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METHODS USED IN CARTOGRAPHY AND ANALYTICAL ANALYSIS OF GEOGRAPHIC DATA

Murodilov Xasanboy Tolibjon o'g'li [1], Rasulov Asrorjon Yo'ldosh o'g'li [1]
[1]*Fergana Polytechnic Institute, 150107 Fergana, Uzbekistan.,*

Abstract: Cartography and analytical analysis of geographic data play a crucial role in understanding spatial patterns, relationships, and trends in various fields such as geography, urban planning, environmental science, and more. This article explores the methods used in cartography and the analytical analysis of geographic data, highlighting their importance in capturing, visualizing, and interpreting spatial information.
Key words: Cartography, Geographic data analysis, Spatial analysis, Map design, Data collection, Data processing, Spatial interpolation, Overlay analysis, Analytical techniques, Geographic information systems (GIS), Remote sensing, Spatial patterns, Spatial relationships, Geographic information science, Spatial data visualization.

Introduction:

Cartography, the art, science, and technique of making and studying maps, has evolved significantly with technological advancements. In parallel, the analytical analysis of geographic data has become more sophisticated, enabling researchers to extract valuable insights from spatial datasets. This article aims to delve into the methods employed in cartography and analyze how they are used in the analytical analysis of geographic data. Cartography, the science and art of mapmaking, plays a crucial role in helping us understand, visualize, and navigate the complexities of our world. In conjunction with the analysis of geographic data, cartography allows us to explore patterns, relationships, and trends that are essential for making informed decisions in various fields such as urban planning, environmental management, and emergency response. This topic delves into the methods and techniques employed in cartography, as well as the analytical tools used to interpret and extract valuable insights from geographic data [1-5]. By integrating cartographic principles with advanced analytical approaches, researchers and practitioners can create more accurate, informative maps and derive meaningful interpretations that support decision-making processes. In this introduction, we will explore the key methods utilized in cartography and the analytical analysis of geographic data, highlighting their significance in understanding our world and addressing complex spatial challenges.

1.1 Developments in cartography in Uzbekistan.

The development of methods used in cartography and analytical analysis of geographic data in Uzbekistan is progressing rapidly, driven by advancements in technology, capacity building initiatives, and government support []3. This progress is enhancing the capabilities of professionals in the field and benefiting various sectors of the country's economy.

- Integration of Geographic Information Systems (GIS): One of the major developments in Uzbekistan is the integration of GIS technology in various sectors. GIS has become a valuable tool for cartographers and analysts to collect, store, analyze, and visualize spatial data. This technology has been utilized in sectors such as urban planning, agriculture, natural resource management, and disaster response.

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- Remote Sensing: The use of satellite imagery and remote sensing technology has become increasingly important in cartography and geographic data analysis in Uzbekistan. These technologies are used for monitoring land use changes, assessing natural disasters, and conducting environmental studies.
- Digital Mapping: The transition from traditional paper maps to digital mapping has been a significant development in Uzbekistan. Digital mapping allows for more efficient data management, analysis, and visualization, leading to more accurate and up-to-date cartographic products.
- Capacity Building: There has been a focus on capacity building and professional development in the field of cartography and geographic data analysis in Uzbekistan. Universities and training institutes offer courses and workshops on GIS, remote sensing, and spatial analysis, aiming to build a skilled workforce in this area.
- Public and Private Sector Collaboration: There is a growing collaboration between the public and private sectors in Uzbekistan in utilizing advanced methods in cartography and geographic data analysis. This collaboration has led to the development of innovative mapping solutions for various applications [6-10].
- Government Support: The Uzbek government has shown support for the development of cartography and geographic data analysis by investing in infrastructure, technology, and data collection programs. Government agencies are increasingly utilizing advanced methods for spatial decision-making and policy formulation.

