Gulf Research Centre Cambridge
Knowledge for All

Workshop 2

Artificial Intelligence in the Gulf: Prospects and Challenges

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Abstract

Artificial Intelligence (*AI*), one of the hottest trends in modern technology, is projected to be a game changer in the global economy, with a contribution estimated at $15.7 trillion by 2030. In light of such crucial worldwide transformation, the Cooperation Council for the Arab States of the Gulf (GCC) is at a decisive crossroads. There is a critical need for strategies to be developed around *AI* in various sectors of the economy, both in order to capture this growing economic opportunity and to ensure competitiveness with other states and actors on the global stage. Moreover, and as much as those adoptions are necessary to remain competitive in the midst of the 4th industrial revolution, GCC countries will need to enable a change in paradigm so as to move from being pure adopters of *AI* to also become developers of the technology. This will require strategic investment in local human capital to research, fund and develop innovations in this space.

The goal of this workshop is to explore the current state, opportunities, and challenges related to *AI* in the GCC. It aims to attract participants from diverse disciplines and sectors such as: engineers, technologists, policymakers, political and social scientists,

educators, researchers and innovators, and experts in relevant fields. The resulting exchange of knowledge is integral to a better and clearer understanding of the challenges ahead of Gulf countries in their pursuit of *AI*.

Description and Rationale

Background

Although the term *AI* has appeared in literature as early as the mid-1950s [1], there still is some confusion with regard to its exact definition and context. The very early developments of *AI* were driven by the gaming industry, particularly to develop a computer program that can play chess [3]. After around half a century in 1997, a computer program (DEEP BLUE) won in a 6-game match against Grandmaster Gary Kasparov, demonstrating the success of *AI* and its ability to outperform the human brain at a given task [4].

Fast forward two decades, *AI* has now evolved from being driven by the development of computer games to complicated systems needed during our daily lives. As defined in a recent report by PricewaterhouseCoopers (PwC) [5], "*AI* is a collective term for computer systems that can sense their environment, think, learn, and take action in response to what they are sensing and their objectives." *AI* systems can have various levels of autonomy and adaptiveness, ranging from systems that assist humans to perform tasks more efficiently to ones with automated decision-making processes without any human intervention [5].

AI applications have gained a significant momentum in recent years across various sectors such as healthcare (e.g., medical data analysis and telemedicine), retail (e.g., product recommendations), manufacturing (e.g., assembly line automation), infrastructure (e.g., smart cities and driverless cars), finance and banking (e.g., fraud detection), and education (e.g., personalized learning).

Prospects

AI is a disruptive technology in today's' global economy. Beyond its implications on how people live and work, it has a tremendous economic potential that remains untapped both globally and at the GCC level. *AI* is predicted to contribute $15.7 trillion to the global economy by 2030 and US$320 billion to the Middle East economy (11% of GDP) [2].

Among the six countries of the GCC, the Kingdom of Saudi Arabia (KSA) is expected to benefit the most from the move towards *AI* with an expected contribution of US$135.2 billion towards its economy. The United Arab Emirates (UAE), in turn, will benefit from a contribution of US$96.0 billion, while the remaining four countries are expected to share a total growth of US$45.9 billion. In relative terms to the GDP of each country, the *AI* contribution to the UAE economy will be the highest with 14% of its GDP [2].

Acknowledging this tremendous economic potential, various *AI* initiatives have been undertaken in recent years especially in the UAE and KSA. Examples from the UAE include establishing a ministry for artificial intelligence [6], launching a national *AI* strategy [7], in addition to other initiatives such as the autonomous transportation strategy [8]. In turn, the Saudi government has identified digital transformation as a key enabler for its 2030 vision, which includes diversifying the economy and promoting knowledge-based sectors [9].

Despite the highlighted initiatives and overall economic potential of *AI*, related efforts have typically been segregated and remain limited in comparison to other growing economies such as China and India. Important barriers exist that hinder the full deployment of *AI* in the GCC. These include - but are not limited to - locally-generated knowledge, economic barriers, social risks, and rigid institutional and policy structures. As such, important questions arise and need to be further studied:

1. Are the Gulf countries on track to catch-up with the global push towards *AI*?
2. Are the current physical and institutional infrastructures ready for such transformation?
3. Is local talent available and ready?
4. Is the GCC economy ready for such job market evolution?
5. Will GCC countries be adopters of *AI* knowledge and technology or will they evolve to become effective developers and contributors at the local and national stages?

Workshop Goals

The goal of this workshop is to explore the current state, opportunities, and challenges related to *AI* in the GCC. Scholars and decision makers will discuss current challenges and practices currently adopted in Gulf cities. Promising and novel implementations of *AI* concepts and technologies will be mapped and assessed.

