditions to hospitals. On the other hand, some patients have their own vital signs kit. They can self-assess and record on the portal. This will be followed by ticking any signs & symptoms they may be experiencing. Each sign or symptom will have red, yellow and green buttons to indicate severity levels. After gathering sufficient data, the clinician, with the help of the algorithms, will decide whether ambulance services, self-transportation to hospital or simply walking with your portal code to the nearest community pharmacy for your drugs is required.

In the area of health education, individual and group education sessions will be scheduled and delivered online. The video blog and gallery will be readily accessible and effective audio-visual teaching means.

The stakeholders to this project will be the Ministry of Health, The Gambia, Ministry of Communication Information Technology, The Gambia, The Gambia national and private telecommunications companies, similar AI bodies and initiatives for capacity building, collaboration and advice, community leaders, IT experts and health personnel.

5. EXPECTED IMPACT ON SOCIETY

By employing above discussed AI tools in health, the society will become healthier and safer. On one part, the society will have extensive access to healthcare, with convenience, less expenditure and more independence in self-care. Secondly, people's knowledge about their health will be enhanced, and their references will be in their pockets accessing it anytime, anywhere. Patients will feel more involved in decisions about their health, and they will not have to worry about loss of previous documents when reporting for revisits at the hospital. During my three years practice as an outpatient clinic nurse who also did run the hypertension and diabetes clinic, I have always received complaints about long waiting hours for consultations and missing previous documents which often interrupted continuity of care. With SparoNCD.AI, all that will become history, with just a punch on the device.

On the other hand, hospital authorities have always expressed their dissatisfaction about hospital data recording while the record clerks often complain about the workload. This initiative, therefore, will bring about a new dimension of obtaining accurate, stratified healthcare data if it is fully adopted.

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Use of AI In the Legal Arena: Do Judges and Prosecutors Need to Be Worried?

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Introduction

Chess challenge between Garry KASPAROV, considered as the best chess player in the world, and Deep Blue computer developed by IBM in 1997 was followed by millions of people with great excitement.[1] Although there are various studies related to Artificial Intelligence (AI) before the challenge, it is an indisputable fact that this challenge contributed very seriously to the curiosity of the whole world towards AI and to where it could reach. In the continuation of this challenge AI showed very serious improvements. Any person who lived in the 20th century, if had observed world at the time of chess challenge, he or she probably would not be too surprised. If the same person, however, observed the development of the world in 2020, he would not believe most of what he saw. This change which took place in a short 20-year period is due to the introduction of AI to human life in such a way that it is impossible to return. AI is involved in human life in many different areas today; it performs the most risky operations with a much higher success rate than surgeons,[2] performs very important tasks in agriculture, production, and military areas.[3]

Why We Need Justice?

Our Prophet Muhammad (SAV) has shown very nicely how it is important to maintain the legal order. One day, Osama, whom our prophet loved very much, was sent to our prophet in order to reduce the punishment given to a woman who stole something from Mahzum Tribe. Our prophet was angry at Osama for mediating an issue against the protection of the right which is one of the orders of Allah and calls out to the public, "previous nations had perished because when any strong person stole, they did not implement any punishment, but when any weak person committed a crime, they eimplemented some punishment to him. He concluded his speech by saying "even if it is my daughter Fatima, I will surely punish her."[4]

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[1] https://www.ibm.com/ibm/history/ibm100/us/en/icons/deepblue, Access date:07.11.2020

[2] https://en.wikipedia.org/wiki/Robot-assisted_surgery Access date:07.11.2020

[3] https://onlinemasters.ohio.edu/blog/5-industries-utilizing-robotics/ Access date:07.11.2020

[4] Buhari, Enbiya, 18, IV. 213-4

Current Situation of AI in Law

In many countries, AI is used within the legal order. We can give an example of an AI application called ROSS, developed by IBM. ROSS scans approximately 1 billion pieces of data in 1 second and provides it to the concerned people. The application allows people in the legal order (lawyer, judge, prosecutor) to save considerable time by obtaining the document they are looking for, in a very short time.[5] We can give an example relevant to this subject; One of

leading constitutional lawyers of Turkey filed on 13.05.2013 to the court about citation from his books without his permission and till today this case has not been finalized.[6]

Sundar Pichai, CEO of Google, believes that the impact of applications based on AI on the development of humanity will contribute more than the presence of fire or electricity.[7] So we have to integrate AI into every aspect of our lives and take advantage of the benefits it will offer.

An AI application called Case Cruncher, developed by 4 Cambridge students, competed with 100 lawyers on outcome estimation over real cases, and as a result of the competition the average of lawyers predicting the decision correctly was 62%, while the application made the correct decision by 86%.[8] We can interpret the contest result as suggesting that purely knowledge-based professions may be affected negatively by AI, while professions that understand/interpret information will continue their importance.

LawGeex, which conducts research on AI, conducted an analysis study with the participation of law professors working at Stanford and Duke Universities. In this study, 20 lawyers with experience in contract review working at leading USA companies and law firms competed in AI which was trained in machine learning and deep learning methods about confidentiality contracts. As a result of the competition, it was revealed that lawyers examined five confidentiality contracts with an average accuracy of 92 minutes and an average accuracy of 85%, while the AI application examined the same five contracts with an accuracy of 94% in 26 seconds.[9]

A study conducted in London in 2017 tested how many applications to the Ombudsman for credit card fraud would be accepted. AI made an accurate estimate of 86.6%. Real employees were 66.3% successful.[10]

[5] https://www.rossintelligence.com/ Access date: 07.11.2020

[6] https://www.anayasa.gen.tr/kac-ayda.htm Access date:07.11.2020

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[8] https://www.case-crunch.com/ Access date:07.11.2020

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[10] http://www.ankarabarosu.org.tr/upload/HD/Donem65/Duyurular/20191221_yapayzekaraporu.pdf, page:20 Access date:07.11.2020

How Lack of Law Disturb the Whole Society?

In June 2020, a 20-year-old girl named Aleyna Cakir was found hanged in her home in Ankara, Turkey. Forensic studies have shown that the victim did not commit suicide. The victim's boyfriend injured the victim many times, and numerous lawsuits have been filed against him. The victim was last seen with her boyfriend and also her boyfriend attended the victim's funeral. Records of the beating of her boyfriend were handed over to the poliçe whichs had been recorded by victim's neighbour. There is also a video showing that the victim was severely beaten by her boyfriend. In the video, the victim lies motionless on the ground. Multiple witnesses reported to the police that they heard victim's boyfriend had said that he was going to kill the victim. Despite this, the victim's boyfriend was not arrested and there was a very serious public reaction.[11]

A similar incident occurred in September 2020. A man named Erdoğan KÜPELİ harassed and threatened a woman who was working as a teacher in 2016 and declared that he would kill her. He constantly followed the teacher by the program which he loaded on her phone, and attempted many times to kill her. Upon the complaint of the teacher, Erdogan KÜPELİ was sentenced to 8 years in prison, but he was not arrested. Erdogan KÜPELİ harassed another woman in 2020, and killed that woman because the woman kept away from him.[12] Both incidents caused a serious social reaction, led to a decrease in public trust in justice and in individuals, to seek individual justice.

When we examine the time of the conclusion of a criminal trial in Turkey, the investigation period regarding the case lasts for an average of 411 days, the court stage takes an average of 296 days, and if the court decision is taken to the higher court by the parties of the case, the duration of the case in the upper court is 700 days on average. If the case is moved to the last stage, the highest court, that takes an average of 1168 days. Hence the average time for the initiation and finalization of a case is 2575 days, which is equal to 7 years and 20 days.[13] In the case of Erdoğan KÜPELİ, which we mentioned above, although the person was sentenced, he was not arrested due to the length of the trial period.

Is It Possible to Use AI in a Criminal Case?

The question we have to ask is is it possible to design an algorithm that can better maintain the legal order by using AI? Law by definition is the application of legal rules determined by people to real life facts. As we gave the examples above, AI performs more successfully and precisely than the most successful lawyers today. First, the facts should be introduced to the AI to be designed, the penalty corresponding to the phenomenon should be specified in the system as a rule, and the result should be achieved by applying the rule to the case. For example it is a fact that Erdoğan KÜPELİ threatens the person. The penalty for threatening a person is 1-2 years of imprisonment. This punishment constitutes the rule. The sentence of Erdoğan KÜPELİ to 2 years in prison constitutes the result. Of course, much more difficult facts and rules will be

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[11] https://www.cnnturk.com/turkiye/aleyna-cakir-nasil-oldu-umit-can-uygun-annesi-intihar-etti-aleyna-cakir-kimdir Access date:07.11.2020

[12] https://onedio.com/haber/gulay-mubarek-i-4-yil-boyunca-tehdit-eden-erdogan-kupeli-tugba-keles-i-oldurdu-925167 Access date: 07.11.2020

[13] https://www.besler.av.tr/davalar-ve-istinaf-mahkemesi-ne-kadar-surer/ Access date:07.11.2020

created in real life. However, as we stated in our study, considering that the application named ROSS analyzes 1 billion data in 1 second, it is obvious that the facts and rules to be created can be easily concluded by the system. In the current situation, the only duty of the lawyer is to analyze the case and apply the rule. Considering that AI analyzes contract details more successfully than experienced lawyers in this field, it is difficult to claim that they will be less successful than current lawyers. Leaving the use of legal rules to AI will both shorten the duration of the trial and ensure that justice is applied equally and objectively to everyone. This will ensure the impartiality and independence of the judiciary.

What Does AI Control on Law Brings to The Society?

In Turkey, in 2020, 12201 people work as a judges or prosecutors.[14] These judges or prosecutors also control the decisions made by AI. In this control, they questioned whether there are subjective criteria to be considered in terms of decision. This allows the decision made by AI to give more accurate results. Judges and prosecutors who are not assigned in this field can be assigned in areas that cannot be left to AI, such as divorce, child custody, and can take part in ensuring a perfect legal order. This will provide a solution that avoids the fears of current judges and prosecutors about losing their jobs.

The question people should ask at this point is very simple: If you are a victim or a suspect, would you want your case to be assessed and dealt with by an AI with clear standards, objectivity, without being personal and unaffected by emotions, or by a subjective lawyer who does not have a standard for his decisions, is open to all kinds of effects and will be able to take decisions in a much longer time?

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[14] https://www.hsk.gov.tr/Eklentiler/Dosyalar/e0a573c2-6b4e-43bb-bb51-a968045002b3.pdf Access date:07.11.2020

A Real-Time, Wireless Data Acquisition System for an Exoskeleton

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Introduction and Background

Spinal cord injuries are different types of damages to the spinal cord that cause changes in its shape and functionality [1] [2]. These changes result in reduction or complete loss of muscle function affecting sensation in other parts of the body [3]. In some cases movement is lost in all four limbs (Tetraplegia) as well as the torso of human body [1] [2]. The annual prevalence of spinal cord injuries is 236 to 1298 cases per million globally [4] [5] with such causes as injuries at workplace, community violence, natural health deficiencies and accidents during leisure activities [6]. Spinal cord injuries result in increased financial and psychosocial burden on patients and their families. They play an intense role in harming the self-esteem of the patients and take a toll on their mental health.

Rehabilitation is vital for gaining lost mobility. Assistive rehabilitation structures are often referred to as exoskeletons. For tetraplegic patients, exoskeletons act as assistive devices for basic torso movements such as flexion (sitting up) and extension (lying down).

A motion-sensing data acquisition system (DAQ) provides the input signal to the exoskeleton which is sent to the control system to guide the movement of structure accordingly. A real-time, wireless data acquisition system based on inertial motion sensors is ideal to study the biomechanics of human joint, differentiate between pairs of movements and to control an upper-body exoskeleton system.

Current State of Technology

Data acquisition systems have been discussed and developed over a considerable period. The early traces of such systems might not have involved the hardware and software technologies that are seen today. However, the current state of technology related to motion-sensing devices

have certain shortcomings. Conventional data acquisition systems use a range of techniques which tend to be expensive with limited range of motion, are unable to be used outdoors, are expert-intensive, and are prone to motion artifacts. These technologies include:

- Optoelectronic systems
- Optical/camera-based techniques
- Mechanical sensors
- Magnetic sensors
- Fiber optic sensors
- Acoustic motion capture systems

Optoelectronics systems are accurate when used with surface markers which are small in number. These systems, however, cannot work in outdoor spaces and do not give accurate information on orientation profile of spine. Mechanical sensors are also accurate, but they have the disadvantage of being inefficient and cumbersome. Furthermore, their range of motion is rather limited.

