Analysis to Climate Change and Predicting Drowning Cities using Tableau

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Abstract: *One of the most important worldwide issues of our day is climate change, which affects livelihoods, economics, and ecosystems all around the world. This study uses Tableau's powerful data visualization features to provide a thorough analysis of patterns and trends related to climate change. By combining many environmental datasets—such as temperature swings, carbon emissions, sea level rise, and biodiversity changes. Moreover, this research utilized a predictive model within Tableau to forecast potential future scenarios based on historical trends and statistical projections. These predictive models offer insights into potential climate trajectories and their implications for various geographic regions, aiding policymakers and stakeholders in informed decision-making and proactive climate adaptation strategies. The findings from this analysis underscore the urgency of addressing climate change, highlighting the acceleration of global warming, the alarming rise in greenhouse gas emissions, and the imminent threats posed to biodiversity and human habitats. Additionally, the interactive nature of Tableau visualizations enhances accessibility, enabling a wider audience to comprehend and engage with complex climate data effortlessly.The visual insights derived from this study serve as a valuable resource for policymakers, educators, and the public, fostering a deeper understanding of the multifaceted challenges posed by climate change and emphasizing the imperative need for concerted global action to mitigate its impacts*

Keywords: Climate Change, Tableau, Data Visualization, Environmental Analysis, Predictive Modelling, Global Warming, Carbon Emissions, Biodiversity, Decision Support, Adaptation Strategies.

I. INTRODUCTION

The phenomenon of climate change has evolved from a distant concern to a central global challenge, compelling societies worldwide to confront its multifaceted impacts on ecosystems, economies, and human well-being. Amidst this backdrop, the need for comprehensive analyses that elucidate the intricate patterns and trends of climate change has become imperative. This study endeavors to delve into the complex fabric of climate change dynamics by harnessing the robust data visualization and analytical capabilities of Tableau, a powerful tool enabling the synthesis, exploration, and interpretation of vast environmental datasets. Tableau, renowned for its versatile and user-friendly interface, offers an ideal platform for processing, analyzing, and presenting complex environmental data. Leveraging its capabilities, this study embarks on an exploratory data analysis (EDA) journey to uncover patterns, correlations, and potential causal relationships within the amassed datasets. By harnessing Tableau's functionalities, this research endeavors to present dynamic visual narratives that elucidate the evolving nature of climate change. These interactive visualizations facilitate the comprehension of intricate climate data by diverse stakeholders, ranging from policymakers and researchers to educators and the general public. Moreover, the incorporation of predictive modeling within Tableau empowers this study to project potential future climate scenarios, thereby aiding in scenario planning and decision-making processes. This study endeavors to unravel the complexities of climate change through the lens of Tableau-powered data visualization and analysis. By amalgamating diverse environmental datasets and leveraging advanced visualization

techniques, this research seeks to illuminate the evolving patterns, trends, and potential future trajectories of climate change. Ultimately, this exploration aims to catalyze informed decision-making and collective action towards mitigating the impacts of climate change on a global scale.
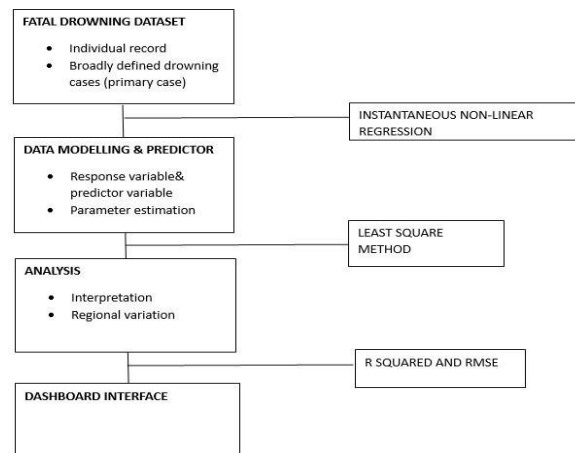
VISUALISATION

Visualization: Visualization, in the context of data analysis, refers to the graphical representation of complex information and data sets. It aims to present data in a visual format that is easily understandable and interpretable, allowing users to grasp patterns, trends, and relationships that might be difficult to discern from raw data alone. Visualization tools, such as Tableau, play a pivotal role in transforming vast and intricate datasets into comprehensible charts, graphs, maps, and interactive dashboards.

