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HeyKID

Interactive Language Learning Platform for Toddlers

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ABSTRACT

The increasing demand for toddler-oriented online education has exposed a lack of web-based platforms that offer interactive learning coupled with speech recognition. While the majority of current solutions come as mobile applications, they do not offer the increased engagement and accessibility that web platforms are capable of. This project introduces an end-to-end web-based e-learning system that is tailored specifically for toddlers, supporting basic concept learning numbers, colours, letters, and shapes and includes progress tracking mechanisms for teachers and parents.

In order to facilitate proper speech recognition from toddlers, a Convolutional Neural Network (CNN) was created and trained over a personalised dataset of toddler speech samples. The audio files were pre-processed using Mel-Frequency Cepstral Coefficients (MFCCs) for acquiring essential spectral characteristics. The final CNN model, after conducting several trials, comprised convolutional and pooling layers followed by fully connected dense layers with dropout measures. This model was particularly tailored to classify speech into predetermined learning categories, therefore facilitating real-time interaction within an educational setting.

The evaluation of the model demonstrated 90.02% classification accuracy with an AUC-ROC of 0.89, indicating high effectiveness in toddler speech detection. Confusion matrix analysis demonstrated high sensitivity and specificity rates and precision and recall rates that consistently exceeded 88%. These findings demonstrate the model's proficiency in speech-based learning and indicate its potential for incorporation into intelligent, interactive, web-based learning systems for early learners.

Keywords: Early Childhood Learning, Speech Recognition, Convolutional Neural Network, MFCC, Web-Based E-Learning, Toddler Education, Interactive Learning

Subject Descriptors:

Computing methodologies → Artificial intelligence → Speech recognition → Neural networks

Applied computing → E-learning → Early childhood education

Mathematics of computing → Statistical learning → Classification metrics