RAQAMLI TEXNOLOGIYALAR VAZIRLIGI

OLIY TA'LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

MUHAMMAD AL-XORAZMIY NOMIDAGI TOSHKENT AXBOROT TEXNOLOGIYALARI UNIVERSITETI

Xalqaro ilmiy amaliy anjuman Toshkent 2025

"Raqamli iqtisodiyot sharoitida fan va ta'limni ishlab chiqarish bilan integratsiyasini rivojlantirishning ustuvor yo'nalishlari"

2025-yil 19-20-dekabr

Toshkent 100084, Amir Temur shox ko'chasi 108 uy

DIG ECO-2025

O‘ZBEKISTON RESPUBLIKASI
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Raqamli iqtisodiyot sharoitida fan va ta’limni ishlab chiqarish bilan integratsiyasini rivojlantirishning ustuvor yo‘nalishlari
(Dig ECO-2025)

Xalqaro ilmiy-amaliy anjumani

MA’RUZALAR TO‘PLAMI

TOSHKENT 2025

CONVOLUTIONAL NEURAL NETWORK ARCHITECTURE FOR FACIAL IMAGE VERIFICATION

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Abstract: This paper presents a deep learning approach to detect real and fake facial images using images with artificial noise (Gaussian noise). The proposed method makes the authentication process more reliable by analyzing the shape and pixel-level uncertainties in facial images. The study uses an architecture trained on the basis of the convolutional neural network (CNN) architecture. The results of the study show that the proposed method is effective in terms of high accuracy, recall and F1-score.

Key words: Gaussian noise, facial, sensitivity, recall, optimize, differential, histogram.

АРХИТЕКТУРА СВЕРТОЧНОЙ НЕЙРОННОЙ СЕТИ ДЛЯ ВЕРИФИКАЦИИ ИЗОБРАЖЕНИЙ ЛИЦ

Аннотация: В этой статье представлен подход глубокого обучения для распознавания реальных и поддельных изображений лиц с использованием изображений с искусственным шумом (гауссовским шумом). Предлагаемый метод повышает надежность процесса аутентификации за счет анализа формы и погрешностей на уровне пикселей в изображениях лиц. В исследовании используется архитектура, обученная на основе архитектуры сверточной нейронной сети (CNN). Результаты исследования показывают, что предложенный метод эффективен с точки зрения высокой точности, запоминания и оценки F1.

Ключевые слова: гауссовский шум, выражение лица, чувствительность, отзыв, оптимизация, дифференциал, гистограмма.

YUZ TASVIRLARINI HAQIQIYLIGINI ANIQLASHDA CNN ARXITEKTURASI

Annotatsiya: Ushbu maqolada sun’iy shovqinli (Gauss shovqini) tasvirlardan foydalangan holda haqiqiy va soxta yuz tasvirlarini tanib olish uchun chuqur o‘rganish yondashuvi keltirilgan. Tavsiya etilgan usul yuz tasvirlaridagi piksel darajasidagi shakl va xatolarni tahlil qilish orqali autentifikatsiya jarayonining ishonchliligini oshiradi. Tadqiqot konvolyutsion neyron tarmoq arxitekturasi (CNN) asosida o‘qitilgan arxitekturadan foydalanadi. Tadqiqot natijalari shuni ko‘rsatadiki,

taklif qilingan usul yuqori aniqlik, eslab qolish va F1 baholash nuqtai nazaridan samarali.

Kalit so‘zlar: Gauss shovqini, yuz ifodasi, sezgirlik, javob, optimallashtirish, differentsial, gistogramma.

Introductionю As a result of the rapid development in the field of artificial intelligence and digital image processing in recent years, the need for image-based biometric authentication systems has increased significantly. In particular, human face-based identification systems are widely used due to their convenience, contactless operation, and high accuracy. However, the security of these systems can be significantly weakened by false images, faces created through generative models (deepfake), or various manipulations. This problem can be reduced by analyzing the natural statistical properties, texture signals and noise structure in facial expressions. Studies show that real images and artificially created or falsified images will have different noise components at the pixel level. In particular, Gaussian noise variation at different levels manifests as an important diagnostic parameter in assessing image validity. This allows us to distinguish between natural and artificial facial features by artificially adding Gaussian noise to the image. Also, the high classification capability of deep learning (deep learning), specifically convolutional neural networks (CNN) - based models, provides a major advantage in this area. CNNs allow the identification of local and global structures of an image, analysis of other differences, and the formation of high-dimensional feature space. Thanks to this, high accuracy is ensured in the separation of real and falsified images.This article proposes a CNN architecture designed to identify realistic and false images based on facial images with the addition of Gaussian noise. The main advantage of the method is that noise-sensitive properties are automatically extracted and optimized for classification by the model. The effectiveness of the proposed approach has been confirmed by experimental investigations, with high results in accuracy, sensitivity, accuracy coefficient (precision) and F1-score.

