Жаратылыстану және техникалық ғылымдар
Естественные и технические науки
Natural and Technical Sciences

МРНТИ: 20.51.17 https://doi.org/10.65247/3105-3432-2025-3.01

INNOVATIVE SOLUTION FOR MACHINE TRANSLATION OF AUDIO RECORDS, UTILIZING VOICE CLONING TECHNOLOGIES

*[1]D.AYUPOV, [1]N.T.FARKHADINOVA
[1]School-lyceum № 23 named after Zoya Kosmodemyanskaya
(Shymkent, Kazakhstan)
*ayupovdaniel07@gmail.com, tanzya1976@gmail.com

Abstract
In the modern world, saturated with different technologies, where a vast amount of information and news is disseminated through the internet, television, and social media, there arises a need for translating content into various languages. This is essential to overcome the language barrier, expand the audience reach, and facilitate communication among people. Addressing this challenge is possible with the use of contemporary IT technologies, such as artificial intelligence. This research covers deep learning methods and the application of AI for translating voice audio recordings from one language to another while preserving the voice parameters of the original speaker. The study covers technical aspects, program development processes, challenges, and opportunities of this technology. Additionally, it explores the potential applications across various domains and presents a comparative analysis of results with other translation and voice cloning research efforts.
Keywords: machine translation, artificial intelligence, deep learning, voice cloning, multilingual communication, audio translation, technology applications.

Introduction

In the era of globalization, accompanied by interactions among various cultures and linguistic groups, there exists a pertinent issue of the language barrier that hinders effective communication. With the advent of artificial intelligence (AI) technologies, new perspectives arise for overcoming this barrier. In this context, the development of technologies capable of providing more efficient translation while preserving the uniqueness of the original speech becomes highly relevant. Artificial intelligence offers the opportunity to translate audio recordings and reproduce them, taking into account intonation, speech mannerisms, and the speaker's voice characteristics. AI-based machine translation coupled with speech synthesis can ensure convenient and personalized translation.

Human communication comes most naturally to us through speech [Quartier T., 2002]. Therefore, the main objective of this research is to develop and test an artificial intelligence (AI) program that combines sophisticated speech recognition, machine translation, and voice synthesis techniques to construct an efficient speech-to-speech translation (S2ST) system. The resulting system vocalizes the translated text while attempting to overcome the language barrier and maintain the distinctive qualities of the speaker's voice.

Main body

Speech-to-Speech Translation (S2ST) is an AI technology with the aim of converting speech from one language to another. S2ST systems leverages a combination of artificial neural networks (ANNs) to convert speech from one language to another. The essence of S2ST lies in its ability to comprehend and process linguistic nuances, intonations, and contextual intricacies inherent in spoken language. By harnessing the power of ANNs, S2ST systems analyze and understand the unique features of the input speech, enabling them to generate accurate and contextually appropriate translations in the desired target language. The significance of S2ST extends beyond mere language conversion, encompassing its potential in multimodal communication. This involves the integration of visual and

gestural information along with speech, creating a comprehensive system that addresses diverse aspects of human interaction.

The system consists of three essential components. Firstly, the initial Artificial Neural Network (ANN) engages in Speech Recognition by analyzing the audio in the source language and transcribing it into text. Secondly, another neural network ensures precise and contextually relevant translation into the target language. Finally, the last ANN employs Voice Synthesis, utilizing the translated text and the speaker's voice characteristics from the original recording to generate a natural-sounding, personalized vocalized translation. This approach adds a vital layer of human connection and emotional nuance, addressing the limitations often found in conventional machine-generated speech.

Without a doubt, machine translation is the foundation of this system. It is a crucial technology that has improved remarkably due to advances in machine learning and natural language processing. Thanks to these developments, machine translation systems can now translate text or speech between languages seamlessly and fluently. This technological ability offers a workable way to break down linguistic barriers in a variety of contexts. Machine translation is widely used in a variety of contexts, from online language learning environments and translation services to real-time communication technologies.