Camera-based systems are considerably accurate and common in tracking human body motion, but they also have some disadvantages such as the following:

- they lack a clear line of sight between the subject and sensor,
- they are expensive,
- they can only be used in an indoor or enclosed space,
- they are prone to motion artifacts.

Magnetic sensors tend to have negative reaction to metals and their own magnetic field gets distorted with other magnetic fields in the environment. Both magnetic and optical systems are costly and require complex instrumentation and setting. Privacy concerns are a major shortcoming in camera based DAQ systems. These systems tend to be impractical for monitoring purposes in free-living environments. Mechanical pedometers are also one of the wearable solutions to measure human motion. Though pedometers are cheap and simple, but their major drawbacks are that they do not have the ability to measure intensity of movement, resulting in inaccurate energy expenditure estimations [7].

Proposed Idea

Inertial sensors are sensors based on the principle of inertia. These sensors range from MEMS (microelectromechanical) sensors which measure a few squares in mm up to gyroscopes that are accurate and measure up to 50 cm in diameter. An inertial measurement unit (IMU) is an electronic device that consists of an accelerometer, gyrometer, and magnetometer, or sometimes, a combination of all three to measure the distance travelled and the angular change due to a body's rotation as well as the effect of magnetic field on both these measurements. Accelerometers are used to detect linear acceleration and rotational rate using the gyroscopes. Magnetometers are used as a heading reference.

The proposed motion-sensing data acquisition system is IMU-based, wireless, portable and low-power to address the gaps mentioned in the current state-of-the-art. This system does not

depend on external measurements; it uses the built-in gyroscope, accelerometer, and magnetometer to measure the position of an object precisely. The proposed system is used as a data acquisition system to provide control input to the upper-body exoskeleton. This exoskeleton is an assistive rehabilitation structure for patients with spinal cord injuries, specifically tetraplegia.

The hardware components are chosen as such that the system turns out to be efficient and cost-effective. The hardware choices can be MPU60X0 as a motion sensor, Wi-Fi-based wemos-D1 mini as a microcontroller unit and TCA-based multiplexer to connect and communicate with multiple sensor nodes placed on different joints of spine via the master node. The overall system design reduces the size of the individual wireless sensor nodes and makes it rugged.

The MPU-60X0 is an integrated 6 axes device for tracking motion. It is a combination of a three axes gyrometer, a three axes accelerometer, a temperature sensor, and an on-board digital motion processor (DMP). The serial protocol that it uses is I2C. With an external magnetometer and I2C bus, the MPU 60X0 provides a 9 axes motion fusion output. Wemos D1 mini is based around the ESP8266 and has one analogue port and 11 digital ports. It is programmed via micro-USB (or remote flash via Wi-Fi).

The accelerometer's measurement relies on gravitational pull. In an ideal situation, there are no external forces acting on the accelerometer and acceleration's magnitude is 1 g. In that case, the acceleration vector's position gives us the sensor's rotation information. The gyrometer's angular velocity (ω) is measured around each of the three axes at measured time intervals (Δt).

$$\omega \times \Delta t = change\ in\ angle$$

The orientation angle obtained will be the original angle plus the change that has occurred. Each IMU sensor module paired with the Wi-Fi module can be used as individual portable motion sensing device. The motion sensors give raw data that is converted into understandable orientation data within the computer program. The use of Wi-Fi based controller means that the system is not confined to an indoor space. Real-time data can be recorded remotely with each sensor acting as a portable device on its own.

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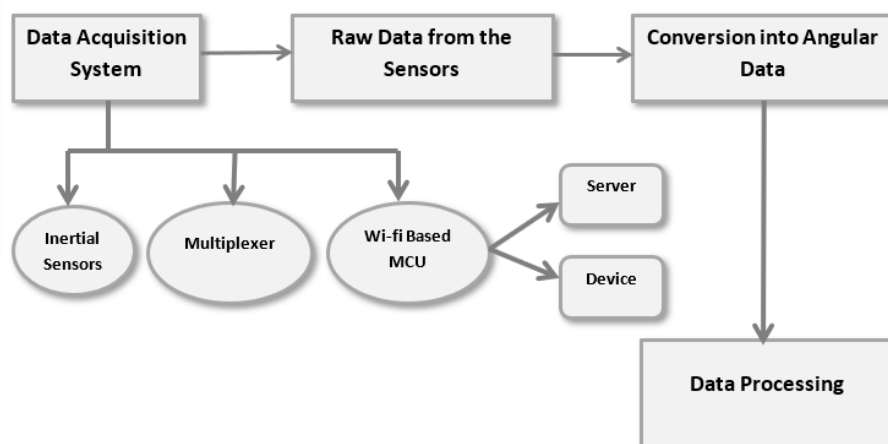
The data collected for both sitting and lying down helps to register orientation values for both these movements in general. The DAQ system can be separately used to provide real-time input signal to the exoskeleton as well as to differentiate between different types of torso movements.

Implementation of Idea

The target audience for the proposed idea is global as the problem presents itself due to variety of reasons which are not limited to a specific geographical area. However, the initial target market lies in low-middle-income countries (LMICs) due to the frugality of the system which makes it ideal to be employed in the LMICs. This can then be implemented in other developing countries and would expand the system capabilities in terms of multiple use cases and variants The data acquisition system has multiple use cases, including rehabilitation services, real-time posture detection and as a motion-sensing system for an exoskeleton device. The DAQ system can be extended to other variants too, for instance, as a motion sensing device for other joints of the human body. The customer segments include healthcare and rehabilitation facilities, hospitals, and private biomedical solution-based companies.

The motion sensor market is forecasted to grow from USD 1.9 billion in 2016 to USD 2.6 billion by 2023. The major factors that are expected to be driving the market are rising demand for medical automation, wearables-industry growth, emerging IoT industry, and enhanced productivity. The proposed idea is based on MEMS-based motion sensor technology which has a Compound Annual Growth Rate (CAGR) of 6.9% during the forecast period (2019–2025). [8] These market dynamics are driven by the reduced size and weight of MEMS-based sensors which has enabled many new applications and ultimately acting as a driver for market. In addition to the compact size, MEMS sensors offer efficiency in terms of low power consumption which is the biggest market requirement in present times. This factor is driving the growth of the motion sensor market.

Impact on Society

The data acquisition system (DAQ) is proposed to improve the lifestyle of patients with spinal cord injuries. The DAQ system is an important part of the rehabilitation process of these patients and an essential component of the rehabilitation assistive devices like exoskeletons. It is reported that physiological improvements of human body activity result in less spasticity of muscles, improved bladder and bowel functions, decreased muscular pain, relief in pressure sores and higher energy levels [9]. With physical improvements, the patients' mental health is improved, and they feel much better emotionally. The proposed system is not expert-intensive, consumes low-power, makes use of the off-the-shelf hardware components and is cost-effective. These factors account for active implementation of rehabilitation services for patients with spinal cord injuries. Competitive solutions are usually imported from abroad with heavy customs duty and import taxes. Indigenous development makes sure the extra cost elements are eliminated and that the rehabilitation services reach those that cannot afford expensive solutions. Reduction of the rehabilitation treatment costs, and improvement of the psychosocial aspect of patients' and their families' lives are some of the biggest positive impacts of the proposed idea implementation.

استخدام الذكاء الاصطناعي لصناعة حلول فعالة من خلال المواصفات

Using Artificial Intelligence to Create Effective Solutions by Standards

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Kingdom of Saudi Arabia

المواصفات القياسية تعتبر أداة فعالة لوضع التشريعات والأنظمة ولوضع الأطر التنظيمية ضمن قالب متفق عليه ضمن سياق معين لتحقيق أهداف محددة تضمن السلامة والأداء والكفاءة ولها انعكاسات تتجاوز ذلك اذا ما تم التعامل معها كأداة حقيقة لمعالجة مشاكل على مستوى الدول والاقتصادات وتسهيل التجارة ورفع كفاءة الصناعة ونقل التقنيات وكذلك يمكن استخدامها على مستوى المنظمات لتحقيق أعلى كفاءة وتميز مؤسسي ولوضع أطر تنظيمية لتحويل الممارسات الجيدة إلى أنظمة فعالة قابلة للتنفيذ وقابلة للقياس والتحديث وفق منهجيات واضحة إلا أن المواصفات القياسية بالرغم من ذلك ما زالت تستخدم ضمن عناوينها ومواضيعها وتصنيفاتها المحددة ضمن مجال تلك المواصفات ولتحقيق المطابقة لمنتج أو خدمة في سياق محدد دون الاستفادة منها على نطاق بحثي واسع لتشكل نماذج فعالة تعالج مشاكل محددة وخارجة عن المألوف نظراً لصعوبة البحث والتحليل للكم الهائل من المواصفات في مجالات مختلفة وهنا يأتي دور الذكاء الاصطناعي ليكون وسيلة فعالة لوضع نموذج تحليلي لمشكلة محددة في أي مجال كانت وتحليلها وتقديم نموذج فعال من خلال تحليل المواصفات في وقت قياسي وتقديم هذا النموذج المنهجي في قالب يمكن تطبيقه من قبل جهة أو منظمة لمعالجة مشكلة وفق نظام وليس وفق ممارسة قابلة للصحة أو الخطأ ووفق المعطيات التي تقدم للنظام الإلكتروني المعزز بالذكاء الاصطناعي وذلك لمعالجة جريمة أو وضع حرج مثل جائحة كورونا وصعوبة استمرارية الأعمال.

المواصفات القياسية تعرف على أنها عبارة عن وثائق يتم وضعها باتفاق عام واعتمادها سواء على المستوى الدولي أو الإقليمي أو الوطني من قبل جهات معترف بها دولياً أو إقليمياً أو وطنياً وتقدم هذه الوثائق لتكون مرجع للاستخدام العام و المتكرر وتتضمن القواعد أو ا لإرشادات العامة أو الخصائص المتعلقة بالأنشطة أو نتائجها وذلك بهدف تحقيق الدرجة المثلى من النظام داخل سياق معين , كما تغطي المواصفات جميع المجالات وجميع المنتجات دون استثناء من الطعام والملابس والأجهزة والمعدات والمواد الكيميائية والقياسات والمجالات الخدمية ونظم الإدارة والسلامة والكفاءة والإنتاج واستمرارية الأعمال وتقنية المعلومات وتحقيق الاستدامة كما تستخدم هذه المواصفات كممكن واداة تشريعية داعمة لوضع السياسات والأنظمة واللوائح التنظيمية وأكواد البناء لكونها نتجت عن أبحاث ومراجعة من قبل خبراء في كل مجال يتعلق بتلك المواصفات كما تم قبولها على مستوى دولي لترتقي لكونها مواصفة قياسية وبلغ عدد المواصفات الدولية الصادرة عن المنظمة الدولية للمواصفات (ISO) ما يقارب 23477 (ISO, 2020)وبلغ عدد المواصفات الصادرة عن المنظمة الدولية الكهروتقنية (IEC) 6952(IEC, 2019) مواصفة حيث استطاعت الدول من خلال هذه المواصفات الحد من الكثير من المشكلات من خلال استخدام المواصفات القياسية الدولية فعلى سبيل المثال استطاعت الدول القضاء على المنتجات المقلدة والخطيرة على صحة الإنسان من خلال تطبيق المواصفات المتعلقة بتلك المنتجات والإلزام بتطبيقها واختبار المنتجات بناء عليها لتحديد مدى مطابقتها للمواصفات كما أن للمواصفات العديد من الفوائد تتركز على تقديم الحلول المثلى للمشاكل المتكررة والاتصال وتسهيل تبادل المعلومات ونشر التقنيات المبتكرة والأكثر استدامة كما تساهم في تسهيل الوصول

للأسواق والتجارة وتضع أساساً ثابتاً لتأكيد الجودة والمطابقة وتساعد على نقل التكنولوجيات وتبادل المعرفة وتوفير شفافية للسوق والحد من عدم تناسق المعلومات وتساهم في تحقيق السلامة والصحة وحماية البيئة كما تعد أداة لتمكين الاقتصادات للدول المصنعة فنقل التقنية يعتبر من أهم مميزات المواصفات حيث ساهم وجود مواصفات دولية موحدة ومعترف بها دولياً على نقل التقنيات من وإلى الدول الصناعية وغيرها محققة بذلك عوائداً مادية انعكست بشكل مباشر على اقتصاد تلك الدول وعلى توفر التقنيات الحديثة لديها مما يمكنها من تطوير صناعتها ودعمها لتحقيق الريادة في الصناعة ومن الشواهد على ذلك الدراسة التي قام بها المعهد البريطاني للمواصفات (BSI) حيث قام ببحث(BSI, 1923-2013) مستقل حول المساهمة الاقتصادية للمواصفات في اقتصاد المملكة المتحدة وتأثيره على الشركات وكون المواصفات تلعب دوراً حيوي في قوة الصناعة في المملكة المتحدة وغالباً يكون غير مرئي في دعم نمو الاقتصاد حيث وجد البحث 8.2 مليار جنية إسترليني هو المبلغ الذي تساهم به المواصفات في اقتصاد المملكة المتحدة . ولا شك أن المنظمات والشركات والمصانع تستخدم المواصفات كأداة لضبط منتجاتها ورفع كفاءة الإنفاق وتقليل الهدر إلى جانب تطبيق المواصفات التي تضمن أن لديهم نظام إدارة فعال وذلك يأتي من خلال تطبيق المواصفات القياسية حسب السياق التي تحتاج له تلك الجهات.

