

NLP in Assistive Technologies for People with Disabilities

Proposers:

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Tutorial abstract:

Accessibility involves the ability of an individual to interact with a product, service, device or in general an environmental condition as naturally as possible. This can be achieved by either designing systems that are directly used or are adaptable to special aids for persons with disabilities through standard interfaces. Augmentative and Alternative Communication (AAC) and Assistive Technologies (AT) are umbrella terms for technologies aimed at bridging the digital divide between people with disabilities with the mainstream environment and to accomplish different tasks. In particular, these are focused on multi-modal communication that includes speech, gestures, text, and symbols. From providing access to web-based communication for individuals with severe motor impairments, improving the intelligibility of output in speech generating devices, to providing educational assistance to people with learning disabilities, the range of AT topics that could or should rely on speech and natural language processing (NLP) technologies is very large. Language is a basic way central to humans for communication. This ability to share thoughts helps to participate in social interactions. Various disabilities affecting the use of conventional tool also disrupt communication and related areas such as oral motor function. Since communication plays a key role in growth and learning abilities of an individual, these communication disorders isolate them from their society. Hence it is important to get timely intervention to improve the condition using individual therapy or by using assistive and augmentative and alternative communication (AAC) devices. In this tutorial we aim to provide a brief overview of the state of the art applications of NLP in various assistive technologies for people with different types of disabilities.

Duration: This will be a half day tutorial.

Tutorial Description (total 150 mins):

Tutorial starts with motivation for the problem. It talks about the existing AAC devices and the technology behind them. It covers how the existing latest approaches can be used to improve the AAC devices and future directions.

The outline of the tutorial topics is as follows:

- 1. A Brief Introduction to Challenges Faced by Persons with Various Disabilities (20 mins)**

- a. Learning and Intellectual Disabilities : Dyslexia, Autism Spectrum Disorder etc.
 - b. Neuro-Motor Disabilities : Cerebral Palsy
 - c. Speech and Hearing Impairments
 - d. Visual Impairments
- 2. Role of Assistive Technologies (AT) and Augmentative and Alternative Communication (AAC) (15 mins)**
- a. Importance of AT and AAC
 - b. Brief descriptions of AT and AAC devices for various disabilities
 - c. Limitations
- 3. NLP Applications and Scope in Assistive Technologies and AAC**
- a. Applications involving Text systems (40 mins)
 - 1. Predictive Keyboard
 - 2. Symbol/ Icon to Text bidirectional machine translation
 - 3. Sign language recognition and translation
 - 4. Local language support: *important for India*
 - b. Applications involving Speech systems (40 mins)
 - 1. Speech operated systems with local language and accent support
 - 2. Dysarthric speech recognition systems
 - 3. Improving dysarthric speech recognition systems
 - c. Challenges in current approaches and future directions (15 mins)
- 4. Q&A (20 mins)**

Description of the Proposer(s)

Sriranjani Ramakrishnan is a senior research engineer at Conduent Labs India (formerly known as Xerox Research Centre India). Her research interests includes *natural language processing, machine learning, deep learning, speech recognition and assistive technology*. She has worked on unsupervised domain adaptation, sentiment analysis, fake news detection, automatic speech recognition, emotion recognition. Sriranjani holds M.S. (by research) degree from Indian Institute of Technology Madras. She has a number of publications and patents in these areas. She has delivered invited talks in speech recognition across multiple universities.

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Manjira Sinha is Assistant Professor at the Center for Education Technology, Indian Institute of Technology Kharagpur. Prior to that she was an associate principal artificial intelligence at Accenture AI Labs and research scientist in the Text and Graph Analytics research group at Conduent Labs India (formerly known as Xerox Research Centre India) for 3 years. She is currently working in NLP for Assistive Technology, Education and Healthcare. She has also worked on *cross-domain Text categorization, Social Media analysis for Urban Informatics, Knowledge Extraction, and Quality Analysis for Call center Interactions*. Manjira has a Ph.D. in Computer Science from the Indian Institute of Technology Kharagpur. She is also visiting faculty in Indian Institute of Information Technology Kalyani. Her areas of interest include Language Comprehension and Psycholinguistics, Natural Language Processing, Assistive Technology and Human Computer Interaction. She has organized a number of workshops and

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Tirthankar Dasgupta is a scientist at Innovation Labs, Tata Consultancy Services Ltd., India in the Text Analytics and Web Intelligence group. He holds a Ph.D. in computer science from Indian Institute of Technology, Kharagpur. His research interests span natural language processing, computational psycholinguistics, machine learning and human computer interaction. He has organized a number of workshops in the area of assistive technology and natural language processing. He is also an active organizing member and regional coordinator of Panini Linguistic Olympiad in India. He was an organizing member of International Linguistic Olympiad 2016 in India. Tithankar is the co-organizer of the 1st workshop on Language, Cognition and Computational Models in Coling 2018.

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