

"SUN'IY INTELLEKT YORDAMIDA GEOINFORMATSION TIZIMLARDA YO'L TARMOQLARINI OPTIMALLASHTIRISH"

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Anotatsiya. Ushbu maqolada sun'iy intellekt (SI) texnologiyalarining geoinformatsion tizimlar (GIT) bilan integratsiyasi orqali yo'l tarmoqlarini optimallashtirish imkoniyatlari tahlil qilinadi. Zamonaviy shaharlarda transport oqimini samarali boshqarish va yo'l infratuzilmasini takomillashtirish muhim ahamiyat kasb etadi. SI asosidagi algoritmlar, jumladan neyron tarmoqlar, genetik algoritmlar va mashinaviy o'rganish metodlari GIT orqali yig'ilgan ma'lumotlarni tahlil qilishda yuqori aniqlik va samaradorlikni ta'minlaydi. Tadqiqot davomida real vaqtda monitoring, tirbandliklarni bashorat qilish, eng maqbul yo'nalishlarni aniqlash kabi vazifalar bo'yicha SI yondashuvlarining afzalliklari yoritiladi. Shuningdek, GIT va SI integratsiyasining amaliy misollari va ularning yo'l tarmog'i rejalashtirishidagi roli ko'rib chiqiladi.

Kalit so'zlar: Sun'iy intellekt, geoinformatsion tizimlar (GIT), yo'l tarmoqlari, transport optimallashtirish, mashinaviy o'rganish, neyron tarmoqlar.

Annotation. This article analyzes the possibilities of optimizing road networks through the integration of artificial intelligence (AI) technologies with geographic information systems (GIS). Effective traffic flow management and road infrastructure improvement are of great importance in modern cities. AI-based algorithms, including neural networks, genetic algorithms, and machine learning methods, provide high accuracy and efficiency in analyzing data collected through GIS. The study highlights the advantages of GIS approaches for tasks such as real-time monitoring, traffic jam prediction, and determining the most optimal routes. Practical examples of GIS and AI integration and their role in road network planning are also considered.

Keywords: Artificial intelligence, geographic information systems (GIS), road networks, transportation optimization, machine learning, neural networks.

Kirish.

Zamonaviy dunyoda shaharlar tez sur'atlarda rivojlanib, transport tizimlari murakkablashmoqda. Yo'l tarmoqlarining samarali ishlashi va transport oqimining optimallashtirilishi – har bir shaharsozlik va yo'l qurilishi sohasida muhim vazifa hisoblanadi. Aholining ko'payishi va transport vositalarining sonining oshishi bilan yo'l infratuzilmasida tirbandliklar paydo bo'lmoqda, bu esa nafaqat vaqt va resurslarning behuda sarflanishiga, balki atrof-muhitning zarar ko'rishiga ham olib keladi. Shu sababli yo'l tarmoqlarini samarali boshqarish va optimallashtirish texnologiyalari dolzarb ahamiyat kasb etmoqda.

Geoinformatsion tizimlar (GIT) – geografik ma'lumotlarni yig'ish, saqlash, tahlil qilish va tasvirlashga imkon beruvchi ilg'or axborot texnologiyalari majmui hisoblanadi. GIT yordamida shaharlarning yo'l tarmoqlari, transport oqimlari va boshqa geografik ob'ektlar haqidagi ma'lumotlar real vaqtda kuzatiladi va qayta ishlanadi. Shu bilan birga, katta hajmdagi ma'lumotlarni samarali tahlil qilish va ulardan maqsadli natijalar chiqarish ko'pincha murakkab hisoblanadi.

Sun'iy intellekt (SI) esa ma'lumotlarni avtomatik ravishda tahlil qilish, o'rganish va qarorlar qabul qilish imkoniyatini beradi. Mashinaviy o'rganish, neyron tarmoqlar, genetik algoritmlar kabi SI metodlari katta hajmdagi ma'lumotlar asosida transport

oqimini bashorat qilish, tirbandliklarni aniqlash va eng maqbul yo'l tarmoqlarini belgilashda yuqori samaradorlik ko'rsatmoqda. SI texnologiyalari geoinformatsion tizimlar bilan birlashganda, shaharsozlik va transport tizimlarini boshqarishning yangi avlodi shakllanmoqda.

Ushbu maqolada sun'iy intellekt yordamida geoinformatsion tizimlarda yo'l tarmoqlarini optimallashtirishga oid metodlar, ularning afzalliklari va amaliy qo'llanilish yo'nalishlari ko'rib chiqiladi. Tadqiqot real vaqtda transport oqimini monitoring qilish, tirbandliklarni bashorat qilish va yo'l qurilishi hamda rekonstruksiya jarayonlarini rejalashtirishda SI integratsiyasining ahamiyatini ta'kidlaydi.

Kamchiliklar va ularning ahamiyati

Sun'iy intellekt va geoinformatsion tizimlarning integratsiyasi transport va yo'l tarmoqlarini optimallashtirishda katta imkoniyatlar yaratgan bo'lsa-da, ushbu yondashuvning ayrim kamchiliklari ham mavjud. Ularga e'tibor qaratish tadqiqotning yanada samarali rivojlanishi uchun muhimdir.

