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Smart Cities: Intelligence, Framework and Machine Learning Algorithm

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Abstract: *The first definition about the smart cities was put forward by Caragliu as "The city is considered smart when its investment in man, socially improves quality of life through co-management." In this paper we will discuss about the technologies used in smart cities. A collection of varied variables established to the concept of the smart city and key elements of the identified city's success was identified by examining current definitions of smart city performance and the diversity of different concepts such as the smart city. This paper describes about the intelligence technologies used in various smart cities to make the one.*

Keywords: SPV, U-City, IoT, Telefonica, ANPR

I. INTRODUCTION

The National Smart City Mission is a program that is being redesigned for cities by the Government. The aim is to bring smart cities across the country by creating resilience and friendliness.

The Urban Development Department [1] is responsible for this work in collaboration with all the relevant national governments.

The facilities initially covered only 100 cities, with time limits for the completion of projects between 2019 and 2023[1]. On 7 September 2019, the industrial city of Aurangabad across 10000 acres in Aurangabad, Maharashtra was the origin of the first smart greenfield city.

A smart city mission visually enhances the environment within a particular city in the country. All the other relevant cities will be chosen by the smart city challenge, where all cities will compete with other cities across the country to reap the benefits of doing the work. Till January 2018, a total number of 99 cities are chosen to be developed as smart cities as part of smart city missions.

Each of the chosen city will make a vehicle or can be said as a special vehicle (SPV), that will be done with a full CEO, to make a smart city equipment center and a provincial government that will provide a total amount of around 1000 crore to the particular company, as an equivalent contribution of 500 crore each [1].

II. CHARACTERISTICS

It has been also said for a smart city (and the community, business group, metropolitan area or region) uses information technology to do the following:

1. Properly use tangible infrastructure (roads, built environment and other tangible assets) by using artificial intelligence and data analysis to support strong economic, social, cultural and healthy development [2].
2. Successful consultation with local authorities through open and innovative processes, to improve the co-ordination of urban institutions through e-governance, with a strong focus on citizen participation and integration [3].
3. Learn, adapt and update and thus respond effectively and quickly to changing situations by improving city intelligence [4].

They are transforming into a solid combination of all the greatness of human ingenuity, integrated intelligence, and artificial intelligence within the city [5]. Urban intelligence "resides in an increasingly successful combination of digital communication networks (sensors), software (knowledge and cognitive ability) and sensors and tags (sensory organs) ".

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III. INTELLIGENCE IN SMART CITIES

3.1 Orchestration Intelligence

Intelligent orchestration requires the ability to pull data and business logic across all different record systems and join it to the full life cycle of customer travel across all channels, internal groups, and business lines within the organization. Data statistics across all platforms are important in providing real-time customer comprehension. This will cause the distinction between channels to blur and enable smooth customer communication [6]. Ultimately, AI will be instrumental in organizing this engagement and engagement across all channels with smart assistants and chat rooms.

3.2 Empowerment Intelligence

Cities provide open platforms, testing centers and smart city infrastructure to integrate the designation of specific regions. This is evident in Kista Science City in Stockholm and Cyberport Zone in Hong Kong. Similar buildings have been established in Melbourne.[30]

3.3 Instrumentation Intelligence

Where city infrastructure is cleverly crafted with real-time data collection, analysis and forecasting model in city districts. There was a lot of discussion about this, peculiarly with regard to surveillance problems in smart cities. Examples of Instrumentation ingenuity have been made in Amsterdam. This is done by:

1. Standard IP infrastructure open to investigators to make plans.
2. The meters without wires transmit information from time to time.
3. Number of households provided with smart energy meters to identify energy consumption and reduce energy consumption.
4. Solar waste composters, energy saving lamps and car charging stations.

IV. FRAMEWORKS

4.1 Technology Skeleton

Work together to build a multi-city technology with varying levels of communication between human and technological systems.

- Digital: Operational-focused infrastructure is needed to connect people and devices to a smart city. This includes innovative services and communication infrastructure. Yovanof, GS and Hazapis, GN define a digital city as "a connected community that includes broadband communications infrastructure; and businesses."
- Intelligent: Cognitive technologies, such as artificial intelligence and machine learning, can be trained in data generated by city devices connected to identify patterns. The effectiveness and impact of specific policy decisions can be attributed to comprehensive strategies that explore the ongoing interactions between people and their urban areas.
- Ubiquitous: The ubiquitous city offers access to social services on any connected device. U-city is an extension of the digital city concept due to the facility being available across all infrastructure
- Wired: The materiality of IT systems is critical to the growth of smart cities in the first stage. Wired infrastructure is needed to support IoT technology and wireless mid-range connectivity. The corded city environment provides widespread access to digital infrastructure and tangible assets. The latest in telecommunications, robots, IoT, and various connected technologies can then be used to support human construction.
- Hybrid: A hybrid city is a combination of physical contact and a visual city associated with the physical environment. This relationship can be visually designed or the presence of a critical number of visible community participants in the visible urban area. Hybrid spaces can be used to secure future projects for smart city services and integration.
- Information city: The duplication of interactive devices in a smart city produces huge data. How this definition is translated and maintained is critical to the growth and security of the Smart city