Existing applications utilises S2ST systems, such as Google Translate and Yandex Translator, rely on sophisticated ANN models like Google's Translatotron for machine translation [Jia Y., 2019]. While these programs offer convenient translation capabilities, they often fall short in replicating the original speaker's voice. The synthesized voice often sounds robotic and lacks the natural intonation.

In recent advancements, there has been a growing emphasis on addressing the limitations of current translation applications. The primary focus has shifted towards not only achieving the most accurate translation of text but also vocalizing it with a realistic and unique speaker's voice from the original audio recording. This shift is driven by the recognition that a more authentic voice enhances the overall user experience. Numerous methods, both software and hardware-oriented, have been proposed in previous instances to optimize waveforms in the context of speech synthesis [Pravin M.G., 2017]. Nevertheless, with the evolution of Text-to-Speech (TTS) that gives an opportunity to integrate more natural and individual voice sounds by cloning the reference voice.

The progress and evolution of AI technologies allow overcoming technical limitations such as using non-realistic, generated voices for text vocalization. Thus, there is an opportunity to explore new methods to achieve a match between the voiced translation and the original. Thus, well trained voice cloning models such as Open-Source XTTS [Gölge E., 2023] or Google's Tacotron [Wang Y., 2017], offer a promising solution.

Voice cloning involves the creation of synthetic speech that mimics the unique vocal characteristics of an individual. This is achieved through advanced machine learning algorithms that analyze and replicate the nuances of pitch, tone, and cadence present in a person's voice. Recent advancements in deep learning, particularly with neural network architectures, have significantly enhanced the fidelity and naturalness of cloned voices. Voice cloning translation potential lies in its ability to reproduce speech in multiple languages, thereby facilitating cross-cultural communication. By combining voice cloning with translation algorithms, it becomes possible to not only convert written text but also spoken words from one language to another while preserving the speaker's unique vocal qualities. This holds immense promise for breaking down language barriers and fostering greater understanding among diverse linguistic communities. By integrating voice cloning with S2ST systems, we can achieve a more natural and personalized translation experience. This is particularly relevant in contexts where conveying emotions and speaker identity is crucial, such as business meetings, educational settings, or even personal conversations.

Methods

To translate spoken language while preserving the speaker's unique voice characteristics, we have implemented a multi-stage approach leveraging the power of artificial neural networks (ANNs)

(Figure 1). This extended section provides an in-depth exploration of the technical aspects associated with each stage, offering comprehensive insights into the selected models, the intricacies of training processes, and the integration strategies employed in this initiative.

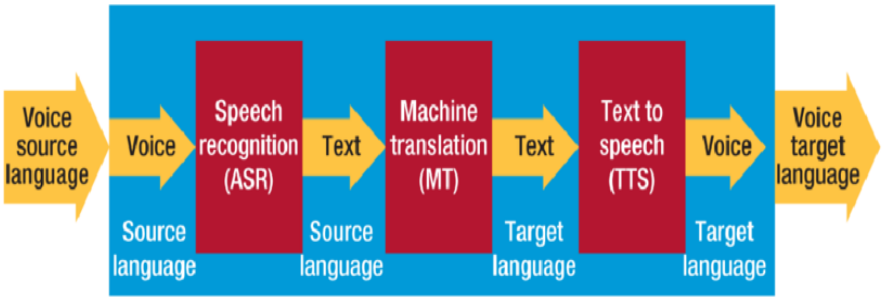

Figure 1. Block Diagram of the S2ST system [Ali K., 2023]

1. Speech Recognition: We opted for Whisper Cog model by OpenAI [Radford A., 2022] known for its high accuracy and robust performance in handling diverse acoustic environments. This model was trained on a large corpus of labeled speech data comprising various languages and accents.

