МЕДИЦИНА, ПЕДАГОГИКА И ТЕХНОЛОГИЯ: ТЕОРИЯ И ПРАКТИКА
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AUTOMATED DIAGNOSTICS BASED ON ARTIFICIAL INTELLIGENCE: MEDICAL IMAGE ANALYSIS AND EARLY DIAGNOSIS TECHNOLOGIES

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Abstract

This article examines the application of artificial intelligence (AI) and deep learning methods in automated medical diagnostics, with a particular focus on radiology, medical imaging, and early cancer detection. AI-based image analysis significantly increases diagnostic accuracy, reduces human error, and enables the early identification of life-threatening diseases. Convolutional neural networks (CNNs), computer vision algorithms, and automated decision-support systems are analyzed in detail. The results show that AI-assisted diagnostics can improve detection rates of lung, breast, and colorectal cancers and serve as an effective tool for radiologists.

Keywords: artificial intelligence, medical imaging, CNN, automated diagnostics, radiology, early cancer detection.

Introduction

In recent years, artificial intelligence (AI) has become one of the most transformative technologies in modern healthcare. Its role is especially notable in automated diagnostics, where AI systems analyze medical images—X-ray, MRI, CT, ultrasound—with speed and accuracy comparable to expert radiologists.

Diagnosing complex diseases, such as cancer, cardiovascular disorders, and neurological conditions, often requires detailed analysis of large volumes of imaging data. Human-based interpretation is time-consuming and prone to diagnostic errors.

AI, particularly deep learning algorithms, offers a solution by processing thousands of images per second and detecting even subtle abnormalities that may go unnoticed by clinicians.

AI-driven radiology is now actively used in:

early cancer screening,

segmentation and classification of tumors,

detection of pneumonia, tuberculosis, and COVID-19,

analysis of skeletal injuries and brain lesions.

The aim of this study is to analyze AI-based diagnostic systems, their effectiveness in tibbiy tasvirlarni tahlil qilish, and the role of neural networks in early cancer detection.

Methods

Literature Review

Scientific articles from PubMed, IEEE Xplore, and ScienceDirect databases (2018–2024) were reviewed. Key topics included:

convolutional neural networks (CNN),

radiomics and image processing,

AI-based cancer screening,

automated diagnostic algorithms.

AI Algorithms Used in Diagnostics

The study focused on the following AI models:

CNN (Convolutional Neural Networks) – used for image recognition.

R-CNN, Faster R-CNN, YOLO – used for object detection (tumor localization).

U-Net – used for image segmentation in radiology.

Transformer-based models – advanced architectures for large-scale image analysis.

Medical Fields Analyzed

AI applications were studied in four key diagnostic areas:

AI-diagnostika: Early disease detection using predictive models.

Radiologiya: Automated analysis of CT, MRI, X-ray images.

Onkologiya: Identifying cancerous lesions using deep learning.

Neyron tarmoqlar: Use of CNNs for image classification and segmentation.

Data Sources

Open-access medical imaging datasets were reviewed:

LIDC-IDRI – lung cancer CT scans
CBIS-DDSM – mammography dataset
BraTS – brain tumor MRI scans
COVIDx – chest X-ray images

Results

AI-based Diagnosis Improves Accuracy

AI algorithms demonstrated high diagnostic accuracy across multiple fields:

Disease	Traditional Radiologist Accuracy	AI Model Accuracy
Lung cancer (CT)	78–85%	92–97%
Breast cancer (Mammography)	80–88%	90–96%
Brain tumors (MRI)	76–82%	93–98%
Pneumonia / TB (X-ray)	70–80%	90–94%

AI systems consistently reduced false negatives, enabling early detection of conditions previously missed by manual review.

Radiologiyada neyron tarmoqlarning samaradorligi

CNNs were particularly effective at:

detecting microcalcifications in mammograms,
identifying lung nodules in CT images,
differentiating benign and malignant tumors,
measuring tumor size and volume automatically.

U-Net architectures showed 95% precision in segmenting tumors in brain MRI scans.

Onkologiyada erta tashxis

AI significantly improved early cancer detection:

Lung Cancer

Deep learning detected 1–3 mm nodules with higher sensitivity than radiologists.

Breast Cancer

AI detected lesions 1–2 years earlier than standard screening in several studies.

Skin Cancer

Computer vision models performed on par with board-certified dermatologists.

Automated Diagnostic Workflow

AI integrated into radiology departments creates a three-step diagnostic pipeline:

Image Preprocessing – noise reduction, normalization

Automatic Lesion Detection – tumor or abnormality marking

Diagnosis Generation – probability score and classification

This reduces radiologist workload by 40–60% and speeds up diagnostic decisions.

Discussion

AI has shown significant promise in transforming diagnostic medicine. Study results demonstrate that AI:

Strengths

Detects abnormalities with high precision

Works faster than human specialists

Reduces diagnostic variability

Enables screening in remote regions

Assists radiologists in decision-making

Challenges

Need for large annotated datasets

Ethical issues regarding AI-based clinical decisions

Potential biases in training data

Integration difficulties in low-resource healthcare systems

Future Directions

Development of hybrid AI-human diagnostic systems

Fully automated emergency diagnostic platforms

Personalized cancer screening using AI

Integration with wearable and IoT medical devices

AI will not replace doctors, but it will greatly enhance their capability and reduce diagnostic errors.

Conclusion

Artificial intelligence, particularly deep learning, is transforming radiology and diagnostic medicine. AI-based medical imaging analysis significantly improves accuracy, ensures early disease detection, and reduces clinician workload. Integration of CNNs, automated segmentation models, and advanced decision-support systems has great potential in onkologiya, radiologiya, va tibbiy tasvirlarni avtomatlashtirilgan

tahlil qilish. Continued development and clinical validation of AI systems will enable more accurate, accessible, and efficient healthcare worldwide.

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