TÁBIYIY HÁM TEXNIKALÍQ ILIMLER

Fizika.Matematika.Texnika.Informatika.

SUN’IY INTELLEKT ASOSIDA TASHXISLASH TIZIMINING TUZILISHI

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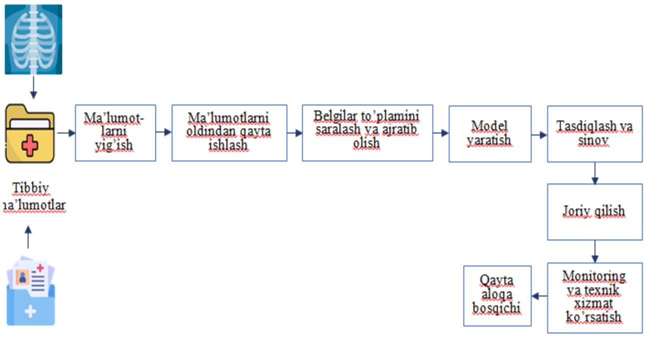
Tayanch so‘zlar: genetik profil, biometrik ma’lumot, qiymatlarni normallashtirish, chuqur o‘rganish, konvolyutsion neyron tarmog‘i, takroriy neyron tarmoqlari, mashinali o‘qitish algoritmlari, belgilar to‘plamini ajratish.

Ключевые слова: генетический профиль, биометрическая информация, нормализация значений, глубокое обучение, сверточная нейронная сеть, рекуррентные нейронные сети, алгоритмы машинного обучения, разделение набора признаков.

Key words: genetic profile, biometric information, normalization of values, deep learning, convolutional neural network, recurrent neural networks, machine learning algorithms, Feature Selection and Extraction.

Kirish. Tibbiy diagnostikaga sun’iy intellektning integratsiyasi orqali tashxislash jarayonida aniqlikning oshishi, xatolarning kamayishi va bemor natijalarining yaxshilanishi bilan ajralib turadigan yangi davrni boshlab berdi. Sun’iy intellekt tizimlari murakkab ma’lumotlar to‘plamini an’anaviy usullarga qaraganda tezroq va aniqroq tahlil qilishga yordam beradi. Ushbu maqolada sog‘liqni saqlash xizmatlarini yaxshilashda sun’iy intellektga asoslangan tashxislash tizimini yaratish va joriy etish bo‘yicha jarayonlar batafsil keltirib o‘tilgan (1-rasm).



1-rasm. *Sun’iy intellektga asoslangan tashxislash tizimini yaratish bosqichlari.*

Tibbiy ma’lumotlarni yig‘ish.

Asosiy qism. Sun’iy intellekt tashxislash tizimining asosi keng va xilma-xil tibbiy ma’lumotlarni to‘plashdir. Tibbiy ma’lumotlar rasm yoki tekst ko‘rinishida bo‘lishi mumkin (1-rasm). Yuqori sifatli, keng qamrovli ma’lumotlar to‘plami samarali sun’iy intellekt modellarini o‘rgatish uchun asos bo‘ladi. Ushbu ma’lumotlar to‘plamlari bemorlarning elektron tarixidan tortib rentgen tasvirlar, genetik profillar va real vaqtda kuzatish mumkin bo‘lgan biometrik ma’lumotlargacha bo‘lishi mumkin [1]. Ushbu ma’lumotlar to‘plamining keng qamrovli bo‘lishi sun’iy intellekt tashxislash tizimini sifatli yaratish uchun juda muhimdir.

Ma’lumotlarni oldindan qayta ishlash.

Ma’lumotlarning standart formatdaligi sun’iy intellekt tizimlarining ishiga sezilarli ta’sir qiladi. Oldindan ishlov berish keng qamrovli tozalash jarayonlarini o‘z ichiga oladi. Masalan, ortiqcha joylarni olib tashlash, qiymatlarni normallashtirish va kategorik ma’lumotlarni kodlash [2]. Ushbu tozalashlar tayyor bo‘lmagan ma'lumotlarni keyingi tahlillarga mos keladigan standart formatga aylantirishga va sun’iy intellekt modelining aniq va tegishli ma’lumotlarni olishi uchun juda muhimdir.

Belgilar to‘plamini ajratib olish.

Ushbu bosqich tashxislash aniqligiga sezilarli hissa qo‘shadigan eng kerakli belgilarni aniqlashni o‘z ichiga oladi. Chuqur o‘rganish kabi ilg‘or algoritmlar belgilar to‘plamini ajratib olishni avtomatlashtirish, o‘lchamlarni kamaytirish va ma’lumotlarning eng muhim jihatlariga e’tiborni qaratish uchun qo‘llaniladi [3]. Bu nafaqat model ishlashini yaxshilaydi, balki hisoblash samaradorligini ham oshiradi.

