How can AI apply to Smart Cities?

In the past 70 years, AI has been a rapidly growing field and is being applied nowadays in a wide range of applications, from healthcare and finance to transportation and education.

What is AI?

Artificial Intelligence (AI) refers to the development of computer systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition and natural language processing. AI technologies involve various techniques, including machine learning, deep learning, and natural language processing, to enable machines to learn and perform tasks without explicit programming.

The potential benefits of AI are numerous**,** including *increased efficiency*, *improved accuracy*, *and better decision-making* in various industries.

AI has furthermore significant potential to transform urban planning by providing new tools and methods for analysing, modelling, and simulating urban systems, thus creating Smart Cities that are more efficient, sustainable, and livable for their citizens.

What is a Smart City?

A Smart City is a city or an urban area that uses technology and data-driven solutions to improve the quality of life for its residents, enhance sustainability, and improve efficiency of urban services. A smart city uses a variety of sensors and devices to collect data, which is then analysed and used to optimize city services, reduce energy consumption, and enhance the safety and security of residents.

Smart cities also make use of advanced communication technologies to connect residents with city services and information, such as mobile apps for reporting issues or accessing public transportation schedules.

The ultimate goal of a smart city is to create a more liveable, sustainable, and efficient urban environment for all its residents.

How can Artificial Intelligence apply to Smart Cities?

AI has the potential to revolutionize urban planning by providing new tools and methods for analyzing and modeling complex urban systems.

By monitoring and analyzing data, AI systems can provide recommendations to improve resource usage, help reduce congestion and improve traffic flow, detect potential security threats, reduce energy consumption, promote waste reduction, etc. AI-powered systems can also provide personalized services to citizens such as personalized recommendations for restaurants, events, and activities based on their preferences.

Improving efficiency in urban mobility

AI can be used to **manage traffic flows** in real-time by analyzing data from sensors, cameras, and other sources. This can help optimize traffic signals, reduce congestion, and improve safety for pedestrians and cyclists.

Usage of Traffic Intelligence Solutions in Odense

In the municipality of Odense, Denmark, such technology allows for **intelligent traffic data collection** since 2019, including the counting, and tracking of cars, pedestrians, and bicycles.
The data was used to enable proactive urban development and traffic management, which was previously lacking. The sensors also allowed for easy and accessible traffic data visualizations, enabling *traffic flow optimization* and *informed city planning*.

AI-Based Traffic Light Optimisation in Moscow, Russia

Based on such data analysis**, Intelligent Traffic Control Systems (ITCS)** can also adjust **traffic signals** in real-time to optimize traffic flow. This can include adjusting the duration of green and red lights at intersections to reduce wait times and improve traffic flow.
In 2020, the implementation of a flexible control scheme, based on state of the art AI techniques, allowed for real time monitoring of traffic and **real time control of traffic lights** in a chosen district in Moscow, Russia.

AI can also be used to develop **predictive maintenance systems** for mobility infrastructure such as roads, bridges, tunnels, and highways. These systems can collect and analyze data to predict when maintenance is needed, which can help to prevent accidents and reduce downtime.

TWIN4ROAD@Essen: AI-based analysis and forecast

In the coming years, the city of Essen, Germany, will rely on artificial intelligence (AI) for the **damage assessment of roads**. A digital twin of Essen's road network was created using car-based mobile mapping and data collection. This included mobile laser scanning measurements, extensive acquisition of road space imagery and continuous GPR-measurements, allowing for reliable assessments on road damages, needs for renovation and potential future potholes.

Smart Parking in Ettelbrück (LX)

Finally, AI can also be used to develop **smart parking systems** that can help drivers find available parking spots quickly and easily. These systems can use real-time data from sensors and cameras to identify available parking spaces and provide real-time updates to drivers.
In order to reduce the 'cruising' time of its citizens, the City of Ettelbruck deployed in 2019 a technology which enables **real-time monitoring and visualisation of the available parking spaces** in the city.

Improving resources management in cities

AI can play a significant role in improving resource management in cities by enabling better decision-making, optimization, and automation of various processes.

