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НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ ЖУРНАЛ МЕНЕДЖМЕНТА И ЭКОНОМИКИ

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O‘ZBEKISTON RESPUBLIKASI

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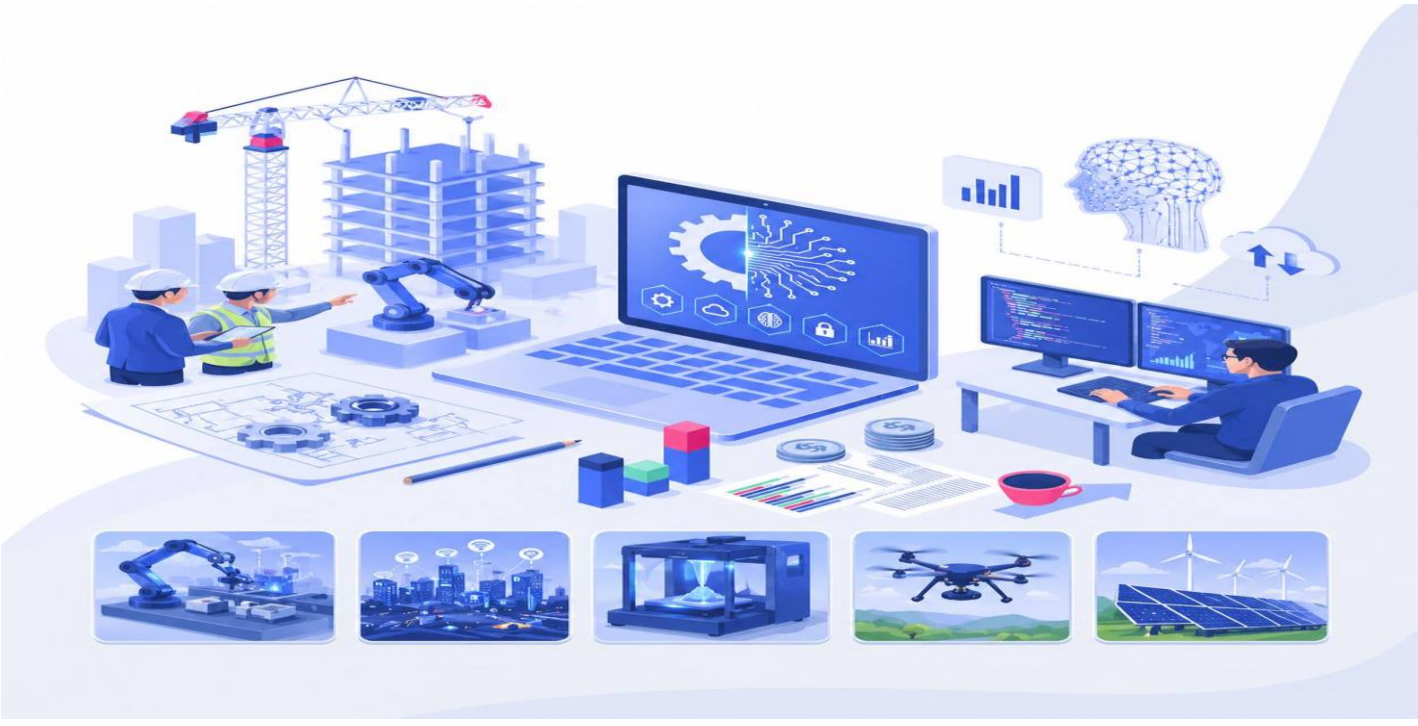

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21 MAY 2026 YIL

МИНИСТЕРСТВО ВЫСШЕГО ОБРАЗОВАНИЯ, НАУКИ И ИННОВАЦИЙ РЕСПУБЛИКИ УЗБЕКИСТАН

ТАШКЕНТСКИЙ ИНСТИТУТ УПРАВЛЕНИЯ И ЭКОНОМИКИ

МЕЖДУНАРОДНАЯ НАУЧНО-ПРАКТИЧЕСКАЯ КОНФЕРЕНЦИЯ НА ТЕМУ «ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ И ЦИФРОВЫЕ ИННОВАЦИОННЫЕ ТЕХНОЛОГИИ В ИНЖЕНЕРИИ: СОВРЕМЕННЫЕ РЕШЕНИЯ И ПЕРСПЕКТИВЫ»

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TASHKENT INSTITUTE OF MANAGEMENT AND ECONOMICS

INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE ON THE THEME "ARTIFICIAL INTELLIGENCE AND DIGITAL INNOVATIVE TECHNOLOGIES IN ENGINEERING: MODERN SOLUTIONS AND PROSPECTS" 21 MAY 2026

“Muhandislikda sun’iy intellekt va raqamli innovatsion texnologiyalar: zamonaviy yechimlar va istiqbollar” Xalqaro ilmiy-amaliy anjuman tezislar to‘plami. 2026-yil 21-may.

