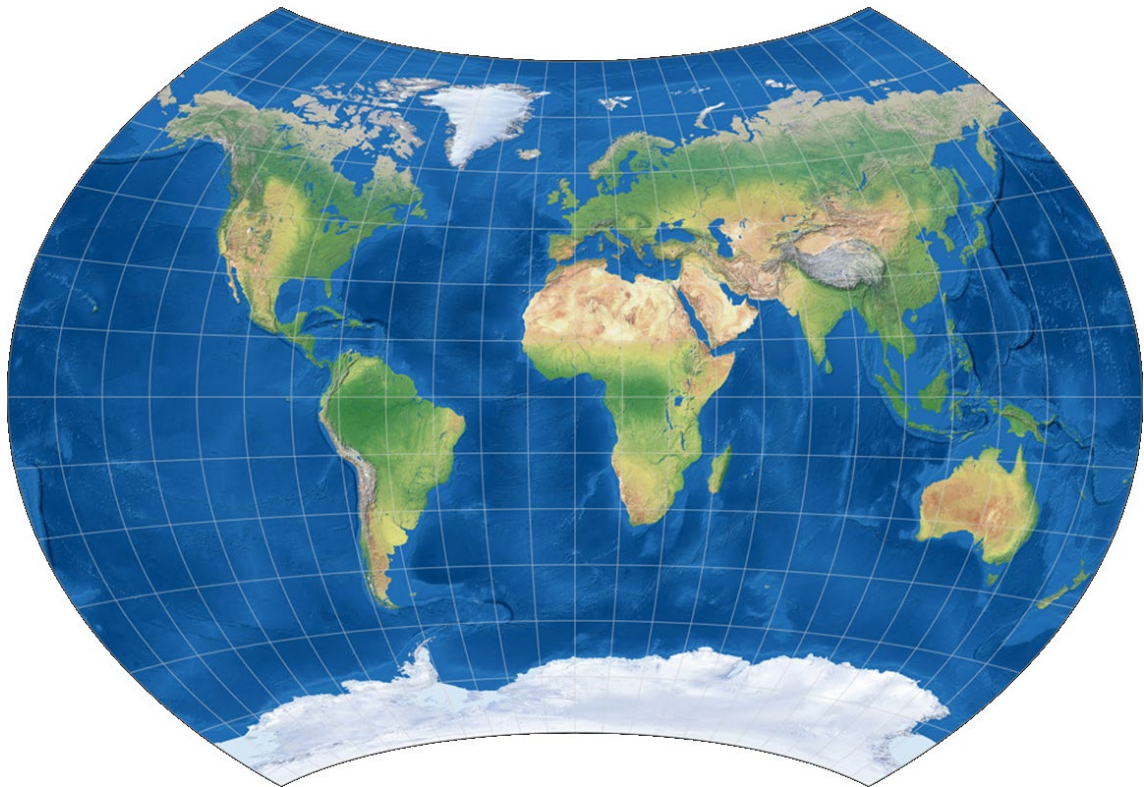


Program and Abstracts

20th International Conference
Geoinformation and Cartography

Zagreb and online
5-7 September 2024



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20thICGC



Zagreb and online 5-7 September 2024

Organizers





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Under the Auspices of



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Introduction

By organizing this conference the Croatian Cartographic Society and the Faculty of Geodesy of the University of Zagreb, wish to contribute to the development of geoinformatics, cartography, geodesy, geography and associated fields with special emphasis on new achievements. A wide range of themes offered, and renowned invited lecturers guarantee interesting lectures and a contemporary approach.

Suggested Themes

- AI, machine learning and robotics
- Big data visualization
- Education in cartography and geoinformation science
- Climate changes and risk management
- LiDAR
- Geodiversity
- Geoheritage and cartoheritage
- Geospatial technologies for local and regional development
- GIS and ecology
- Location-based services and web mapping
- Map projections
- Maps for autonomous vehicles
- Maritime, military and topographic cartography
- Remote sensing and cartography
- Satellite technologies in cartography
- Spatial data visualization and analysis
- UAV – unmanned aerial vehicles

The Organizing Committee is going to consider proposals of other themes from fields connecting cartography, geography, geodesy, geoinformatics and related professions.

Conference program, lecture abstracts and presentations are going to be published at the Croatian Cartographic Society website.