إن استخدام المواصفات وفق الأساليب الحالية والمعتمدة بشكل أساسي على تطبيقها وفق المجال المحدد بها وعلى منتج أو خدمة تتناسب معها يعد وسيلة ممتازة لتحقيق أهداف محددة ومُعرفة إلا أن المواصفات كمراجع قد يصعب ربطها ببعضها وتحليلها على نطاق بحثي واسع لتشكل نماذج فعالة تعالج مشاكل محددة وخارجة عن المألوف نظراً لصعوبة البحث والتحليل للكم الهائل من المواصفات في مجالات مختلفة وهنا يأتي دور الذكاء الاصطناعي ليكون وسيلة فعالة لوضع نموذج تحليلي لمشكلة محددة في أي مجال كانت وتحليلها وتقديم نموذج فعال فالمواصفات تعتبر ثروة ومخزون معلومات هائل بالإمكان تفعيل استخدامه لحل المشكلات ولوضع حلول مبتكرة واستباقية حسب معطيات محددة لتشكيل نموذج قابل للتنفيذ ويمكن تحقيق ذلك من خلال استخدام تقنيات معززة بالذكاء الاصطناعي بحيث يتم ادخال المشكلة إلى ذلك النظام والذي يتضمن بداخلة جميع المواصفات القياسية الدولية أو على مستوى دولة معينة بحيث يقوم النظام بتحليل المشكلة واستخراج جميع المعلومات وطرق العمل من خلال تحليل عدد كبير من المواصفات المدخلة سابقاً في ذلك النظام بعد أن يقوم باستبعاد جميع المواصفات التي ليس لها ارتباط بطبيعة المشكلة المدخلة ومن ثم يقوم بتحليلها واستخراج نموذج يمكن أن يطبق من قبل أي منظمة لحل هذه المشكلة ووضعها وفق أفضل ممارسة يمكن تطبيقها فعلى سبيل المثال لو تم تزويد النظام بجميع المواصفات الخاصة بالنظم الإدارية وتصنيفها على هذا الأساس ومن ثم ادخل للنظام مشكلة متعلقة بصعوبة عمل الموظفين خلال جائحة كورونا فسيقوم النظام بدورة بتحديد جميع مجالات المواصفات الإدارية وتصنيفها وتحليلها بشكل دقيق خلال مستخرجاً نموذج مبني على جميع المواصفات التي قام بتحليلها بحيث يمكن للجهة التي تعاني من صعوبة عمل موظفيها أثناء الجائحة أن تطبق هذا النموذج لحل المشكلة بشكل فعال ومستدام بعيداً عن أي اجتهادات قد تكون غير مضمونة النتائج.

solved problem model
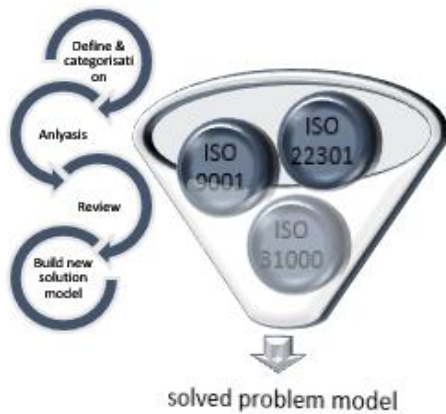
إن هذه الأنظمة تصمم على أساس مبدأ التصنيف والتحليل ومن ثم اسقاط النتائج على نموذج عمل ومن الأمثلة البسيطة التي تقوم على مبدأ النماذج العملية جوائز التميز المؤسسي فهي قائمة على وضع العديد من الممارسات ضمن نموذج موحد وتقييم الجهات ومنحها جوائز التميز وفق ذلك النموذج إلا أن هذه الفكرة المقترحة مرتبطة بأنظمة معززة بالذكاء الاصطناعي قد تكون قادرة على معالجة الجريمة أو نقل التقنيات أو تحقيق السلامة والكفاءة والأداء لمنتج أو خدمة. كما أن فكرة النظام بالإمكان أن تستخدم لإدخال معايير التميز المؤسسي كمدخلات مخزنة داخل هذه الأنظمة بحيث يستطيع هذا النظام المعزز بالذكاء الاصطناعي أن يقوم بفرز معايير الجائزة والتعامل معها على أساس قاعدة معلومات قابلة للتحليل أثناء أدخال مشكلة لدى منظمة أو شركة أو مصنع بحيث يقوم النظام بتحديد المشكلة وتحليلها وتحديد في أي معيار تقع على ذلك وبناء على ذلك يقدم حلول بمنية على نماذج التميز المؤسسي والتي بنيت من الأساس على أفضل الممارسات في مجال الجودة.

تعمل كثير من المنظمات على وضع معايير واشتراطات وتسعى للحصول على شهادات في مجالات محددة بينما قد لا يكون لدى تلك المنظمات الوعي الكامل بالمواصفات القياسية وكيفية الاستفادة منها للتطوير ولتقليل الهدر ولضمان بناء

أنظمة تلك المنظمات وفق تحليل كافي لجميع المراجع التي تعالج مشـكلة أو حالة لدى تلك المنظمات ولذا وجود نظام إلكتروني معزز بالذكاء الاصـطناعي ومجهز بمخزون بيانات المواصـفات القياسـية كأسـاس للبحث والتحليل من شـأنه أنه يحدث مفهوماً وبعداً جديدة لتطبيق المواصفات ولحل المشكلات وصناعة الحلول الفعالة.

إن مثل هذه الأفكار بالإمكان أن يتم تنفيذها من قبل جهات التقييس الدولية أو الوطنية أو جهات تقويم المطابقة أو الشـركات المعنية بالبحث والتطوير أو الشـركات الاستشـارية بحيث يستفيد من هذه التقنيات العديد من الجهات سواء جهات حكومية أو خاصة أو مصانع أو على مستوى استراتيجي للدول فمن الممكن على سبيل المثال أن تسعى دولة معينة لتفعيل الاستفادة القصوى من الطائرات المسيرة (الدرونز) فبالإمكان أن يكون أقصر الطرق لوضع قالب عمل واضح لكيفية وضع الإطار التنظيمي ولوضـــع أفضـــل التقنيات المتوفرة وماهي الأنظمة المقترحة لتطبيقها على تلك الأنواع من الطائرات وماهي الاختبارات التي يجب تطبيقها لضمان سلامتها وملائمتها للاستخدام المتكرر ضمن نطاق سكني محدد من خلال استخدام نظام تحليل المواصفات المعزز بالذكاء الاصطناعي.

قد يتأثر المجتمع بشـــكل غير مباشــر من تفعيل أنظمة قائمة على التحليل المنطقي من خلال الأثر الناتج عن تطبيق تلك النماذج على أرض الواقع فبمجرد أن تسـتخدم مثل هذه النماذج فالمواصـفات لها دور في إدارة الأزمات وتسـريع التحول الرقمي للمجتمعات وتعزيز ســبل الرعاية الصـــحية واســتخدام التقنيات لمعالجة قدرة منظمة محددة على تحقيق التميز المؤسـسي على سبيل المثال بمجرد أن تقوم منظمة معينة بتطبيق النموذج سيستشعر أثر تميز المنظمات المجتمع بأكمله فنجاح وزارت الصحة على مستوى العالم ينعكس بشكل مباشر على صحة وسلامة المجتمعات بشكل مباشر بالرغم من أن الطرق والنماذج المستخدمة لم تمس المجتمع بشكل مباشر بل لامست الأنظمة والمنتجات والخدمات المقدمة كمنظومة عمل شمولية منفذة بشكل منهجي بحيث تعطي نتائج فعالة قابلة للقياس من قبل المجتمع والمنظمات.

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BEST 5 ESSAYS
STUDENT CATEGORY

Category: STUDENT   **Position: 1st**

SANAD: A Learning Tool for Visually Impaired

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I.   Introduction and Background

Differently abled people have less access to basic services like education, practising daily life, employment as well as communication. In such a special group of people, visually impaired people have fewer interactions with the outside world, since vision is very crucial for any human to see and participate in day to day life. According to a health report published by the World Health Organization (WHO) 36 million people in the world are visually impaired (WHO). Visually impaired people need support and services to practice their daily life routine; particularly, they cannot take care of themselves in a new environment without extra support. Therefore, as technology keeps developing, Artificial Intelligence (AI) applications can contribute deeply in developing solutions to serve this section of the society.

Under category of AI, Computer vision and machine learning systems are widely discussed topics used to solve society's issues. In the present context of helping the visually impaired, the idea is to develop a tool fitted with a camera and headphone to guide the visually impaired person to know the people and the objects around them without additional support from others. By applying computer vision, the tool will recognize the faces of people around or in front of him/her and inform them through a series of voice messages via headphone. This way the visually impaired will be able to visualize the surrounding environment from voices. Not only that, the tool can guide the user to reach a certain destination. The next section will describe the project idea more.

II.   Current State of Technology

Computer vision is one field of artificial intelligence that is used to understand and process the content of digital images. Over the years, the machine is becoming better in vision and nowadays, AI and deep learning are being used in various applications, especially pattern recognition. There is a lot of research being done on pattern recognition, for example one group (Rohit, P, Prasad, and Gowda,) has introduced an image recognition system applied to transform visual images into audios. The images will be captured using joystick model. The Mask R-CNN processor will detect objects/obstacles and save it at google API, and then detected object will be converted to audio using Text-to-Speech convertor.

Another similar approach done by (Shahira, Tripathy and Lijiya), they develop simple and cost-effective object detection system assist visually impaired challenged people. The project idea is to design a system informing the user (visually impaired) about the nearest object around them (obstacles) Furthermore, the distance between user and detected object would also be detected and the user informed as of it well. The user will receive the information through speech.