2. Machine Translation: With the source language text in hand, the next stage involves accurately and contextually translating it into the target language. We opted for the state-of-the-art Transformer-based neural machine translation (NMT) model, Seamless Communication [Barrault L., 2023]. This model excels in capturing long-range dependencies and context within sentences, leading to more natural and accurate translations. Additionally, Seamless Communication incorporates a "contextualization" module that utilizes external knowledge sources like Wikipedia to enhance the translation's semantic coherence and relevance. The experiments reveal that the contextualization improves the translation quality by 2 BLEU scores [Choi H., 2017].

To further optimize translation quality, we employed a technique called back-translation [Rico S., 2016]. In this approach, the translated text is back-translated into the source language and compared to the original text. Any discrepancies identified during back-translation serve as training signals for the NMT model, allowing it to refine its translation strategies and improve accuracy. Thus, implementing attention mechanisms to this AI model [Nikolas A., 2021].

3. Voice Synthesis: To achieve personalized voice cloning, we integrated the Open-Source XTTS model [Gölge E., 2023] into the app. XTTS utilizes a deep convolutional autoencoder architecture to learn speaker-specific vocal characteristics from short audio recordings. This allows the model to generate high-fidelity synthetic speech that closely resembles the original speaker's voice, including pitch, intonation, and vocal timbre [Ruggiero G., 2021]. XTTS was trained on a dataset of diverse speaker voices and linguistic backgrounds, ensuring generalizability across different speakers and languages.

The trained models were then integrated into a single software program. "Seamless Communication" handled text translation, while XTTS performed voice synthesis using the speaker's voice extracted from the original audio recording. This approach ensured that the translated text was vocalized with the speaker's unique vocal characteristics, maintaining a sense of naturalness and personal connection.

We performed an in-depth review of the S2ST system's performance by combining qualitative evaluations with quantitative indicators like BLEU score [Roukos S., 2002]. Human reviewers were asked to score the overall quality, fluency, and naturalness of the synthetic speech generated by the system through subjective hearing tests. This qualitative method revealed nuances that quantitative measures can miss and offered valuable insights about the features of the speech generated by our system.

To understand more about the synthetic speech's acoustic properties, we also used spectrographic analysis. This required looking at spectrograms to find patterns in pronunciation, intonation, and pitch

in order to make sure that the S2ST system translated the information effectively while retaining the expressive and emotional characteristics of the original speaker. Through the integration of spectrographic analysis, subjective evaluations, and quantitative measurements, our review aimed to provide a thorough grasp of the capabilities and constraints of the system. The program's effectiveness and reliability were highlighted by the thorough testing and evaluation processes, which also demonstrated the system's potential for real-world use in a variety of language and communication contexts.

Results

A total of three sets of tests were done in order to fully evaluate the performance of our S2ST system under various conditions and scenarios. The purpose of these tests was to offer detailed understandings of the system's strengths and weaknesses so that decisions about its use and potential improvements could be made with knowledge:

1. Machine Translation Accuracy:

We used the BLEU score as a standard metric for translation quality, comparing the system's generated translations against multiple human reference translations and popular translation services results for the same source text.

Source language text: *Нейронные сети представляют собой модель машинного обучения, вдохновленную работой человеческого мозга.*
Human (Reference) translation: *Neural networks represent a machine learning model inspired by the functioning of the human brain.*
Google translate: *Neural networks are a machine learning model inspired by the workings of the human brain.*
Our program result: *Neural networks are a machine learning model inspired by the functioning of the human brain.*

After calculating the BLEU score, Google Translate obtained a score of 0.875 (out of maximum 1), while our system achieved a higher score of 0.9375 (out of maximum 1). This indicates that our system outperforms Google Translate in terms of translation accuracy.

We tested the system with various language pairs and text styles/genres, such as news articles, conversations, technical documents and then compared it to human translation and Google Translate results (Table 1).