Keynote Speakers



Prof. Emer. Wolfgang Kainz

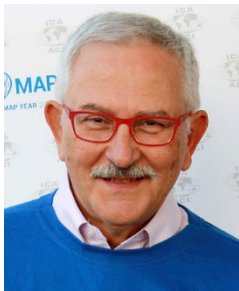
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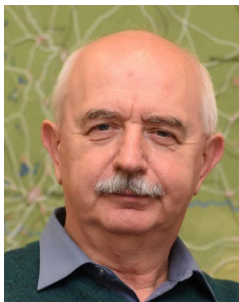
Editor-in-Chief of ISPRS International Journal of Geo-Information

Past Chair of the Austrian Cartographic Commission



Prof. Emer. Evangelos Livieratos

Evangelos Livieratos is professor emeritus of the Faculty of Engineering, Aristotle University of Thessaloniki (AUTH). Elected full-professor (1979) at the Chair of Higher Geodesy and Cartography, School of Rural and Surveying Engineering, Faculty of Engineering, AUTH. Author, organiser and elected Chair of the Commission on Cartographic Heritage into the Digital of the ICA with four mandates (2005-2019). Founder and editor of the international web journal *e-Perimetron*



Prof. Dr. László Zentai

Professor and head of the Department of Cartography and Geoinformatics at Eötvös Loránd University in Budapest. Vice-Rector of the university. An active orienteer and member of the International Orienteering Federation's Council.

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20th International Conference on Geoinformation and Cartography

First day program, Thursday, 5 September 2024

Location: Faculty of Geodesy, University of Zagreb, temporary location: Zagreb, Grada Gospića 1A (Tekstilpromet building)

9:00–10:00 Registration

10:00–10:30 Opening Ceremony

10:30–11:00 Keynote Lecture

Evangelos LIVIERATOS	The Importance of Cartographic Literacy in GI Science: Maps vs Images
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11:00–11:30 Coffee Break

11:30–12:00 Keynote Lecture

László ZENTAI	The European Higher Education Area, the European University Alliances: Chance for Inter- and Multidisciplinary University Programmes, Chance for Cartography and Geoinformatics
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12:00–12:20 Presentation

Dubravka MLINARIĆ	Teaching Cartography at Accademic Level in Croatia: Preliminary Results
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12:20–13:00 Sponsor Presentations

Geomatika d.o.o.	Golden Sponsor
List Labs d.o.o.	Sponsor
Geomodeling d.o.o.	Sponsor
Zavod za fotogrametriju d.d.	Sponsor



13:00–14:00 Lunch at the Odeon Restaurant, Grada Gospića 1A

14:00–15:00 Presentations:

Damir MEDAK	Studies of geodesy and geoinformatics at the Faculty of Geodesy, University of Zagreb and the Labirint Project
Dušan PETROVIČ	Studies of geodesy and geoinformatics at the Faculty of Civil and Geodetic Engineering, University of Ljubljana
Krisztián KERKOVITS	Studies at the Department of Cartography and Geoinformatics, Eötvös Loránd University in Budapest

19:00

Dinner at the Medvedgrad Beerhaus, Ilica 49



Second day program, Friday, 6 September 2024

Location: Faculty of Geodesy, University of Zagreb, temporary location: Zagreb, Grada Gospića 1A (Tekstilpromet building)

10:00–10:30 Keynote Lecture

Wolfgang KAINZ	From GIS and Remote Sensing to Spatial Data Science
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10:30–11:30 Presentations

Damir MEDAK, Mario MILER, Luka RUMORA, Dino DOBRINIĆ, Ivan BRKIĆ	The First LiDAR Survey of Croatia – a 3D model for a webGIS
Robert ŽUPAN, Stanislav FRANGES	Web Cartography Using AI
Dušan PETROVIĆ	Archiving Analogue Material of Basic Topographic Plan of Slovenia

11:30–12:00 Coffee Break

12:00–13:30 ICA Commission on Map Projections

Krisztián KERKOVITS	ICA Commission on Map Projections
Atima THARATIPYAKUL, Haw Yuh LOH, Simon T. PERRAULT, Yong WANG, Michael T. GASTNER	Effectiveness of Large-Language Models in Recognizing Spatially Intensive Statistical Data
Miljenko LAPAINE	Hammer Projection
Krisztián KERKOVITS	A Low-distortion Authalic Sphere for Regional Maps
Tome MARELIĆ	Are Portolan Charts and Portolan Mile Geometrically Rooted in Classical Antiquity? Cartometric Analysis of The Carte Pisane, Cortona, Avignon, Lucca Charts, and Al-Shirazi's "Greek Map"

13:30–14:30 Lunch at the Odeon Restaurant, Grada Gospića 1A

14:30–15:30 Presentations

Dino BEČIĆ	Spatial Patterns and Housing Inequalities – An Exploratory Analysis in the City of Zagreb
Julijan SUTLOVIĆ	A Case Study of Geopolitical Discourse Conflict: Lokrum Island's Geographical Name
Denis RADOŠ, Branimir VUKOSAV, Mislav Stjepan ČAGALJ	Ergonyms Associated with the Name "Dalmatia" in Croatia
Vinka KOLIĆ BUBIĆ, Valerija FILIPOVIĆ	Hydrographic Institute of the Republic of Croatia – Development and Activities

Free afternoon



Third day program, Saturday, 9 September 2024

Guided Tour to Medvednica Mountain

Medvednica is a mountain in central Croatia, just north of Zagreb, and marking the southern border of the historic region of Zagorje. The highest peak, at 1,035 m is Sljeme. Most of the area of Medvednica is a nature park (*park prirode*). During Miocene and Pliocene, the mountain was an island within the Pannonian Sea.