A Forward-Looking Model Project for Street Lighting

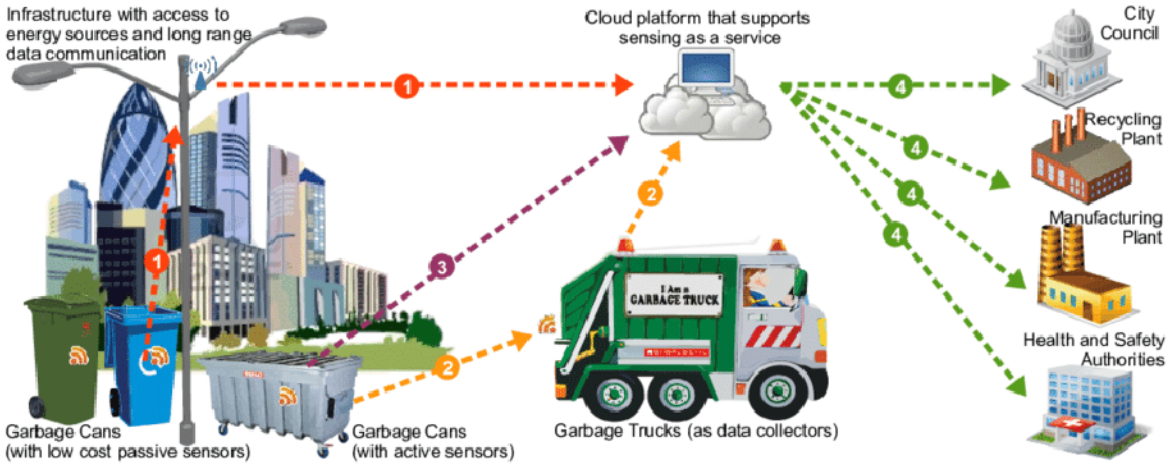
Analyzing data from various sources such as sensors to **predict energy demand and supply** can help city authorities to better manage energy grids and reduce energy waste, leading to significant cost savings and reduced carbon emissions. In 2022, the city of Bad Hersfeld, Germany has for example put in place **a dynamic adaptive lighting control system for street lighting**, which resulted in energy savings of around 77%. The sensor-based detection of wet road conditions leads to considerable additional energy savings and reduced glare effects by lowering the dimming level of the streetlights.

AI can also be used to **monitor the energy consumption of smart buildings** and identify patterns that may indicate equipment failure or maintenance requirements. This was the case in Barcelona, Spain in 2020, with **an energy efficiency software based on artificial intelligence for non-residential buildings** that connected the internal data with external variables, creating a digital twin. Both external and internal factors are considered by intelligent algorithms after making a connection via the BMS of the building.

Increasing Energy Efficiency in Buildings Using AI

A similar approach can also help cities **optimize water usage** with sensors, weather forecasts, or water supply systems. It allows for better management of water resources, detecting leaks and reducing water waste, leading to improved water sustainability.

Furthermore, AI can analyse data from waste collection routes or recycling facilities, thus helping city authorities to **better manage waste collection**, reduce the amount of waste going to landfills, and **increase recycling rates**. **An intelligent waste management system** was implemented in Ludwigsburg, Germany, where 15 waste bins were installed with inbuilt sensors on the lids. The sensors and camera monitored the level of waste in the bins which was then communicated to a mobile app.



Improving the citizens' quality of life

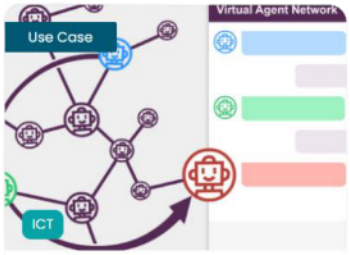
AI can help cities engage with their citizens by **analyzing social media**, surveys, and other data to understand their needs and preferences. This can help cities design services that better meet the needs of their citizens.