III.   Proposed Idea and its Novelty Idea

This project is intended to develop a wearable device fitted with a camera to guide the visually impaired person to do their regular chores without additional support from others. This device will function in three modes viz. Object Detection, Pathfinder and Face Recognition. In Object Detection mode, the user will be briefed through a series of voice message regarding their surrounding objects (book, car, chair, bag., etc.). In Pathfinder mode, the user can navigate through the specific routes, roads and their place of interest. In Face Recognition mode, the unit will first detect and then recognize a face from a pre-trained dataset. The hardware implementation is carried out using Jetson Nano single board computer with necessary accessories, and a camera used to capture the real time video. The diagram below summarizes the project idea.
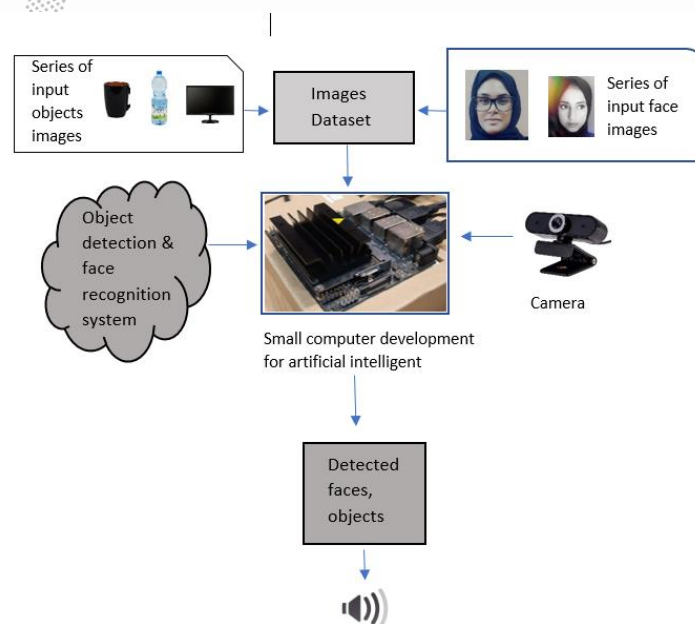

Figure 1:system block diagram

A. Object Detection

Object Detection is a computer vision technique related to image processing used for locating and recognizing objects of interest in a digital images or videos/live stream. For example; in any environment such a room, office, street there will be a number of objects like chairs, tables, screens, cars, buildings, bikes and even human. The job of detection system is to locate positions and recognize the type of objects, where this information will be used for the intelligent system. The proposed system used pre-trained dataset that contains a number of objects classified. The dataset is fed into SSD v2 mobilenet detection model, so whenever an object is detected, the system will compare it with the pre-trained object and if they are matched then the object has been recognized.

B. Face Recognition

The face recognition system divides into two main processes and they are the detecting of faces from the surrounded environment, and then recognizing the faces from the detected ones depending on the pre-trained images so as to identify individuals in real-time. The proposed project will serve the visually impaired by identifying individuals without the need to distinguish and track their voices with high accuracy. Besides, the methodology depends on training the images using python and OpenCV and after the recognition process, the results are converted via the text-to-speech library.

C. Path Finder and Navigation

Path finder system will guide the user to reach a certain place. For example, the device will alert the user if there is an obstacle in front of them, such as a tree, a car, a wall etc. It is also considered as an application of object detection system as the machine processes the surrounding environment.

IV. Implementation of Idea

A. Pre-requirement:

1. software:

- Python
  Python is a programming language that is commonly used for computer vision projects that makes it easy to accomplish tasks involving imaging, videos (fullscale).

- OpenCV (library)
  Open Source Computer Vison is a library used for state-of-art and machine learning projects. It was built to provide instruction for computer vision (PAL).

- COCO dataset
  Common Object in Context is a large-scale object detection and segmentation. The dataset contains large number pre-defined images. It contains 80 labeled and segmented objects, for example, bus, bicycle, table, TV screen and person (tech.amikelive).

2. Hardware:

- Single board computer
  Nvidia jetson nano is a powerful computer used to develop AI project and it can handle the heavy processing of images and videos (developer.nvidia).

Figure 2:Jetson nano developer kit

- Pi camera
  Pi camera has a small size and low weight and can be carried by the users. For real time video, the camera can support video capture of three different resolutions (Element14).

Figure 3: pi camera

Implementation and result:

With the software and hardware implementaion done,
the obtained result as shown e.g. in Figure 5 are for the Object Detection system. The objects shown within this images are captured from real time video. Each detected object, like cup, keyboard will be breifed to the user through voice via headphone. That will let the visually imapaired become aware of the objects around them, as well as helping them to find objects that they wish to find o approach.
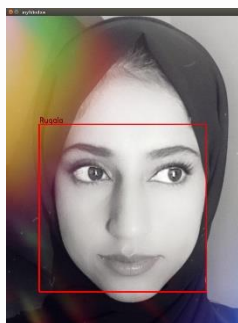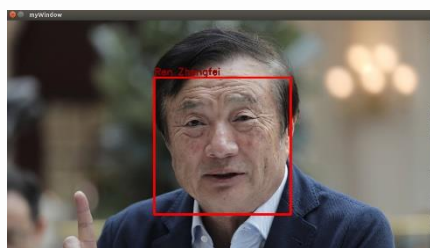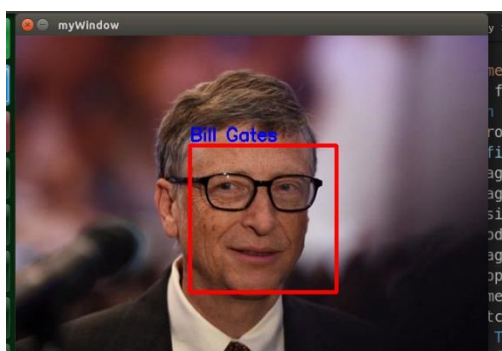
Figure 4: Project setup

The next part is the Face Recognition system, as illustrated in Figure 6. A number of faces are detected by bounding box and labeled by their names.

Figure 5: Object detection system result

Expected Impact on Society

Visually impaired are a part of society and applying artificial intelligence-based system to serve them will highly contribute on improving their functionality and consequently to societal development. This project will allow them to interact with surrounding environment and people by knowing the objects around them, who are there. Not only that, the project will guide them to reach a certain destination as per their need. All of these will enhance their living status in order to be self-dependent and productive in society. In addition, this project helps the country move toward a digital revolution to solve issues using technology. Contributing to the continuity of the learning of visually impaired people, it also will allow them to be productive and functioning at their work.

Conclusion

To conclude, Artificial intelligence applications are being widely used to support the needs of visually impaired persons. This idea is based on computer vision and machine learning. The system will convert real time video into images and then process each image to detect and locate a face or an object. The main goal of this idea to support visually impaired people in order to enable their lives with dignity and independence. The proposed idea is a hardware tool do three functions; recognize people faces, detect and classify objects and guide the user. Through its real time system, the user would be continuously briefed about names of people and objects around them, through a voice assistant. The idea will help visually impaired people to visualize the world and to safely interact with it. Hence making them self-dependent and productive.

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Certification and Auditing as Tools for Effective Data Regulation and Oversight in Artificial Intelligence

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Since they were first invented some two hundred years ago, computers have come a long way capability wise. Looking at their capabilities in stages, we have seen them evolve over time from useful high-speed calculators meant to support decision making in the first stage, into expert systems that mimic the reasoning of human experts in solving knowledge intensive problems by applying sophisticated rule based systems in the second stage of capability (Grosan, 2011; Barth & Arnold, 1999). Now we have entered a third stage of computer capability whereby computers are being built to go beyond initial programming and learn to learn. This new level of computer systems are commonly referred to as artificially intelligent systems. Artificial intelligence (AI) is simply the "science of making machines do things that would require intelligence if done by men" (Marvin Minsky in Yazdani & Narayanan, 1984; retrieved from Barth & Arnold 1999). On this basis, the second level of computers qualify as a simple form of AI. However, unlike their third level counterparts, they are unable to go beyond their initial programming and learn to learn. It is this ability of a machine or computer system to approximate the capabilities of the human brain that lies at the principle heart of AI (Barth & Arnold, 1999). Therefore, the logical conclusion to the advancement of the field of AI, are machines that can learn to learn, act as autonomous agents, assess their environment, and think with values, motives, and emotions, all without human intervention or assistance (Barth & Arnold, 1999).

AI systems 'learn' through a process which is known as Machine Learning (ML). A concentration within AI, machine learning is a method of data analysis that automates analytical model building so that computer systems can make decisions by identifying patterns learned from analysed data, with minimal human intervention (SAS Institute). Machine learning algorithms build a model based on sample data known as 'training data' in order to

make predictions and decisions on a new data set without being explicitly programmed to do so and improve with experience (Lee J G, Jun S, et al; 2017).The success and reliability of AI systems therefore depends heavily on the kind and quality of the underlying data with which they are trained, thereby making the analysis of large datasets crucial to the development of powerful machine learning algorithms and data, the most important aspect of teaching AI systems to operate (Yanisky - Ravid & Hallisey, 2019). Despite data playing such a vital role in teaching AI systems to work, there is currently a surprising lack of adequate regulation schemes and oversight on what kind of data is 'fed' to the machine learning algorithms powering these systems. This lack of oversight makes the introduction of partial, incomplete, wrong, biased, or misleading data possible in the training of AI systems (Yanisky - Ravid & Hallisey, 2019). This 'bad' data opens up AI to making potentially discriminatory or illegal outcome predictions that can have an adverse effect on both groups and individuals alike, eventually increasing inequality through the disenfranchisement of groups already in need of protection from discrimination, such as women, people of colour, ethnic minorities, etc. One famous example of AI getting it wrong is when Amazon's AI facial recognition software Rekognition, wrongly identified twenty-eight members of the United States Congress as individuals who had jail mug shots (Snow, 2018).

The field of AI has previously benefitted from overly permissive regulatory regimes. The technology has become such an important part of the economic and social fabric of our societies that as the Collingridge dilemma warned, controlling it in light of growing awareness of its potential for harm is proving extremely difficult (Rubinfeld & Gal, 2017). The shortcomings of Amazon's Rekognition software are a reminder of this potential for defective AI to harm humans. Regulation that is retroactive in nature, as opposed to being proactive, perpetuates this. There is therefore a need for adequate proactive oversight on the datasets which are used to train AI systems because the problems associated with AI are usually a result of 'bad' data. It is better to reduce the risks of these bad outcomes from the very beginning of training the AI instead of acting retroactively (Yanisky - Ravid & Hallisey, 2019). This essay proposes that current regulatory regimes be revised and updated to make them more comprehensive, consistent and anticipatory in nature. This will make them better equipped to regulate the quality of datasets that are 'fed' to AI thereby tackling the issue of defective and potentially dangerous AI from the root. These improved data regulation schemes would be built around data quality certification programs and auditing regimes that are based on uniform standards of ethics that are universal and can hold sway across different jurisdictions. Tried and proven in other industries such as food and pharmaceuticals, these regulations would also help provide the AI industry with comprehensive industry standards that set clear parameters on what is legal and acceptable behaviour and what is not (Yanisky - Ravid & Hallisey, 2019). This is not however, a suggestion towards over strict regulatory measures that stifle AI development, but instead that we find a balance between regulation that is neither too permissive nor too restrictive. The case for anticipatory and proactive data regulation schemes that can keep up with the political and social implications of AI is made even stronger by the opaque nature of the developing process of AI systems. The opacity of the process makes it very difficult to trace the outcomes produced by machine learning applications to particular inputs and pin point the rationale behind these outcomes until after the fact. (Scherer, 2016). This means that defects in the system only become obvious once the AI begins to malfunction and makes incorrect and potentially harmful outcome predictions. This potential for defective AI to negatively impact

people's lives before malfunctions are detected does not only put humans at risk of harm, it could also through the loss of consumer trust, financially ruin the firms in the AI industry and compromise the future of AI technology. It is therefore vital that AI systems are not tainted by 'bad' data that is partial, incomplete, wrong, biased, or misleading. To protect dataset quality and reduce the risk of AI systems operating on assumptions derived from discriminatory, unethical, and even potentially illegal datasets, the data used in training AI systems needs to undergo careful standardized evaluation paired with continued audits of the data being used to give system feedback.

The implementation of the proposed data quality certification programs and auditing regimes will mean carefully scrutinizing how data is initially collected in order to limit the volumes of partial, incomplete, wrong, biased, or misleading data being introduced in training datasets. Effectively implementing a certification process will require input from both government agencies, third party auditors and the industry. Government agencies can see to it that adequate regulatory regimes are drafted, implemented and enforced for data that is collected and stored within their jurisdictions, and provide protection against unethical collection and use of the private data belonging to their citizens. The AI industry would benefit from having one main international body which would act not only as a third party arbiter but also assists governments in developing comprehensive regulatory regimes and legal frameworks that protect consumers while also making room for technological innovation. The international third party arbiter could also be mandated to settle disputes within the industry and between firms and governments. The industry for its part can be consulted in order to help regulators determine how best to not over regulate. Certification can then be issued by this third party body with mandatory audits being carried out at regular intervals. The fact that data is generated and harvested by humans and human driven systems, opens the door for human bias and prejudice, be it conscious or unconscious, to determine what kind of data is collected and possibly taint the quality of the data. This can be dealt with by encouraging diversity in the field of AI. Ethics and its importance in data collection is an issue that needs to be emphasized in the training of the industry's various stakeholders from data providers, programmers, manufacturers, distributors, to sellers. Everyone involved in getting a finished product to the consumer needs to be made to understand that ethical practice is in their industry's best interests. They also need to know that groups and individuals who fail to exercise due diligence in accordance with regulations will be held accountable should AI make mistakes that have adverse effects on people's lives.