The departure of the tour is on Saturday, September 9, 2024 at 10 a.m. in front of the starting station of the cable car.



On Sljeme, at the top of Medvednica, we will see the place where there used to be a trigonometer and a wooden pyramid above it. The first wooden structure on Sljeme was erected in 1869 and served as a trigonometer of the first order. Citizens were able to enjoy the view from Sljeme for the first time in 1870, when the forest on its top was completely cut down. In the same year, German surveyor Nitzl brought Zagreb merchants Lovrenčić and Meško to Sljeme, who were so delighted by the view from the mountain that they decided to build a solid wooden pyramid on its top. Although only 4 meters high, the small pyramid was the first object in the history of Croatian mountaineering!





As the forest grew, so did the pyramid: in 1877, a new 8-m-high wooden structure was built, and in 1889, it was replaced by an even 12-m iron lookout tower. With the construction of the first iron TV tower on Sljemen in 1960, the pyramid became redundant, so it was moved to Japetić in Samoborska Gora, where it still welcomes mountaineers today. In 1973, a new TV tower was designed. The new Sljeme tower was conceived as a paradise for visitors looking for distant views, with an elevator that would take them 81 m high to an open observation deck or to a slightly lower cafe with a view of all corners of the world. There was even a luxury restaurant with a rotating platform in the plan, which was never built. Unfortunately, the tower was only open to visitors for less than two years, after which visitors to Sljeme had to be satisfied with "only" the view of Zagorje from the viewpoint on the top of the mountain. Today, the OIV (Odašiljači i veze / Digital signals and networks) Sljeme tower is one of the symbols of Zagreb, it is the trademark of Medvednica and the highest tourist point of the Croatian capital, which is worth visiting and experiencing. It is only 50 m away from the upper station of the new, modern Sljeme Cable Car.



Hotel Tomislavov dom represents a masterpiece of Croatian and international architecture of the thirties of the last century. It was built in 1937 according to the idea of architect Stjepan Planić as a 4-storey building perfectly integrated into the natural environment thanks to the Y floor plan, the first of its kind in Croatia and among the first in Europe. Tomislav's home has a glazed dining room and a large terrace for sunbathing in the western wing, an example of the harmonious use of different materials (stone and timber, concrete and glass) characteristic of the Zagreb school of modern architecture between the two wars. Lunch awaits us at the Tomislavov dom hotel at 1 pm. Return to the city by cable car in the afternoon.

Open in Google Maps:

<https://goo.gl/maps/3WbTtGtSo88Nr7hB9>

Zagreb Cable Car address

Address: Dolje, 10000 Zagreb

GPS Coordinates: 45.861077, 15.982681



*Hotel Tomislavov dom
Restoran Tomislav*



Daily menu

Beef soup 3,00 €
Mushroom soup 3,50 €

Bean broth 5,50 €
Bean broth with sausage 6,50 €

Breaded chicken, fries 14,00 €
Pork stew, pasta 10,00 €
Grilled pork loin, boiled vegetables 16,00 €
Turkey fillet in bacon sauce, croquettes 13,00 €
Trout in cornmeal, Swiss chard and potatoes 17,00 €
Pasta with vegetables 8,00 €

Salad 3,00 €

Cherry or apple strudel 3,00 €
Chocolate mousse 3,00 €
Sljeme gibanica – national dish 4,00 €
Apple pie 3,50 €

Bon appetit!



20th International Conference
on Geoinformation and Cartography

Abstracts



Spatial Patterns and Housing Inequalities – An Exploratory Analysis in the City of Zagreb

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Abstract

This study investigates spatial patterns and housing inequalities in city districts of Zagreb, Croatia, in response to its growing population and evolving urban landscape. The primary goal is to apply advanced spatial analysis techniques to analyze housing distribution, identify spatial autocorrelations, and detect clusters of housing availability within districts. The research involves collecting and integrating various data sources, including demographic data (such as the number of households and population count), and big data. Geographic data science concepts will be employed to create a cohesive spatial framework and conduct detailed analyses.

The methodology includes gathering demographic data and housing information from official records, supplemented with real-time data obtained through advanced data retrieval. This data will then be integrated into a comprehensive spatial framework. Spatial autocorrelation analysis using Moran's I and Getis-Ord Gi* statistics will identify patterns and clusters of housing values. Cluster analysis will define areas of high and low housing density, while spatial regression models will explore the relationships between demographic characteristics and housing availability. Additionally, exploratory spatial data analysis (ESDA) techniques will identify outliers and spatial heterogeneity, providing a deeper understanding of the spatial distribution of housing data.