1.2 Study area

The issues of geoinformation mapping using modern computer programs based on GAT and cartographic information and knowledge bases, as well as the development of scientific and methodological bases for creating maps and atlases using web technologies have been considered in the research of many foreign scientists. In particular, foreign scientists Richard Gardiner Donohue II, A.M.MacEachren, Björn Sandvik, scientists from the CIS countries Yu.B. , V.S.Tikunov, Ye.I.Khalugin, S.V.Shaytura, S.N.Shibalov, P.R.Kikin, M.Yu.Dubinin, A.M.Kostikova, A.A.Makarenko, G.I.Zagrebin, etc. Research on this topic in Uzbekistan T. Mirzaliyev, L. Kh. Gulomova, A. Egamberdiyev, E. Yu. Safarov, P. R. Reymov, S. A. Avezov, K. I. Gadoyev, Sh. M. Prenov, K. R. Khakimova, D. N. Rakhmonov, R. K. Oymatov, K. K. Bekanov and performed by others. In these studies, the main attention is focused on the issues of design, compilation, preparation and publication of various thematic and target maps (fig.1), as well as their use.

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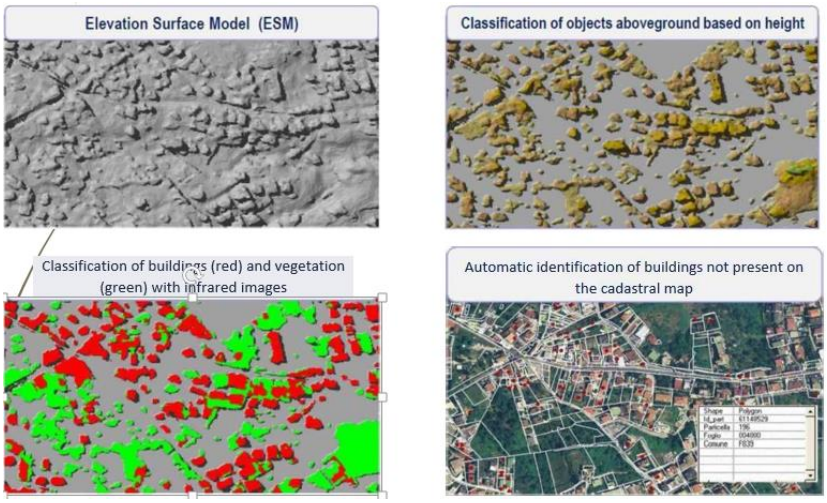

Figure 1. *web maps created by researchers.*

This study differs from the above-mentioned studies in that it is devoted to the issues of creating a sectoral web map based on modern GAT and web technologies, dedicated to the important problems of consistent development in the mapping of all networks [11-15].

Methods

1. Data Collection: The first step in cartography and analytical analysis involves collecting relevant geographic data from various sources such as satellite imagery, GPS, surveys, and remote sensing technologies. This data may include elevation, land cover, population density, and other spatial attributes.

2. Data Processing: Once the data is collected, it goes through a series of processing steps to clean, organize, and prepare it for analysis. This includes data integration, transformation, and conversion into suitable formats for visualization and interpretation.

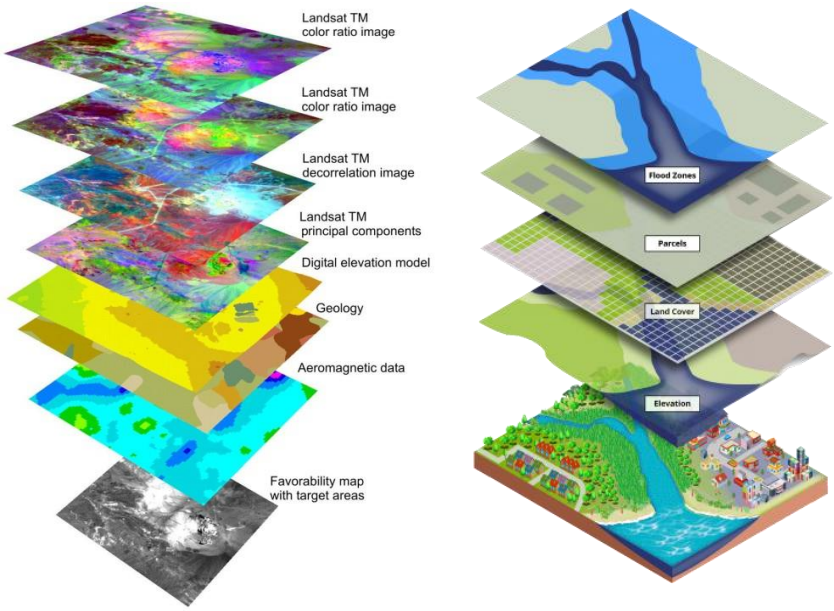

Figure 2. *A scheme for a traceable layer when transferring digital data to a web map.*