Table 1

Translation quality test among different text styles

Text Styles	Human translation	Google Translate	Our system translation
Scientific	9	7	8
Journalistic	9	8	9
Conversational	10	9	9.5
Literary	8	8	8
OVERALL	*9*	*8*	*8.625*

Each translation - whether produced by an AI system or a human - was given a score on a 10-point scale to indicate its quality. Based on our analysis, AI ranks highest in conversational and journalistic genres, demonstrating remarkable performance. On the other hand, AI performs worse in scientific and literary genres, which is expected given these more sophisticated linguistic fields.

2. Voice Cloning Fidelity: We assessed the fidelity of the cloned voice by the correspondence between the spectrograms (Figure 2-4) of the original voice and the cloned one.

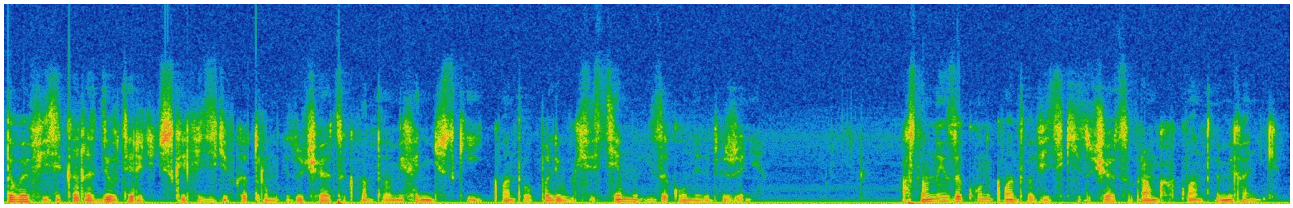

Figure 2. Original human voice

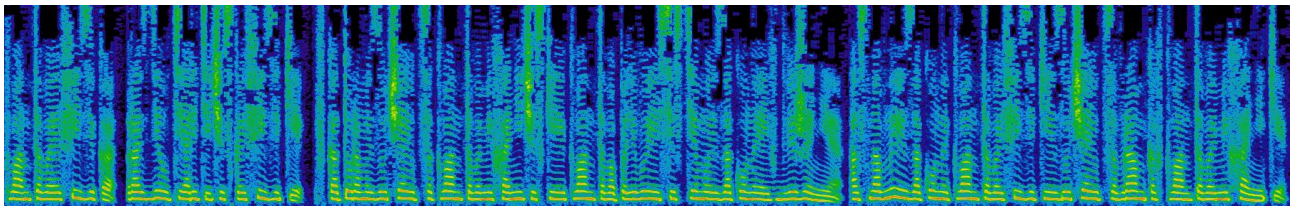

Figure 3. Google Translate AI generated voice

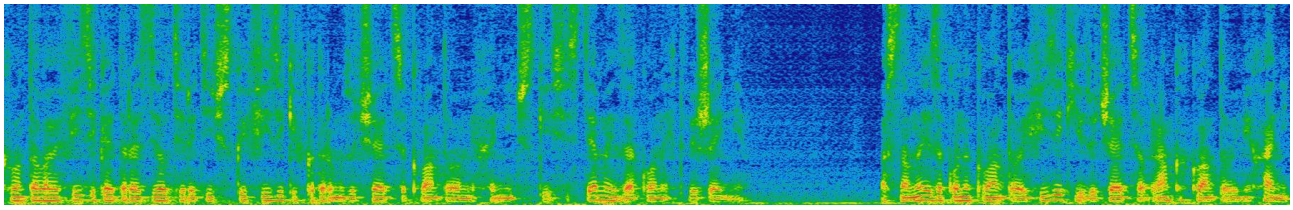

Figure 4. Our program AI cloned voice

The spectrogram analysis reveals helpful details about the final result. After analyzing all of the spectrograms, it is clear that the ones shown on Figure 2 and Figure 4 are more similar to each other than the one in Figure 3, which is the basic synthesized voice from Google. Notably, similar background noise and pauses at the same times are visible in both the original and cloned speech spectrograms, which is well in context of voice naturalness. However, spectrograms also show that the cloned voice has a slight robotic undertone in addition to seeming louder than the original. Despite these small differences, the overall sound of the cloned voice quite closely represents that of the original.