The expected outcomes of this research focus on providing detailed insights into the spatial distribution of housing within Zagreb's districts. The study will pinpoint areas with significant housing availability issues and elucidate the demographic factors driving these patterns. These insights could be crucial in developing informed strategies to address housing inequalities and promote sustainable urban development. By leveraging advanced spatial analysis methods and integrating comprehensive data sources, the study aims to offer a robust and accurate analysis, providing a comprehensive view of the housing landscape in Zagreb. This focused approach will provide targeted insights that can directly influence local urban planning initiatives, ensuring that development efforts are well-informed and effectively address the specific needs and challenges of different districts in Zagreb.

Keywords: Housing, Spatial analysis, ESDA, R, Zagreb



From GIS and Remote Sensing to Spatial Data Science

Wolfgang KAINZ

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Abstract

The presentation discusses the transition from GIS and remote sensing to geo-information science and on to spatial data science by looking at the historic evolution of GIS and the central position of spatial modeling and analysis. The role of mathematics, particularly the role of topology, for structuring spatial data will be explained. Relationships between the disciplines involved in spatial data science as well as several misconceptions about them will be discussed as well. Finally, a reasoning is given why we should move on from geo-information science to spatial data science, how geographic information systems fit into this concept and their future development.



A Low-Distortion Authalic Sphere for Regional Maps

KERKOVITS Krisztián

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Abstract

Development of oblique-aspect map projections of the ellipsoid is usually greatly simplified by auxiliary spheres. The process can be described as a double mapping: in the first step, we map the spheroid onto an auxiliary sphere; then the graticule is rotated on the sphere and finally, a sphere-to-plane map projection is applied. A drawback of this approach is that the first mapping to the auxiliary sphere may introduce unwanted distortions. Therefore, various auxiliary spheres were developed for different use-cases (global / regional maps) and distortion properties (for conformal / equal-area map projections). However, to the best knowledge of the author, the equal-area auxiliary sphere (aka. authalic sphere) has only been developed for global maps, greatly limiting its potential flexibility. Unlike the realizations available in previous literature, the authalic sphere proposed has minimal distortion at the neighbourhood of a freely chosen standard parallel. For this reason, the distortions caused by this authalic sphere can be neglected. The derivation is very similar to the Gaussian conformal sphere used presently in Switzerland and the Netherlands. Some possible use-cases and further development possibilities will be presented. Interesting side results of the study include surprising mathematical connections between the Gaussian conformal sphere and the low-distortion authalic sphere.

Keywords: map projections, double mapping, auxiliary sphere, Gaussian sphere, authalic sphere



Hydrographic Institute of the Republic of Croatia – Development and Activities

Vinka KOLIĆ BUBIĆ, Valerija FILIPOVIĆ

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Abstract

The Hydrographic Institute carries out hydrographic activity of interest to the Republic of Croatia, covering scientific research, development and professional tasks relating to the safety of navigation, hydrographic-geodetic survey of the Adriatic, marine geodesy, construction and production of nautical charts and publications, oceanographic research, submarine geology research, as well as publishing and printing.

Nautical cartography, as a branch of thematic cartography, has specific application in maritime industry, especially for the purpose of displaying marine navigation areas at different scales, containing all the elements for safe navigation. Technological products of nautical cartography are paper charts and Electronic Navigational Charts (ENC), as the essential part of worldwide marine navigation. Official paper navigational charts show a navigational area (part of the Earth's surface), including all the elements necessary for navigation. Their use is mandatory to ensure hydrographic-navigational safety at sea.

The Hydrographic Institute is responsible for the development of navigational safety service in the Adriatic, within the worldwide navigational safety system, and in cooperation with the Ministry of the Sea, Transport and Infrastructure, port authorities, the Croatian Navy, lighthouse authorities, and hydrographic offices of all maritime countries, following recommendations of the International Hydrographic Organization (IHO), the International Maritime Organization (IMO) and the International Association of Lighthouse Authorities (IALA).

Regarding the production of charts, the entire area of responsibility for the eastern Adriatic coast, under Croatian jurisdiction, is covered by relevant official editions of navigational charts and publications (paper and digital). This applies especially to navigation areas of SOLAS ships. The Hydrographic Institute is continuously focused on increasing the number of Electronic Navigational Charts (ENC) by publishing ENCs of marinas and harbours based on the new hydrographic survey. The entire ENC folio is made available to seafarers and maritime administrations worldwide through PRIMAR RENC. Electronic Navigational Charts are made available on vessels of the Croatian Navy through Agreement between the Navy and the Fleet of the Ministry of the Sea, Transport and Infrastructure. Support is provided for the Ministry of Defence – survey for military purposes and Additional Military Layers (AML) for the Adriatic Sea under Croatian jurisdiction. Contracts have also been concluded with maritime administrations and the Croatian Navy on the use of ENCs for administrative purposes (WMS for ENCs). The navigational warning service works in good condition, cooperating effectively with navigational safety entities in Croatia and neighbouring countries, and the NAVAREA III Coordinator.