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3. Map Design: Cartographers use specialized software tools to design and create maps that effectively communicate spatial information. This process involves selecting appropriate map projections, scales, symbols, and colors to represent geographic features accurately.
4. Spatial Analysis: Analytical techniques such as spatial interpolation, overlay analysis, clustering, and network analysis are applied to geographic data to identify patterns, relationships, and trends. These methods help in understanding spatial distributions, hotspots, and correlations within the data.

Results

The application of cartography methods and analytical analysis of geographic data yields valuable insights for decision-making in diverse fields [9]. For instance, urban planners use spatial analysis to optimize infrastructure development, environmental scientists monitor changes in ecosystems, and emergency responders use maps to coordinate disaster relief efforts [16-20].

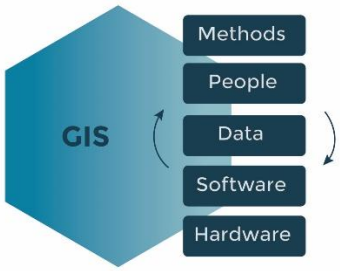

Figure 2. *A scheme for integrating digital data into a card view.*

The digital mapping revolution has brought innovative ways of creating maps through advanced tools and techniques. These tools enable accurate and dynamic mapping that will revolutionize the way we view and interact with geographic data. In addition, the use of geographic information systems (GIS) has enabled user-friendly visualization of complex data sets. This has opened new possibilities for spatial analysis and decision-making, making the Digital Mapping Revolution an important tool for various industries [10, 11]. One of the key aspects of this revolution is the integration of real-time data into maps, providing up-to-date information for a wide range of applications. This real-time data increases the accuracy and relevance of maps, making them more useful and valuable to users.

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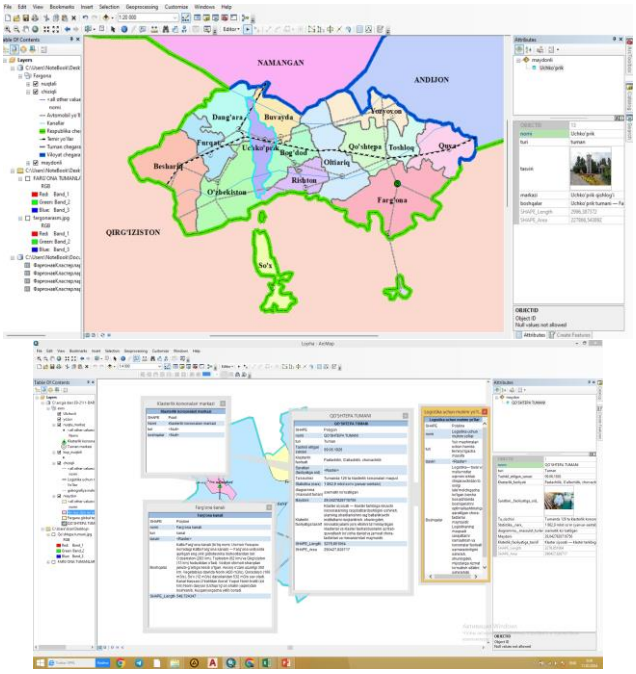

Figure 2. *Representation of digital data through a web map.*

Discussion

By combining the art of cartography with advanced analytical tools, researchers can create visually engaging maps that convey complex spatial information effectively. The integration of geographic data analysis enhances our understanding of spatial phenomena, enabling us to make informed decisions and address complex spatial challenges. Methods used in cartography and analytical analysis of geographic data have evolved significantly over the years, driven by advancements in technology and a growing demand for more sophisticated spatial analysis tools. One of the key methods employed in this field is Geographic Information Systems (GIS), which allow professionals to store, analyze, and visualize spatial data in a dynamic and interactive way [13].