Throughout the workshop, the exchange of knowledge aims to bridge the current gap between different stakeholders such as government policy makers, researchers and innovators, and private sector entities. In addition, the workshop will specifically address the key elements that the GCC countries need to focus on in the next decade in order to leverage the potential of *AI* and transition towards more knowledge-based economies.

Workshop Scope and Proposed Topics

This workshop will have four general themes (T1 to T4) to address the prospects and challenges of *AI* in the Gulf. The themes are illustrated in Figure 1 and detailed below:

<u>T1–Technology and Infrastructure:</u> Big data, machine learning, Internet of Things (IoT), networking and transportation infrastructure, automation, autonomous cars, etc.

<u>T2–Education and R&D:</u> Industry research & development, *AI* training and skill development, new *AI* degrees and technical diplomas, role of academic institutions, etc.

<u>T3–Policy & Legislation:</u> Governance and regulations, *AI* and the law, cybersecurity issues, new emerging threats, etc.

<u>T4–Social Implication & Responsibility:</u> Robotics and machine ethics, social connections VS isolations, equality VS inequality, telemedicine and medical condition diagnosis, jobs made obsolete VS created, etc.
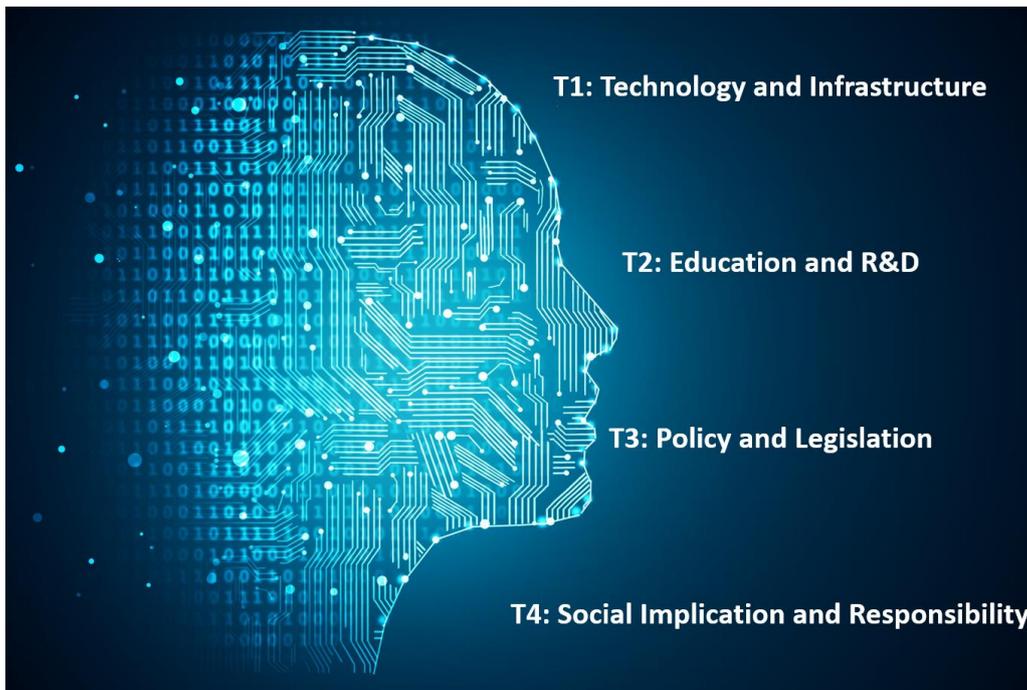
Figure 1. Workshop themes

Edited Book
An additional aim of the workshop is to publish an edited book based on the individual papers presented. It is hoped that this volume will fill a gap in the relatively thin but growing literature available on *AI* and its implication on Gulf's economies and citizens.

Contributions to Gulf Education, Research, Development, and Innovations
This workshop will provide a venue to discuss and debate the prospects and challenges of *AI* in the GCC. A collaborative effort is needed from various stakeholders within and between Gulf countries to align efforts and successfully leverage the power of *AI*. Such efforts require an active engagement of governmental entities, private sector, academic institutions, and citizens.
This workshop will enable and facilitate a multi-disciplinary discussion and exchange of knowledge and ideas. We hope that this will boost interest and research in the area and act as a catalyst for innovation, entrepreneurship, and R&D. Another contribution of this workshop is to set a framework and engage students, government officials, and policy makers to pave the way towards a smarter and more sustainable future.

