

## Using machine learning for translation and speech generation in e-book reading applications

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In recent years, the introduction of Machine Learning (ML) has significantly changed the functionality of e-book reading applications, particularly in terms of text translation and speech generation. However, even the most advanced solutions face several problems that affect their effectiveness and user experience. Let's look at three popular mobile applications: Google Play Books, Audible, and Speechify.

Google Play Books: Text translation in a multilingual environment [1]. Google Play Books supports automatic translation of e-book texts through its integration with Google Translate. This is useful for users who want to read books in other languages, but face the following problems:

- There are often mistakes in the translation of literary works, especially in the case of poetry or complex metaphors. For example, in novels with regional dialects, the translation may lose its artistic value;
- translation of large amounts of text in real time can be slow, making it difficult to read;
- although Google Translate supports more than 100 languages, specific cultural features are often ignored. For example, the level of politeness is often incorrectly displayed in texts of Japanese literature.

Audible: speech generation for audiobooks [2]. Audible is a leader in the field of audiobooks, but its integration of ML-based speech generation is still limited. The program uses mostly human voice recordings, but the company is experimenting with ML to create TTS versions of books. Also, TTS is used only in books selected by the company, which severely limits its library. Also, the generation of speech in the service is accompanied by several problems:

- experimental TTS books have mechanical intonations that reduce the quality of perception compared to voice acting by professional actors;
- synthetic voices cannot always convey the tone or emotions that are important for literary texts (for example, dramatic scenes);
- generation of speech for books in languages other than English is often accompanied by incorrect emphasis or pronunciation.

Speechify: inclusivity and personalization [3]. Speechify specializes in converting text to speech using ML. The program is popular among people with visual impairments or dyslexia. It has the same problems as classic TTS: incorrect accents in languages other than English and lack of emotions. The program also has individual problems:

- Speechify sometimes misinterprets abbreviations, special characters, or complex terms such as scientific concepts or formulas;
- access to high-quality voices and advanced features requires an expensive subscription, which makes the program less accessible to a wide audience;
- despite the functions of adjusting the speech speed or voice selection, the program does not yet support the creation of individual voices, for example, based on user recordings.

So, after analyzing solutions to improve the functionality of machine learning-based reading, the following common problems can be identified:

- device power limitations - real-time speech generation or translation consumes significant computing resources, which can reduce the performance of mobile devices;
- privacy and confidentiality - transferring texts for processing to the cloud raises issues of personal data security, especially when reading sensitive or private content;
- localization and cultural context - despite the progress of ML, multilingual systems often ignore cultural features or meanings that are critical to understanding a text.

Using ML to translate text and generate speech in eBook applications has enormous potential, but also faces significant challenges. With the improvement of data and logarithmic rules for artificial intelligence, it will be possible to achieve 100% translation results in the future [4], which will lead to the abandonment of some approaches based on translation agencies [5]. The development of neural units in mobile processors, such as Snapdragon 8 Elite [6] and Apple A18 [7], may provide better opportunities for using machine learning on mobile devices. However, to achieve a high-quality user experience, developers need to improve the technology, considering the specifics of literary texts, natural speech, and localization needs. This requires both further development of models and work on their adaptability for users.

**Ключові слова:** MACHINE LEARNING, TRANSLATION.

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