Our research focused on the subtle nuances of the synthetic speech and examined how listeners perceived the speaker's resemblance, intonation, and emotional engagement. Through a thorough investigation, we aimed to clarify the minute details that add up to a more genuine and emotionally impactful listening experience. Listeners' assessments involved a careful comparison between the speech synthesized by our AI-driven S2ST technology and the original speaker. Speaker likeness was one of the parameters used to measure how well the system could replicate the unique characteristics of the original speaker's voice, resulting in an accurate portrayal.

Discussion

The system has the potential to revolutionize communication across languages. However, like any new technology, it has its limitations and challenges.

Limitations and main problems

One of the primary challenges facing this technology is the translation accuracy. Even the most advanced machine translation systems are prone to errors, including style mismatches and hallucinations, particularly when dealing with intricate or technical language [Jianhui P., 2024]. Accurate machine translation has a wide range of applications, including in business, healthcare, and education. Furthermore, real-time translation's computing demands present major challenges,

especially when working with complicated linguistic structures or in situations with limited resources. It is essential to address these problems in order to avoid miscommunication and misconceptions when communicating between languages.

Another challenges are Linguistic and Cultural. Language is not merely a system of words but a reflection of cultural nuances, social norms, and historical contexts. Machine translation (MT) systems encounter difficulties in capturing the rich tapestry of human communication, including intonation, emotion, and non-verbal cues. Errors and misinterpretations result from current systems' frequent struggles with idiomatic terms, cultural references, and linguistic nuances. Cultural sensitivities and linguistic conventions vary widely across communities, presenting formidable barriers to accurate translation and intercultural understanding.

Third limitation is system's reliance on vast datasets of both speech and text poses another significant challenge. The collection and curation of these datasets can be resource-intensive and time-consuming. This challenge often results in limitations, as S2ST systems are commonly restricted to a select number of languages due to the constraints associated with assembling comprehensive datasets.

Ethical and Privacy Concerns. S2ST systems can be susceptible to security vulnerabilities. The deployment of S2ST technology raises profound ethical questions regarding privacy, data security, and consent. Voice data collected for translation purposes may be susceptible to misuse, surveillance, or unauthorized access, posing risks to individual autonomy and confidentiality. Furthermore, the potential for bias and discrimination in automated translation algorithms underscores the need for robust ethical frameworks and accountability mechanisms. For example, S2ST models could be used to create deepfakes, which are videos or audio recordings in which a person's face or voice has been replaced with that of another person. Deepfakes could be used to spread misinformation or to damage someone's reputation. Just a few seconds of audio is all it takes to bypass voice security measures and steal your identity [Slivova M., 2021]. Although all categories of fake multimedia (i.e. fake news, fake images, and fake audio) could be sources of disinformation and misinformation, audiovisualbased deepfakes are expected to be much more devastating [Masood M., 2021: P.3].

Addressing the limitations and challenges of S2ST technology requires a multi-faceted approach encompassing technological innovation, linguistic research, and ethical deliberation. To improve current systems, create new techniques, and advance inclusive design principles, cooperation between researchers, developers, linguists, and end users is crucial. Authorities also need to pass laws that protect user rights, encourage openness, and reduce possible negative effects of S2ST usage.

S2ST with voice cloning, however, has the power to completely alter cross-linguistic communication. It may have the following advantages:

Breaking language barriers. This system can help to break down language barriers and promote understanding between people from different cultures.

Language Learning and Pronunciation. Voice cloning can be employed to generate native-like pronunciation guides for language learners. Learners can benefit from exposure to authentic accents and intonations, improving their ability to comprehend and reproduce sounds accurately.

Multilingual Virtual Assistants. Integrating voice cloning with translation capabilities can enhance the functionality of virtual assistants. Users can interact with these assistants in their preferred language, and the responses can be translated and delivered in the user's chosen language with a cloned voice.