Anticipated Participants

We encourage participants from various disciplines, including but not limited to: engineering, policy-making and governance, economics, social science, and data science. Applications and case studies from the Gulf region are highly encouraged. Researchers with Gulf region experience (both native and non-native) are also encouraged to apply. In addition, the workshop is also open to representatives of private companies, governments, NGOs, and think tanks. Papers are accepted from individuals, co-authors, and small group contributions depending on the topic and/or institution.
Potential topics for anticipated papers include, but are not limited to:

- Case studies of current *AI* initiatives in the Gulf
- *AI* potential assessment by sector (e.g., finance, healthcare, infrastructure, governance, etc.)
- Barriers to effective *AI* implementation
    - Economic
    - Infrastructure and technology
    - Political
    - Social/behavioral, etc.
- Opportunities and solutions
    - Automation
    - Smart cities
    - ICT technologies
    - Knowledge-based economy
    - Human capital development
    - Sustainable critical infrastructure, etc.
- Agents of change towards *AI* implementation
    - Role of public institutions and governance
    - Role of private sector
    - Role of academia
    - Role of citizens

Workshop Director Profiles

Dr. Elie Azar is an Industrial and Systems Engineering faculty at Khalifa University of Science and Technology in Abu Dhabi, UAE. His main research focus is on smart and sustainable buildings and communities through the modeling and analysis of complex building systems and human behavior. Dr. Azar has worked as a construction engineer and building energy analyst in North America, the Middle East, and Europe. He has also authored more than 40 publications in peer reviewed journals and refereed conference proceedings, book chapters, in addition to two books on sustainability and smart cities in the Gulf. His research has been internationally recognized on several occasions through various international academic awards. Dr. Azar earned his bachelor's degree in Mechanical Engineering from Ecole Polytechnique de Montreal, and his Master of Science and Doctorate of Philosophy in Civil and Environmental Engineering from the University of Wisconsin-Madison.

Mr. Anthony N. Haddad is a Senior Manager for Middle East Expansions at Amazon.com, and spends his time between Seattle and Dubai. Anthony's work at Amazon is focused on building scalable products and services in the digital and retail spaces across Asia, Europe and the Middle East. Most recently, Anthony helped to drive Amazon's acquisition of Souq.com, the incumbent e-commerce retailer in the Middle East, and is focused on product integration and expansions in the GCC and Middle East. Previously, Anthony worked in strategy management consulting, advising clients in government, telco and education in the GCC. Anthony's academic career includes a Bachelor of Arts degree from the American University of Beirut; a Master of Arts degree in foreign relations and economic development at the School of Advanced International Studies, Johns Hopkins, and a Masters of Business Administration degree from the Wharton School, University of Pennsylvania

Selected Readings

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Artificial Intelligence in the Gulf: Prospects and Challenges

Paper Presenter Abstracts:

Strategy for Artificial Intelligence in Bahrain: Challenges and Opportunities

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Abstract:

Artificial Intelligence (AI) matters because of the huge economic and social potential of this technology. This includes improving existing industries and disrupting markets. It is estimated that "AI could contribute up to $15.7 trillion [1] to the global economy in 2030." Currently, Bahrain has a considerable financial sector, several large telecom and energy companies, and is hosting AWS cloud computing's regional center. It has also started a drive toward entrepreneurship and IT startups, with several active incubators and accelerators.

However, developing the national capacity for utilizing the promise of AI requires a clear strategic approach that utilizes existing resources as well as introduces missing

key elements. This study will investigate the role of key stakeholders within the Kingdom of Bahrain in building a strategy for utilizing AI for economic growth. Active stakeholders include: the Bahrain Economic Development Board, the Information and eGovernment Authority, the research and higher-education sector, as well as major industry representatives such as telecom, as well as energy and aluminum companies.

A proposed strategy will be constructed by identifying stakeholders to ensure key elements necessary for the success of AI nationally, including: an overview of current use of AI, current state of access to data, the state of research and development in AI and its commercialization, capacity building and supply of skills in AI through higher education, and the support of adoption of AI within the economic and financial organizations.

Artificial Intelligence, Machine Learning and Blockchain: A Review and Research Challenges

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Abstract:

Recently, Artificial Intelligence (AI), Machine Learning and Blockchain have become three of the most challenging disruptive technologies that may revolutionize the technology industry in the modern world. In this paper we present a detailed review and research challenges of Artificial Intelligence, Machine Learning methodologies and its intersection with emerging Blockchain technology, its applications and platforms specifically targeting the programs initiated in Gulf region. We also identify the open research challenges and how it will revolutionize the academia and tech industries in Gulf region and specifically about the impact on day to day life of people in United Arab Emirates.

KPIs Impact on the levels of Innovation to Promote AI in Infrastructure Projects

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Abstract:

The whole world is in a race to harness the benefits of Artificial Intelligence (AI) to boost productivity and enhance its economy. The United Arab Emirates (UAE) has achieved a leap in delivering quality transport infrastructure, ranked the first worldwide . In the AI era, UAE was the first country to appoint a Minister of State for AI and announced its AI Strategy 2031 with the aim to increase GDP by 35% and reduce government spending by 50% annually . Transportation is a key sector that will have direct contribution to this strategy through using AI to reduce accidents, to cut operational costs, to reduce traffic and to legislate more effective traffic policies. To achieve these milestones, public-private partnership is expected to play a vital role in the economy.