Birinchidan, SI tizimlari yuqori sifatli va katta hajmdagi ma'lumotlarga tayanadi. Ammo geoinformatsion ma'lumotlarning to'liqligi va ishonchliligi ko'pincha cheklangan bo'lishi mumkin. Noaniq, eskirgan yoki yetarlicha yangilanmagan ma'lumotlar natijalar sifatiga salbiy ta'sir ko'rsatadi. Shu bois ma'lumotlar yig'ish va tozalash jarayoni murakkab va vaqt talab qiluvchi bo'lishi mumkin.

Ikkinchidan, sun'iy intellekt modellarining murakkabligi va ularning ishlashini tushunish qiyinligi mavjud. Ko'p hollarda «qora quti» deb ataluvchi tizimlar natijalarining ichki mantiqini aniqlash mushkul bo'ladi, bu esa qaror qabul qilish jarayonida shaffoflikni kamaytiradi. Ayniqsa, yo'l tarmoqlarini rejalashtirish kabi strategik sohalarda bu kamchilik muhimdir.

Uchinchidan, SI tizimlarining real vaqtda ishlashi uchun yuqori hisoblash quvvatlari va zamonaviy texnologiyalar talab etiladi. Bu esa infrastruktura xarajatlarini oshiradi va kichik shahar yoki kam resursli hududlarda ushbu texnologiyalarni joriy qilishni qiyinlashtiradi.

To'rtinchidan, inson omilining kamayishi ham muhim kamchilik sifatida ko'riladi. Sun'iy intellekt asosida qabul qilingan qarorlar inson nazorati va ekspert bahosidan mahrum bo'lsa, noto'g'ri yoki kontekstga mos kelmaydigan natijalar yuzaga kelishi mumkin.

Shu bilan birga, ushbu kamchiliklarga qaramay, SI va GIT integratsiyasi yo'l tarmoqlarini boshqarish va optimallashtirish sohasida yangi imkoniyatlar ochib beradi. Ularning samarali qo'llanilishi uchun kamchiliklarni bartaraf etish yo'llarini izlash va texnologiyalarni rivojlantirish zarur.

Introduction.

In the modern world, cities are developing rapidly, and transport systems are becoming more complex. The efficient operation of road networks and the optimization of traffic flow are important tasks in every field of urban planning and road construction. With the increase in population and the number of vehicles, traffic jams are occurring in the road infrastructure, which not only leads to a waste of time and resources, but also to environmental damage. Therefore, technologies for effective management and optimization of road networks are gaining urgent importance.

Geographic information systems (GIS) are a set of advanced information technologies that allow collecting, storing, analyzing and visualizing geographic data. With the help of GIS, information about road networks, traffic flows and other geographic objects of cities is monitored and processed in real time. At the same time, it is often difficult to effectively analyze large amounts of data and derive targeted results from them.

Artificial intelligence (AI) provides the ability to automatically analyze, learn, and make decisions from data. AI methods such as machine learning, neural networks, and genetic algorithms are highly effective in predicting traffic flows, identifying traffic jams, and determining the most optimal road networks based on large amounts of data.

When AI technologies are combined with geographic information systems, a new generation of urban planning and transport system management is being formed.

This article reviews methods for optimizing road networks in geographic information systems using artificial intelligence, their advantages, and practical applications. The study emphasizes the importance of AI integration in real-time traffic flow monitoring, traffic jam prediction, and planning road construction and reconstruction processes.

Disadvantages and their significance

Although the integration of artificial intelligence and geographic information systems has created great opportunities for optimizing transport and road networks, this approach also has some disadvantages. Paying attention to them is important for the more effective development of research.

First, SI systems rely on high-quality and large-scale data. However, the completeness and reliability of geoinformation data can often be limited. Inaccurate, outdated or insufficiently updated data negatively affects the quality of the results. Therefore, the process of collecting and cleaning data can be complex and time-consuming.

Second, there is the complexity of artificial intelligence models and the difficulty of understanding their operation. In many cases, it is difficult to determine the internal logic of the results of the so-called “black box” systems, which reduces transparency in the decision-making process. This drawback is especially important in strategic areas such as road network planning.

Third, high computing power and modern technologies are required for real-time operation of SI systems. This increases infrastructure costs and makes it difficult to implement these technologies in small cities or areas with limited resources.

Fourth, the reduction of the human factor is also seen as a significant drawback. Decisions based on artificial intelligence, when deprived of human control and expert judgment, can lead to incorrect or out-of-context results.

However, despite these shortcomings, the integration of SI and GIT opens up new opportunities in the field of management and optimization of road networks. For their effective application, it is necessary to find ways to eliminate shortcomings and develop technologies

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Conclusion

The integration of artificial intelligence and geographic information systems is creating new opportunities in the field of road network optimization. Using SI methods, traffic flow analysis, traffic jam prediction, and determination of optimal routes are more effective than traditional methods and can significantly improve urban planning and road construction processes. However, there are also some problems, such as the need for high-quality data, model complexity, high computational power requirements, and reduced human factor. By eliminating these shortcomings and further developing technologies, the importance of artificial intelligence and geographic information systems in road network management will increase. As a result, this approach will

serve to increase the efficiency of transport systems and the sustainable development of cities.

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