The success of AI systems and applications, have proven for the most part, beneficial to mankind. From diagnostic and medical use; fraud detection and prevention; the grading of academic essays; to pseudo-intelligent digital personal assistants, AI applications play an important role in the lives of many people. However, when compromised by bad data AI can make illegal and discriminatory outcome predictions that could pose serious risks to human safety, rights, and property. By better regulating the data being used to train AI systems and regularly auditing the data it learns from, the prevalence of issues resulting from bad data such as discrimination, cyber security risks and personal privacy breaches can be drastically reduced. Effective anticipatory and proactive data regulation in AI when properly implemented and enforced, has the potential to make AI safer and more successful while reducing the potential for discrimination, bias and prejudice in our societies wherever it is implemented.

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Category: STUDENT   **Position: 3ʳᵈ**

Integrated Machine Learning and Bioinformatics Approaches for the Development of Potential Therapeutics against Pandemic Diseases

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Abstract

Machine learning is a part of Artificial Intelligence (AI) that leads to analyze large amounts of medical and genomic data. Machine learning algorithms although proven powerful in making computational predictions and neural networks but they also provide translational knowledge and solution to many problems, especially in bioinformatics. They serve as an advanced tool in the field of bioinformatics. Genetics and proteomics programming are the best approaches to explain machine learning in bioinformatics, where multiple tools are used to analyzed potential novel biomarkers, molecular phenotypes, novel drug targets, differentially expressed genes (DEGs), and determining unfamiliar diseases which can be further translated to clinical actions. The *COVID-19* pandemic determines the global health disaster of the current time and the greatest challenge that has confronted after World War 2. To address this challenge, machine learning has increased the accuracy of bioinformatics to execute various in-silico techniques such as e.g. Microarray, Next Generation Sequencing (NGS), drug designing, reverse vaccinology, CRISPR CAS, and molecular simulations to develop potential drugs and vaccines that can treat multiple global pandemic diseases including COVID-19, Diabetes Cancer, HCV, and other Flavivirus infections. Bioinformatics provides a powerful interdisciplinary framework for quantifying the experiment with efficient results computationally in the shortest time.

Keywords: Machine learning**,** Bioinformatics**,** Drug designing, NGS, CRISPR CAS, potential inhibitors, and vaccine development.

Introduction and Background

Machine learning (ML) is a branch of Artificial Intelligence (AI) and computer science that provides the competence of motorized learning to the machines without being explicitly programmed. Major machine learning task consists of the following: **1)** Data preprocessing **2)** Feature optimization **3)** Model parameterization **4)** Model training **5)** Exploratory data analysis.

The bioinformatics approach is used to analyze the extensive biological data based on computation, biology, statistics, and mathematics.

In the post-genomic era, the role of computer has been enhanced dramatically. While the first wave of the pre-genomic era did not focus on computational analysis. Due to this, many important problems are still unsolved.

In other words,

"Bioinformatician would love to change the biological world"

With the advent of new high throughput technologies (DNA Microarray, RNA Sequencing, ChIP Seq, and Genome-Wide Gene Expression), novel data has been obtained from various computational techniques to solve these problems. Since the late 1980s machine learning methods were not much computationally intensive (Baldi, Brunak et al. 2001). But after the advancement in computational sciences, ML and bioinformatics have a significant impact on the development of novel medicine and vaccines.

According to Sir Thomas:

"A problem well put is half solved. This much is obvious. What is not so obvious, however, is how to put a problem well"

Therefore, ML and bioinformatics become a need of today's world to solve problems effectively. According to previous studies, biological data is increasing day-by-day and researchers fetch multiple problems to extract information from a large scale of datasets. The large amount of biological data creates an analytical need for developing algorithmic, visualizing, and networking software. This computational software classifying the DNA sequences, molecular structures, coding and non-coding regions in DNA, post-translational modification, gene mutation, and expression of genes. These factors are essential to our understanding of life evolution as well as the discovery of novel drugs and vaccines.

The field of bioinformatics demonstrates that computational sciences changed the traditional engineering and scientific disciplines. There is a strong relation between ML and bioinformatics.

According to **Juan Enriquez:**

"If you want to compete in bioinformatics, first you need to compete in machine learning"

Due to bioinformatics and ML tools, large quantity of biological data exploded in a short time. The genome of various species has been completely sequenced including humans. Machine learning based on new high throughput technologies is used to analyze the sequences of DNA, RNA, genes, and proteins. In ML various important methods have been made, including the Gaussian method, Bayesian reasoning, hidden Markov model, and maximum entropy method. These methods are used for solving multiple problems in bioinformatics.

High-throughput Techniques

Today, algorithms of ML are widely used for the analysis of high-dimensional biomedical data. It helps in the early diagnosis of multiple genetic disorders. The ML algorithms (supervised

and unsupervised) are substantially applied in bioinformatics to perform multiple tasks such as molecular prediction, sequence alignment, microarrays, RNA sequencing, evolution, feature selection genomics, proteomics, data mining, and systems biology (Shastry and Sanjay 2020).

The vital application of ML in bioinformatics is the clustering of high-throughput genomics data. Widely used ML servers in bioinformatics are: **GALAXY, CyVerse, MATLAB (Simiology), R based pipeline, and Genome Space** (Naresh, Kumar et al. 2020). These servers are used to analyze the sequence of genomic data computationally in a short time frame and help in the early diagnosis of genetic disorders.

To perform computational analysis using ML-based servers in bioinformatics, there are certain steps to be followed (as shown in Figure 1).
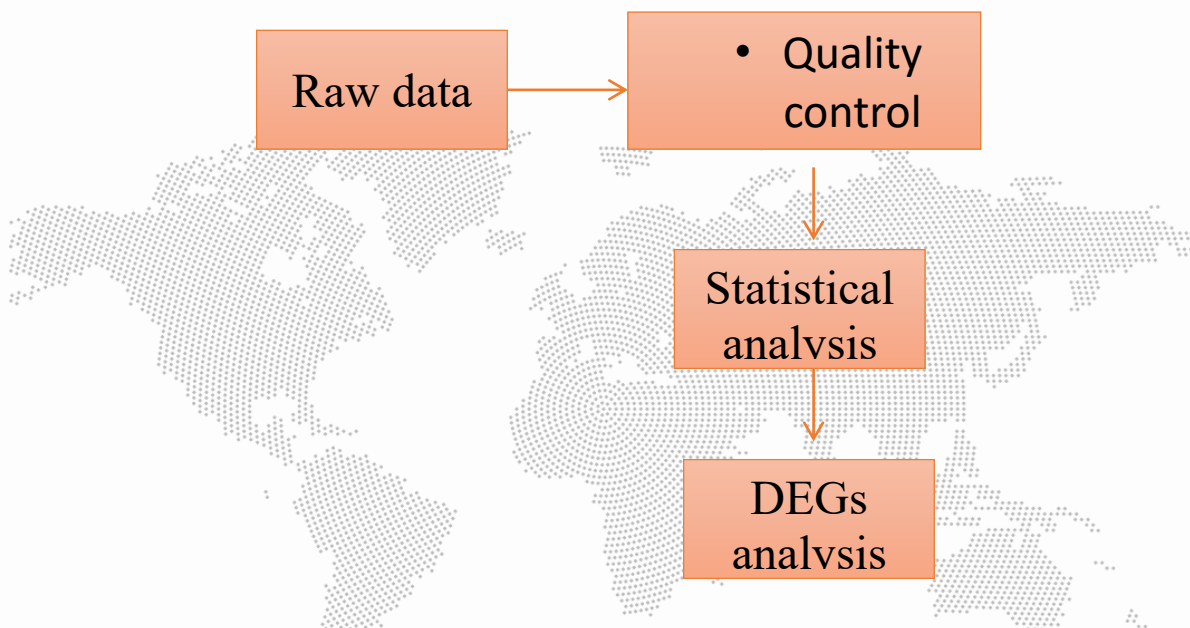

Figure 1: Raw data of diseases consists of DNA sequences obtained from the ArrayExpress database. Moreover, these check the quality of short sequences and normalize the data. Further statistical analysis is performed to analyze the differentially expressed genes that are used to design potential drugs and novel biomarkers.

Proposed Novel Idea

In this digital world, we are more probable to die from global pandemic diseases like COVID-19 (SARS-Cov-2), cancer, influenza, dengue, HCV, diabetes, cancer, AIDS, and heart diseases. Statistical analysis demonstrates that 8.8 million people died every year due to cancer including breast cancer in women. Diabetes is also a global pandemic especially type 2 diabetes which affects middle age, old age, and children as well. The prevalence of type 2 diabetes is about 34.2 million worldwide and 19.86 % in Pakistan. The biggest task in the world is to develop an effective and safe drug or vaccine against COVID-19 and other pandemic diseases (influenza, dengue, HCV, diabetes, cancer, and AIDS). COVID-19 is an emerging and global challenge for public health. World Health Organization (WHO) has shown more confirmed cases in 28 countries than China (Huang, Wang et al. 2020).

The global pandemic diseases will come to an end when the world population develops immunity against these diseases. *The mortality rate is increasing day by day worldwide, including, in Pakistan. Therefore there is a need to provide a solution to this problem as soon as possible.* For, this purpose, machine learning and bioinformatics approaches would be used to achieve this task. Researchers of the world now focus on the treatment of COVID-19 while ignoring other global pandemics. Consequently, there is a need for the world to design a single methodology to treat multiple pandemics at a time.

There is a significant proposed research methodology (shown in Figure 2) that *includes all the in-silico approaches to design novel compounds in a short time frame and at a low cost.*

According to Alan Watts':

<div align="center">

"You are the universe experiencing itself"

</div>

Therefore, experiencing these techniques will appear as a game-changer for the entire world.
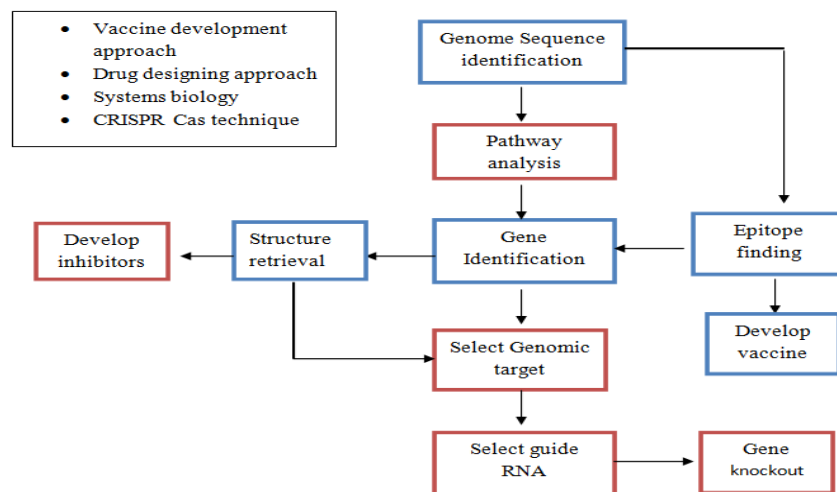

Figure 2: *Development of vaccines and other novel drugs by analyzing gene targets in a short time and* at a low cost.

Implementation of Idea

With the help of high throughput sequencing bioinformatics techniques, researchers can be able to treat various diseases at low cost and in a short time as compared to other traditional sequencing methods which are time-consuming like Pyrosequencing and Maxam and Gilbert method etc. This proposed methodology will be implemented on COVID-19 patients through Next Generation Sequencing techniques (RNA Seq, ChIP Seq, and GWAS). The first step will be the collection of blood samples from patients of different regions. Collect blood samples of patients and extract mRNA and DNA from it. Moreover, sequence the complementary DNA and align it with the reference genome. Further ML-based servers (GALAXY and Genome Space) will be used for the analysis of Differentially Expressed Genes (DEGs). Due to the NGS technique, researchers would be able to identify novel biomarkers and drug targets that help in the treatment of diseases including COVID-19 and other pandemic diseases.

