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BABBLE NOISE AUGMENTATION FOR PHONE RECOGNITION APPLIED TO CHILDREN READING ALOUD IN A CLASSROOM ENVIRONMENT

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OBJECTIVES

Reading is a key step in a child's learning, but teachers do not have time to spend individually with each student to monitor progress. We are developing a tool that aims at automatically evaluating children's fluency and pronunciation as they read aloud.

CHALLENGES

- Lack of children speech data in French
- Characteristic non-reader children's prosody
- **Babble noise present in classroom environment**

CORPORA

- Lalilo French children corpus, composed of 5-7 year-old children reading aloud in a classroom environment
- Commonvoice French adult corpus
- DEMAND babble noise corpus [1]

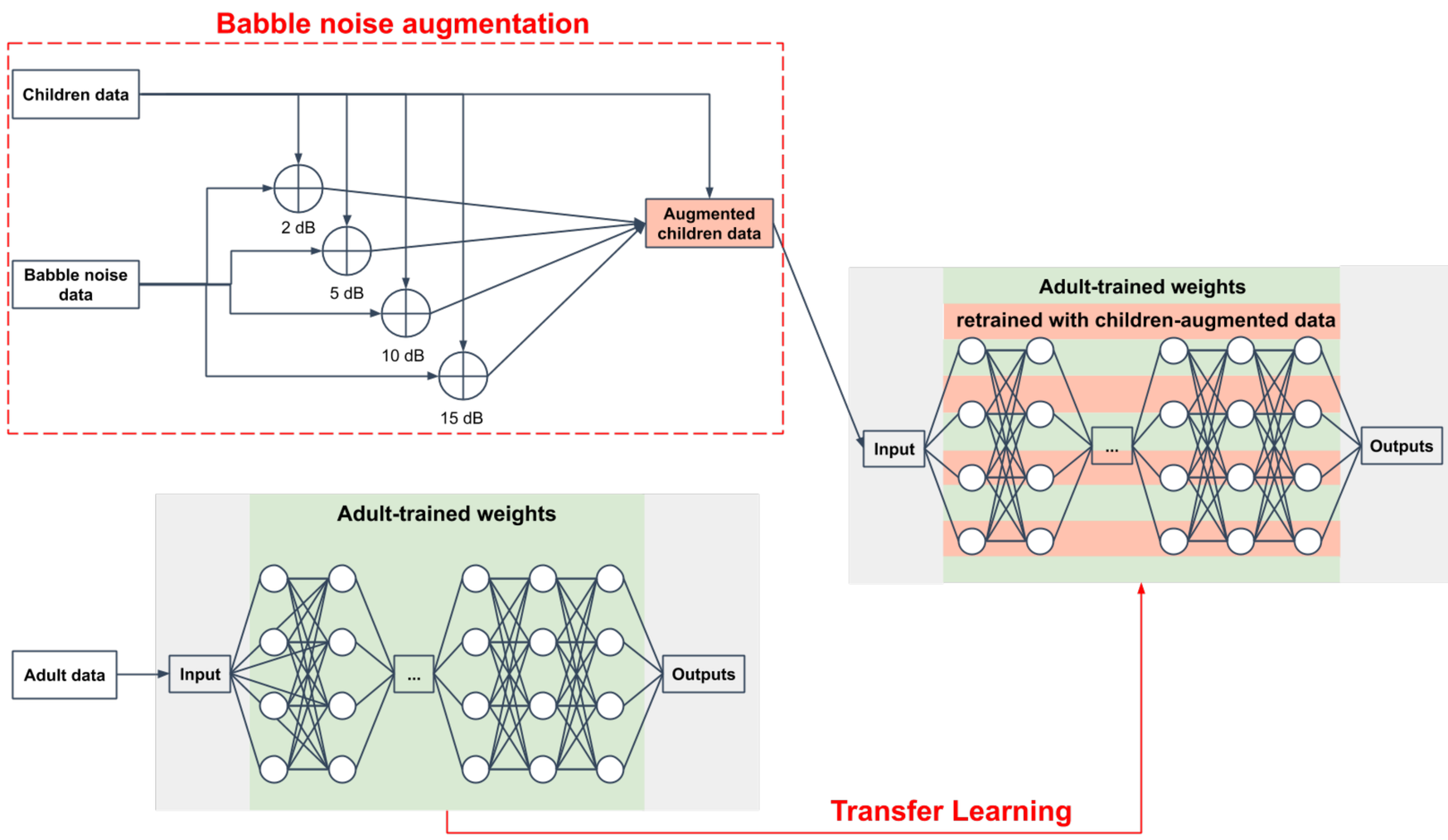
Corpus	**Lalilo**		**Commonvoice**	**DEMAND**
Set	Train	Test	Train	Babble
Duration (h)	13.8	0.8	148.9	1.3
SNR (dB)	24 ±13	22 ±11	35 ±16	–