Ushbu to‘plamda — “Muhandislikda sun’iy intellekt va raqamli innovatsion texnologiyalar: zamonaviy yechimlar va istiqbollar” Xalqaro ilmiy –amaliy anjuman ishtirokchilarining tezislari keltirilgan. Anjuman kun tartibiga kiritilgan masalalar dolzarb bo‘lib, u yalpi ma‘ruzalar va amaliy zamonaviy muhandislik ta’limida raqamli transformatsiya va sun’iy intellekt, muhandislik yechimlari va sanoat 4.0, robototexnika va avtomatlashtirilgan boshqaruv tizimlari, kiberxavfsizlik va ma'lumotlarni himoya qilish, ta’limda axborot va innovatsion texnologiyalarning qo‘llanilishi, biznes jarayonlar va raqamli iqtisodiyotga axborot texnologiyalarining o‘rni kabi sho‘balardan tashkil topgan. To‘plam sohasi mutaxassislari, ilmiy tadqiqotchilar, professor-o‘qituvchilar, doktorantlar, magistrlar va talabalar uchun mo‘ljallangan.

Maqolalarda keltirilgan ma‘lumotlarning haqqoniyligi uchun mualliflar mas‘uldir.

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Tahririyat jamoasi

VOICE ANALYSIS TECHNOLOGIES SPECIAL ALGORITHMS AND ARTIFICIAL INTELLECT MODELS

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Abstract. This in the article voice analysis in technologies applicable special algorithms and artificial intellect models is studied. Speech signals again performance , acoustic features separate to take and mechanical study methods efficiency seeing is released. In the study neuron networks and deep study models application separately is illuminated.

Keywords: Voice analysis , speech familiar , artificial intelligence , machine study , deep learning , acoustic model, signal processing performance , neuron networks , natural the language again work , intellectual systems .

Аннотация. В данной статье исследуются технологии анализа голоса, в которых применяются специальные алгоритмы и модели искусственного интеллекта. Рассматриваются производительность распознавания речевых сигналов, отдельные акустические характеристики и эффективность методов машинного обучения. В исследовании отдельно освещается применение нейронных сетей и моделей глубокого обучения.

Ключевые слова: Анализ голоса, распознавание речи, искусственный интеллект, машинное обучение, глубокое обучение, акустическая модель, производительность обработки сигналов, нейронные сети, работа с естественным языком, интеллектуальные системы.

Annotatasiya. Maqolada ovoz tahlili texnologiyalarda qo‘llaniladigan maxsus algoritmlar va sun’iy intellekt modellari keltirilgan. Nutq signallarining ishlashi, akustik xususiyatlarni alohida ko‘rib chiqish va mexanik o‘rganish usullarining samaradorligini ko‘rish imkoniyati beriladi. Tadqiqotda neyron tarmoqlari va chuqur o‘rganish modellarining qo‘llanilishi alohida yoritiladi.

Kalit so'zlar: Ovoz tahlili, nutqni tanishtirish, sun'iy intellekt, mashinani o'rganish, chuqur o'rganish, akustik model, signalni qayta ishlash samaradorligi, neyron tarmoqlari, tilning tabiiy ishlashi, intellektual tizimlar.

Introduction. Voice analysis technologies last in years information technologies and artificial intellect in the field the most current from directions to one became . Human speech analysis to do through user with computer in the middle natural communication provision , automatic translation to do , vocal

management systems and security in monitoring wide application opportunities to the surface is coming .

Voice signal complicated , time according to variable and various to noises sensitive happened because of him/her again work for special algorithms are required . Signal digitization , filtration to do , frequency spectrum separation such as initial from stages so , acoustic and prosodic features remove to take for the model via training information This is prepared . Mel- Frequency in processes Capstral Coefficients (MFCC), spectrogram , filterbank such as methods wide is used .

Last in years artificial of intellect mechanical study and deep study models voice in the analysis big efficiency In particular , convolutional neuron networks (CNN), recurrent neuron networks (RNN, LSTM) and Transformer architecture the speech segmentation , sounds separation and content in understanding high accuracy gives . With this together , naturally the language again working (NLP) methods with together when used out of the blue semantic also get information possible .

This of the research purpose voice in the analysis applicable modern algorithms and artificial intellect models theoretical the basics seeing exit , their efficiency assessment and various practical in the fields application opportunities illuminating from giving consists of . This approach not only technician processes , but human-computer communication further natural and effective to be to provide focused .

Voice analysis technologies in the study used methodology one how many from stages organization finds . This methodological approach mainly voice signals to collect them again performance , features separation , mechanical study models teaching and testing processes own inside takes . Every one stage technological in terms of thorough working issued is high accuracy and to efficiency to achieve provides .

Data collection

Research in the process various kind from sources – open speech corpus , conversation recordings , podcast and various voiced from orders consists of information collected . Information various gender , age and dialect has from individuals taken of the system universality to increase Also , noisy in the environment written information was also entered .

Data again work

Voice signal at a frequency of 16 kHz digitized . Noise reduce for spectral subtraction and Wiener filtering methods was used . Then the signal was short

timely To frames separated , each one frame on Hamming window This process frequency spectrum more precisely to take opportunity gives .