Keywords: cartography, paper charts, Electronic Navigational Charts, Additional Military Layers



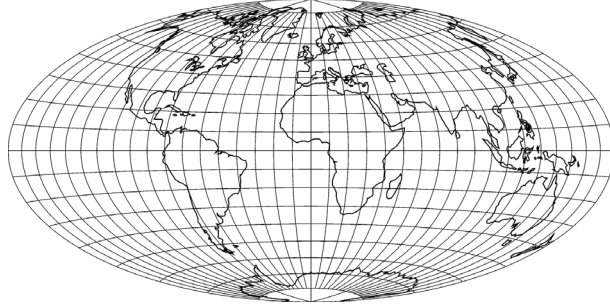
Hammer Projection

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Abstract

Ernst Hammer was a German cartographer, geodesist, astronomer and mathematician (1858-1925). At the age of only 26, he was appointed professor of higher and lower geodesy at the Technical University of Stuttgart, later becoming professor of geodesy and practical astronomy. Many people wrote about his works on map projections or were inspired by his works, for example Winkel (1922), Eckert-Greifendorff (1935), Wagner (1949), Briesemeister (1953), Leighly (1955), Kavrayskiy (1958), Tobler (1962, 1964), Solov'ev (1969), Frančula (1971), Maling (1973), Canters, Declair (1989), Bugaevsky, Snyder (1995), Snyder (1997), Jenny (2012) and others.



In cartography, Hammer's projection is known and is named after him. This projection is sometimes called the Hammer-Aitoff projection because Hammer proposed it after being inspired by the way David Aitoff constructed the projection known today as the Aitoff projection.

In a previous paper, I derived the conditions that a single point must meet to be a standard point of a map projection. Assuming

$$\frac{\partial y}{\partial \varphi} \frac{\partial x}{\partial \lambda} - \frac{\partial x}{\partial \varphi} \frac{\partial y}{\partial \lambda} > 0 \quad (1)$$

these conditions are

$$\frac{\partial x}{\partial \lambda} = \frac{\partial y}{\partial \varphi} \cos \varphi \quad \text{and} \quad \frac{\partial y}{\partial \lambda} = -\frac{\partial x}{\partial \varphi} \cos \varphi \quad (2)$$

and

$$\left(\frac{\partial x}{\partial \varphi}\right)^2 + \left(\frac{\partial y}{\partial \varphi}\right)^2 = 1. \quad (3)$$

In (1)-(3) $x = x(\varphi, \lambda)$, $y = y(\varphi, \lambda)$ are functions that define the map projection, and $\varphi \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, $\lambda \in [-\pi, \pi]$ geographic coordinates. Conditions (2) mean that the point is mapped conformally, i.e. that Tissot's indicatrix will be a circle. Condition (3) means that this circle will be unit. It is shown that for some projections the system (2)-(3) is easily solvable.

However, for some, such as the Hammer projection, the solution is not entirely straightforward. In this paper, it is shown that a lot of mathematical dexterity needs to be used to solve the system (2)-(3). Finally, it is shown that the Hammer projection has only one standard point.

Keywords: map projections, Hammer projection, standard point



The Importance of Cartographic Literacy in GI Science: Maps vs Images

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Abstract

Starting from the description of phenomena that determine and consist the ‘geospace’, the keynote address analyse the mapping process in the *separation* and in the *system* modes and the placement of *cartographic literacy* in these two modes of mapping. The issue of *map* vs *image* is then approached in the cognitive relation of the triad of ICA aims, namely Cartography, Map and GI Science. The missing of *cartographic literacy* is projected as a fundamental threat for a balance symbiosis of *maps* and *images* for proper uses each in representing the geometric, physical and man-made phenomena of our planet-earth in environmental danger, thus supporting effective decision making and wise interventions, based on data, information and knowledge.



Are Portolan Charts and Portolan Mile Geometrically Rooted in Classical Antiquity? Cartometric Analysis of the Carte Pisane, Cortona, Avignon, Lucca Charts, and Al-Shirazi's "Greek Map"

Tome MARELIĆ

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Abstract

Some of the earliest-made known portolan charts (Pisane, Cortona, Avignon, and Lucca charts) and Qutb al-Din al-Shirazi's schematic (1282) resembling "a map of the Mediterranean that was drawn by the sages of Greece and the ancient geometers" were cartometrically analysed. The findings yield a set of completely new insights into the earliest known stages of nautical cartography in the Mediterranean region. The Mediterranean appears to have been drawn nearly identically on the Carte Pisane and Lucca chart, suggesting that the majority of their coverage was copied by using the same template, whereas the preserved fragment of the Avignon chart represents an intermediate step between the Pisane–Lucca model and Pietro Vesconte's model (1311–13). The average length of squares' sides within grids common to the Carte Pisane, Avignon chart, and al-Shirazi's schematic is around 125 km along the parallel $\varphi=36^\circ$ – a value that corresponds to 100 portolan miles (miglia) and to a two-degree interval along the parallel $\varphi=36^\circ$ according to Ptolemy's incorrect estimation of the Earth's size. Since their coastline shapes are far from those on the plate carrée projection, the appearance of these grids suggests that their authors were oblivious to how distances along the longitudinal and latitudinal arcs on the Earth's sphere are distributed and projected. The proposed hypothesis suggests that such a scenario could have occurred if the late medieval cartographer (unfamiliar with differences between spherical and Euclidean geometry) erroneously combined different spatial datasets from classical antiquity by unwittingly superimposing Ptolemy's longitudes onto the manually reproduced mosaic of regional maps or charts that were originally made according to Eratosthenes' correctly obtained size of the Earth by treating them as distances.