Entertainment Industry. Voice cloning has the potential to revolutionize the entertainment industry by enabling seamless dubbing and localization of content. Actors' voices can be cloned and translated into various languages, expanding the global reach of films, TV shows, and other media. S2ST with voice clonning can be used to create new forms of entertainment and art.

Real-time translation and vocalization perspectives. The combined technologies provide numerous advantages in the field of advertising. Real-time dynamic translation and voiceover of advertisements

is possible to adapt them to the language and cultural background of the audience. By using a specific approach, advertising efforts are more effective and have a greater influence on a wider range of audiences. Additionally, the technology makes it possible for dynamic content, such streaming services and live broadcasts, to be translated and be well-voiced in real time. This flexibility makes sure that content is always relevant and easily accessible, meeting the changing needs of a wide range of international viewers.

Assistive Technologies. Individuals with speech disorders or language disabilities could benefit from voice cloning technology. Cloning a user's voice and translating their speech into different languages can empower them to communicate more effectively in a variety of settings.

Improved access to information. S2ST can make it easier for people to access information in other languages. This could benefit students, businesses, and travelers. A vast array of educational programs, videos, and online lessons can be made more accessible to global audiences through seamless voice translation [Perez A., 2021].

Conclusion

In conclusion, our study emphasizes how important innovation is in the field of communication. The S2ST technology, which accurately imitates a speaker's speech, seems as an essential tool for breaking down language barriers and promoting a new era of global understanding and cooperation. Although our research highlights the issues this technology has, its promising potential inspires further study and development. Future research and development efforts in voice cloning and translation should concentrate on improving naturalness, strengthening security, and improving accuracy in order to move us closer to a more cohesive and integrated world of global communication.

References

Ali K.A.R., Mays Z.H. (2023) *Real-time speech recognition of arabic language* [Electronic resource]: URL: https://www.researchgate.net/publication/369634637_Realtime_speech_recognition_of_arabic_language (date of access: 29.03.2025).

Barrault L., Chung Y., Coria M., Dale D., Dong N., et al. (2023) *Seamless: Multilingual Expressive and Streaming Speech Translation* [Electronic resource]: URL: https://ai.meta.com/research/publications/seamless-multilingual-expressive-and-streaming-speech-translation/ (date of access: 30.03.2025).

Choi H., Cho K., Bengio Y. (2016) *Context-dependent word representation for neural machine translation* [Electronic resource]: URL: https://www.scopus.com/record/display.uri?eid=2-s2.0-85014469233&origin=inward&txGid=51f7fd61b8808a2bcac463f66ec05ff3 (date of access: 03.03.2025).

Gölge E. (2023) *XTTS - open-source TTS in 13 languages with voice-cloning* [Electronic resource]: URL: https://medium.com/machine-learns/xtts-open-source-tts-in-13-languagese05c19782a03 (date of access: 14.03.2025).

Jia Y., Weiss R. (2019) *Introducing Translatotron: An End-to-End Speech-to-Speech Translation Model* [Electronic resource]: URL: https://blog.research.google/2019/05/introducing translatotron-end-to-end.html (date of access: 15.02.2025).

Jianhui P., Fanghua Y., Longyue W., Dian Y., Derek F.W., Shuming S., Zhaopeng T. (2024) *Salute the Classic: Revisiting Challenges of Machine Translation in the Age of Large Language Models of Machine Translation* [Electronic resource]: URL: https://arxiv.org/abs/2401.08350 (date of access: 16.01.2025).

Masood M., Nawaz M., Mahmood M.K., Javed A., Irtaza A. (2021) *Deepfakes Generation and Detection: State-of-the-art, open challenges, countermeasures, and way forward* [Electronic resource]: URL: https://arxiv.org/abs/2103.00484 (date of access: 25.02.2025).

Nikolas A. (2021) *Why multi-head self attention works: math, intuitions and 10+1 hidden insights* [Electronic resource]: URL: https://theaisummer.com/self-attention/ (date of access: 25.03.2025).