The ambitious AI Strategy will be broken-down into more relevant and specific goals and projects as it cascades from national level to sector level, and ultimately, to organizational level. For example, Dubai has its own Autonomous Transportation Strategy which aims to achieve 25% of all trips in Dubai using autonomous technology in 2030. Therefore, the alignment of the national AI Strategy execution with that at organizational level requires the adoption of carefully designed Key Performance Indicators (KPIs).

The aim of this paper is to investigate the effective deployment of KPIs to control the execution of UAE AI Strategy in the transportation sector.
The research objectives are
- Examine how entities use innovation to come up with initiatives related to their fields.
- Investigate how the national AI strategy is cascaded down to different entities.
- Investigate how KPIs are used to measure and monitor the performance of different entities towards reaching the strategy objectives.
- Examine how KPIs affect employees' performance and motivation to reach the desired results.

The research presents the analysis of case studies in UAE organizations that have embarked on using AI. It will examine their use of KPIs to support the adoption of AI. The research developed a framework for the analysis, selection and implementation of KPIs through understanding the role KPI can play in promoting the adoption of AI. The paper, also, examined the reasons for KPIs implementation failures, their impact on individual and team effectiveness, and effectiveness in AI Strategy implementation.

Two case studies of organizations, involved in the delivery and operation of transport facilities, representing public and private sectors, are analysed to examine their approach to the selection and adoption of KPI to support their AI strategy. These organizations are taking substantial steps towards implementing AI using KPIs.

The research demonstrated how the effective selection and adoption of KPIs enabled management to develop a clear focus for innovation that delivered progress towards the achievement of the organisations' AI goals. There was evidence that the effective KPIs have contributed to enhancing the AI maturity levels with the examined organisations. On the other hand, this study proved that innovation is hindered by the excessive pressure caused by KPIs systems. Such pressure resulted in repelling talents and unethical employees' practices.

The benefits of Machine Learning (ML) and Artificial Intelligence (AI) for healthcare applications

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Abstract:

The increasing interest in healthcare knowledge of data has heightened the need for Artificial Intelligence (AI) and Machine Learning (ML) algorithms and tools suitable to predict decisions in the heath domains. Artificial Intelligence specifically the sub-fields of machine and deep learning provides optimal cost-effective options to expand the universe of knowledge and solutions in healthcare. In this context, the main aim of this paper is to present a research study, extending AI and ML algorithms in order to empower healthcare practitioners and academics to understand and decide for serious health problems.

With the introduction of the AI and ML we can accumulate, analyse, and elaborate on all the structured and unstructured data collected and obtain valuable insights. The combination of AI and ML is a research area that presents interesting challenges for the future of healthcare. These new challenges are related to the application of AI/ML algorithms into the healthcare ecosystem.

In this paper, we initially present a study of the applied machine learning algorithms for healthcare. We present the most commonly used methods to answer different types of questions in healthcare analytics. Based on the type of questions answered, there is another useful way to define ML algorithms. There are two types of ML algorithms, supervised and unsupervised training algorithms. Methods that require input data with

known label are called supervised training algorithm, and these that do not require prior knowledge of what answers are expected are called unsupervised. The majority of the ML algorithms applicable in healthcare are supervised learning algorithms. For supervised learning algorithms, we need to focus on data fidelity specially for the training data. This is particular challenging in healthcare, when unstructured data is critical and data comes from multiple sources. Also, we present best practices for successful ML algorithms providing different use cases.

The GCC and Global Health Diplomacy: The New Drive towards Artificial Intelligence

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Abstract:

Health diplomacy has become an important part of the global efforts to serve communities. Its importance has been increasing in recent years as there has been a marked intensity in public or academic writings in this field. In recent years, the GCC states allocate huge financial resources for their health sectors as part of their strategic visions. Health diplomacy plays a critical role in this policy direction with the need for knowhow and the interdependence of our world. The GCC is also planning to be one of the top destinations for healthcare worldwide. The momentum in health sector is reflected in the different GCC visions such as UAE vision 2021, Qatar Vision 2030, Saudi Arabia Vision 2030, Kuwait vision 2035, Bahrain vision 2030. The paper will look into Artificial Intelligence as central to health sector in the post hydrocarbon future of the GCC. It will provide an overview of the GCC efforts in AI in the health sector and its international cooperation in this sphere. The paper will discuss the GCC investments in the field of AI in health sector as it will contribute in their future economies. The premise of the paper is that the financial resources provided by the GCC in the field of AI in health sector for the transformation of their economies will lead enhance global health diplomacy. The paper claim that this new area has a huge potential in research and needs to be further investigated.