Keywords: portolan charts, portolan mile, Carte Pisane, Cortona chart, Avignon chart, Lucca chart, Qutb al-Din al-Shirazi, portolan chart origins, cartometric analysis

Note: On August 20, 2024, the Cartographica journal accepted the original scientific paper presenting and discussing these findings for publication. Aside from that, the study's findings have not yet been presented at conferences.



The First LiDAR Survey of Croatia – a 3D model for a webGIS

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Abstract

The first detailed LIDAR survey of the whole territory of Croatia has been performed between 2020 and 2023 within the project “Multisensory aerial survey of Republic of Croatia for the purposes of reduction of disaster risks”. The partners on the project were State Geodetic Administration of the Republic of Croatia, City of Zagreb and University of Zagreb – Faculty of Geodesy.

It was planned that the density of points should be at least of 8 points per square meter for urban areas (approx. 30% of Croatian territory), and at least of 4 points per square meter outside urban areas. In addition, survey of 4000 km of embankments with the point density of 20 points per square meter was ordered by the public company Hrvatske vode (Croatian Waters). The project was funded by European Union with contributions from Hrvatske vode and Ministry of science and education of Croatia.

Surveying with airborne LiDAR technology and the classification were performed by the consortium of private enterprises. Specialists from University of Zagreb – Faculty of Geodesy prepared the specification of measurements, performed the quality control and hosted a unique geoinformation system with quick and easy access to all data.

At the end of the project, the whole territory of Republic of Croatia has been surveyed with more detail than a minimal number of points. Public access to all classified data has been ensured through a webGIS.

This presentation gives an overview of the first 3D survey of Republic of Croatia, stressing the usage of latest geoinformation technology for quick access of data. Finally, the demonstration of the LiDAR webGIS capabilities is given.

Keywords: LiDAR, webGIS, 3D model



Teaching Cartography at Academic Level in Croatia: Preliminary Results

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Abstract

Based on a research conducted with qualitative methods (semi-structured questionnaire) on a selected sample ($N = 17$, 9 expert interviews and 8 student interviews), data were collected on various aspects of cartography teaching at the academic level in Croatia, ranging from undergraduate to graduate and postgraduate level. Classes are held in Zagreb and Zadar, and respondents come from all parts of Croatia, from Korčula to Đakovo and Osijek. Students' involvement in publishing their research in various fields of cartography as a discipline in professional scientific and professional journals within Croatia was also assessed, as part of their interests and realized scientific affinities. Research has been or is still being conducted by students and professors/mentors in fields such as geography, history, art history, geodesy, aviation, forestry, agronomy and architecture. Preliminary results indicate specific course design and delivery practices driven by trends in motivation for choosing that particular subject and knowledge acquisition related to student satisfaction with cartography instruction as well as accessibility of knowledge about the spatial location of the institution. The results also show patterns in students' assessment of the quality of skills acquired, as well as assessment of the innovativeness of teaching, technological support and institutional infrastructure. In terms of identifying existing challenges and defining best practices for further improving the organization and delivery of cartography courses at Croatian universities, respondents rated (subjectively) the practical skills and knowledge acquired and the effectiveness of their education in motivating them to work independently. They also assessed the compatibility of the learned and acquired elements with the requirements of their future professions and the labor market in the coming decades of the 21st century.