Related works

As noted above, many researchers have developed facial recognition methods based on geometric properties. Zangeneh and Moradi (2018) presented an approach based on differential geometric points of the nose, eyebrows and mouth[1]. An SVM classifier is used to recognize facial images. Sharifara et al. (2017) first identifies haar-like texture features and then checks the process using the extended local binary pattern (LBP) and SVM with Adaboost [2]. Muqeet and Holambe (2019) proposed a new facial feature separation method using DIWT (Directional Wavelet Transform) and LBP [3]. The quadtree subdivision method is also used to enable adaptive routing choice in local areasharifara et al. (2017) first identifies haar-like texture features and then checks the process using the extended local binary pattern (LBP) and SVM with Adaboost[4]. Muqeet and Holambe (2019) proposed a new facial feature separation method using DIWT (Directional Wavelet Transform) and LBP. The quadtree subdivision method is also used to enable adaptive routing choice in local areas [5]. LBP histogram features are extracted from the high-level DIWT sub-bands and a set

of local descriptive features is generated. Geetics and Indu (2018) have suggested that texture and edge information play a unique role in facial representation by distinguishing, normalizing, and combining Orthogonal Combination of LBP (OC-LBP) and Histogram of Oriented Gradients (HOG) features [6].

The proposed method takes the color face image as input and identifies the face Area (Region of Interest, RoI) using the Hetero-PSO-Adaboost-SVM face recognition technique. The geometric properties are then separated using the ASM model. Also, texture features are derived from the Y (grayscale) sub-model using the autocorrelation method, and Color features from the Cb and Cr color sub-models. identical or similar; otherwise, they are considered different. Figure 1 below shows the general functions of the proposed method.

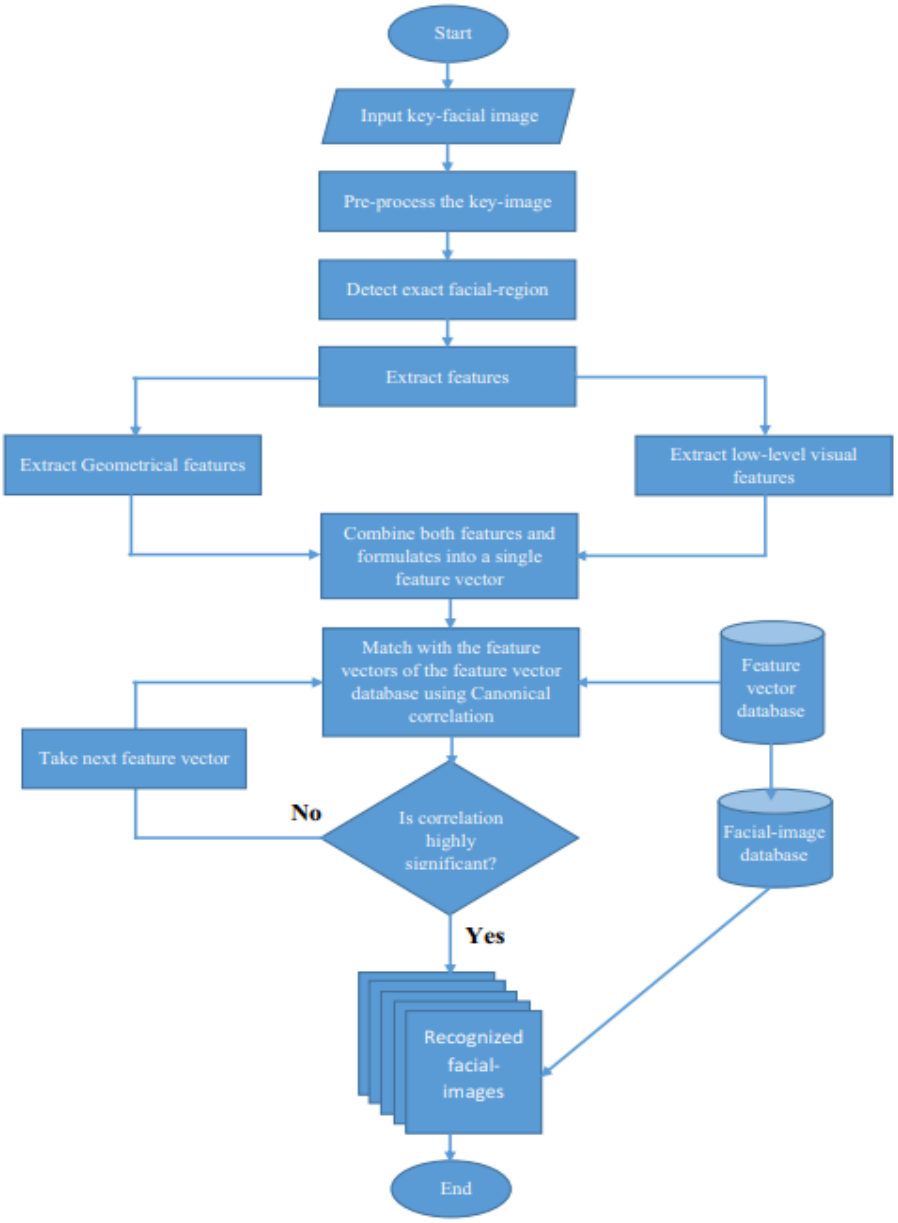

Figure1. Outline of the proppsed method

Separated geometric properties and low-level visual properties are combined into a single property vector. This vector is compared to the feature vector of the target face image, using multivariate Canonical correlation to determine the

similarity. The correlation between introduced and Target feature vectors using Chisquared statistics is checked at various significant levels (α).