They leverage principles of design such as color, shape, and layout to enhance comprehension and retention of information. Interactive visualizations enable users to explore data dynamically, uncovering deeper insights through filters, tooltips, and drill-down functionalities. Visualizations play a crucial role in storytelling, helping to communicate narratives and findings in a compelling and persuasive manner.

They are used across various domains including business, science, academia, and journalism to present information in a visually engaging manner. By bridging the gap between raw data and human understanding, visualizations empower users to make data-driven decisions with confidence. Overall, visualization is a powerful tool for transforming data into actionable insights, fostering better understanding and communication of complex information.

The essence of visualization lies in its ability to translate abstract data into visual elements that engage the viewer's cognitive processes, facilitating a deeper understanding of the information at hand. Through intuitive representations, visualizations allow stakeholders, researchers, policymakers, and the general public to comprehend the complexities of climate change trends, fostering informed decision-making, and advocating for proactive measures to address this global challenge.


Visualization is a key component of this research, as it serves as the bridge between complex data and meaningful understanding. Visualizations are not only informative but also persuasive. They have the power to influence decision-makers, engage the public, and foster a deeper understanding of the challenges faced by drowning cities. As we embark on this data science journey to analyze drowning cities and their vulnerability to environmental factors, we must keep in mind the profound significance of the problem and the role data science, machine learning, and tools like Tableau play in our quest for solutions.

DATA SCIENCE

Data science relies heavily on visualization techniques to uncover patterns, trends, and relationships within complex datasets. Visualization plays a pivotal role in exploratory data analysis, model evaluation, and communicating findings. It transforms data into intuitive and informative visual representations, facilitating better comprehension and informed decision-making for diverse stakeholders.

DEPTH OF DATA SCIENCE :
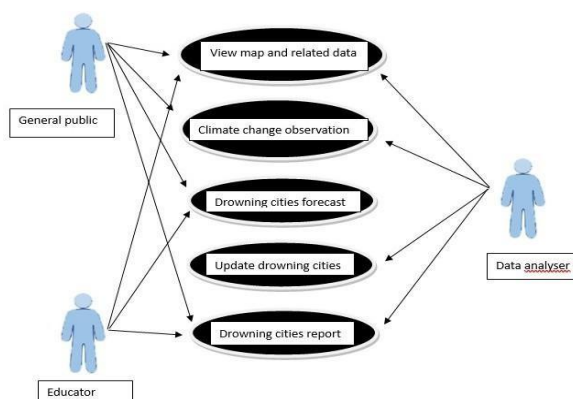
- Data Sources: Identifying and selecting appropriate data sources relevant to the problem at hand is crucial. It's essential to consider the quality, quantity, and accessibility of data
- Data Gathering: This step involves the extraction of data from the chosen sources. Depending on the source, it may require tools or techniques like web scraping, database queries, or data acquisition via APIs.
- Data Storage: Once collected, data needs to be stored in a structured manner, often using databases or data warehouses. Data should be organized for easy retrieval and analysis.
- Data Cleaning: Data collected from various sources is rarely perfect. It often contains errors, inconsistencies, and missing values. Data cleaning, also known as data preprocessing, is the process of cleaning and transforming data into a usable format.

VISUALIZATION TOOLS TABLEAU
Comprehending Tableau:
Data analysts, scientists, and professionals can utilize this industry-leading data visualization platform to convert unstructured data into meaningful insights. It is the best option for developing dynamic dashboards that successfully convey complex information due to its user- friendly layout and abundance of capabilities. Let's examine some important Tableau features before building a dashboard for cities that are drowning:

- Data Connection: Tableau supports various data sources, from spreadsheets and databases to cloud-based data stores. It offers a user-friendly way to connect to, import, and update data.
- Data Preparation: Tableau provides built-in tools for data cleaning and transformation, helping users handle missing values, reshape data, and ensure its quality.
- Drag-and-Drop Interface: One of Tableau's defining features is its drag-and-drop interface, which allows users to effortlessly create visualizations by selecting and dropping data fields onto the canvas.
- Rich Visualizations: Tableau offers a broad selection of visualization options, including bar charts, scatter plots, heatmaps, geographic maps, and more. Users can choose the most suitable visualization for their data and purpose.
- Interactivity: Interactivity is a hallmark of Tableau. Dashboards can be designed to allow users to filter, drill down, and explore data, creating a dynamic and engaging experience.
- Custom Calculations: Advanced users can create calculated fields and perform custom data transformations directly within Tableau.
- Advanced Analytics: Tableau supports integrations with R and Python, allowing for advanced analytics and predictive modeling.

II. LITERATURE REVIEW

Existing literature underscores the pivotal role of data sources in data science endeavours. Researchers emphasize the significance of selecting appropriate sources based on factors such as data quality, quantity, and accessibility. The

process of data gathering involves extracting information using varied techniques like web scraping, API utilization, or database queries. Post-collection, structured data storage ensures easy access and retrieval, while data cleaning stands as a critical step to rectify errors and prepare data for analysis. Scholars emphasize these foundational steps as imperative for meaningful insights and robust analyses in data science. A literature review for a project like the one described might include.

The platform offers customizable features, allowing users to tailor their analysis based on specific regions, timeframes, and variables of interest. With interactive maps, graphs, and charts, Climatic Explorer empowers researchers, policymakers, and the general public to better understand the complexities of climate change and its impacts on local and global scales. Its user-friendly interface makes complex climate data accessible and actionable for a wide range of users, facilitating informed decision-making and strategic planning in various sectors such as agriculture, urban planning, and disaster management.

Here's an overview of what you could find in a literature review for a project on creating a Tableau dashboard for drowning cities based on environmental factors:

DROWNING CITIES

Review 1: Urban Vulnerability to Climate Change and Flooding

This review discusses the increasing vulnerability of urban areas to climate change, with a focus on flooding. It emphasizes the importance of data-driven decision- making for city resilience. The paper highlights the need for comprehensive dashboards to monitor environmental factors, drawing from historical examples like Hurricane Katrina and recent flood events in urban regions.

Urban areas are particularly vulnerable to the impacts of climate change, especially flooding, due to factors like high population density, impervious surfaces, and inadequate infrastructure. As temperatures rise, extreme weather events, including heavy rainfall and storm surges, become more frequent and intense, exacerbating flood risks. Urbanization often leads to the destruction of natural drainage systems, further amplifying flood vulnerability.

Additionally, socio-economic disparities can compound vulnerability, with marginalized communities disproportionately affected by flooding and its aftermath. Effective urban planning, green infrastructure, and early warning systems are essential for mitigating these risks and enhancing resilience to climate change-induced flooding in urban areas. Collaborative efforts involving governments, communities, and stakeholders are crucial for implementing adaptive measures and safeguarding urban populations against the impacts of climate change- induced flooding.

Review 2: Data Science Approaches for Environmental Analysis

This literature review covers the use of data science techniques in environmental analysis. It discusses the significance of collecting and visualizing data from various sources and highlights the role of data visualization tools like Tableau in making complex environmental data more accessible. It also emphasizes the need for interdisciplinary collaboration between data scientists and environmental experts.

Firstly, data preprocessing involves cleaning and transforming raw environmental data for analysis. Secondly, descriptive analytics helps in summarizing and visualizing patterns in the data, such as trends and anomalies. Thirdly, predictive modeling employs algorithms to forecast environmental parameters like air quality or biodiversity changes.

Fourthly, clustering methods can group similar environmental features or regions based on their characteristics. Fifthly, classification techniques can classify environmental samples into different categories based on predefined criteria. Sixthly, spatial analysis involves examining environmental data in geographic contexts to understand spatial patterns and relationships. Seventhly, time series analysis helps in identifying temporal trends and seasonality in environmental data.

Review 3: Dashboard Design and User Engagement

This review delves into the principles of effective dashboard design. It discusses the importance of user engagement, interactivity, and storytelling in conveying complex information. The paper offers insights into how well-designed dashboards can enhance decision-making, pointing out best practices in dashboard creation.