Regulating Artificial Intelligence Systems: a Regulatory Proposal for Qatar

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Abstract:

With the acceleration of Artificial Intelligence (IA), applications and the advances in computing and robotics, many valid concerns have been raised regarding the future impacts of IA on social and economic aspects of the society. On the one hand, new technologies offer new opportunities for governments and policy-makers to reach the maximum potentials of the data sources available for managing and directing the societal assets in smarter and more innovative ways. On the other hand, relying on new technologies and robotics poses fundamental threats, as governments create independent agents, which can act autonomously from human beings, invade their privacy, and make decisions on their behalf. This situation with all ethical, economic, legal, and security aspects raises a fundamental question about the role of government in regulating IA. In other words, where should governments intervene to draw the line between the potential benefits of using AI, and the expected risks resulting from the utilization of AI applications? To answer this question is to address the regulatory challenges facing governments in minimizing the potential hazards associated with the widespread utilization of modern technological applications on the people in the society. In this context, the paper argues that recent developments in AI calls for a regulatory intervention form governments in order to strike the balance between potential benefits and the expected threats for AI. Nonetheless, any attempt to regulate the AI is bound by the meaning with associate to this concept as AI means different things to different people and poses divers types of risks in different policy domains. In order to follow-up on this argument, the paper examines the regulatory efforts made by the Qatari government to ensure safe access and utilization of new technological applications.

Knowledge, Attitude and Perceptions of Financial Industry Employees Toward AI in the GCC Region

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Abstract:

This paper aims to highlight the knowledge, attitude and perceptions of professionals working the financial services industry in various countries in the GCC region. The financial services industry is at crossroads around the world due to successive waves of innovation from mainframes, databases, desktop, and personal computing, business

software, big data, internet of things (IoT) and Artificial Intelligence (AI). Many start-ups such as Financial Technology (FinTechs) providers are challenging the traditional banking system by offering faster services without compromising on compliance and risk. By the end of 2017, almost US$2 trillion worth of the total assets were held by the GCC financial institutions. However, financial institutions in the GCC region are taking a hit as costs rise and income drops. However, recent unprecedented developments in big data, virtual reality, e-commerce, machine learning, and AI offers enormous business opportunities to financial institutions.

An online and paper-based quantitative questionnaire is developed to obtained the responses of 157 professionals from six GCC countries. Descriptive and inferential statistical methods used to analyze the data using SPSS. The nature of this study is empirical.

The findings show that the overwhelming majority of the respondents are familiar with AI from a business and finance perspective.

The research also shows that an overwhelming majority of the respondents in the GCC countries are concerned about ethical, security and data privacy issues. This research is novel in many aspects such as it provides an overview of what is happening in the area of AI in the GCC. Moreover, this study sheds light regarding the awareness of the professionals towards AI in the financial industry.

Free Zones in Dubai: Accelerators for Artificial Intelligence in the Gulf?

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Abstract:

The government of Dubai is committed to advancing artificial intelligence (AI) innovation across the emirate and within the United Arab Emirates, where national strategies and economic policies aim to develop a technology-driven, knowledge economy. Since the 1980s, Dubai has implemented another economic strategy built, in large part, upon a free zone-led development model. The January 2019 launch of the emirate's 50-year charter demonstrates Dubai's long-term commitment to free zone development. This article argues that AI and free zone-centric economic strategies need not proceed in parallel. Rather, better alignment between AI innovation and ongoing free zone developmental processes not only complements a range of economic policies, from diversification to coordination between emirates, but also maximizes the impact of AI services and applications by providing an amendable and sustainable environment for AI technologies.

Artificial intelligence and security in the Gulf

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Abstract:

Artificial intelligence (AI) and security are closely linked issues. On one hand, as algorithmic methods for predicting consumer and citizen behaviour become widely adopted, their success is dependent on access to massive datasets directly including or enabling the inference of sensitive personal characteristics. AI also exacerbates existing security risks to businesses and governments from the deletion, manipulation, and theft of valuable data. Such risks are especially high in the Gulf due to the combination of concentrated global capital, knowledge-intensive industries with variable understanding of cybersecurity risks, and international supply chains that introduce significant vulnerabilities. On the other hand, AI itself provides an important new avenue for research and product development in security, offering scalable real-time threat detection and increasingly automated responses. By increasing the capability of existing security tools, AI also creates new dangers related to privacy, censorship and surveillance.

Despite the close connection between AI and security, security does not feature on the AI agenda in the six states of the Gulf Cooperation Council (GCC): Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates (UAE). This paper investigates the reasons for this omission, arguing that the GCC states may use AI for security purposes but without openly acknowledging this aspect of their AI adoption. It suggests instead that a more transparent acknowledgement of the security uses of AI systems, and an inclusive approach to their development, could prevent inadvertent insecurities and a reduction in individual freedoms.