Keywords: cartography teaching, university education, Croatia, best practices



Archiving Analogue Material of Basic Topographic Plan of Slovenia

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Abstract

The Basic topographic plan (Temeljni topografski načrt – TTN) was the largest-scale topographic map systematically covering the entire territory of the present-day country of Slovenia, and at the time of its creation it was an outstanding cartographic achievement, as the territory of Slovenia was one of the few in the world to be fully represented on a detailed topographic map of such a large scale. It was produced between 1961 and 1984 on the basis of aerial survey images and additional field surveys, with only the formerly closed areas of Kočevska Reka and Gotenica covered by sheets produced after 1990. Most of the area was shown on 2,543 sheets measuring 3×2.25 km at a scale of 1: 5000 (size 60×45 cm), while the less populated, predominantly mountainous areas were shown on 258 sheets at a scale of 1: 10,000, each covering an area of 6×4.5 km. Some intermediate areas were also shown at both scales. The sheets were produced on dimensionally stable plastic foils in a maximum of 6 layers (situation, names, watercourses, water surfaces, relief and vegetation) and were also printed in colour on cartographic and transparent paper for a period of time, and after printing was discontinued, a joint copy was made on film, from which copies were made for the users, first using the ozalid copying technique and later using photocopiers. The content of the sheets was renewed according to the topicality of the area and the extent of the changes until 1997, when the renewal was abandoned due to the general obsolescence of the content and the obsolescence of the technology. At that time, the most recent state layers were scanned at a resolution of 300 dpi. As an up-to-date replacement, orthophotos with geographic names were initially produced for most of the sheet areas, and later a vector topographic dataset of the National Topographic Model. Nevertheless, both analogue copies of the merged originals and orthophotos with names and raster images of the layers were regularly issued to users until 2019, when the National Surveying and Mapping Authority (SMA), as custodian, completely exclude the TTN as part of the system due to its obsolescence. All the material remained in the premises of the SMA as an archive, occupying the space of 40 iron drawer cabinets measuring $120 \times 80 \times 95$ cm. Due to the lack of archive space, the SMA decided to hand over the material to the Slovenian Archives, but the Archives wanted to limit the amount of material. This raised the crucial problem of which material to keep and which to discard. An examination of the folders containing the individual sheets revealed that, in addition to the printed sheets, orthophotos, merged copies and folios of the individual layers mentioned above, there was a lot of other material stored, ranging from the layers of additions and corrections on the folios, lists of control points, renewal checklists, and even sheets printed on a paper-coated metal plate. The choice of material to be archived was based on the principles of potential user interest in analysing changes over time and preserving the heritage of the cartographic and reproduction techniques used to produce the sheets.

Keywords: Basic Topographic Plan, archive, Slovenia, plastic foils



Ergonyms Associated with the Name "Dalmatia" in Croatia

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Abstract

The concept of spatial identities is increasingly prevalent in contemporary geographical science, but also in other sciences, especially social sciences. Essentially, it is a term that unites the geographical specificity of space and the feeling, i.e. the connection of the population with the space. Spatial identities are most often expressed through specific geographical names, that is, toponyms that become the "carriers" of the identity. They are at the same time the key to researching both the expression and the distribution of a particular spatial identity.

In this paper, with the help of spatial referencing ergonim (names of associations, companies and trades), the Dalmatian regional identity is investigated, i.e. its expression in the four southernmost Croatian counties, which spatially coincide with the historical and cultural region of Dalmatia. The name "Dalmatia", as well as all its derivatives, is researched in available online ergonim databases and the results are displayed at the level of local self-government units - cities and municipalities. The obtained results are presented using cartograms with the aim of better understanding the spatial aspects of regional identity, i.e. comparing the expression of the same in individual cities and municipalities of Dalmatia.

Keywords: ergonyms, Dalmatia, Croatia, spatial identity



A Case Study of Geopolitical Discourse Conflict: Lokrum Island's Geographical Name

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Abstract

The conflict of geopolitical discourse is vividly illustrated through the examination of various geographical names assigned to Lokrum Island on early modern nautical charts and in navigation guides. By delving into the geopolitical dynamics between the Republic of Venice and the Republic of Dubrovnik, this research underscores how geographical names (toponyms) not only reflect but also shape territorial ambitions and political narratives.

The study employs a comparative qualitative analysis of historical cartographic sources and navigation guides, utilizing an interdisciplinary approach that integrates contemporary research paradigms such as border studies, imagology, cultural geography, and geopolitical discourse. This approach allows for an in-depth exploration of how toponyms function within the broader context of political ideology and cartographic tradition. Particular attention is given to the role of toponyms as instruments of political and cultural hegemony, demonstrating how powerful states like the Republic of Venice used cartography as a means to legitimize their territorial claims. The analysis shows that cartographic representations actively contribute to the construction and perpetuation of ideological narratives. The island was named with multiple names, such as Iacroma, croma, and similar names, and Scoglio di San Marco. The findings reveal that renaming Lokrum Island was a strategic tool for asserting dominance and shaping political discourse. The name Scoglio di San Marco was carefully chosen to assert control and influence over the island.

This research contributes to the broader understanding of how cartography and toponymy function as instruments within geopolitical discourse. It provides insights into the geopolitical processes through which cartography and place names are used to assert power and control, ultimately enriching comprehension of geopolitical strategies and their historical roots.