Perez A., Garces G., Gimenez A., et al. (2021) *Towards cross-lingual voice cloning in higher education* [Electronic resource]: URL: https://www.sciencedirect.com/science/article/pii/S095219762100261X (date of access: 15.01.2025).

Pravin M.G. (2017) *A survey on methods of TTS and various test for evaluating the quality of synthesized speech* [Electronic resource]: URL: https://www.researchgate.net/publication/353155941_A_SURVEY_ON_METHODS_OF_TTS_AND_VARIOUS_TEST_FOR_EVALUATING_THE_QUALITY_OF_SYNTHESIZED_SPEECH (date of access: 14.02.2025).

Quatieri T.F. (2002) *Discrete-time speech signal processing: principles and practice* [Electronic resource]: URL: https://search.worldcat.org/title/discrete-time-speech-signal-processing-principles-and-practice/oclc/297575046?referer=di&ht=edition (date of access: 2002).

Radford A., Woon Kim J. (2022) *Robust Speech Recognition via Large-Scale Weak Supervision* [Electronic resource]: URL: https://cdn.openai.com/papers/whisper.pdf (date of access: 21.02.2025).

Roukos S., Jing Zhu W., Papineni K., Ward T. (2002) *BLEU: a Method for Automatic Evaluation of Machine Translation* [Electronic resource]: URL: https://www.researchgate.net/publication/2588204_BLEU_a_Method_for_Automatic_Evaluation_of_Machine_Translation (date of access: 06.01.2025).

Ruggiero G., Zovato E., Di Caro L., Pollet V. (2021) *Voice Cloning: a Multi-Speaker Text-to-Speech Synthesis Approach based on Transfer Learning* [Electronic resource]: URL: https://arxiv.org/abs/2102.05630 (date of access: 10.02.2025).

Slivova M., Nawaz M., Vozňák M., Tovarek J., Partila P. (2021) *Detection of speaker liveness with CNN isolated word ASR for verification systems* [Electronic resource]: URL: https://www.researchgate.net/publication/352496109_Detection_of_speaker_liveness_with_CNN_isolated_word_ASR_for_verification_systems (date of access: 17.02.2025).

Wang Y., Skerry-Ryan RJ, Stanton D., et al. (2017) *Tacotron: Towards End-to-End Speech Synthesis* [Electronic resource]: URL: https://arxiv.org/abs/1703.10135 (date of access: 27.03.2025).

Дауысты клондау технологияларын пайдаланатын аудио жазбаларды машиналық аударуға арналған инновациялық шешім

[1]Д.Аюпов, [1]Т.Н.Фархадинова
[1]Зоя Космодемьянская атындағы № 23 мектеп-лицейі *(Шымкент, Қазақстан)*

Аңдатпа
Түрлі технологияларға қанықкан, ақпарат пен жаңалықтардың үлкен көлемі интернет, теледидар және әлеуметтік желілер арқылы таралатын заманауи әлемде мазмұнды әртүрлі тілдерге аудару қажеттілігі туындайды. Бұл тілдік кедергіні жеңу, аудиторияны кеңейту және адамдар арасындағы қарым-қатынасты жеңілдету үшін қажет. Бұл мәселені шешу жасанды интеллект сияқты заманауи IT-технологияларды қолдану арқылы мүмкін болады. Бұл зерттеу терең оқыту әдістерін және бастапқы динамиктің дауыс параметрлерін сақтай отырып, дауыстық аудио жазбаларды бір тілден екінші тілге аудару үшін AI қолдануын қамтиды. Зерттеу техникалық аспектілерді, бағдарламаны әзірлеу процестерін, осы технологияның қиындықтары мен мүмкіндіктерін қамтиды. Оған қоса, ол әртүрлі домендердегі әлеуетті қолданбаларды зерттейді және басқа аударма және дауысты клондау зерттеулерімен нәтижелердің салыстырмалы талдауын ұсынады.
Түйін сөздер: нейрондық желілер, AI, IT, информатика, дауыс синтезі, аудио аударма, аудармашы, жасанды интеллект, S2ST, Технологияны қолдану, көптілді қарым-қатынас.

