MIRZO ULUG‘BEK NOMIDAGI
O‘ZBEKISTON MILLIY UNIVERSITETI
JIZZAX FILIALI

KOMPYUTER ILMLARI VA MUHANDISLIK TEXNOLOGIYALARI

XALQARO ILMIY-TEXNIK ANJUMAN MATERIALLARI TO‘PLAMI

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O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

MIRZO ULUG‘BEK NOMIDAGI O‘ZBEKISTON MILLIY UNIVERSITETINING JIZZAX FILIALI

KOMPYUTER ILMLARI VA MUHANDISLIK TEXNOLOGIYALARI

mavzusidagi Xalqaro ilmiy-texnik anjuman materiallari to‘plami

(2025-yil 26-27-sentabr)

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JIZZAX-2025

Kompyuter ilmlari va muhandislik texnologiyalari. Xalqaro ilmiy-texnik anjuman materiallari to‘plami – Jizzax: O‘zMU Jizzax filiali, 2025-yil 26-27-sentabr. 355-bet.

Xalqaro miqyosidagi ilmiy-texnik anjuman materiallarida zamonaviy kompyuter ilmlari va muhandislik texnologiyalari sohasidagi innovatsion tadqiqotlar aks etgan.

Globallashuv sharoitida davlatimizni yanada barqaror va jadal sur’atlar bilan rivojlantirish bo‘yicha amalga oshirilayotgan islohotlar samarasini yaxshilash sohasidagi ilmiy-tadqiqot ishlariga alohida e’tibor qaratilgan. Zero iqtisodiyotning, ijtimoiy sohalarni qamrab olgan modernizatsiya jarayonlari, hayotning barcha sohalarini liberallashtirishni talab qilmoqda.

Ushbu ilmiy ma’ruza tezislari to‘plamida mamlakatimiz va xorijlik turli yo‘nalishlarda faoliyat olib borayotgan mutaxassislar, olimlar, professor-o‘qituvchilar, ilmiy tadqiqot institutlari va markazlarining ilmiy xodimlari, tadqiqotchilari, magistr va talabalarning ilmiy-tadqiqot ishlari natijalari mujassamlashgan.

Mazkur to‘plamga kiritilgan ma’ruza tezislarining mazmuni, undagi statistik ma’lumotlar va me’yoriy hujjatlarning to‘g‘riligi hamda tanqidiy fikr-mulohazalar, keltirilgan takliflarga mualliflarning o‘zlari mas’uldirlar.

PERFORMANCE COMPARISON OF MACHINE LEARNING MODELS IN MEDICAL IMAGE RECOGNITION

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Annotation. This paper presents a comparison of the ML models for medical image recognition tasks. Conventional techniques e.g. SVM and Random Forest and also recent deep learning structures e.g. CNNs are analysed. Model accuracy, precision, recall, F1-score, inference time and performance are measured, and the models are verified, and benchmark medical imaging datasets are validated to ensure accuracy of the image. Both approaches have their advantages and disadvantages and the presented methods provide an insight into the applied use of each method in automated medical diagnosis.

Key words: medical imaging, machine learning, deep learning, CNN, SVM, model evaluation, healthcare AI.

Machine learning (ML) and artificial intelligence (AI) technologies have been integrated into healthcare to transform the way diagnosis and decision-making processes are done. Specific to medical image recognition, the emergence of ML models is one of the leading domains which are applied to help clinicians detect patterns or abnormal deviations from observed data. Medical images come from X-rays, magnetic resonance imaging (MRI) and computed tomography (CT) and ultrasound. They use this data to diagnose diseases as varied as cancer, neurological disorders, cardiovascular conditions, and infections. However, manually analyzing such images may be laborious and rely on experience of and consistent diagnosis by radiologists or clinicians. There is an error in interpretation that can delay or wrong diagnosis. To overcome this problem, various ML-based systems have been developed by researchers to automate many image classification and segmentation tasks. These models can be traditional algorithms like Support Vector Machines (SVM), Random Forests (RF), and k-Nearest Neighbors (k-NN), or sophisticated deep learning architectures like Convolutional Neural Networks (CNNs). CNNs are well known for their high accuracy in the image analysis tasks, but simple ML models are widely used because of easy training method and understanding even in low resources scenario [3]. This study systematically evaluates the performance of machine learning models for various medical image recognition tasks. We study accuracy, precision, recall, F1-score and inference time of these images designed to give insight into their respective advantages, limitations, and use cases in real clinical settings [4]. The methodology comprised selection and pre-processing of three publicly accessible and widely used medical imaging datasets ChestX-ray14 (for pneumonia and lung disease diagnosis); Brain MRI dataset (for tumor categorization); and the EyePACS dataset (for diabetic retinopathy classification based off of fundus images) [5]. The datasets selected for this study sought to incorporate diverse models of imaging and objectives of diagnosis. All

images were resized to a uniform resolution of 224×224 pixels and normalized for intensity values to form training (70% of images), validation (15%), and test (15%) sets. To develop generalized results, data augmentation was performed, including horizontal flipping, random rotation, and zoom. Four models were evaluated:

1. Support Vector Machine (SVM): radial basis function (RBF) kernel (with grid search optimization of hyperparameters).

2. Random Forest (RF): 100 estimators; maximum tree depth computed by cross-validation.

3. k-Nearest Neighbors (k-NN): with k=5 and Euclidean distance metric.