Keywords: geopolitical discourse, Lokrum Island, Adriatic Sea, nautical charts, toponym, history of cartography



Effectiveness of Large-Language Models in Recognizing Spatially Intensive Statistical Data

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Abstract

A statistical quantity associated with a geographic enumeration unit is termed “intensive” if its value is, at least approximately, independent of the unit’s spatial extent. For instance, the corporate tax rate, expressed as a percentage of income, levied by a U.S. state is an intensive quantity because every subdivision within the state (e.g., county) applies the same rate. Distinguishing between intensive and non-intensive quantities is crucial in cartography because only intensive ones are suitable for color-coding on choropleth maps. This study evaluates the ability of large language models (LLMs) to identify whether a quantity is intensive. We selected the three currently most popular LLMs in the Ollama platform: Gemma (version 7B), Llama 3 (8B), and Mistral (7B). We tested these models using 1,326 indicators from the World Bank Data Catalog. For ground truth data, we manually classified each indicator as intensive (1,006 indicators) or non-intensive (320).

Our study involved various prompts, combining three distinct definitions of “intensive” from the literature with five types of verbal data descriptions:

I0: Indicator title only.

I1: I0 and a unit hint.

I2: I1 and the World Bank’s indicator description.

I3: I2 and the first five rows of non-missing data. Each row consisted of a country name and the corresponding indicator value.

I4: I3 and the slope, alongside the confidence interval, of a regression line against the logarithm of the area.

We benchmarked our results against a simple rule-based method that identifies intensiveness based on keywords such as “per,” “%,” or “percent.” Additionally, we classified the data using a Support Vector Machine (SVM) with a radial basis function kernel, incorporating the slope as the sole feature. The data set was split into 80% for training and 20% for testing. Our findings highlight performance variations across models and prompts, using the F1-score as a metric, chosen for its balanced accounting of precision and recall.

Overall, certain combinations of LLMs, intensiveness definitions, and data descriptions performed well in the classification. The optimal combination, achieving an F1-score of 0.961, involved Llama 3 as the LLM, with a prompt incorporating the slope and its confidence interval (I4) as well as the intensiveness definition by the International Union of Pure and Applied Chemistry (2019): “Physical quantity whose magnitude is independent of the extent of the system.” While this result surpassed the simple rule-based method’s F1-score of 0.916, the SVM model still attained the highest F1-score of 0.980. Nevertheless, LLM-based methods can offer potential advantages, such as the straightforward extension to multiple languages and the provision of verbal explanations to users. Additionally, LLMs have the potential to facilitate more complex tasks, such as recommending a thematic map type and layout based on the data types and values. These aspects warrant further investigation.

Keywords: Geospatial statistics, machine learning, prompt engineering, thematic maps



The European Higher Education Area, the European University Alliances: Chance for Inter- and Multidisciplinary University Programmes, Chance for Cartography and Geoinformatics

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Abstract

The political and economic changes in Europe in the late 1980s and early 1990s also affected higher education. In the last decades, the higher education systems of the individual countries have been transformed and standardised, but the political will to govern higher education was also necessary for the development of the Bologna Process and the European Higher Education Area. A new development in this field in the last decade has been the creation of European University Alliances. The aim of the European University Alliances was to strengthen cooperation between European higher education institutions and to promote the development of common European values and identities. The first such call for proposals was launched in 2019 under the Erasmus+ programme. In the longer term, the associations aim to develop a European university status that will allow for the joint delivery of courses and simplify the award of European diplomas. The member institutions of the European University Alliances will work in close administrative, teaching and research cooperation. They also contribute to improving the quality of education and enhancing research activities. Experience from the first years shows that the Associations have brought many benefits to the participating institutions. They have helped to manage crises (Covid pandemic), strengthen cooperation between institutions and increase the mobility of students and staff. Participation in joint university programmes can bring significant results for our field. Cartography and geoinformatics can be part of many inter- and multidisciplinary programmes and can contribute to the success of these courses. In this presentation I will review the joint programmes launched so far by some European University Alliances with a special focus on the contribution of our field.

Keywords: higher education, European Higher Education Area, joint programmes



Web Cartography Using AI

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Abstract

The integration of Artificial Intelligence (AI) into web cartography is revolutionizing the way maps are created, visualized, and used. We will present the keyways AI enhances web-based mapping technologies, focusing on improvements in data collection, analysis, and cartographic design. AI-powered algorithms can automate the processing of vast geographic datasets, such as satellite imagery and GPS data, allowing for real-time updates and more accurate, dynamic maps. This capability is particularly beneficial for applications requiring timely information, such as disaster response and urban planning. Furthermore, AI enhances cartographic design by enabling the creation of dynamic and personalized map layers that adapt to user preferences. These AI-driven maps can automatically adjust the level of detail and optimize visual elements like color schemes and symbols, making complex data more intuitive and accessible. Showing highlights how AI not only improves the aesthetic quality of maps but also enhances their usability by tailoring content to individual needs. By examining current AI applications in web cartography and exploring future possibilities, this study demonstrates how AI is transforming maps from static representations into interactive, intelligent tools. This evolution is making maps more responsive to user demands, thereby expanding their potential applications and improving decision-making processes across various fields.

Keywords: AI, web cartography, maps



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