



Leveraging Open Geospatial Data for Public Visualization.

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ABSTRACT

Open geospatial data, referring to openly available geographic information, has become increasingly important, facilitated by organizations like the Open Geospatial Consortium (OGC). This data is commonly utilized through Geographic Information Systems (GIS) for public visualizations, offering benefits such as simplified data representation, pattern identification, and improved decision-making. Despite advancements, challenges including intellectual property, standardization, privacy, and analytical capacity persist, hindering effective use. This paper explores the multifaceted benefits and challenges of open geospatial data for public visualizations, emphasizing the need for better connections between data communities. Overcoming challenges requires addressing data reliability concerns and ensuring quality. Despite obstacles, the potential of open geospatial data for public visualizations is substantial. The future holds promise for informing public policy, environmental initiatives, and enhancing transparency. Collaborations between geomatics/GIS and open data communities are pivotal to realizing the transformative power of open geospatial data in governance and societal progress.

Keywords: Geospatial Data, Public Visualization

1. Introduction

Open geospatial data, referring to geographic information that is openly available, has gained increasing significance in recent years. The Open Geospatial Consortium (OGC), established in 1992, has played a pivotal role in promoting the use of open geospatial data[1]. Geospatial data is commonly interpreted through Geographic Information Systems (GIS), which compile data and present it in a digital visual format[2]. This data is valuable for public visualizations as it allows for the creation of maps, charts, and other visual representations that can simplify complex data, reveal patterns, aid in decision-making, and improve engagement[2][3]. For instance, providing geospatial data to the public can take the form of budget data, crime statistics, real estate data, education information, and public transportation routes[2]. Despite the progress in data availability and visualization tools, substantial work is still needed to better connect geospatial and open data communities[1]. Challenges such as intellectual property issues, standardization, privacy, and analytical capacity remain significant barriers to the effective use of open geospatial data[1][4]. Therefore, understanding the background of open geospatial data and its potential for public visualizations is crucial for addressing these challenges and maximizing its benefits.

The benefits and challenges of using open geospatial data for public visualizations are multifaceted. Open geospatial data, which encompasses openly available geographic information, has seen major advancements in accessibility and utilization. It enables improved governance, citizen engagement, and innovation, as stated by the Open Data Charter[2]. Geospatial visualization offers organizations the ability to address issues, make better decisions, and build dashboards and applications for improved understanding and operational efficiency[3][5]. However, challenges such as intellectual property issues, standardization, privacy, and analytical capacity remain significant barriers to the effective use of open geospatial data[1][4]. Overcoming these challenges requires the development of accessible interfaces, addressing doubts about data reliability, and ensuring data quality and accuracy[4][7]. Despite these challenges, the potential of open geospatial data for public visualizations is substantial, and efforts to better connect the open data and geospatial data communities are crucial for maximizing its benefits[1][9]. Therefore, understanding the benefits and challenges of leveraging open geospatial data for public visualization is essential for effectively utilizing this valuable resource.

2. Review of Literature

Accessibility of open data for public use

The availability of open geospatial data provides increased community engagement and improved efficiency, ultimately reducing costs and encouraging progress and innovation[6]. However, challenges such as limited digital literacy and lack of accessible interfaces can hinder citizen participation[10]. To address this, the development of user-centric interfaces and visualization tools is essential to make open data more accessible and comprehensible to the public[10]. For instance, the New York City Open Data initiative has created a repository of datasets that can be accessed by site visitors, showcasing the potential of open data in producing important tools and research[6]. Additionally, the use of open geospatial data and GIS applications, such as the City

Dashboard of London, can significantly improve citizen access to important information, aiding in public education and decision-making[2]. By leveraging open data, organizations can enhance data that is already available, leading to improved efficiencies and reduced costs[6]. Therefore, the accessibility of open geospatial data is crucial for promoting community engagement, innovation, and economic progress.

Ability to visualize data for public education/decision-making

Open geospatial data and GIS applications play a vital role in visualizing data for public education and decision-making. The Open Data Charter emphasizes that easily accessible and usable open data allows for improved governance and citizen engagement[2]. Geospatial data, interpreted through Geographic Information Systems (GIS), provides the public with access to a wide range of information, including landmarks, public facilities, crime statistics, and real estate data[2]. This enables the creation of maps, charts, and other visual representations that can simplify complex data, reveal patterns, and aid in decision-making[2][13]. For example, the utilities industry heavily relies on geospatial visualization to identify network outages and manage facilities tied to geographic locations, ultimately minimizing the duration of outages and reducing costs and risks associated with long-term outages[2]. The ability to visualize open geospatial data is essential for public education and decision-making, as it empowers citizens and organizations to better understand complex information and make informed choices.