4.2 Human Framework

The efforts of smart cities have positive effects that can be measured by the quality of life of its citizens and visitors.

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- Creativity: Arts and culture programs are areas with a strong focus on planning a smart city. Innovation is associated with curiosity and creativity, and various projects have shown that knowledge practitioners participate in a wide variety of cultural and artistic activities.
- Learning: As the part of travelling is a predominant factor for Smart city development, making a proficient workforce with education programs are important. The city's learning ability which includes all the education system, which is including all the staff training and support available, and its development and culture.
- Humanity: This centre of attention on capital and some social capital means inclusion, and general permission to public services in city planning.
- Knowledge: Information economy development is at the heart of Smart city projects. Smart cities aspiring to be economic centers in emerging technologies and emerging services emphasize the importance of innovation in city development.

4.3 Institutional Skeleton

According to Moser, M. A., since the 1990s, the movement of intelligent societies has been a strategy to expand the base of IT-engaged users. The members of such Communities are the people who are ready to share their interests and work in partnership with the government of that country and other organizations to enforce the use of Information Technology to improve the quality of the daily life as a result of the deteriorating diversity of daily activities. Eger, J. M. argued that an intelligent society made an informed and agreed decision to use technology as a solution to their business needs and social. It is very important to understand that these IT applications and subsequent improvements can be very costly without the help of an institution; indeed, institutional involvement is essential to the success of intelligent community programs. However, it is important to know that the spread of technology is not the end in itself, but a way to revitalize cities with a new economy and society. In summary, it is possible to prove that any smart city plans need government support to be successful.

The significance of these three distinct dimensions is that only communication between them can make it possible to develop a real sense of a wise city.

4.4 Energy Skeleton

Smart cities use data and technology to create efficiency, improve sustainability, create economic development, and improve the quality of life of the people living and working in the city[7]. Extremely legal, the wise city states: "… An urban environment with technologies that are securely integrated into all information ... and the Internet of Things (IoT) sectors to better manage city assets."

The smart city is empowered by “smart connections” for a variety of things like street lighting, smart buildings, distributed energy resources (DER), data statistics, and smart navigation. Among these, power is the most important; that is why service companies play a major role in smart cities.

4.5 Data Management Skeleton

Smart Cities utilizes a combination of data collection, processing, and distribution technology by integrating computer and communication technology and data security and privacy measures that promote the use of innovation to promote the quality of life of its citizens and dimensions including: resources, health, transportation, entertainment and government services.

V. MACHINE LEARNING

The task of analyzing a cell profile can be done mechanically and is more suitable for image-based measurements [8]. Patience based on the brain close to the loop simulator can be created using machine learning [9]. A person's sensitivity to interpreting line sensors and conditions related to human behavior and mental health through the use of computers, social media and smart phones, machine learning can easily identify the state of mental needs [10]. Early detection is also possible for sarcoma patients [11]. Diagnosis and study of diabetes by mechanical reading will help physicians more easily [12]. Major health-based electronics and great detail in machine learning provide an outstanding milestone in the

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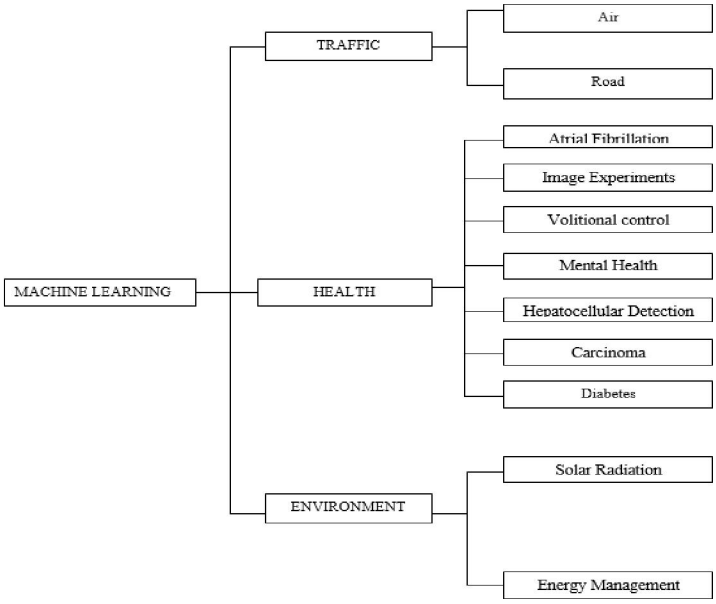
health sciences by diagnosing diabetes [13]. Machine learning, solar radiation and grid performance and grid performance in grid point management [14]. The mechanical learning approach will go a long way in achieving comfort with the addition of energy saving [15]. The improved retreat tree, the random forest tree and the improved tree is a machine learning method that will produce clean water energy with a low water content [16]. Mechanical learning that can significantly improve air quality monitoring by measuring the sensor packet of real-time data [17].