4. Convolutional Neural Network (CNN): An automated custom 4 layer deep CNN that trained using Adam optimizer, binary cross-entropy loss, batch size 32, and learning rate 0.0001 across 50 epochs. Model was trained in TensorFlow and implemented on GPU hardware.

The performance of the model was determined using classic evaluation metrics. The highest accuracy across all datasets was obtained from the CNNs with an average accuracy of 92.6%, precision 0.91, recall 0.92, and F1-score 0.915. The CNN also achieved better feature extraction performance especially for complex textures present in MRI and fundus images. Random Forests next, achieving 87.4% accuracy, again because of ensemble-wide learning and better robustness against overfitting. SVMs gave accurate results (84.2% accuracy), however, had sensitivity towards hyperparameter selection and data scaling. The k-NN algorithms, which were the simplest to implement, tended to perform inconsistently in terms of performance, and had an average accuracy of 78.1% over high-dimensional images. CNNs performed best in inference: for GPU-based inference and processing, they have the fastest inference time and are applicable to real-time or near real-time diagnostics. However, their training stage is much more computationally demanding. On the other hand, traditional models (SVM, RF) learned faster but more preprocessing and feature engineering needed. Furthermore, interpretability of feature importance in RF emerged as an important edge in explainable AI for healthcare practitioners. Our comparison show that these deep learning models, especially CNN, can handle the more complex visual patterns for medical images. This research adds to the already emerging literature that focuses on tuning artificial intelligence in healthcare by effectively comparing the advantages and disadvantages of various machine learning architectures in medical image analysis. The results provide a benchmark for AI researchers who, ideally, can follow and adopt machine learning and clinical diagnostics for medical practitioners.

Foydalanilgan adabiyotlar ro‘yxati:

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MASHINANI O‘RGANISH, CHUQUR O‘RGANISH, NEYRON TARMOQLAR

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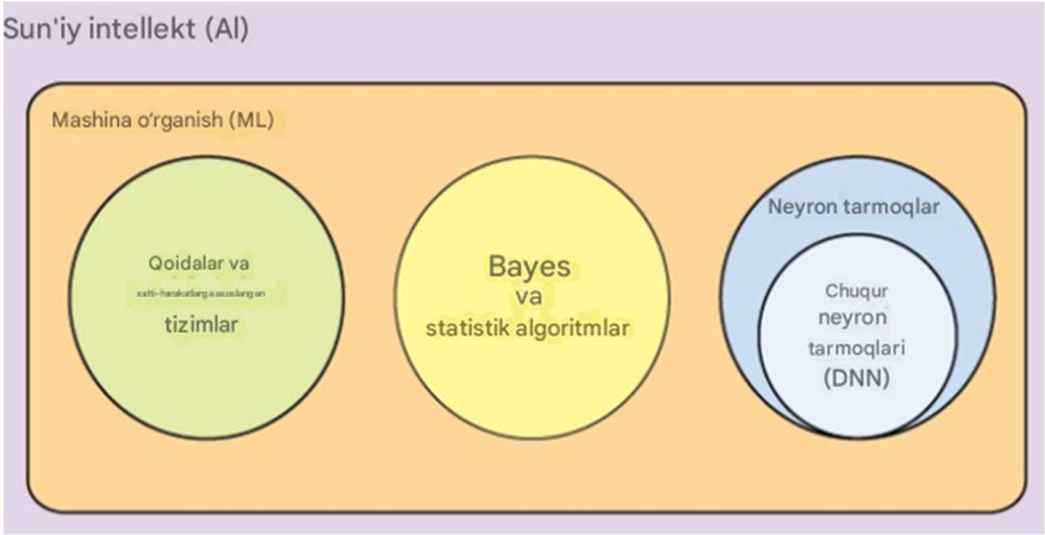
AI qanday ishlashi va uning turli xil foydalanish holatlari va ilovalari bilan tanishishdan oldin, keling, sun'iy intellekt atamalari va tushunchalarini qayta ko‘rib chiqamiz va sun'iy intellekt, mashinani o‘rganish, chuqur o‘rganish va neyron tarmoqlar tushunchalarini ajratamiz.



Bu atamalar ba’zan bir-birining o‘rnida ishlatiladi, lekin ular bir xil narsani anglatmaydi.

Sun'iy intellekt - bu aqlli xatti-harakatlarni simulyatsiya qilish bilan shug'ullanadigan kompyuter fanining bir bo‘limi.

AI tizimlari odatda rejalashtirish, o‘rganish, fikrlash, muammolarni hal qilish, bilimlarni namoyish qilish, idrok etish, harakat va manipulyatsiya kabi inson aql-zakovati bilan bog'liq xatti-harakatlarni va kamroq darajada ijtimoiy intellekt va ijodkorlikni namoyish etadi.