









## 4.2 資料品質影響

由於教育資料集大部份音訊是以現場授課的形式呈現，因此裡面包含著學生的說話聲、環境音等，再加上收音裝置與錄音軟體對音訊品質的影響，以上各種因素也直接影響了模型效能，因此在錯誤率方面仍然有進步空間。

## 5 結論

由本次實驗能發現在特定領域中時常出現專有名詞的狀況，例如在課程上可能會有至少一半的句字出現專有名詞，若 ASR 模型在訓練過程中未學習過此領域的資訊，此因素將會使效能銳減。另外，在實際情況下專有名詞也常會以英文的形式出現，因此我們使用遷移式學習的方式先使模型在資料缺乏的情況下，能夠擁有語碼轉換與特定領域的能力，而在我們的實驗結果上有顯著的改善。

另外，由於教育資料集大部份帶有環境雜音的關係，因此錯誤率仍然還有很大的進步空間，其中我們也嘗試過使用語言模型輔助，但也許是語言模型訓練資料的問題造成實驗上錯誤率不減反增，因此我們仍然會對語言模型部份持續實驗，並嘗試加入語言分類器來增加中英語碼轉換的效能。

## References

- Hui Bu, Jiayu Du, Xingyu Na, Bengu Wu, and Hao Zheng. 2017. Aishell-1: An open-source mandarin speech corpus and a speech recognition baseline. In *2017 20th conference of the oriental chapter of the international coordinating committee on speech databases and speech I/O systems and assessment (O-COCOSDA)*, pages 1–5. IEEE.
- Jiayu Du, Xingyu Na, Xuechen Liu, and Hui Bu. 2018. Aishell-2: Transforming mandarin asr research into industrial scale. *arXiv preprint arXiv:1808.10583*.
- Alex Graves, Santiago Fernández, Faustino Gomez, and Jürgen Schmidhuber. 2006. Connectionist temporal classification: labelling unsegmented sequence data with recurrent neural networks. In *Proceedings of the 23rd international conference on Machine learning*, pages 369–376.
- Anmol Gulati, James Qin, Chung-Cheng Chiu, Niki Parmar, Yu Zhang, Jiahui Yu, Wei Han, Shibo Wang, Zhengdong Zhang, Yonghui Wu, and Ruoming Pang. 2020a. Conformer: Convolution-augmented transformer for speech recognition.
- Anmol Gulati, James Qin, Chung-Cheng Chiu, Niki Parmar, Yu Zhang, Jiahui Yu, Wei Han, Shibo Wang, Zhengdong Zhang, Yonghui Wu, et al. 2020b. Conformer: Convolution-augmented transformer for speech recognition. *arXiv preprint arXiv:2005.08100*.
- Suyoun Kim, Takaaki Hori, and Shinji Watanabe. 2017. Joint ctc-attention based end-to-end speech recognition using multi-task learning. In *2017 IEEE international conference on acoustics, speech and signal processing (ICASSP)*, pages 4835–4839. IEEE.
- DP Kingma and J Ba. 2017. Adam: A method for stochastic. *optimization*.
- Tom Ko, Vijayaditya Peddinti, Daniel Povey, and Sanjeev Khudanpur. 2015. Audio augmentation for speech recognition. In *Sixteenth annual conference of the international speech communication association*.
- Hou-An Lin and Chia-Ping Chen. 2021. Exploiting low-resource code-switching data to mandarin-english speech recognition systems. In *Proceedings of the 33rd Conference on Computational Linguistics and Speech Processing (ROCLING 2021)*, pages 81–86.
- Tomohiro Nakatani. 2019. Improving transformer-based end-to-end speech recognition with connectionist temporal classification and language model integration. In *Proc. Interspeech*.
- Daniel S Park, William Chan, Yu Zhang, Chung-Cheng Chiu, Barret Zoph, Ekin D Cubuk, and Quoc V Le. 2019. Specaugment: A simple data augmentation method for automatic speech recognition. *arXiv preprint arXiv:1904.08779*.
- Emiru Tsunoo, Yosuke Kashiwagi, Toshiyuki Kumakura, and Shinji Watanabe. 2019. Transformer asr with contextual block processing. In *2019 IEEE Automatic Speech Recognition and Understanding Workshop (ASRU)*, pages 427–433. IEEE.
- Emiru Tsunoo, Yosuke Kashiwagi, and Shinji Watanabe. 2020. Streaming transformer asr with blockwise synchronous beam search.
- Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N Gomez, Łukasz Kaiser, and Illia Polosukhin. 2017. Attention is all you need. *Advances in neural information processing systems*, 30.
- Dong Wang and Thomas Fang Zheng. 2015. Transfer learning for speech and language processing.
- Shinji Watanabe, Takaaki Hori, Shigeki Karita, Tomoki Hayashi, Jiro Nishitoba, Yuya Unno, Nelson Enrique Yalta Soplín, Jahn Heymann, Matthew Wiesner, Nanxin Chen, et al. 2018. Espnet: End-to-end speech processing toolkit. *arXiv preprint arXiv:1804.00015*.