Information on corpora

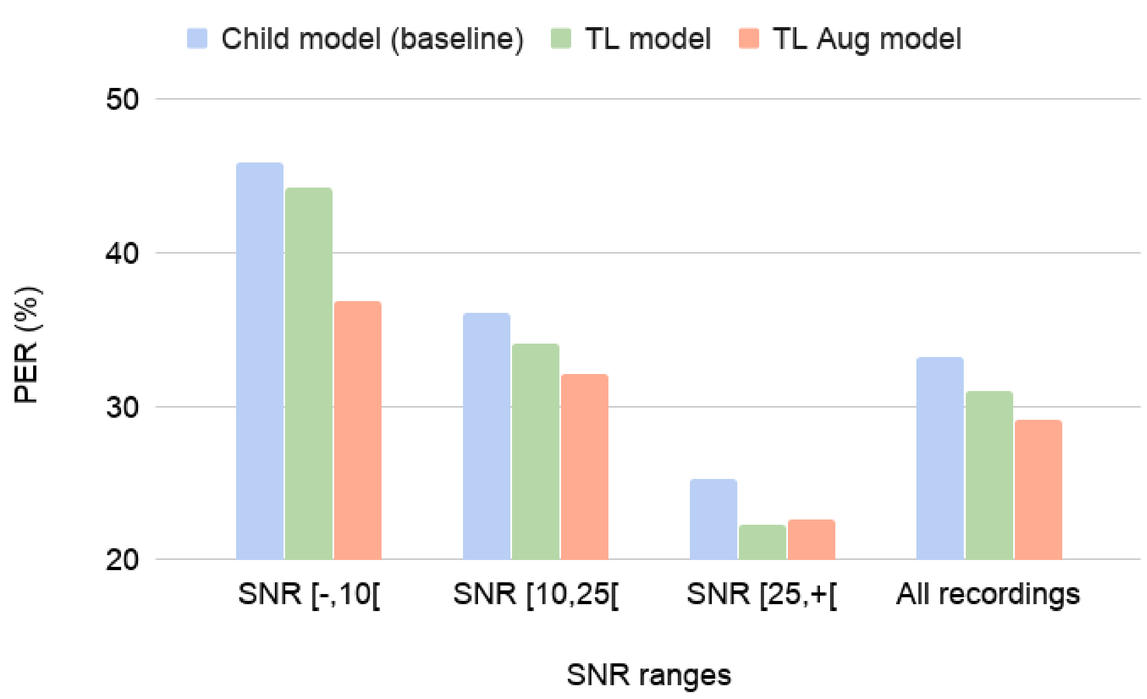
METHOD

The baseline model is a children-trained factorized time-delay neural network [2]. We combine two methods to improve our system's performance:

- **Babble noise augmentation (Aug)**: concatenating children data with babble noise data at different signal to noise ratios (SNR) to train the acoustic model → makes the model more robust to classroom babble noise
- **Transfer Learning (TL, [3])**: transferring knowledge learned from a big corpus of adult data by re-training it with children data → overcomes lack of children data



RESULTS



Phoneme Error Rate (PER,%) obtained with the different acoustic models, global (All files) and for different SNR ranges

CONCLUSION

- Transfer learning brings overall relative improvement of 7%, with a greater efficiency on clean recordings.
- Babble noise augmentation brings further decrease of PER, especially on low and medium SNR ranges (respectively 17% and 6% relative improvement over TL model). While the improvement over TL model is not significant for clean recordings, the PER is not degraded. While the improvement over TL model is not significant for clean recordings, the global relative PER improvements brought by the TL-Aug model are 6% over the TL model and 12% over the baseline model.

References

[1] Thiemann J. et al. (2013). *DEMAND: a collection of multi-channel recordings of Acoustic Noise in Diverse Environments*
[2] Povey D. et al. (2018). *Semi-Orthogonal Low-Rank Matrix Factorization for Deep Neural Networks*
[3] Shivakumar P.G. and Georgiou P. (2018). *Transfer Learning from Adult to Children for Speech Recognition: Evaluation, Analysis and Recommendations.*