Promoting transparency and accountability

Open geospatial data promotes transparency and accountability by providing citizens with access to valuable information. The integration of open geospatial data with participatory governance policies holds the key to a more transparent government[14]. By creating visually compelling maps and sharing data through open data platforms, government entities can foster innovation and support a more transparent government[14]. For instance, the state of Maryland has utilized GIS and open data to transform its information and create a platform for innovation, ultimately improving decision-making and communication with citizens, businesses, developers, journalists, and nonprofit organizations[14]. The use of open geospatial data not only enhances transparency but also encourages collaboration and data-driven discussions, ultimately leading to more accountable governance[13]. Therefore, open geospatial data plays a crucial role in promoting transparency and accountability within government entities and organizations.

Enabling innovation through data usage and analysis

Open geospatial data enables innovation by providing organizations with the ability to build geospatial applications and dashboards that render large amounts of data streaming in real time, ultimately leading to improved understanding and operational efficiency[6][2]. The availability of open geospatial data encourages progress and innovation by providing access to valuable information that can be used to create important tools and research[6]. By leveraging open geospatial data, organizations can address issues, make better decisions, and build applications that support economic innovation[2]. Additionally, the use of open geospatial data can lead to improved efficiencies, reduced costs, and enhanced operational efficiency by providing access to valuable information that can be used to create important tools and research[6]. Therefore, open geospatial data plays a crucial role in enabling innovation through the usage and analysis of valuable information.

Issues with data quality control

The challenges related to data quality control in open geospatial data can significantly impact its reliability and usability. For instance, in the context of public health emergencies, the lack of common data standards and interoperability hinders the ability of public health entities to collect and share certain data elements in a specific and exchangeable way[15]. Similarly, in the U.S. healthcare system, the lack of standardized data has been a longstanding issue, limiting the ability to share data electronically and impeding interoperability[17]. This lack of standardization can lead to inconsistencies in data collection and exchange, affecting the overall quality and reliability of the data. Furthermore, the incorrect use of open data can also pose challenges related to data quality, as it may lead to misinterpretation and misrepresentation of information[6]. Addressing these challenges requires the establishment of common data standards, improved interoperability, and a focus on ensuring the accuracy and reliability of the data.

Lack of standardization and interoperability

The lack of standardization and interoperability in open geospatial data presents significant challenges, particularly in the context of public health emergencies and the U.S. healthcare system. In public health, the absence of common data standards and interoperability impedes the exchange of vital information, ultimately impacting the national response to emergencies[15]. Similarly, in the U.S. healthcare system, the lack of standardized data has been a longstanding issue, limiting the ability to share data electronically and impeding interoperability[17]. This lack of standardization and interoperability hinders the seamless exchange of information between different data systems, leading to inefficiencies and barriers in data sharing and utilization. Overcoming these challenges requires the establishment of common data standards for collecting and sharing information, as well as efforts to improve the interoperability of data systems to ensure seamless exchange and utilization of open geospatial data.

Privacy concerns related to open data

Privacy concerns related to open geospatial data can arise due to the sensitive nature of the information being shared. In the context of public health emergencies, the sharing of patient characteristics and clinical information raises privacy concerns, particularly if the data is not adequately anonymized or protected[15]. Similarly, in the U.S. healthcare system, the sharing of electronic health records (EHRs) and clinical data raises privacy concerns, especially if the data is not securely managed and shared[17]. These privacy concerns can impact the trust and willingness of individuals to share their data, ultimately affecting the overall availability and usability of open geospatial data. Addressing these concerns requires robust privacy protection measures, including anonymization, encryption, and secure data sharing protocols, to ensure that sensitive information is adequately safeguarded.

Difficulty accessing or interpreting data for the public

The challenges related to accessing and interpreting open geospatial data for the public can hinder citizen participation and engagement. Limited digital literacy and lack of accessible interfaces are key barriers that can alienate citizens and discourage their active involvement in accessing and interpreting open data[10]. Additionally, doubts about the reliability and credibility of open data can further impede public access and interpretation, as some citizens may express skepticism regarding the accuracy and trustworthiness of the shared information[10]. Overcoming these challenges necessitates the development of user-centric interfaces, visualization tools, and accessible platforms that can simplify complex data and make it more comprehensible to the public[10]. Furthermore, efforts to address doubts about data reliability and credibility are essential to foster trust and confidence in the open geospatial data shared with the public.

Use cases of open geospatial data visualizations successfully informing public policy, environmental initiatives, etc.