Also, air quality can be calculated with different filters and distance percentages [18]. To train an effective model, a large amount of data from the last decade entitled AIRNet will predict air quality through machine learning [19].

Mechanical learning to predict solar energy production from the past, regardless of database [20]. Display of data from both researchers and practitioners has emerged as an important factor in business intelligence and throughout this type of emerging research on the impact of machine learning on the aspect of business analytics [21]. Explicit mechanical learning will require in-depth knowledge to empower beyond human computation [22]. Identify the bubbles in the substrate and it is also worthwhile to be able to get out of the dust by machine reading [23]. The complex relationships between surface water, surface and climate can be easily exploited in a mechanical learning algorithm that will benefit the agricultural region [24].

Mathematical risk and early detection of myrtle rust can occur with machine learning [25]. Mechanical studies have a significant impact on nitrogen deficits, have led to this large and highly concentrated agriculture [26]. Machine learning makes a huge impact on agricultural productivity [27]. Big data from a multi-camera with multiple cameras will predict maize crop ratings [28]. The reversal of the line of mechanized e- learning assistance in agriculture [29].

Home automation with speech and device redesign and machine learning control is a very useful value for home needs [30, 31]. Extensive performance data from home and live system facilitates the use and utilization of more energy [32]. The concept of suicide and emotion is indicated by machine learning [33]. By using a large number of data set on the use of intelligent home sensors, machine learning predicts human activities [34, 35]. Mechanical learning predicts human activities by intelligently considering human-computer interactions and patterns rearrangement patterns [36, 37]



5.1 ML Algorithm

$$E = \Sigma_{k=1}^{K} \Sigma_{\mathbf{x} \in C_i} d^2(\mathbf{x}, \mathbf{m}_k) \quad (1)$$

The K-means algorithm is an easy categorizations analysis method and is widely used in data mining approach.

$$d^2(\mathbf{x}, \mathbf{m}_k) = \sum_{n=1}^{N} (x_n - m_{kn})^2 \quad (2)$$

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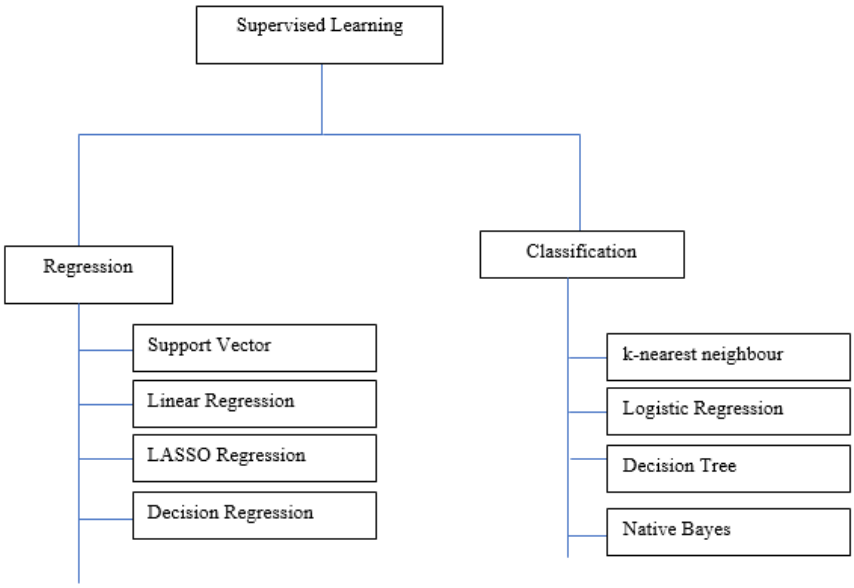
A good division is always done by decreasing the number of distances by two to the "representation" in each collection for example the Euclidean distance. The process of grouping objects into categories of similar objects is known as assembling. Equation 1 and 2 used for the k-means algorithm.