AI and 4IR skill development ecosystems in the Gulf: Capacity-building for localised specialisation and innovation

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Abstract:

We first provide a circumscribed review of a number of recent studies and reports, initiated globally and expanded regionally, that highlight the challenges and opportunities of AI and 4IR. We provide a few necessary definitions and then outline a skills formation category for individuals and companies to build capacity and capability so as to significantly and sustainably participate in the current wave of AI and 4IR activities, within the Gulf region. Whilst acknowledging the previous work on the education and training systems (and the increased emphasis on promotion of STEM subjects and 'coding-for-all' initiatives as a potential long-term skill re-orientation) in a number of regional locations, we focus on the learning and upskilling required for participating and innovating in the nascent yet practical use cases and projects2 at workplaces. We have outlined [and at a later iteration, will expand upon] two case vignettes and our geographical focus remains on the city-level context of Dhahran and Tehran, exploring the in-situ learning episodes and upskilling strategies.

In the second part of the paper, we acknowledge the 'innovation imperative' within the current state of play in use cases, particularly by enterprises, whether local or foreign multinationals in the Gulf. We draw conceptually on ecosystem-inspired models for skills development and progression. Starting with the contextual factors (e.g. '4Ts model'), we expand upon the recently introduced 'social ecosystem model' and workplace analytical and conceptual tools such as skill webs. We point to the prominent use of ecosystems as a vehicle of talent and skill development as well as in-project upskilling (such as in domains of interprofessional learning and judgement capability) which forms a core ingredient for technical innovation. Lastly, the third part of the paper point to recent policy learning vistas in the Gulf along impact scenarios on two key dimensions of diffusion and consequences, and concludes.

Comparing Machine Learning Methods Predicting Student Performance Using Pre-Admission Data

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Abstract:

Students' success has recently become a primary strategic objective for higher education institutions. Budget constraints are forcing universities to pay more attention to sustain students' enrollment without compromising quality of education. With the proliferation of big data analytics and Machine Learning, universities are increasingly relying on students' data to predict students' performance. Most research uses data captured during the students' first academic year. In this paper, we compare Machine Learning methods to determine the most accurate one in predicting student performance using data available prior to the start of the academic program.

Machine Learning & A.I. for Entertainment Apps

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Abstract:

Applying Machine Learning (ML) & Artificial Intelligence (AI) allows organizations to transform their customer experience by connecting the right users with the right pieces of content or other users around content. In this paper we explore methods of implementing ML & AI, opinions on what an organization needs to implement successful models and user experiences and how we do it at Anghami for recommendations at scale millions of times a day. We show how we approach ML to cater for our users that are mostly concentrated in the GCC region and the iterative process we follow to continue to deliver and improve upon our users experiences.

The Art and Science of Data and Mind Control: AI in the UAE and Beyond?

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Abstract:

The application of Artificial intelligence (AI) algorithms are extensively improving everyday tasks worldwide. Surfing the internet has its transformational benefits but also its severe drawbacks. Recently, companies started harvesting and selling user data in exchange to getting free access to their websites and social media platforms, AI algorithms would personalize the content shown to the users based on their inputs. Research found that significant success in influencing users' views in matters ranging from political stands to promoting product sales was achieved using this approach. Internet corporations are currently deliberately exploring vulnerabilities in human psychology via psychologists who devise methods to "design minds" and hook users

interminably. This way companies keep users engaged online as long as possible and advertising income is maximized. Better knowledge and understanding of the human information processing mechanisms may confer advantages in this strategy. Recently, in-depth discussions have been taking place about the many benefits that AI brings to the table, as well as its immanent downsides and their ethical considerations. This includes privacy concerns and limits of freewell versus the ability to predict human actions in the age of AI. This paper will discuss some of the strides and challenges of these implications globally and in the United Arab Emirates (UAE) in specific.

Women and the Fourth Industrial Revolution: An examination of the UAE's national AI strategy

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Abstract:

Although industrial progress may be relegated to just a few lectures in the class of world history, the speed at which that progress was made stretched across centuries. What has been dubbed the "Fourth Industrial Revolution (4IR)" however, is expected to happen in just a manner of decades. In fact, it has already begun, changing every aspect of modern society by "blurring the lines between the physical, digital, and biological spheres" thanks to the exponential advancement and adoption of technologies, such as artificial intelligence (AI). As Klaus Schwab, Founder and CEO of the World Economic Forum and author of The Fourth Industrial Revolution, wrote in 2016:

"The speed of current breakthroughs has no historical precedent. When compared with previous industrial revolutions, the Fourth is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance."

The 4IR is an extension of the First, Second, and Third Industrial Revolutions. The First stretched from the late 18th century until the beginning of the 19th century and saw the rise of mechanization. The Second began at the end of the 19th century until the early 20th century, characterized by the widespread adoption of new energy sources such as gas, oil, and electricity, as well as the development of telecommunication systems. The Third began with the rise of computers in the late 1960s and eventually saw the mass adoption of digital technologies and the Internet of Things (IOT). The Fourth (or the 4IR) builds particularly on the Third Revolution's "data-centric foundations."