Open geospatial data visualizations have been instrumental in informing public policy and driving environmental initiatives. For instance, the Open Data Charter emphasizes that easily accessible and usable open data allows for improved governance and citizen engagement, spurring innovation and economic development[2]. In the environmental sector, geospatial data services have been integrated into environmental impact assessments, enabling informed decision-making and the protection of vulnerable ecosystems[20]. By leveraging geospatial data, organizations can pinpoint areas with high resource potential, promote sustainable development practices, and track and protect endangered species from illegal activities[20]. Furthermore, geospatial visualization has been used to address public policy challenges, such as in the utilities industry, where it has enabled the identification of network outages and the minimization of service disruptions, ultimately reducing costs and risks associated with long-term outages[3]. These use cases demonstrate the significant impact of open geospatial data visualizations in informing public policy, driving environmental initiatives, and promoting sustainable development practices.

New technologies and integrations that leverage the potential of open geospatial data

The potential of open geospatial data is being leveraged through new technologies and integrations that enable the visualization and analysis of vast amounts of spatial data. Geospatial visualization has enabled organizations to build dashboards and applications that render large amounts of data streaming in real time, ultimately leading to improved understanding and operational efficiency[3]. For example, the City Dashboard of London provides residents with real-time transport updates, weather information, and news headlines, showcasing the power of geospatial visualization in enhancing citizen access to important information[3]. Additionally, the integration of geospatial data services into environmental impact assessments has enabled organizations to make informed decisions, protect vulnerable ecosystems, and work towards a sustainable future[20]. The surge in demand for geospatial information services is indicative of the immense potential and relevance of geospatial data in driving sustainability initiatives worldwide[20]. These new technologies and integrations are harnessing the power of open geospatial data to drive innovation, inform decision-making, and promote environmental sustainability.

3. Discussion

Future directions for stakeholders to better harness this data

Stakeholders can better harness open geospatial data by addressing gaps related to intellectual property, standardization, privacy, and analytical capacity. The Open Data Charter emphasizes the need for greater coordination between the geomatics/GIS and open data communities to maximize the potential of open geospatial data for analysis and innovation[19]. This coordination can be achieved through the establishment of common data standards, improved interoperability, and a focus on ensuring the accuracy and reliability of the data[19]. Furthermore, stakeholders can promote the development of user-centric interfaces, visualization tools, and accessible platforms that simplify complex data and make it more comprehensible to the public[8]. By addressing doubts about data reliability and credibility, stakeholders can foster trust and confidence in the open geospatial data shared with the public, ultimately promoting greater citizen engagement and participation[8]. These future directions are essential for stakeholders to better harness the potential of open geospatial data and drive innovation, inform decision-making, and promote environmental sustainability.

4. Conclusions & Recommendations

Summary of open geospatial data's current utility and limitations

Open geospatial data has made significant strides in accessibility and utilization, enabling improved governance, citizen engagement, and innovation. However, challenges such as limited digital literacy, lack of accessible interfaces, doubts about data reliability, and privacy concerns remain significant barriers to the effective use of open geospatial data. While the availability of data has increased, substantial work is still needed to better connect geospatial and open data communities. The potential of open geospatial data for public visualizations is substantial, but it requires addressing these challenges to maximize its benefits[19][10].

Proposals for how key challenges can be addressed by different stakeholders

Stakeholders can address the challenges of open geospatial data by focusing on several key areas. Firstly, the development of user-centric interfaces, visualization tools, and accessible platforms is essential to make open geospatial data more comprehensible to the public. Additionally, efforts to address doubts about data reliability and credibility are crucial to foster trust and confidence in the shared information. Furthermore, the establishment of common

data standards, improved interoperability, and a focus on ensuring the accuracy and reliability of the data are essential to overcome the challenges related to data quality control and lack of standardization. Robust privacy protection measures, including anonymization, encryption, and secure data sharing protocols, are also necessary to address privacy concerns related to open geospatial data[2][10].

Concluding statements on the promising future of open data use for public visualization

Despite the existing challenges, the future of open geospatial data for public visualization is promising. The potential for open geospatial data to inform public policy, drive environmental initiatives, and promote transparency and accountability is substantial. By addressing the current limitations and challenges, stakeholders can better harness the potential of open geospatial data and drive innovation, inform decision-making, and promote environmental sustainability. The coordination between the geomatics/GIS and open data communities is crucial to maximize the potential of open geospatial data for analysis and innovation. With the right strategies and collaborations, open geospatial data has the power to revolutionize the way societies are governed and lead to significant progress in the open data landscape[19][10].

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