

Automatic Assessment of Reading Ability of Children

This project developed methods to automatically analyse children’s reading aloud performance, detecting reading errors and correctly pronounced words as well as providing an overall reading ability index based on their performance on several reading tasks. An automatic tool for reading assessment can be a great complement and time-saving asset to the usual evaluations by teachers.



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Indicators	
Funding	33k €
Journal Papers	3
Conference Papers	10
Concluded MSc	3
Two Main Publications	
J. Proença, D. Celorico, S. Candeias, C. Lopes, F. Perdigão, Children’s Reading Aloud Performance: a Database and Automatic Detection of Disfluencies, ISCA - “Conf. of the International Speech Communication Association - INTERSPEECH”, Dresden, Germany, Vol. 1, pp. 1655 - 1659, September, 2015	
J. Proença, D. Celorico, S. Candeias, C. Lopes, F. Perdigão, The LetsRead Corpus of Portuguese Children Reading Aloud for Performance Evaluation, “ELRA International Conf. on Language Resources and Evaluation, - LREC”, Portorož, Slovenia, Vol. 1, pp. 781 - 785, May, 2016	

PROJECT WEBPAGE URL
<https://www.it.pt/Projects/Index/1938>
http://lsi.co.it.pt/spl/projects_letsread.html



Fig. 1 Recording session in a primary school.



Fig. 2 Snapshot of the LETSREAD demo.

GENERAL MOTIVATION AND OBJECTIVES

To evaluate the reading aloud ability of primary school children, teachers or tutors usually need to make the effort of providing a level-appropriate reading task to the child, manually take notes for time and accuracy, and calculate a metric such as correct words per minute. This 1-on-1 procedure can be very time-consuming and manual evaluations are not consistently equal and depend on evaluator bias and experience. An automatic system that can perform these steps accurately would be a great complement to the usual methods and an indispensable tool for teachers. It could also lead to more frequent assessments of a child throughout the school year, and a higher-quality accompaniment of their education. Providing an overall performance score can give a clear overview of a child’s status and can also be beneficial for an analysis of a child’s progress over time.

The objective of the project is to develop a tool that automatically provides an overall reading performance metric for a child based on several reading tasks. For that purpose, all reading disfluencies and errors must be automatically detected, including mispronunciations, false starts and repetitions.

CHALLENGE

The main challenge is to automatically identify and detect all the various reading problems in utterances of children who are learning how to read. The speech of children has different acoustic characteristics than the speech of adults, for which speech recognition technologies are significantly mature, and great care needs to be taken to build specifically tailored acoustic models. The features that teachers take into account when deciding on an overall reading aloud performance score need to be identified, automatically obtained and their information combined into a single score.

WORK DESCRIPTION AND ACHIEVEMENTS

- A large database (20 hours) of 284 children reading aloud was collected in Portuguese public and private primary schools. Reading tasks with prompts of sentences and pseudowords (nonsense words) of varying difficulty were designed with the purpose of obtaining varied examples of reading mistakes. The audio was manually transcribed with annotation of all linguistic and extra-linguistic events.

- Acoustic models were trained based on hidden Markov models and neural networks, for both speech decoding and phonetic recognition. An accurate phonetic recognition was developed to detect mispronunciations.

- An automatic annotation system was developed to find correct and incorrect words in an utterance corresponding to a reading attempt. The built system follows two steps: first, a strict decoding using the prompt’s words detects false-starts, repetitions and candidate words; in the second step, candidates for words are classified as mispronounced or not based on phonetic recognition and the likelihood of allowable pronunciations.

- The opinion of 100 primary schools teachers was gathered for the level of reading performance of children in the database. A crowdsourcing-like application was developed, where a teacher could listen to several utterances of a child reading, and give a 0-5 score for overall performance. These scores function as a ground truth for classification.

- From automatic annotation, several performance-related metrics are extracted based on speed, accuracy and presence of specific problems. These features are combined in regression models that closely predict the opinion of teachers (95% correlation).

- A Demo application was developed (Fig. 2), where the reading attempts of the database’s children can be heard and analysed. A colour coded automatic annotation of a child’s utterance is displayed, marking extra content and correctly or incorrectly pronounced words. Performance metrics are computed, including the predicted overall reading ability score. The child’s current score and the score accumulated over several reading tasks can be compared to the ones given by teachers.