Features separation

Voice in the analysis the most effective from the features one Mel-Frequency Capstral Coefficients (MFCC) were used . From except , prosodic characteristics (intonation , volume) height , duration) also removed Also , the log-Mel spectrogram and filterbank indicators neuron to networks to be included additional information as was applied .

Models selection .

Artificial intellect from models three main direction from the test held :

Convolutional neuron networks (CNN): sound from signals visual spectral features separation for .

Recurrent neuron networks (RNN, LSTM, GRU): to time related sequences modeling for

Transformer architecture : voiced in commands semantic context understanding for .

Education and testing .

Model is 70% informative read , 15 % validation for and 15% for testing Adam optimizer in training and Cross-Entropy loss function The model was used work efficiency Accuracy , error rate (WER – Word Error Rate), and using the F1 criterion was evaluated .

Experimental environment .

Research Google Colab and based on NVIDIA GPU take gone . TensorFlow and PyTorch libraries used .

Methodology stages together voice analysis technologies effective performance providing , various practical to tasks flexible solutions to give opportunity created .

Research during various algorithms and artificial intellect models based on voice analysis efficiency evaluated . Results this showed that different model architectures information type and to the conditions looking at various accuracy level showed .

First of all , traditional from methods used The base model (based on HMM – Hidden Markov Model and GMM – Gaussian Mixture Model) has an accuracy of approximately 72% This indicator noiseless in the environment relatively satisfactory although noisy in the environment noticeable decrease observed .

Next in stages CNN -based model on log-Mel spectrograms This was read . approach visual features effective studied , 86 % accuracy CNN models advantage – short sound from segments clear features separate to take ability . However , time sequence into account in receiving restrictions existence because of , long the words analysis in doing errors increased .

RNN and his/her modifications (LSTM and GRU) and to time related sequences better Modeling , 90% accuracy In particular , LSTM has shown that long term context in storage efficiency high was . Nevertheless , the teaching process more it took time and calculation expenses increased .

Transformer architecture based on the built model the most high the results It is contextual . information deep learn to receive because of noisy high in the environment accuracy save Transformer - based model Accuracy reached 93% , and Word Error Rate reached 6.8% . organization This result is consistent with the RNN and CNN models . than better is an indicator .

Above results this proves that the voice in the analysis modern deep study architectures traditional from algorithms noticeable at the level Especially Transformer based models real time in systems , voice management in interfaces and security in monitoring application for the most promising is considered .

Also , prosodic characteristics (intonation , volume) height , duration) additional parameter as input model increased accuracy by 2–3% We watched . This is in speech emotional situations in determining additional opportunity creates.

Received results voice analysis in technologies various algorithms and models efficiency comparison opportunity gave . Discussion in the process following main aspects clarified .

Result. First , traditional methods (HMM, GMM) are currently on the day only control group as application They are simple . in environments work to the possibility has although it is complicated in conditions (noise , background) sounds , fast speech (significant) errors gives .

Secondly , CNN models strong side – spectral features effective separate This is what they are doing . voiced commands detection , short signal segments analysis in doing comfortable But time sequence in consideration CNN cannot complete solution that it is not showed .

Third , RNN, LSTM and GRU models time in sequence based on because of long the words again at work high accuracy gives . Their main The disadvantage is the lack of education . slowness and big calculation It requires resources .

Fourth , transformer architecture voice in the analysis the most promising direction that It is determined that parallel computing opportunity because of faster is read and long contexts effective again It works . Especially noisy . even in high environments result give real life in applications important is an advantage .

From this besides , research this showed that prosodic features input model efficiency increases . Intonation and sound height such as parameters user's emotional status in determining big help This gives human-computer communication further naturalizes .

Discussion in the process again one important aspect – real time to systems integration to do issue rose . Voiced management systems users for fast answer return Therefore , Transformer models optimized variants (like DistilBERT , wav2vec 2.0) in practice effective application possible .

Also , information the quality is also great importance Different age , gender , dialect has of individuals voices The model is more stable worked . So, in the future voice bodies further expansion current task to be remains .

Traditional algorithms (HMM, GMM) basic control on duty application possible , but modern applications for enough it's not .

CNN models spectral features effective Although it is learned , time context good into account can't .

RNN and LSTM models time sequence in modeling good result gave , but resource demanding

Transformer -based models the most high accuracy showed and voice analysis practical systems for the most promising approach is considered .

Prosodic features additional accordingly when applied , the results further improved , this and the speech semantic and emotional in terms of deeper analysis to do opportunity gives.

Conclusion

This research voice analysis in technologies applicable special algorithms and artificial intellect models efficiency analysis to do was taken . to the results according to the following to conclusions arrival possible :

In the future the research further develop for following directions important is :

- Voice bodies expansion and various languages cover to take .
- Transformer -based models optimization and real time to systems adaptation.

- Voice multimodal systems (video, face) for analysis expression , sensor data with together with integration to do
- Security , education , medicine and industry in the fields voice analysis technologies wide application

So artificially intellect and deep to study based voice analysis technologies human-computer communication noticeable at the level development , real time in applications wide application and intellectual systems efficiency increase is expected .

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