The impact of the 4IR on global competition and the international balance of power depends on how organizations and governments decide to utilize the technologies associated with the 4IR, particularly AI. Due to the fact that AI is a general-purpose technology, it has the potential to touch on almost every aspect of modern society, from making our smartphones even smarter to altering the nature of warfare due to the proliferation of lethal autonomous weapons. Who will dominate in this new era? Paul

Scharre, senior fellow with the Center for a New American Security (CNAS) and Michael Horowitz, professor at the University of Pennsylvania argue that the dominant nations will be those "with access to the best data, computing resources, human capital, and process of innovation..." Further, a 2018 CNAS report detailed the key elements of national power in the 4IR, these include:

- Owning large quantities of the right type of data
- Training, sustaining, and enabling an AI-capable talent pool
- Computing resources
- Organization incentivized and aligned to effectively adopt AI
- Public-private cooperation
- The willingness to act

Another key element, implicit in those outlined above, is the inclusion of women in the development, deployment, and governance of AI. Not only is the inclusion of women a matter of national economic and military dominance in the 4IR, but more importantly, it is a matter of ethics and humanity. As stated in the WEF's 2018 Global Gender Gap report:

"The age of the Fourth Industrial Revolution (4IR) brings about unprecedented opportunities as well as new challenges. To take full advantage of new technologies, we need to place emphasis on what makes us human: the capacity to learn new skills as well as our creativity, empathy and ingenuity. By developing our unique traits and talents, humanity can cope with increasingly fast technological change and ensure broad-based progress for all. The equal contribution of women and men in this process of deep economic and societal transformation is critical."

Governments across the world are jockeying for power in this new era by developing national AI strategies. To date, however, only 18 countries and/or regions have coordinated national AI strategies, and despite the importance of "owning the right type of data" and "enabling an AI-capable talent pool," which undoubtedly must include women, no single national AI strategy outlines women's inclusion, or gender more broadly, as an exclusive strategic priority. Unfortunately, adequate data and theories regarding this topic are not yet available due to the fact that most national AI strategies have only been made public since 2017-2018 and are vague at best. Thus, academic research into the political and national strategies around AI beyond national security considerations are scant. Although notable work is currently being done at research centers such as the Future of Humanity Institute at the University of Oxford. To assist in informing future research on this topic, this paper will focus on the following questions:

Is ensuring the participation of women in the development, deployment, and governance of artificial intelligence (AI) vital to the future success, security, and prominence of nations in the 4IR? If so, should women's inclusion in AI be considered an exclusive priority in national AI strategies?

I conclude that women's inclusion in AI is a significant factor in ensuring the successful development, deployment and governance of AI, and therefore should be included in national AI strategies. This is for a variety of reasons which can be grouped into three broad categories, outlined below:

- • Social–AI has the potential to exacerbate and entrench existing bias and inequality, particularly gender and racial inequality
- • Security–Due to the fact that AI is a general-purpose technology, it has the potential to impact every aspect of society and this can have a major impact on national and international security
- • Economic–As governments jockey for power in the 4IR, they need a workforce with the skills and abilities to match labor market demands, this includes AI skills and expertise

For this research, I focus particularly on the economic category and the importance of including women in strategies to "train, sustain, and enable an AI-capable talent pool," one of the key elements of national power in the 4IR listed by Scharre and Horowtiz. I examine the research questions from a qualitative approach utilizing academic research from a variety of fields, such as security, business, science, technology, women and gender studies as well as relevant news articles and data from government and intergovernmental organizations, to understand the current status of women in AI and why women's inclusion is important.

In the first section of this paper, I will examine more broadly the status of women in the 4IR and why women's inclusion is important. Then, I will briefly examine the current state of national AI strategies and their priorities as categorized by the Canadian Institute for Advanced Research (CIFAR), and finally, proceed to examine the United Arab Emirates (UAE) as a specific case study in order to further contextualize this research. The use of the UAE as a case study, or the use of a case study at all, is important due to the fact that to-date, national AI strategies are quite varied and difficult to study from a broad perspective. Therefore, examining a specific case study offers a better analysis of the research questions. In particular, the UAE is a useful case study because it has not only made AI a significant national strategic priority–evident in the creation of its UAE Strategy for Artificial Intelligence and the world's first Minister of State for Artificial Intelligence in 2017–but it has also indicated that the "empowerment of women" is a national strategic priority with the launch of the National Strategy for the Empowerment of Emirati Women in 2015. The UAE has also led the way in the Gulf region in the pursuit of both of these priorities by establishing advisory councils, government initiatives, and allocated funding for programs.