Impact on Society

The pandemic diseases are claiming lives across different age groups. As the mortality rate increases day by day due to pandemic diseases worldwide including Pakistan, *therefore, it is a need of the world to provide a solution to this problem as soon as possible. Implementing* these techniques can help a lot to control the mortality rate. Bioinformatics tools are used to identify gene targets that are responsible for causing various diseases in humans. These gene targets are further studied through a machine-learning algorithm to design effective vaccines and inhibitors. Machine learning and bioinformatics provide a way for researchers to build more effective public health systems. Thus our health care systems should develop more dimensions to encounter the next pandemic. We need to do everything we can to fight against the pandemic so that we can save more lives. Today, the COVID-19 pandemic teaches our society about humanity, that we are together.

According to Abdul Sattar Edhi:

"No religion is greater than humanity"

Conclusion

The main conclusion derived from this framework is to develop effective medicines and vaccines that are used to treat these global pandemic diseases through machine learning techniques in bioinformatics. For this purpose, high throughput sequencing methods (RNA Sequencing, ChIP Sequencing, CRISPR-CAS, and Systems biology) are used to fight against the pandemic by developing immunity in people through medicines and vaccines in a short time.

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**Artificial Intelligence Alignment as Integrated Embedded Smart
AI Pandemic, Environment, and Disaster Country Management System**

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Introduction and Background

Artificial Intelligence can be integrated as part of supporting six pillars of Smart City Development including Environment, Living, Mobility, Governance, Economy and Peoples. Integration of Smart City Pillars under Integrated Embedded Smart AI System with advanced Data Analytic, Machine Learning and Deep Learning Technology will create better advantage for the Smart City Development specifically and more advantage for development of Smart Country or event Smart Global Integrated System. Some countries with cutting edge technology have started massive development of integrating advanced technology in Smart City which raised more advanced technology as part readiness to Smart Integrated Country. It has been started with adoption of integrating between governance and public services or most popular integrating between living, mobility, economy, and peoples. As now we can see most people get in touch with family through message service portals, paying their bill or tax, get governance service, and healthcare through online system based to Artificial Intelligence and Machine Learning.

Smart City Pillar adoption as preference to develop Smart Integrated Country especially in Integrated Embedded Global Pandemic Environment Disaster Management System will be fully beneficial not only for the countries which have adopted it but also for developing country that has just started to implement it.

Background of this essay is a brief idea discussion for aligning Disaster Early Warning System, Pandemic Data, and Environment Data Information to Advanced Country Integrated Embedded AI Pandemic Environment and Disaster Management System, which could be shared and made accessible for governance and for citizens as decision maker preferences.

Current state of the technology

Presently in the University where I have studied, we have several Remote Early Warning System as part Local Disaster Management System. There are Remote Earth Quake and Tsunami Early Warning System, Flooding Early Detection System, Remote Air Quality Monitoring System, etc. The systems are configured as partially remote system or limited accessible integrated system. Disadvantage of the existing system, and probably in similar ones, which has been found in several countries that implement nonintegrated remoted system is the presence of spurious error in output message which leads to misinterpretation, since the system is not integrated with AI System which has capability in Data Analytic, Machine Learning, and Deep Learning. Data Spurious Error or non-revalidated Data through Machine Learning Data Analytic will lead to non-valid data predicted presentation and follow with wrong calculation in risk and mitigation. Even worse, in several cases, this will lead to panic within citizen due to misleading information or false information.

Similarly, a lesson learnt during global pandemic is that insufficient information and false data have escalated to cause unnecessary nonproductive citizen argument and late response from governance or public authority decision maker to take decision since they do not have enough consolidated information and proper predicted analysis in risk and mitigation.

In fact, present days Integrated Pandemic, Environment, and Disaster Country Management System still not fully integrated and embedded with latest AI technology which capable to consolidated predicted report or dashboard to governance/ decision maker to have alternative decision based on risk and mitigation evaluated by Integrated Embedded AI System. A lesson learnt during present or previous global and local pandemic or natural disaster in different countries is that we found volatility, uncertainty and complexity at every stage, time, and place, due to insufficient data, resulting in misinterpretation of the same by Governments.

Proposed Idea

In early 2017, Artificial Intelligence technology has reached Deep Learning frameworks, which are capable of developing AI with efficiency, accuracy, predictability and visually analyzing data in comprehensive dashboard reporting.

The brief idea of Integrated Embedded Smart AI Pandemic, Environment, and Disaster Country Management System development is as follows:

1. Upgrade the Remote Early Warning Station and Environment Monitoring Station to be capable of sharing reliable and accurate data continuously/ periodically.
2. Develop and Upgrade dedicated Central Pandemic Environment and Disaster Management System Data Server in quadruple multi redundant configuration to ensure high reliability and availability data server.
3. Integrate and gather data from Remote Early Identification Units, such as early disaster detection system (Island or Offshore Earthquake Detection, Tsunami Early Detection, Early Flood Detection, Early Landslide Detection), Environment Station Data Monitoring (Temperature, Humidity, Emission, Solar Light Intensity) and Pandemic

Data, and shared data from Government Health Authority. All gathered data will be integrated as under Early Detection Disaster Management group based on atype of risk, impact, and mitigation.

4. Selecting Infrastructures Artificial Intelligence including modelling of Machine Learning and Deep Learning such as Artificial Neural Network (ANNs), Recurrent Neural Networks (RNNs), Convolutional Neural Networks (CNNs), Generative Adversarial Networks (GANs), Auto encoders, Deep Belief Networks).

5. Cleaning and Data Calibration to get valid and accountability data for Machine Learning and Deep Learning processing.
   For this process we can utilize several methods which are available as parts of AI Machine Learning and Deep Learning, such as linear progression method, through Machine Learning or in advanced big data Deep Boltzmann Machine and Deep Belief Networks (DBN) will be helpful with the capability to reduce false data which lead to invalid or inaccurate data information.
   The capability of generating output for such processes, which have unsymmetrical behavior will make RNNs method as other option for early fault or false data detection, feature data extraction and data distribution estimator.

6. Development of Integrated Pandemic, Environment, and Disaster Country Management System Big Data Server including selecting data set.
   During this stage selection of datasets, including target (dependent) and feature (independent) will be part of segregation data prior further data processing.
   Further processing is to include reviewing the correlation factor, prediction analysis, and initiate mitigation or Data Visualization.

7. Data Visualization modelling (data analytic, predictive, and alternative risk mitigation). During this stage utilizing Generative Adversarial Networks (GANs) will be part of the option since GANs architectures utilizes generator model and a discriminator modelling which will very useful to produce accurate classification image results

8. Data shared access to public through extra Advanced Message Service system, which covered various platform global messages service and local messages services including PAGA annunciation and Public Display Monitoring.
   The simple transmission data information could bind the AI Platform with Browser Automation Software, which have the capability to deliver messages through Instant Messaging Platform Applications such as WhatsApp, Telegram, WeChat, etc. For advanced Integrated Information Management System, dedicated Pandemic, Environment, and Disaster extra Advanced Management System (i-PEDeXMS) Application in various platforms including Android or IOS Application will be available. Meanwhile the information would be accessible through website.

The main outcome from the proposed brief idea is that every country should have dedicated strategically centralized shared data information related to pandemic, environment, and natural disasters as part of early warning information, citizen information references, and optional pre-mitigation information which could be used by the country's decision makers.

Idea Implementation

The implementation of i-PEDeXMS will be define in three (three) stages:

1. Local System Integration

   a. Upgrade the Remote Disaster Early Warning Station and Environment Monitoring Station.
   b. Provision of Centralized Disaster and Environment Monitoring Station Data Server or Cloud Base.
   c. Exploratory Data Analysis through Artificial Intelligence Machine Learning and Deep Learning.
   During this stage, dependent/ target data will be defined. Dependent data for Disaster Early Warning Station could be categorized such Flood EWS 1 – 5, Earthquake EWS 1 - 8, etc. Environment Monitoring dependent data frame could be categorized such Emission Cat 1 – 5, Heat Index Cat 1 – 4, Noise Level Index 1 – 5, etc.
   Global or International Standard or Research Data will part of the option for Base Data References like Heat Index, Emission Threshold Limit, etc.
   Integration with GIS Map will make other advantages for AI Deep Learning to evaluate and make prediction related to pre-mitigation and optional decision tree based on prediction analysis.
   d. Data Visualization will show the integrated dashboard reporting post of data processing and analytic done by AI including preview, pre- mitigation analysis, various option decision tree, etc.
   e. Integrated Data Sharing will be defined and categorized based to stakeholder and target audience such government/ decision maker information or citizen shared information

2. Moderate Stage Integration:

   a. Integrated all data Environment and Early Warning Disaster System in Central Data Base
   b. Integrated Data Pandemic from Government Data Server
   c. Exploratory Data Analysis, Machine Learning, and Deep Learning Data Processing
   d. Data Visualization
   e. Integrated Data Sharing

3. Advanced Stage Integration:

   a. Integrated Embedded Pandemic Data, Environment Monitoring, and Early Warning Disaster Management System to Quadruple Redundant Central Pandemic Environment and Disaster Management System Data Server
   b. Integrated Advanced Artificial Intelligence Data Processing
   c. Integrated Advanced Data Visualization
   d. Integrated Advanced Data Sharing

Expected Impact on Society

The expected impact of implementation of Integrated Embedded AI system in Central Pandemic Environment and Disaster Advanced Management System to the society including but not limited to the following mentioned:

1. Integrated Disaster Information could help the government to identify the risks and prepare the mitigation using early information received.
2. Meanwhile for the citizen, early warning and pre-mitigation information will lead them to proper and mature response especially if emergency evacuation is required.
3. Integrated Environment Information could be utilized for farming and agro-industry development, especially related solar radiation index, weather prediction, etc.
4. Integrated Pandemic information will lead to citizen and government awareness, especially for prevention of pandemic escalation.
5. During i-PEDeXMS Development stages, government, as the country's main stakeholder could involve the citizens as volunteers in development, commissioning, operating and maintaining the local/ remote system.
6. Integrated Embedded AI Information System will prevent the spread of hoax or misleading information.
7. Since the system is integrated to GIS Map, the reference guidance for travelling especially to the area which is categorized as high risk including advisory information will save lives.
8. Mainly the outcome is Integrated Embedded AI System will strengthen Country Society, Mobility, Economy, Government, Environment, and Citizen Quality of life.

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Panoptic Structures and Surveillance in Nigerian Hospitals

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Jeremy Bentham, the father of utilitarianism, desired to create an architectural structure where people would obey the prevailing rules and norms of an institution. After some consideration, he created the Panopticon. The Panopticon is an architectural structure that consists of a rotunda, a circular building, which has an inspection house at the centre. The cells within the rotunda are lit up at all times making the people in the cells visible to the inspectors in the inspection house. However, the inspection house windows are tinted so the inspectors are not visible to the inmates in the rotunda. The concept of the design is to allow all those in the cells to be observed by a single security guard without the inmates being able to tell who is watching them or when they are being watched. Motivated by this lack of knowledge, the inmates tend to self-regulate their behaviour to avoid punishment. I will use this idea in proposing a system for developing transparency and accountability I the Nigerian healthcare system.

Ranking 75th out of 79th in the Global Connectivity Index (2019), Nigeria has fallen behind especially in technological developments for the healthcare sector. When comparing technology in Nigerian hospitals to that of hospitals in more developed countries, it becomes obvious that the Nigerian healthcare sector is lacking. For example, telemedicine, a branch of digital healthcare that uses telecommunications and technology to remotely diagnose and treat patients, is still not widely implemented across hospitals in Nigeria.

Besides lacking the adequate technology for medical equipment and machines, adequate surveillance systems are not developed in Nigeria. This raises issues of security, transparency and accountability in Nigerian hospitals. Security, transparency and accountability are three important aspects that need to be present for there to be a successful and transparent medical system. Therefore, structures must be in place to ensure that these three elements are present.