Model yaratish.

Sun’iy intellekt modellari tozalangan ma’lumotlar to‘plamidan foydalangan holda o‘qitiladi, bu yerda mashinali o‘qitish algoritmlari bashorat qilish uchun ma’lumotlarning belgilar to‘plamini o‘rganadi. Mashinani o‘qitish algoritmi tibbiy dasturga bog‘liq ravishda tanlanadi. Tasvirga asoslangan tashxislash uchun konvolyutsion neyron tarmog‘i (CNN – convolutional neural network) qo‘llaniladi. Ketma-ket ma’lumotlar to‘plami uchun esa takroriy neyron tarmoqlari (RNN Recurrent neural network) qo‘llaniladi [4]. Modelning yangi, ko‘rilmagan ma’lumotlar to‘plamini umumlashtirish qobiliyatini oshirish uchun qat’iy o‘qitish usullari, shu jumladan o‘zaro tekshirish usullari qo‘llaniladi.

Tasdiqlash va sinov.

Modelning samaradorligi o‘quv bosqichida foydalanilmagan ma’lumotlar to‘plami bilan tekshiriladi va baholanadi. Modelning tashxislash samaradorligini baholash uchun aniqlik, ta’sirchanlik va sezuvchanlik kabi ko‘rsatkichlar hisoblanadi [5]. Ushbu sinov bosqichi sun’iy intellekt tizimining haqiqiy muhitda qo‘llanilishidan oldin uning ishonchliligi va klinik foydasini aniqlash uchun muhim ahamiyatga ega.

Joriy qilish.

Joriy qilish bu bevosita ma’lum shifoxona tibbiy ma’lumotlarini sun’iy intellekt tizimi bilan integratsiyalashni o‘z ichiga oladi. Bu esa mavjud sog‘liqni saqlash tizimining axborot texnologiya tizimlari bilan uzluksiz aloqasini talab qiladi. Ushbu bosqich ko‘pincha ma’lumotlarning maxfiyligiga aloqador muammolarni va sun’iy intellekt tizimidan foydalanuvchi sog‘liqni saqlash mutaxassislarini o‘qitish zaruriyatini keltirib chiqaradi [6]. Sun’iy intellekt tizimini muvaffaqiyatli joriy qilish orqali sog‘liqni saqlash mutaxassislari yanada samarali ishlaydi va ularning tashxislash aniqligini oshadi.

Monitoring va texnik xizmat ko‘rsatish.

Sun’iy intellekt tizimining vaqt o‘tishi bilan ham optimal ishlashini ta’minlash uchun doimiy monitoring muhim ahamiyatga ega. Qolaversa, yangi ma’lumotlar va keyingi takomillashgan klinik ko‘rsatmalar orqali modelni doimiy yangilab turish talab qilinadi. Tizimning ko‘p qamrovli va optimal ishlashini ta’minlash uchun tizim bilan bevosita ishlovchi sog‘liqni saqlash mutaxassislarining fikr mulohazalarini e’tiborga olish kerak bo‘ladi.

Qayta aloqa bosqishi.

Sun’iy intellekt tizimini doimiy takomillashtirishga radiologlar, patologlar va umumiy amaliyot shifokorlari kabi oxirgi foydalanuvchilar tomonidan tuzilgan qayta aloqa tizimi yordam beradi [7]. Sun’iy intellekt tizimining funksionalligi, foydalanish qulayligi va yaxshilash kerak bo‘lgan sohalari bo‘yicha fikr-mulohazalar tizimning samarali va klinik ehtiyojlarga mos bo‘lishini ta’minlaydigan yangilanishlari uchun juda muhimdir.

Xulosa. Hozirgi kunda sun’iy intellektga asoslangan tashxislash tizimlari tibbiy diagnostika sohasida inqilob qilmoqda. Ular yuqori aniqlik, samarali va kengaytiriladigan yechimlarni taqdim etish qobiliyati bilan ajralib turadi. Yuqorida ta’kidlangan tuzilma, bizga kelgusida ishlab chiqilishi kerak bo‘lgan tashxislash dasturiy ta’minoti uchun asos hisoblanadi. Bunday tizim bemorlarni tashxislash va boshqarishni sezilarli darajada yaxshilaydi. Sog‘liqni saqlashning yanada shaxsiylashtirilgan va kasalliklarni erta aniqlashga doir muammolariga yechimlar topishda yordam beradi.

Adabiyotlar

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REZYUME. Sun’iy intellekt tizimlari kasalliklarni erta aniqlash va davolashda yuqori aniqlik va samaradorlikni ta’minlaydi. Sog‘liqni saqlash sohasida tashxislash jarayonini sezilarli darajada yaxshilaydi. Ushbu maqolada sun’iy intellektga asoslangan tashxislash tizimini tuzilishi ko‘rib chiqilgan.