Инновационное решение для машинного перевода аудиозаписей, с использованием ИИ технологий клонирования голоса

[1]Д.Аюпов, [1]Т.Н.Фархадинова
[1]Школа-лицей № 23 имени Зои Космодемьянской (Шымкент, Казахстан)

Аннотация
В современном мире, насыщенном различными технологиями, где огромное количество информации и новостей распространяется через Интернет, телевидение и социальные сети, возникает потребность в переводе контента на различные языки. Это необходимо для преодоления языкового барьера, расширения охвата аудитории и облегчения общения между людьми. Решение этой проблемы возможно с использованием современных IT-технологий, таких как искусственный интеллект. Это исследование охватывает методы глубокого обучения и применение искусственного интеллекта для перевода голосовых аудиозаписей с одного языка на другой с сохранением параметров голоса исходного говорящего. Исследование охватывает технические аспекты, процессы разработки программ, проблемы и возможности этой технологии. Кроме того, в нем исследуются потенциальные применения в различных областях и представлен сравнительный анализ результатов с другими исследованиями в области перевода и клонирования голоса.
Ключевые слова: нейронные сети, ИИ, информатика, синтез голоса, искусственный интеллект, аудио перевод, IT, применение технологий, многоязычное общение, S2ST, глубокое обучение.

Поступила в редакцию: 20.01.2024
Одобрена: 12.03.2024
Первая публикация на сайте: 22.12.2024

МРНТИ: 44.31.29, 44.31.35 https://doi.org/10.65247/3105-3432-2025-3.02

АЛЬТЕРНАТИВНЫЕ ИСТОЧНИКИ ЭНЕРГИИ И НОВЫЙ СПОСОБ ПОЛУЧЕНИЯ ЭНЕРГИИ ИЗ ДОЖДЯ

**[1]А.МУХАМЕТЖАН, [1]Г.А.АЛМАБЕКОВА*
[1]Назарбаев Интеллектуальная школа химико-биологического направления (Алматы, Казахстан)
**amukhametzhan2007@gmail.com, almabekova0309@gmail.com*

Аннотация
В статье рассмотрены виды источников альтернативной энергии, их плюсы и минусы и новый способ получения энергии из дождя с помощью пьезоэлементов. Экология земли находится в критическом состояний из-за многовекового использования нечистой энергии. Традиционные источники энергии как сжигание угля или использование природных газов являются нечистой энергией и наносят огромный вред экологии. Глобальное потепление, загрязнение воздуха и другие экологические проблемы подвигло человечество к созданию новых и новых источников альтернативной энергии. Однако пока альтернативная энергетика не способна полностью заменить традиционную энергетику, люди должны развивать зеленую энергию и придумывать их источники. В этой статье подробно описываются 8 видов альтернативных источников энергии, их плюсы и минусы и уровень развития в мире. Также целью данной статьи является рассказать о новом индивидуальном методе получении электричества от кинетической энергии дождя и будущее применение данной идеи. В статье описываются цели, методологии, результаты и выводы данной работы. Новый метод представляет из себя пленку, который состоит из 50 пьезоэлементов. Пьезоэлементы соединены с друг другом чтобы получить больше напряжений для превращения их в электричество. Дождь – механическая энергия, заставляющая пьезоэлементов деформироваться. При деформации, пьезоэлементы генерируют ток. Пленку можно установить на крыши домов или зонтов, чтобы в дождливые дни энергию можно было использовать для освещения. Такой метод получения энергии подходит к дождливым местностям. Статья предоставляет информацию о будущем применений нового метода.
Ключевые слова: альтернативные источники энергии, экологические проблемы, энергия из дождя, «умная» пленка, пьезоэлементы.

Введение

Тема данной статьи является актуальной для всего мира. Глобальные экологические проблемы являются общей бедой. В целях предотвратить глобальное потепление, вымирание видов,