In terms of transparency, the Nigerian healthcare system has what can be called a "Transparency Problem". Information is extremely important for the health care industry because it is used to improve peoples' lives. However, in Nigeria, there is a lack of transparency in the healthcare system and this creates an environment that supports corruption. It is not surprising to learn that Nigeria scored 26 out of 100 on the Corruption Perceptions Index (2019). Due to the lack of information on the distribution and use of the drug supply, there are incidents of theft and resale of drugs, as well as illegal pricing of drugs that are supposed to be free. The corrupt environment also allows for the high pricing of drugs to exploit the wealthy. Moreover, bribes (another form of corruption) to medical personnel have allowed for an

environment of incompetent professionals to be created. This puts the patients at risk and destroys their faith in the Nigerian healthcare system.

Furthermore, the lack of transparency also affects the doctor-patient relationship. Patients are forced to put their blind trust in doctors because they are not aware of their rights and this gives the doctors the ability to withhold information to control the patients' choices under the guise of "patient welfare". This lack of information also leads to improper patient tracking and poor healthcare insurance policies. Without the proper tracking or health insurance policies, it is very easy for patients to skip out on their hospital bills without repercussions or for criminals to access hospitals without the police being notified.

To solve the "Transparency Problem," I propose a modified surveillance system using Bentham's Panopticon as a model. These modifications will overcome some of the shortcomings of the Panopticon while making the system applicable to a Nigerian hospital as opposed to the prison setting it was originally designed for.

In this surveillance system, hospitals would have cameras with some specific features distributed throughout the facility. First, they will be quite small and concealed. This is to maintain the illusion that the cameras are omnipresent. All hospital employees will be made aware of the presence of the cameras but not their location. The camera location will only be known by the Chief Executive Officer of the hospital. This new system will increase the surveillance standards in the hospital which should lead to decreases in issues such as theft, corruption and bribery in the hospitals.

Facial recognition software powered by Artificial intelligence (AI) will be the second feature of the hospital cameras. This is because to achieve smooth running surveillance, it is more beneficial to use the AI system to reduce the chances of human error. AI software makes it easier to track who is moving in and out of the hospital daily rather than having to rely on human memory or an inefficient paper and pen check-in system. Having said all this, without a database to compare the facial recognitions to, the effectiveness of this feature is greatly reduced. This leads me to my next point.

Communication between federal agencies is very essential to ensure a smooth flow of information. With this in mind, I propose the integration and digitalization of information between the Nigerian government, the National Bureau of Statistics and the Federal Ministry of Health. With information from these three agencies, we can build a database in which most of the people in the country are accounted for. This database combined with the facial recognition software mentioned earlier will then prevent issues such as lack of proper patient identification and general fraud within the health space in Nigeria.

Lastly, and in addition to the surveillance system and cameras, hospitals should contain posters and charts that summarize the rights of patients. This will help patients to be aware of their rights as they come in for a consultation or any other medical procedure.

The recommendations above are unfortunately very utopian when you consider the state of the Nigerian healthcare system. However, all hope is not lost as a journey begins with a single step.

Before permanently implementing these structures, one must have a trial run to test the effectiveness. The suggested partner hospital is Lagoon Hospital in Ikoyi, Lagos. Lagoon hospital is an accredited hospital in Lagos with a good digital record of patients. The partnership will span over a year where the AI systems and undetectable cameras will be installed in the discussed spaces, the posters put up and conscious awareness in the employees created. Records concerning the quality of their drug supply and their yearly revenue will be acquired before the trial begins. There will be two check-in points, six months apart, within the year. During these check-in times, the condition of the AI software and the cameras will be checked over to ensure efficiency. The revenue generated by the hospital will also be noted. Furthermore, surveys will be given out to patients who visited the hospital during this period so to record their opinions on the hospital service. Comparing these records of the different periods will give us an idea of the impact on productivity that the trial has had. And after acquiring these results, planning can begin to expand the implementation of this scheme to other hospitals.

Nonetheless, setting up a database for the general population will be a major challenge when expanding the surveillance structures. This project, due to its novelty, will be focused on hospitals in the Lagos Island local government at first. I chose this area because Lagos Island is one of the more developed areas of Lagos and would most likely have the infrastructure available to support the surveillance structures. A suggestion to overcome the database challenge would be to hire a popular database software company (for example the Oracle Corporation) and partner with the Nigerian government to begin the digitalization of citizen records. A lot of discussion and communication is crucial to get everybody on the same page. It will be very time and resource consuming as it is difficult to collect data on the population of this area. However, if this goal is achieved, the benefits are multifold.

It is also important to discuss the specific impacts that these measures may have on Nigeria. Some are obvious i.e. the improvement in security and the reduction in corrupt acts, while some other impacts are not as obvious. With increased surveillance structures, there will be a reduction in the number of rotations a doctor has to perform to check on the patients as the AI software will shoulder some of the workloads. This decrease in interaction lessens the chances of infections spreading between doctor and patient. Due to the Covid-19 virus, this point has become even more pertinent. In Nigeria where some doctors do not have the appropriate protective equipment available, a reduction in interactions with patients can go a long way in protecting them from the virus.

These benefits are not limited to just the health sector. Previously, I mentioned that information from various organizations would be integrated as part of my proposal. With this general information on citizens becoming available, it will be easier to keep track of patients who owe

the hospital money, and this can then translate to higher cash flows in the economy. With a higher cash flow, the cost of healthcare would become more affordable over time.

When talking about surveillance, we must highlight the balance between information and privacy so to maintain good hospital-patient relationships. Only basic information will be public; private and sensitive information will be shared only with relevant stakeholders and only with the patients' consent. The power will be in their hands. These are only some of the benefits available for increased surveillance. I do recognize that the Nigerian healthcare sector requires more than just an increase in surveillance to be fully rehabilitated, but I believe that this is a step in the right direction.

CLAIR, Un Pas En Avant Vers Un Air Plus Pur

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La pollution de l'air est l'un des problèmes majeurs du 21e siècle. Ce phénomène, aussi dangereux pour l'environnement que pour l'être humain, représente une altération de la qualité de l'air. Il est souvent caractérisé par la présence de particules en suspension dans l'atmosphère.

Parmi les causes principales qui alimentent ce type de pollution, on retrouve les procédés industriels. Nombreux de ces derniers consistent à libérer un excès de gaz ou de liquides qui sont brûlés grâce à un dispositif de combustion. Ce processus est appelé le torchage de gaz et représente une source conséquente de pollution atmosphérique. Néanmoins, d'autres causes, telles que les véhicules à moteur ou les centrales thermiques sont également non négligeables.

Afin de déterminer les conséquences de la pollution de l'air, plusieurs études sont menées. Des données publiées par l'Organisation mondiale de la santé (OMS) (World Health Organisation, 2018) démontrent que sept millions de décès sont causés chaque année par ce phénomène. En effet, lorsqu'on respire, certaines particules fines, qui ne peuvent être naturellement éliminées par le corps, continuent leur chemin vers les poumons. Par conséquent, elles représentent une cause directe de nombreuses maladies respiratoires, pulmonaires et cardio-vasculaires.

Parmi les régions les plus touchées, on retrouve l'Asie, en première position, qui comptabilise plus de deux millions de morts par an, au même titre que les régions du pacifique occidentale. L'Afrique, quant à elle, totaliserait un million de décès chaque année, suivie par la région méditerranéenne orientale et la région Européenne dont les chiffres s'élèvent à 500 000 morts par an. En dernière position, la région des Amériques indique plus de 300 000 décès dus à la pollution de l'air.

Pour lutter contre ce fléau, il existe plusieurs moyens ayant pour but de contrôler la pollution atmosphérique. Les capteurs, par exemple, font partie des technologies les plus utilisées. Ces petits objets sont dotés de la capacité à mesurer la qualité de l'air en identifiant le taux de polluants qui le composent. D'ailleurs, leur installation dans les usines et les

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centrales thermiques se multiplie.

L'intelligence artificielle, la robotique, les drones et les objets connectés peuvent également servir à contrôler et prévenir la dégradation de la qualité de l'air. Les techniques récentes d'intelligence artificielle possèdent le potentiel nécessaire afin de contribuer à une meilleure compréhension, prévention, voire à la réduction de la pollution. Grâce à une analyse plus précise, il est possible d'en identifier les causes et conséquences directes car, malgré les nombreuses recherches et travaux dans le domaine, l'impact réel de la pollution reste à ce jour flou, considéré comme sous estimé.

D'après une étude récente supervisée par Microsoft, on estime qu'une exploitation optimale des outils d'intelligence artificielle, pourraient, d'ici 2030, contribuer à une réduction de 2.5 à 4% des émissions de carbones, qui sont une cause majeure de la pollution de l'air.

Parmi les travaux dans ce domaine, on retrouve un grand intérêt pour les techniques d'apprentissage profond (Deep Learning) dans la prévision des pics de pollution en utilisant des données sur la composition atmosphérique. L'apprentissage profond peut se résumer en trois étapes. D'abord, le choix et la préparation d'une base de données adéquate. Ensuite, le choix d'un algorithme d'apprentissage et enfin, la phase d'apprentissage qui sert à créer un modèle dit « de référence » capable de réaliser des prédictions. Grâce à ces techniques, on constate dores et déjà des résultats prometteurs, que les auteurs citent dans (Ayturan et al.,2018) et qui indiquent qu'il serait possible de prédire le niveau de pollution jusqu'à 120 heures à l'avance.

Les objets connectés attisent eux aussi l'intérêt des spécialistes. On retrouve dans certaines villes des installations de ces derniers sur les routes dans le but de fluidifier, contrôler et optimiser le trafic routier et ainsi, diminuer la pollution.

Néanmoins, on remarque que la majorité des études menées dans le domaine de la pollution de l'air se focalisent sur l'analyse de la composition de ce dernier, c'est-à-dire des particules. La plupart utilisent des outils sophistiqués, complexes et difficilement procurables, qui sont initialement destinés à un usage professionnel. Notre projet, intitulé CLAIR, a pour but de développer un outil logiciel simple qui permet d'avoir des informations en temps réel sur la qualité de l'air à partir d'images. Il s'agit d'un modèle intelligent qui utilise la vision par ordinateur afin d'estimer le niveau de pollution.

Ce projet est inspiré par Skikda, une magnifique ville côtière de l'Est de l'Algérie. Récemment, Skikda s'est imposée parmi les destinations les plus prisées par les touristes. Grâce à ses longues plages aux eaux claires et limpides, et à son climat souvent doux et ensoleillé, la ville suggère une atmosphère pure où la verdure prend le dessus sur la vie urbaine. Mais la réalité est différente car, depuis plusieurs années, la ville suffoque sous un air de plus en plus pollué. En effet, Skikda possède l'une des plus grandes zones industrielles du pays, occupée par la Société nationale de gaz et de pétrole. Plus de la moitié de sa surface est monopolisée par le pôle industriel. De ce fait, chaque jour, les citoyens respirent un air impur, pollué par le torchage du gaz qui ne peut être exploité pour des raisons techniques, économiques ou de sécurité. Ce dernier est brûlé de manière ininterrompue causant des effets alarmants sur la ville. On peut aisément constater, en allant à la plage, le feu jaillir des torches en action. Leur effet est tel, que même à travers une vue satellite on aperçoit un nuage de fumée noire qui surplombe la ville.

Le projet CLAIR vise à contribuer à la réduction de la pollution de l'air. Il consiste en trois étapes principales. D'abord, en raison de l'absence d'une base de données d'images

de pollution atmosphérique, nous construisons la nôtre en prenant des photos grâce à des Smartphones. Nous nous concentrons principalement sur les zones adjacentes au pôle industriel, où la pollution est clairement visible. Les images sont ensuite étiquetées et divisées en trois classes selon le niveau de pollution, à savoir, faible (ou inexistant), moyen et élevé. Ensuite, nous réalisons un apprentissage profond afin de doter le modèle de la capacité à estimer le niveau de pollution à partir de données visuelles. Pour cela, nous utilisons un réseau de neurones connu pour son efficacité dans des tâches similaires, à savoir, le réseau de neurones convolutif. Enfin, une fois que le modèle parvient à atteindre des résultats satisfaisants, nous l'intégrons à un système dotés de capteurs connectés dont la tâche est de vérifier la composition réelle de l'air en termes de particules. Cela nous servira à réaliser un apprentissage par renforcement afin d'améliorer la précision du modèle.