Dashboard design plays a pivotal role in user engagement by presenting information in a visually appealing and intuitive manner. Clean layouts, meaningful data visualization, and easy navigation enhance user experience, encouraging users to interact more frequently. Incorporating interactive elements like filters, drill-down options, and real-time updates keeps users engaged by empowering them to explore data dynamically.

Personalization features allow users to customize their dashboards according to their preferences and priorities, fostering a sense of ownership and relevance. Continuous feedback loops and user testing help refine dashboard designs, ensuring they meet evolving user needs and preferences, ultimately maximizing engagement and effectiveness. Collaborative features such as commenting, sharing, and collaborative editing foster a sense of community and interaction among users, further driving engagement. Regular user feedback and iterative design improvements based on user behaviour analytics help optimize the dashboard for maximum engagement and satisfaction. Overall, a well-executed dashboard design not only presents data effectively but also cultivates a positive user experience, resulting in higher engagement levels and better decision-making outcomes.

URBAN RESILIENCE

1. Urban Resilience and Climate Change Adaptation: Cutter et al. (2008) explored urban resilience amid climate change, stressing adaptive strategies crucial for cities.

2. Environmental Data Analysis and Visualization: Keim and Andrienko (2005) highlighted data analysis and visualization's importance in understanding intricate environmental data.

3. Climate Change Impact on Urban Flooding: Hirabayashi et al. (2013) showcased climate change's effect on urban flooding, emphasizing robust data analysis and visualization.

4. Dashboard Design Principles: Few (2006) discussed effective dashboard design principles centered on user engagement, interactivity, and storytelling.

5. Geospatial Analysis and Mapping: Longley et al. (2015) delved into geospatial analysis crucial for understanding environmental geographic facets.

III. PROPOSED METHODOLOGY

AN INTEGRATED MULTI-DIMENSIONAL TECHNOLOGY

The project of creating a comprehensive Tableau dashboard for drowning cities based on factors like drought, flood, precipitation, temperature, and disease has a wide range of applications across various sectors. Here are some key areas where this project can be applied and how it can be beneficial.

Disaster Management and Response:

Application: Emergency agencies can utilize the dashboard for real-time monitoring and response to natural disasters, aiding city vulnerability assessments. How: Tracking environmental factors and disease stats facilitates proactive responses to floods, droughts, and outbreaks, optimizing resource allocation and evacuation planning.

Urban Planning and Development:

Application: Urban planners use the dashboard for informed decisions in flood-prone or drought-affected areas, shaping infrastructure development.

How: Visualizing environmental data pinpoints high-risk zones, guiding adaptive city planning such as improved drainage systems.

Public Health and Healthcare:

	Methodology	Analysis
Existing methodology	TOOLS/ TABLEAU	Special purpose systems,2D script based, produce visual of fatal accidents
Proposed methodology	TOOLS/T ABLEAU	Special purpose systems deal with accuracy and understanding format of graphical representation of visualizing drowning cities

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Application: Public health authorities monitor disease and environmental correlations for early detection and prevention.

How: Analysis of disease stats with climate data informs targeted interventions like vaccination campaigns and vector control.

Environmental Conservation:

Application: Environmental organizations leverage the dashboard to comprehend climate impacts on ecosystems and plan conservation actions.

How: Visualizing environmental data highlights areas needing conservation efforts due to climate-induced risks.

Research and Academia:

Application: Researchers access the dashboard for comprehensive studies on climate change and disease effects in urban settings.

How: Valuable data within the dashboard aids analysis, enabling contributions to understanding climate-related challenges in cities.

IV. EXISTING METHODOLOGY

Climatic Explorer, a web-based interface, allows users to view a wide range of climatic data sets. Users can search for and examine data on temperature, precipitation, sea level rise, and other climatic factors. Users can use the system's interactive maps, graphs, and charts to study and analyze climatic patterns and changes.

