Chapter 23
Automatic Speech Recognition to Enhance Learning for Disabled Students

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ABSTRACT

This chapter introduces the potential of Automatic Speech Recognition Technology (ASR) in the challenge of inclusive education. ASR technology combined with Information and Communication Technology (ICT) enhances the learning of disabled people both in and outside the classroom. In the classroom, deaf and hearing-impaired students can benefit from a real-time transcription of what the teacher is saying. Also, a real-time transcription facilitates note taking for students with visual or physical disabilities. Outside the classroom, transcription and other media files (audio, slides, video, etc.) are powerful educational resources for all students, disabled or able-bodied. Some of most relevant projects and systems around the world are described and compared in this chapter to provide updated information about ASR technology performance and its application to enhancing the learning of disabled students.

INTRODUCTION

Traditionally, *Special Education* was the only choice for people with disabilities or special needs. Fortunately, there have been strong movements in favor of integrating disabled students (Arnáiz, 2003). As a consequence of these movements, new concepts like '*education for all', 'integrative education' or 'inclusive education'* are replacing the traditional idea of special education. According to Echeita (Echeita, 2006), real and complete *inclusive education* must be a process that constantly strives for improvement. It must identify and remove barriers inside the classroom (and eventually outside). It must aim for equal opportunity in the participation of and achievement by

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all students disabled or not, and place particular emphasis on groups of students who are at risk of marginalization, exclusion or failure.

To meet the challenge of inclusive education, a multidisciplinary effort from governments, educators, psychologists, educators, social workers, parents, students, researchers and, in general, of the whole society is required.

Regarding barriers that hinder equal access to education, there are many which are not completely removed yet. For example, in the classroom, listening to what the teacher is saying becomes difficult or even impossible for deaf or hearing-impaired students. Seeing what the teacher is showing with slides or on the board is a problem for visually impaired or blind students, and note taking can be a challenge for physically disabled and aurally or visually impaired students. Outside the classroom, access to educational resources such as multimedia files (videos, slides or audio files) can also be difficult for students with some disability.

Researchers around the world are working on removing these barriers through Automatic Speech Recognition (ASR) technology. The common idea is that, inside the classroom, ASR technology provides a transcription of what the teacher is saying in real time. This transcription is showed to disabled students to assist them in note taking. Information and communication technology (ICT) can easily provide synchronized multimedia resources (e.g., recorded audio and/or video, slides, etc.) outside the classroom. The transcription and these educational resources can be accessible for all students, disabled or not. Not only students with disabilities (aural, visual, physical, dyslexic, etc.) benefit from enhanced learning but also able-bodied students and students who don't speak the teacher's language.

This chapter provides a review of some of the most relevant projects and systems based on ASR technology and ICT aiming for the inclusive education. These projects demonstrate that ASR can really help disabled students when accuracy is good enough. Regarding (Park, Hazen, & Glass, 2005) and (Thong et al., 2002), a Word Error Rate (WER) between 30% and 50% is a highly erroneous transcription and the text is difficult or impossible to understand. However, other authors fix the level of comprehension at a WER of less than 15% (Wald et al., 2004).

According to the accuracy achieved, some authors reported in English 77% accuracy (Glass J., Hazen et al., 2004) and others reported a particular case of 90% accuracy (Leitch & MacMillan, 2003). Other projects in Spanish reported an accuracy of 83% (Revuelta et al., 2009). However, there are other languages such as Portuguese with worse results, a Word Error Rate (WER) of 43% (Trancoso et al., 2008). These results were expected since the technology is more developed in English. The languages supported depend on the commercial ASR systems used. The projects listed in this chapter are based on different commercial ASR systems such as Dragon NaturallySpeaking, ViaVoice, Microsoft Speech Engine, etc.

Apart from benefits for disabled students, ASR technology and ICT have other important advantages. It provides a cost-effective solution for accessibility in education. Otherwise, it would be necessary to hire dedicated staff such as Sing Language Interpreters, personal note takers, etc. to support disabled students. Besides reducing costs, it encourages independence of students with disabilities.

Another advantage of using ASR technology is that it provides automatically educational resources useful for more effective and higher quality e-learning. Synchronized editable multimedia resources can be easily created for this purpose (Bain et al., 2007).

At the end of chapter, it shows the comparison and discussion of the projects submitted. This discussion is intended to give an overview of the complexities and peculiarities of such applications, as well as the main differences between the existing systems.