En intégrant ce dernier dans une application mobile destinée au grand publique, nous espérons récolter un nombre conséquent de nouvelles informations sur la pollution de diverses régions en Algérie mais également dans le monde. Ces précieuses données serviront à une meilleure compréhension du problème et au développement d'un outil de prévision de pollution atmosphérique. Une version de CLAIR est également prévue pour un usage professionnel. Il s'agira d'un logiciel qui pourra être intégrée dans les machines industrielles, centrales thermiques, etc., afin de contrôler les émissions de polluants de ces dernières.

En plus de l'intérêt principal du projet, nous espérons que cet outil contribuera à sensibiliser les gens sur le danger qui les entoure. D'abord, il encourage les professionnels à ne pas négliger l'impact environnemental des machines et à considérer de plus en plus l'optimisation des zones industrielles. Ils auront à leur disposition un outil performant et dont l'installation ne nécessite pas de changement dans leurs infrastructures.

Ensuite, nous croyons que grâce à sa simplicité d'utilisation, CLAIR va créer un élan de curiosité chez les utilisateurs en les poussant à vouloir connaître la qualité de l'air qu'ils respirent. Par conséquent, cela développera en eux une volonté de contribuer à protéger la planète afin de retrouver un environnement plus saint et plus sûre pour eux et pour les générations futures.

Pour conclure, nous espérons, à travers CLAIR, aider à éveiller les consciences afin que chacun contribue à préserver la planète avant qu'il ne soit trop tard.

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Category: STUDENT **Position: 5th**

Artificial Intelligence in E-Governance

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Introduction

This paper seeks to examine and demonstrate the manner in which artificial intelligence in electronic governance (e-governance) can essentially improve good governance to safeguard the effectiveness and efficiency of indispensible public service delivery. Initially, it will be necessary to briefly outline what actually are AI and E-governance, respectively.

Artificial intelligence (AI) also called machine intelligence is a comprehensive division of computer science concerned with structuring smart technologies capable of executing tasks that usually necessitate human intellect. AI talks about the replication of human intellect in machines, programmed to reason and imitate the performances of human beings. The word can also be relevant to any device that demonstrates qualities connected with a human thinking for instance problem-solving and research.

The ultimate quality of non-natural intelligence is its capacity to give good reasons as well as capturing measures that ensure the finest opportunity of attaining a particular target.

E-governance or electronic governance is the use of electronic technology for providing government essential services, sharing of information, exchanging transactions, incorporation of several impartial structures between the public, employees, businesses and the government. It is regularly connected with back office practices and collaborations within the whole government framework. The government services can be made accessible to the public in a suitable, proficient, and transparent approach through electronic governance.

Amongst the enormous record of government roles and duties, enactment of changing procedures, forwarding documents to several fronts, providing services, facilitating trades to withstand, preserving law and order, diminishing the cost of living, etc., would be main

preference. The consultation and collaboration interval between government, citizens, employees and corporations prior to executing a law or a policy is the main barricade. E-governance talks about the tactical incorporation of intelligent systems to generate a modest, ethical, responsible, approachable, reasonable, and transparent atmosphere which is comfortable and cost minimal for networking between public, employees, businesses, and the government.

In the following section I describe some of the reasons for E-governance.
Firstly, it makes the process of collecting and gathering information on the citizens and businesses easier for the government. It assists citizens, employees, and the businesses to take part in the procedures of decision making, prior to initiating a new policy while enhancing citizens' hopes towards increasing capacity of the authorities to address the needs of the society. Also it extends the provision of virtual services and the use of technology for tactical planning and attainment of the progressive targets of the government.

Machine Intelligence is the right approach to eradicate deceptions by programming and maintaining the services transparency in the data that is communicated and accessed by the public or interest group.

Understanding AI in E-governance:

Governments can use Artificial Intelligence to strategize, enhance policies and create sound decisions, get better communication as well as engage with citizens and businesses to develop the quality and reliability of public services.

The United Nations has urged its membership to incorporate intelligent applications towards improving the governance and providing services more faithfully to citizens. In addition, the United Nation targets implementing e-governance to support developing and under-developed nations in minimizing the expense and time of the government for enhanced economic development. Machine Intelligence with its sub-domain technologies has the capacity to revolutionize some present-day fundamental limitations to deliver government functions.

The majority of the government procedures in developing and under-developed nations conduct paperwork as an essential segment of their governance. Hence apportioning, accomplishing, as well as forwarding documents within departments can be very timewasting. Likewise, occasionally, the paperwork to make an important decision. Consequently, computerizing various functions moderates the paperwork and saves valuable time of government.

Artificial intelligence in e-governance assists in resolving citizens' demands in lesser time, enabling accessibility to information concerning all government services, and each of the government services, when needed, are just a click away. It can improve a wide range of applications, and we shall review some of them to see how technological advancement can transfigure various areas for better governance.

Finance:

Artificial intelligence (AI) in finance incorporates everything from fraud detection to computerization of tasks. It allows computers to accomplish human tasks concerning customer demand, forecasting, modified client service, recommendations, as well as responsive and precise policymaking centered on huge multitudes of shapeless information.

Artificial Intelligence is therefore becoming essential for any financial institution expecting to be a leading player in the business. Machine intelligence in finance assists financial institutions with its ability to counter cyber-attacks and to prevent deception.

Digital finance reacts to the necessities of financial management and the issue of old-fashioned monetary composition by way of fashioning job more effective and efficient. Its primary benefit for financial services is the imposing computational quickness and "the analytical potential it offers" (Castleman, 2020), enabling faster as well as more reliable rulings, established on perfect analytical projections. The average financial service providers are using digital services, and digitalization is every essential for business institutions to remain pertinent and competitive in the industry. Monitoring and regulating financial transaction with electronic means can improve the performance of financial institutions.

Security:

As government controls certain key information concerning the citizens, businesses, and its government officials. Such information must be secured and protected from fraud perpetrators to avoid breakdowns of secretive data. Incorporating Artificial Intelligence system can strongly assist in systematizing as well as safeguarding the data with entrenched machine learning algorithms which detect interferences in the digital database and protect the data from cybercriminals.

Justice:

Regulating and implementing laws is a primary operation in every governance structural design. Establishing AI techniques can enrich and systematize the prevailing functionalities for enhancing the application of law and order. Enforcement of law involving "facial detection, identifying languages, drones, Robocop, autonomous proto cars, predictive analytics, and cyber defense", (SHARMA, 2019) are evolving and delivering research knowledge concerning the violations of law that are taking place in the contemporary world. Therefore, technology can assist in resolving problems and maintain justice.

Crime fighting and prevention:

Cybercrime refers to the criminal activities that are carried on a computer network. Preventing attacks and fighting crimes is every essential in modern-day world of digitalization, as large number of cybercriminals are committing cyber offenses, extensively. Consequently, there has been a considerable demand for electronic governance policies to address cybercrime, prevent attacks, risk, vulnerabilities, and condemn offensive threats.

Artificial intelligence as an academic discipline can prevent and protect information system in order to achieve the pertinent goal of preserving the integrity, availability, and confidentiality of system information resources.

Immigration:

Immigration management is comprehended as the diverse policies, strategies, procedures, and processes discussed and accepted by important actors at national or international level to plan a structure to administer the migratory movements in an orderly manner. AI can gradually revolutionize the migration sector and often move to perform tasks such as "identity checkings, border control and security, and analysis of information about visa and asylum applications" (Akhmetova, 2020), with the use of algorithmic decision making in immigration management.
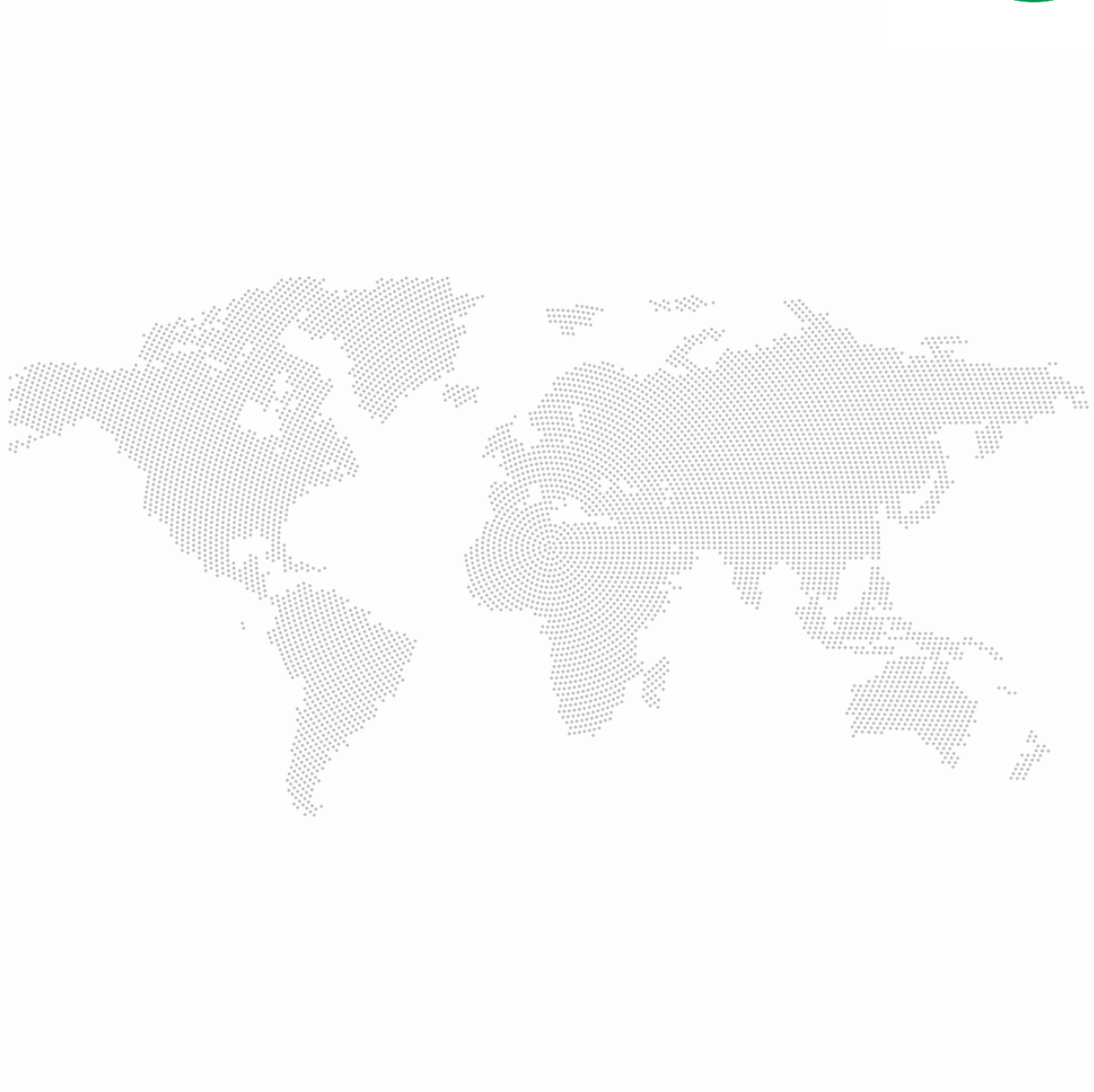
Emergency response:

Emergency response to natural disasters as well as main industrial calamities during emergency periods can be tardy as a result of governmental structural response sequences. But through AI automated system and predictive analytics, the authorities can predict the weather and other factors that facilitate in taking pre-emptive actions in addressing emergency issues.

Conclusion

AI in E-governance is digitalizing government services and functions with the integration of public, business, and government procedures on a single platform. Laws as well as Decision Regulation are becoming less complicated. Computerizations and digital interfaces are altering the dynamics of governance. The developing AI technologies are refurbishing the performance and stimulating the system to be extra public orientated. E-governance is bringing together citizens with the government by means of fashioning more transparency in the procedures of government throughout the entire domain.

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