It gathers data from various sources such as satellites, weather stations, and climate models to provide comprehensive insights into different climatic variables like temperature, precipitation, wind patterns, and more. Users can access historical data to track long-term trends and projections to anticipate future climate scenarios. The platform offers customizable features, allowing users to tailor their analysis based on specific regions, timeframes, and variables of interest.

With interactive maps, graphs, and charts, Climatic Explorer empowers researchers, policymakers, and the general public to better understand the complexities of climate change and its impacts on local and global scales. Its user-friendly interface makes complex climate data accessible and actionable for a wide range of users, facilitating informed decision-making and strategic planning in various sectors such as agriculture, urban planning, and disaster management.

The ESGF, a global alliance, allows you access to a large volume of climate model data. It allows scientists to download and show outputs from numerous institutes' climate models throughout the world.

Burden of fatal drowning in California, 2005–2019

William Koon, Orion Stewart, Robert Brander, Linda Quan, Amy E Peden

Objective To characterise risk factors for fatal drowning in California, USA to inform priorities for prevention, policy, and research. Methods This retrospective population-based epidemiological review of death certificate data evaluated fatal drowning events in California from 2005 to 2019. Unintentional, intentional, and undetermined drowning deaths and rates were described by the person (age, sex, race) and context-based variables (region and body of water).

Results in California's fatal drowning rate was 1.48 per 100,000 population (n=9237). The regions with the highest fatal drowning rates were in sparsely populated northern areas, notably among older adults (75–84 years: 2.54 per 100,000; 85+: 3.47 per 100,000) and non-Hispanic American Indian or Alaska Native individuals (2.84 per 100,000). Male drowning deaths were 2.7 times more frequent than females. Most incidents occurred in swimming pools (27%), rivers/canals (22.4%), and coastal waters (20.2%). Alarmingly, intentional fatal drowning rates surged by 89% during the study period The Tableau dashboard plays a crucial role in enabling data-driven decisions and effective communication across various applications. Its interactive and visual features make complex data easily understandable and actionable for diverse stakeholders. This contributes to improved responses in cities grappling with drowning challenges induced by climate change. Moreover, the dashboard serves as a cornerstone for ongoing research, policy shaping, and public involvement, addressing the urgent issue of climate related vulnerabilities in urban settings.

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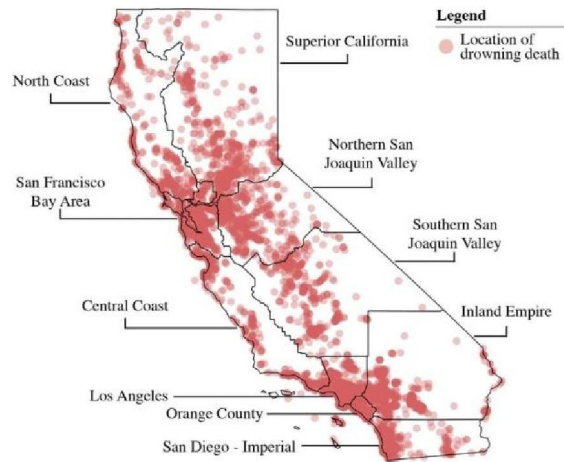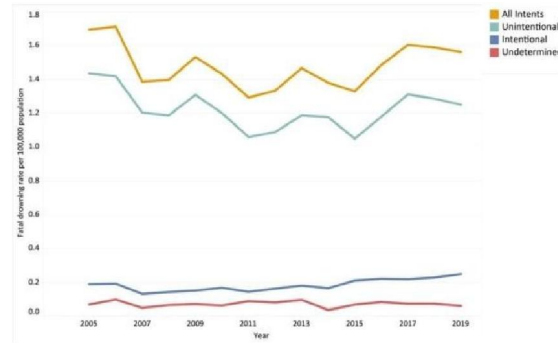
V. RESULT AND DISCUSSION

The proposed model is accurate in creating a comprehensive Tableau dashboard for drowning cities analysis, focusing on factors like drought, flood, precipitation, temperature, and disease, requires a structured methodology. This methodology outlines the key steps and processes involved in building an effective and informative dashboard that can help stakeholders make data-driven decisions to address the challenges faced by vulnerable urban areas.

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