РЕЗЮМЕ. Системы искусственного интеллекта обеспечивают высокую точность и эффективность раннего выявления и лечения заболеваний. Значительно улучшает диагностический процесс в сфере здравоохранения. В данной статье рассматривается структура системы диагностики на основе искусственного интеллекта.

SUMMARY. Artificial intelligence systems provide high accuracy and efficiency in early detection and treatment of diseases. Significantly improves the diagnostic process in the healthcare sector. This article examines the structure of the diagnosis system based on artificial intelligence.

DEVELOPMENT OF NANOMATERIALS TO INCREASE THE PERFORMANCE OF SILICON ELECTRONICS

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Tayanch so‘zlar: silisidlar, elemenlar tarkibi, VLSI (o‘ta keng ko‘lamli integral mikrosxemalar), faza tarkibi, elektron diffraktsiya sxemasi.

Ключевые слова: силициды, элементный состав, СБИС (сверхбольшие интегральные схемы), фазовый состав, электронограмма.

Key words: silicides, elemental composition, VLSIC (very large-scale integrated circuits), phase composition, electronogram.

Advances in solid state and semiconductor physics have contributed to the emergence of nanoelectronics, which focuses on the creation of new materials and semiconductor devices. Silicon remains a key material for integrated circuits, but further development is needed for submicron technologies. New silicide-based heterostructures can expand the horizons of nanoelectronics. An important task is the development of silicon-compatible photodetectors for visible and ultraviolet spectra, which is relevant for ecology, biotechnology and medicine.

The compound Mg_2Si is a well-known promising material for the conversion of thermoelectric energy in the temperature range from 500 to 800 K. The fundamental electronic properties of Mg_2Si single crystals have been widely studied both theoretically and experimentally. The formation of epitaxial Mg_2Si films on silicon is complicated by the low sticking coefficient of magnesium to silicon at elevated substrate temperatures. The most interest has been shown in the works on the formation of thin films of stoichiometric Mg_2Si on silicon by molecular beam epitaxy. However, the substrate temperature during growth cannot exceed 200°C, which ensures the formation of only polycrystalline Mg_2Si films with a sufficiently developed surface relief. To create silicide-silicon heterojunctions and construct new semiconductor devices, this is not a sufficient condition. The works present the results of studies on the reflection and transmission spectra for Mg_2Si films grown by multiple and single annealing processes [1]. For the polycrystalline Mg_2Si film obtained by multiple annealing, the absorption spectrum is presented in Figure 1.a. For comparison, the spectra of Mg_2Si and Si single crystals are also shown in this figure. In the Mg_2Si single crystal, intrinsic absorption due to indirect transitions begins at photon energies of 0.67-0.75 eV, and the absorption coefficient α has small values (10-100 cm^{-1}) (Figure 1.a). Starting from energies of 1.8-2.8 eV, direct interband transitions occur, and the absorption coefficient α sharply increases (up to ≈10^6 cm^{-1}) (Figure 1.a). The Mg_2Si film exhibits a higher value of the absorption coefficient α near the absorption edge (Figure 1.a) compared to the single crystal, which is associated with contributions from structural defects and stoichiometry disruption.

The maximum value of the absorption coefficient for the film (≈$1.1\cdot10^6$ cm^{-1}) is slightly less than that of the single crystal (≈$1.5\cdot10^6$ cm^{-1}) (Figure 1.a), which corresponds to a small loss of valence electrons at broken bonds in the Mg2Si lattice and at the grain boundaries. From the spectral dependence of the absorption coefficient α (Figure 1.a), the energy of the first direct transition is determined to be 0.7±0.05 eV and the second, strongest transition - 2.2±0.05 eV. Figure 1.b presents the spectra for the first series of films grown by single annealing, and Figure 1.c - for the second series. For both series of samples, a decrease in the absorption coefficient α and a shift of the maximum value of α to the region of higher photon energies are observed compared to the single crystal. For the film with epitaxially oriented grains (550°C), the minimum coefficient α is observed in the energy range up to 2 eV (Figure 1.b), which corresponds to minimal absorption at defects. It is evident that with a decrease in the temperature of single annealing, there is an increase in α in this energy range (Figure 1.b), which is associated with an increase in the number of defects. A sharp increase in the absorption coefficient α in the films, associated with direct transitions, is observed at lower photon energy values (1.1-1.7 eV) compared to the single crystal (1.9 and 2.3 eV): for the film with epitaxial grains (550°C) at energy hν≈1.7 eV, for the film at 500°C hν≈1.8 eV, for the film at 450°C hν≈2.0 eV (Figure 1.b). The shift of the energies of direct transitions to the low-energy region for the films (Figure 1.b) occurs due to an increase in the contribution of silicon atoms and a decrease in the contribution of magnesium atoms. This is possible in the case of