GIS software enables users to overlay different layers of spatial information, such as terrain data, land use patterns, population demographics, and infrastructure networks, to identify spatial relationships and patterns. This enables decision-makers in various fields, from urban planning to natural resource management, to make informed choices based on a better understanding of spatial data. Another important method used in cartography and spatial analysis is remote sensing, which involves the collection of data from sensors mounted on satellites or aircraft. Remote sensing technology allows for the acquisition of detailed imagery and spatial data over large areas, providing valuable insights into environmental changes, urban development, and land cover dynamics. Spatial interpolation methods, such as Kriging, Inverse Distance Weighting, and Splining, are commonly used in cartography and geographic analysis to estimate values at locations where data is not available. These methods help to fill in data gaps and create continuous surfaces that can be used for mapping and analysis purposes. Spatial statistics and spatial data mining techniques are employed to analyze patterns, trends, and relationships within spatial data sets. These methods help in identifying clusters, hotspots, spatial autocorrelation, and other spatial patterns that can inform decision-making processes and guide further research [21,22].

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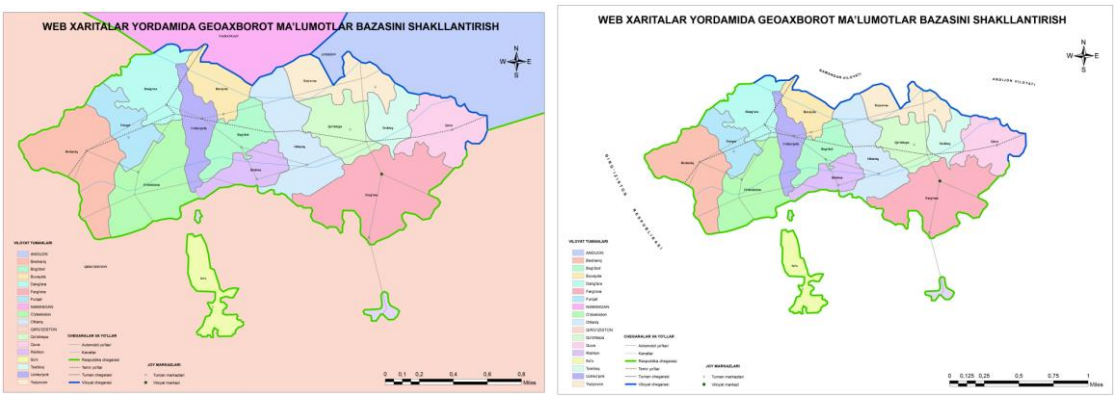

Figure 2. *Electronic map of Fergana region created using ArcGIS software.*

Overall, the methods used in cartography and analytical analysis of geographic data play a vital role in understanding complex spatial relationships, informing policy decisions, and supporting various research endeavors. As technology continues to advance, we can expect these methods to become even more sophisticated and powerful, opening new possibilities for spatial analysis and visualization.

Conclusion

In conclusion, the field of cartography and analytical analysis of geographic data has seen significant advancements in recent years, with a wide range of methods and techniques being used to create, analyze, and visualize spatial information. From traditional map-making methods to modern Geographic Information Systems (GIS) technologies, professionals in this field have a variety of tools at their disposal to effectively communicate spatial data. The integration of advanced statistical and spatial analysis techniques has allowed for a deeper understanding of complex geographic relationships and patterns [8]. By employing methods such as spatial interpolation, clustering analysis, and geostatistics, researchers and practitioners can extract valuable insights from spatial data to support decision-making processes across various disciplines. Moreover, the growing importance of interactive and dynamic mapping tools has enabled users to explore and interact with spatial information in more intuitive ways. From web-based mapping platforms to mobile applications, the accessibility of geographic data and visualization tools continues to expand, providing new opportunities for collaboration and communication. Overall, the methods used in cartography and analytical analysis of geographic data play a crucial role in understanding the world around us, informing planning and policy decisions, and advancing research in diverse fields. As technology continues to evolve, the future of this field holds great promise for further innovation and discovery.

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