In terms of categories KNN it is often used for the ease of the formula. We can calculate back-up moment, with Bayes theorem and easy to manage complex parameter measurements.

In case of unchecked reading algorithms present data into a section of sections to make a easy structural focus. Enhanced learning is a good use for machine learning to solve this kind of problems. In supervised learning, the machine takes examples when the unattended machine tries to find hidden or unsecure data. A different type of usable algorithm used for a different smart system is shown in Table 1. In order to extract the right, one has to use a machine learning algorithm to get the results you want.

Machine Learning Algorithm	**Purpose**
Neural Network	Smart Health
K-means	Smart City, Smart Home
Clustering detector	Smart Traffic
Support vector machine	Smart Human Active Control
Support vector regression	Smart whether
Linear regression	Smart market analysis

Table 1: Algorithm and Purposes

VI. TECHNOLOGY FOR SMART CITIES

Mobile devices (such as Smartphones, tablets, ...) are other key technologies that allow citizens to connect to smart city services. Bicycle- sharing programs are a staple in smart cities. Wise travel is also important in smart cities.

CCTV and Intelligent travel systems are also being used for safety and security purposes. Some of the smart cities also have the digital libraries which is available for public to read. Online collective data division platforms are on-line database services that allow the sensor owners to register themselves and join their devices to feed data to an online database and allow builders to connect to the database and build their systems based on that data.

Other supporting technologies include telecommunications, telehealth, blockchain, fintech, online banking technology.

Electronic cards (commonly known as smart cards) are another common feature of smart city situation. These cards contain a unique encrypted identifier that allows the owner to access a wide range of government services (or e-services) without having to set up multiple accounts. One identifier allows governments to compile data about citizens and their

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interests to improve service delivery and determine common interests of groups. This technology has been used in Southampton.

Reusable balls allow for some limited amount of access to city centers (e.g. for reloading trucks, ...). The opening and closing of these hurdles are traditionally done manually, using an electronic pass but can also be done with an ANPR camera connected to the bollard system.

VII. EXAMPLES OF SMART CITIES

Examples of technology and schemes of a prosperous city have been made in Singapore, India, Dubai, Milton Keynes, Southampton, Amsterdam, Barcelona, Madrid and Singapore, known for their efforts to develop broadband networks and e-services that support innovation, growth, and inclusion. There are many cities that are actively pursuing a smart city strategy:

7.1 Amsterdam

Amsterdam street lights have been upgraded to allow municipal councils to turn down lights based on pedestrian use.

The Amsterdam smart city program which started in 2009 currently includes 170+ projects developed jointly by local citizens, government and businesses. To encourage local residents' efforts, the City conducts an annual Amsterdam Smart City Challenge, accepting proposals for applications and development in line with the City's framework. An example of an improved resident app is Mobypark, which allows park owners to hire people for a certain amount of money.

7.2 Barcelona

Barcelona has launched a number of projects that could be considered applications of 'smart city' within its "CityOS" strategy. Barcelona also built a new bus network based on Barcelona's most common travel data analysis, using vertical, horizontal and separated routes with multiple intersections. The integration of many intelligent city technologies can be seen through the use of intelligent robots.

7.3 Columbus, Ohio

In 2017 summer, the City of Columbus, Ohio began to pursue a good city plan. The city has partnered with an American Electric Power Ohio to create the group for new electric charging stations for the new launched electric vehicles. Build perks for people to come and participate in the boarding transit. In doing so, the United States Department for Transportation has given the City a amount of $ 40 million grant.

One of the reasons the company was involved in selecting new locations for charging electric vehicles was data collection. The data we collect will help us build a bigger market in the future."

VIII. ENVIRONMENT IN SMART CITIES

Smart cities are purchased in the form of a combination of the need for some major municipal reforms and the availability of technology.

8.1 Major Challenges for Municipalities

In phase where all the budget cuts and economic crisis are done in many western countries, changes and innovation in the public sector appear to be of really huge amount of importance. It is obligatory to increase or improve the efficiency of the pre-existing services and to make some new features in a line within the current situation.

ICT applications can also give some of the answers when responding to those managerial, democratic or political challenges.

8.2 Smart City Technology

Digital Internet-connected devices produce a huge number of data that can be processed using information generated by computer, using a process which is called as Big Data.

All of the above-mentioned things can increase the abundance, coherence and class of the things. Also, it reduces the cut and waste price. Telefonica has given a model of smart cities which is based on data collection.

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