In my conclusion, I suggest that a potential strategy to include women in national AI strategies is "gender mainstreaming," defined as "the deliberate consideration of gender in all stages of program and policy planning, implementation and evaluation, with a view to incorporate the impact of gender at all levels of decision-making."

"Women's inclusion" in this paper refers specifically to the active integration of individuals who identify as women in the development, deployment, and governance of AI. "Development" refers to the AI talent pool that is developing the technical aspects of this technology (such as facial recognition, predictive analytics, speech processing, etc.), and is the main focus of the UAE case study. "Deployment" refers to the utilization of AI technologies by governments, organizations, companies, civil society groups, etc. in their operations, strategies, products, services, and/or other activities. "Governance" refers to the local, federal, and/or international policy and legal space.

This research uses the gender binary of "women" and "men," and therefore does not address the issues exclusively facing individuals who identify as nonbinary or gender nonconforming. One of the primary reasons for this focus is that most of the data collected on gender in the labour market and in education is based on the binary, particularly in the Gulf Cooperation Council (GCC), of which the UAE is a member. Of course, this lack of disagregated data is an issue in and of itself, and the focus on the gender binary also often results in essentialism and further discrimination. As the AI Now Institute explained in its 2018 report when referring specifically to STEM pipeline research, "the persistent focus on gender as a binary often results in treating it as a biologically essential category that maps to certain attributes," which then leads to the implication that "the problem is one that resides within women's individual psychology...as opposed to an issue with the institutions and their cultures. Although it's beyond the scope of this research, it's important that researchers in this space work to broaden the perception of "gender" in the field of AI to address particular issues faced by individuals and groups who are not included in the gender binary.

By examining whether or not women's inclusion in AI is fundamental to the future success of nations in the 4IR, the hope is that this research may lead to further research regarding several important questions related to AI, including why nations that have national AI strategies to-date have not made women's inclusion a strategic priority and how they should do so. These questions are outlined in the conclusion of this paper.

Facing a Utopian Future: Comments on Robotics and Artificial Intelligence from Islamic Perspective(s)

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Abstract:

The aim of this article is to approach comments on robotics and artificial intelligence from Islamic perspective(s). Since the discourse on these new technologies has emerged quite recently and there are Islamic initiatives preparing guidelines for the use and construction of AI and robots, which have not been published yet, this article will use the analysis of fatwas as a starting point. The analysis will be done through the lens of following questions: To what extent can Islamic positions on AI and robotics be found in fatwas? What statements are made by the Islamic scholars? How do the attitudes differ between robotics and AI? The 14 Arabic and English Islamic legal opinions I analyzed were all coming from the Qatari based web pages Islamweb.net and were issued between 2002 and 2019. An analysis of the content and the methods showed that the Islamic scholars (1) have a fairly clear stance on the treatment of robotics but not on AI (2) are not concerned that these technologies could harm humans or that their creators usurp God's power to create and (3) rather tend to avoid dealing with difficult issues such as the impacts of developing strong AI.

AI & Well-Being: Can AI make you happy in the city?

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Abstract:

Happiness and well-being have been high goals in society for a long time, and various cultures have interpreted these notions in a variety of ways. These interpretations have been rendered in the form of long running debates as well as more formal, practical and evidence-based models. The models have focused on different scales and contexts of well-being, from the individual and their Subjective Well-Being (SWB), to their needs in a city context, such as the ABCDE model of happiness needs (covering people's needs; Affective, Basic, Cognitive, Deeper, and Enabling), or the context of workplace well-being, as well as larger scales, as described by the Happy Cities Agenda, a model that illustrates the various design actions and enabling themes that promote a happier city that is Socially Smart. However, practitioners have always looked for ways of improving happiness in efficient and consistent ways. To this end, much research has focused on these goals by creating and developing tools, be they social or otherwise, to increase happiness. More recently information technology has helped society in achieving its goals in general, and Artificial Intelligence (AI) is the latest development in this domain, which uses data along with advanced algorithms in order to make even bigger leaps, by allowing machines to undertake tasks typically requiring human intelligence. Advances in AI have spanned a wide variety of applications, including well-being, health, and wellness. These applications have revealed themselves in various ways, where they are woven into everyday tasks to help people achieve more efficient and better-quality outcomes, or have been embodied by the various robots and devices that are appearing in homes and workplaces. AI has been seen in apps and robots that deliver specific functions and benefits, such as better sleep, fitness, and therapy, or as part of other services that are now better optimised or personalised, as well as in the health sector, where AI helps medical practitioners in being able to analyse symptoms and images, diagnose diseases, and take better decisions. This paper attempts to make sense of the connections and relationship between these various manifestations and mapping them to the way that happiness and well-being are understood in the various contexts of people's lives. This pragmatic approach aims to find the utility of AI towards happier lives from various perspectives, offering directions for further work to ensure a wider coverage for all aspects of well-being.