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Russian sign language learning simulator - FG 2024 Submission

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Abstract— In the context of an evolving assistive technology market, it is critically important to meet the needs of approximately 500 million people worldwide suffering from hearing loss.

We introduce an online simulator for learning Russian Sign Language, allowing the evaluation of learned signs correctness using a machine learning model. For demonstrations, we utilize a 3D avatar to show the reference sign, enabling to learn the sign from various angles and at a convenient speed for the student. We can automatically create 3D avatars based on sign language videos, so we can add new signs to the simulator very fast.

This paper presents a Russian Sign Language simulator, but potentially, the model can be retrained on other sign languages.

I. INTRODUCTION

According to WHO data [1], 480 million people worldwide suffer from disabling hearing loss. This number is only expected to increase, with projections reaching 700 million people by 2050. We introduce a Sign Language (SL) learning simulator, a tool designed to facilitate learning individual signs and their assessment. Also, learners can complete tasks on the platform to assess their comprehension of learned signs. Gamification elements such as levels and trophies enhance the user experience and further motivate users.

Employees of institutions that serve people with hearing impairments can learn basic sign sets with the SL learning simulator. It can also be used to train special signs or to learn another sign language

The simulator is based on lightweight model with an S3D architecture [2], thus signs are recognized at a frequency of 2-3 signs per second even on relatively weak PCs without a GPU. The model recognizes 1598 signs. We also have a more 'heavy' GPU model[4] based on the mViTv2 [3] architecture.

II. MAIN FUNCTIONALITY

The simulator has three main sections — "Learning", "Practice", and "Dictionary". In the "Learning", the user studies signs shown by a 3D avatar. This allows for quickly adding new signs. After studying the signs, the user solves verification tasks section (Fig. 1) that are generated randomly. This helps to check the learned signs understanding level. The user must demonstrate a given word or sequences corresponding to sentences in sign language to web camera in "Practice" section (Fig. 2). The model will recognize the sign. Correct signs will be marked in green. "Dictionary" is a section for quickly searching any sign. It's convenient for users who wish to recall or learn individual signs (for example, for communication in a foreign sign language).
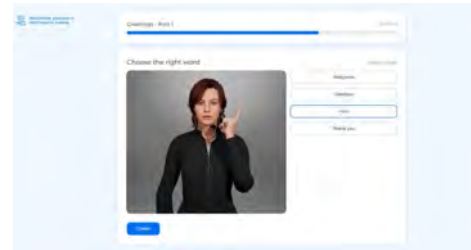
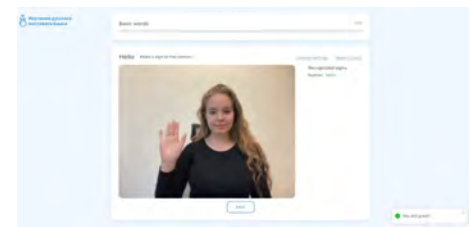Fig. 1. The learning section page. Tasks

Fig. 2. The practice section page.

To evaluate the simulator's effectiveness in facilitating learning, we conducted a blind test at the Shuba Technical School Boarding House for the Disabled [5]. The results indicated no statistical difference in the quality of sign demonstration and recognition between participants utilizing the simulator and those who did not.

III. CONCLUSIONS

We introduce a Russian Sign Language learning simulator that empowers users to independently study signs and assess their mastery without instructor intervention. Employing a machine learning model enables anytime self-assessment, while the use of 3D avatars supports personalized learning of sign nuances from various perspectives. You can try the simulator on https://sign-study.ds-hub.ru.

REFERENCES

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