The Dublin Beat Understanding Citizen Sentiment

In 2019, the Dublin City Council used **a social intelligence and speech analytics platform to better understand how citizens experience the city region.**

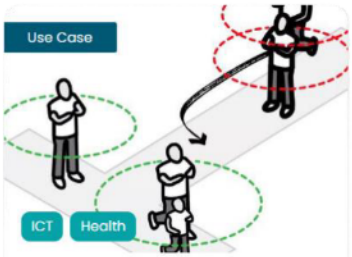
Using natural language processing (NLP) and machine learning, unstructured data such as the opinions of citizens expressed via social media in an anonymous and aggregate manner were organized and deciphered by AI models. This data was presented via visual dashboards from which insights can be extracted and used to improve city life.

AI-powered chatbots can also provide automated assistance to citizens, handling a wide range of queries and issues without requiring human intervention. Powered by conversational AI, **a virtual agent network (VAN)** was for example implemented for the Finnish immigration, taxation, patent, and company registration services in 2018. This VAN was able to seamlessly "hand over" visitors to their digital colleagues when a user asks a question specific to each particular department - all in the same chat window.



World's First Virtual Agent Network

AI-powered video analytics can be used to automatically detect potential threats and improve public safety. This was especially seen with tools developed for the public response to the COVID-19 pandemic.



Using AI to Measure the 'Busyness' of London Streets

The city of London, UK indeed used an **AI tool to detect when and where people were unable to maintain a safe distance between each other**, gaining an overview of how effective mitigation measures are.

The tool also provided advice to government authorities and businesses on how to create safe spaces and maintain distance. It even recognized couples walking together or adults with children and differentiated them from others who may have been ignoring social distancing rules.

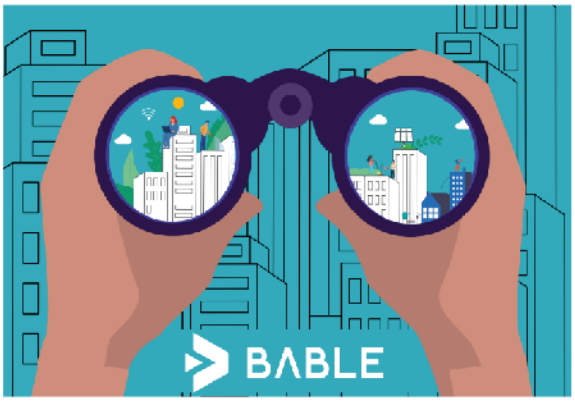
Another application was used by Swiss cities, who placed **cameras at strategics points in train stations to assess how many people wore hygiene masks**. The station cameras filmed the flow of people, and the software evaluated on-site whether the people were wearing a mask or not. By analysing the effectiveness of mask requirement policies, cities could react accordingly and intelligently to better improve the public health of their inhabitants.

Counting Mask Wearers on Swiss Transport with AI

Overall, AI has the potential to revolutionize urban planning by providing new tools and methods for analyzing and modeling complex urban systems. This can help planners make more informed decisions and create more livable, sustainable, and resilient cities for their citizens. However, it is important to ensure that AI is implemented responsibly, with a focus on **transparency, accountability, and privacy**.

Such technology can still provide accurate analytics, while remaining non-intrusive. An example of this is **the Privacy-by-Design approach** the Hugh Lane Gallery in Dublin, Ireland took to measure how many visitors attend the gallery and how they move throughout it. Anonymised numerical data representing flows and movement were visualised through heat maps on a dashboard, which the Gallery management could access. During the entire process, no images of individuals within the line of sight of the cameras were stored.

Dublin´s Hugh Lane Gallery: Understanding visitor flows using a...



About BABLE.DIGITAL

BABLE.DIGITAL is a subsidiary of BABLE Smart Cities GmbH, which is the facilitator for Smart Cities in Europe. BABLE.DIGITAL creates innovative Software solutions using cutting edge technologies such as Artificial Intelligence, Data Analyzing and Software Engineering.

That includes embedded Data (e.g. from Iot devices), open public data to support traffic management, waste management and citizen engagement.

Get in touch!

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