Results

Various noises may appear during image acquisition or manipulation for further analysis. Therefore, the proposed method uses the Soft-Support Vector Data Description (Soft-SVDD) technique, which is used to reduce or eliminate the effect of noise (anomaly) in the image. The main goal of SVDD is to detect noisy pixels in the feature space of the image; the feature space is the transformed domain of the image. The important feature of SVDD is that it transforms the real data into the feature space using a kernel function and detects global anomalies for high-dimensional data. The detected noisy pixels are replaced with the median values of the normal (non-anomaly) pixels of the image. The denoising technique is expressed by the following formula, which makes the proposed face recognition method effective even in images severely affected by various noises:

$$\| f_{k,l} - C_{k,l} \|^2 \le r^2 \quad (1)$$

where ||.|| is the Euclidean norm, Ck,l is the average intensity of pixels in the window. To identify noisy pixels, the image is divided into 3×3 windows. The classification of pixels is as follows: if the value of f k,l is within the radius r, it is considered normal; otherwise, it is considered abnormal. Using the determined radius r and the center Ck,l, pixels are classified as normal or abnormal. If the pixels are normal, they are left for further processing; otherwise, their median values are changed.

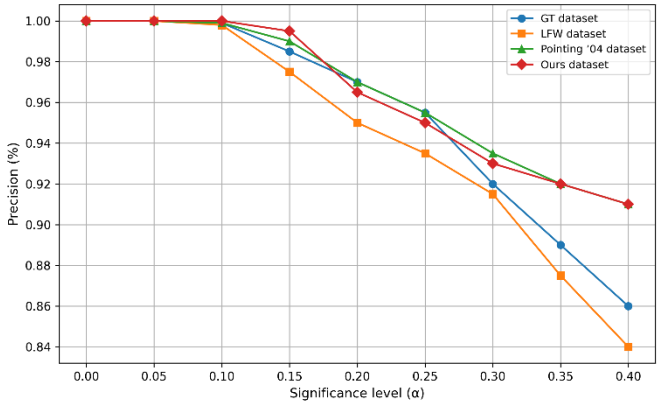

Figure 2. Line graph: database-wise. Significance vs F-measure

Table I.
The value of the results obtained

Dataset	Precision	Recall	F-score
GT	0.9651	0.9785	0.9678
LFW	0.9475	0.9681	0.9515
Pointing ’04	0.9684	0.9804	0.9708
Ours DB	0.9673	0.9793	0.9696

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SUN’IY INTELLEKT VA KOMPYUTER KO‘RINISHI ASOSIDA TIBBIY TASVIRLARDAN FOYDALANGAN HOLDA BOSH MIYA KASALLIKLARINI ERTA ANIQLASH MODELLARINING TAHLILI

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Annotatsiya: Ushbu maqola sun’iy intellekt texnologiyalarining neyro-onkologiya sohasida qo‘llanilishiga oid zamonaviy ilmiy yutuqlarni tahlil qilishga bag‘ishlangan. Tadqiqotda markaziy asab tizimining eng keng tarqalgan va agressiv o‘smalari hisoblangan gliomalarni aniqlash, tasniflash, prognozlash hamda davolashni rejalashtirish jarayonlarida sun’iy intellekt modellarining samaradorligi yoritiladi. Radiologik tasvirlar, gistopatologik ko‘rsatkichlar va genomik ma’lumotlarni integratsiyalash orqali tashxis aniqligini oshirish imkoniyatlari ko‘rib chiqiladi. Shuningdek, tasvirlar asosida molekulyar biomarkerlarni aniqlash orqali invaziv diagnostik usullarga bo‘lgan ehtiyojni kamaytirish istiqbollari ilmiy jihatdan asoslab beriladi.

Kalit so‘zlar: miyadagi o‘smalar, glioma, sun’iy intellekt, tibbiy tasvirlar tahlili, neyrodiagnostika, chuqur o‘rganish modellari, konvolyutsion neyron tarmoqlar, magnit-rezonans tomografiya, kompyuter ko‘rinishi, avtomatlashtirilgan tashxis

АНАЛИЗ МОДЕЛЕЙ РАННЕГО ВЫЯВЛЕНИЯ ЗАБОЛЕВАНИЙ ГОЛОВНОГО МОЗГА НА ОСНОВЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА И КОМПЬЮТЕРНОГО ЗРЕНИЯ С ИСПОЛЬЗОВАНИЕМ МЕДИЦИНСКИХ ИЗОБРАЖЕНИЙ