The VoicePrivacy 2020 Challenge

Post-evaluation analysis

Odyssey 2020

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Aim

Investigate the anonymized data collection:

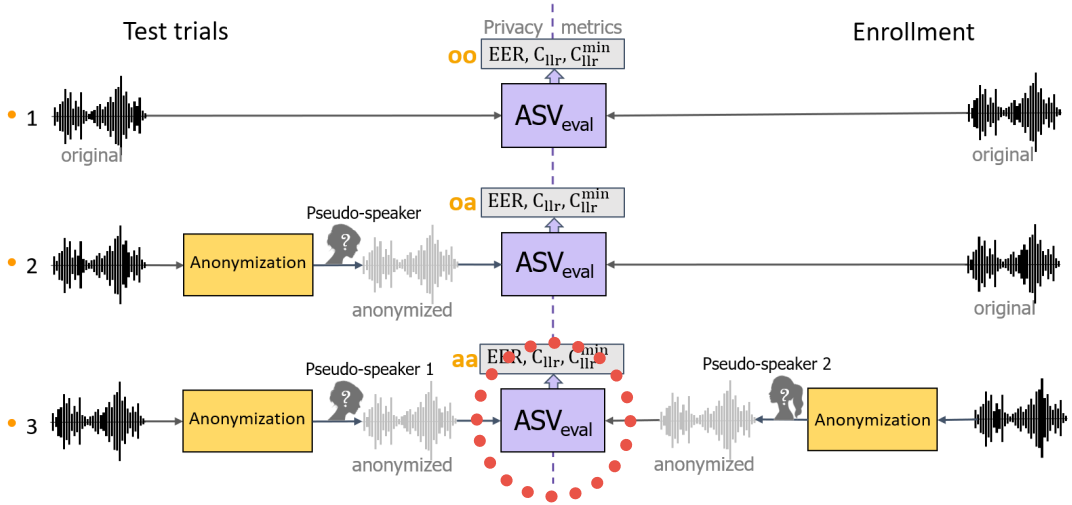
- Training more advanced attack models
- Downstream tasks, i.e. ASR training

Introduction: aim

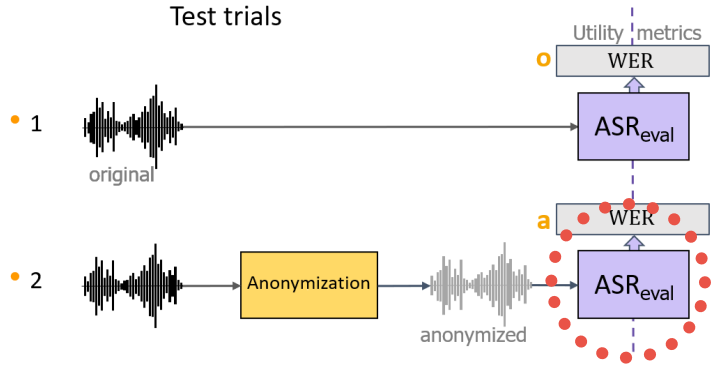
Investigate the anonymized data collection:

- Training more advanced attack models $\mathbf{ASV}_{\mathbf{eval}}^{\mathbf{anon}}$
- Downstream tasks, i.e. ASR training $\mathbf{ASR}_{\mathbf{eval}}^{\mathbf{anon}}$

Objective evaluation: automatic speaker verification (ASV_{eval})



Objective evaluation: automatic speech recognition (ASR_{eval})



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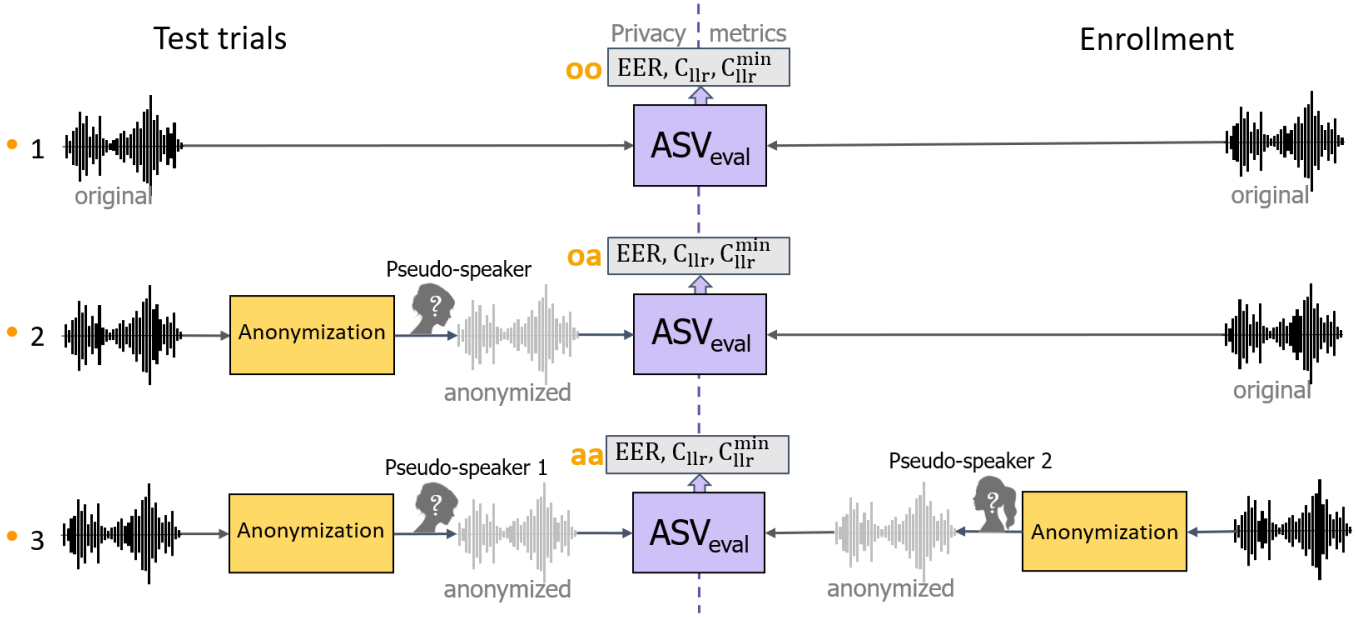

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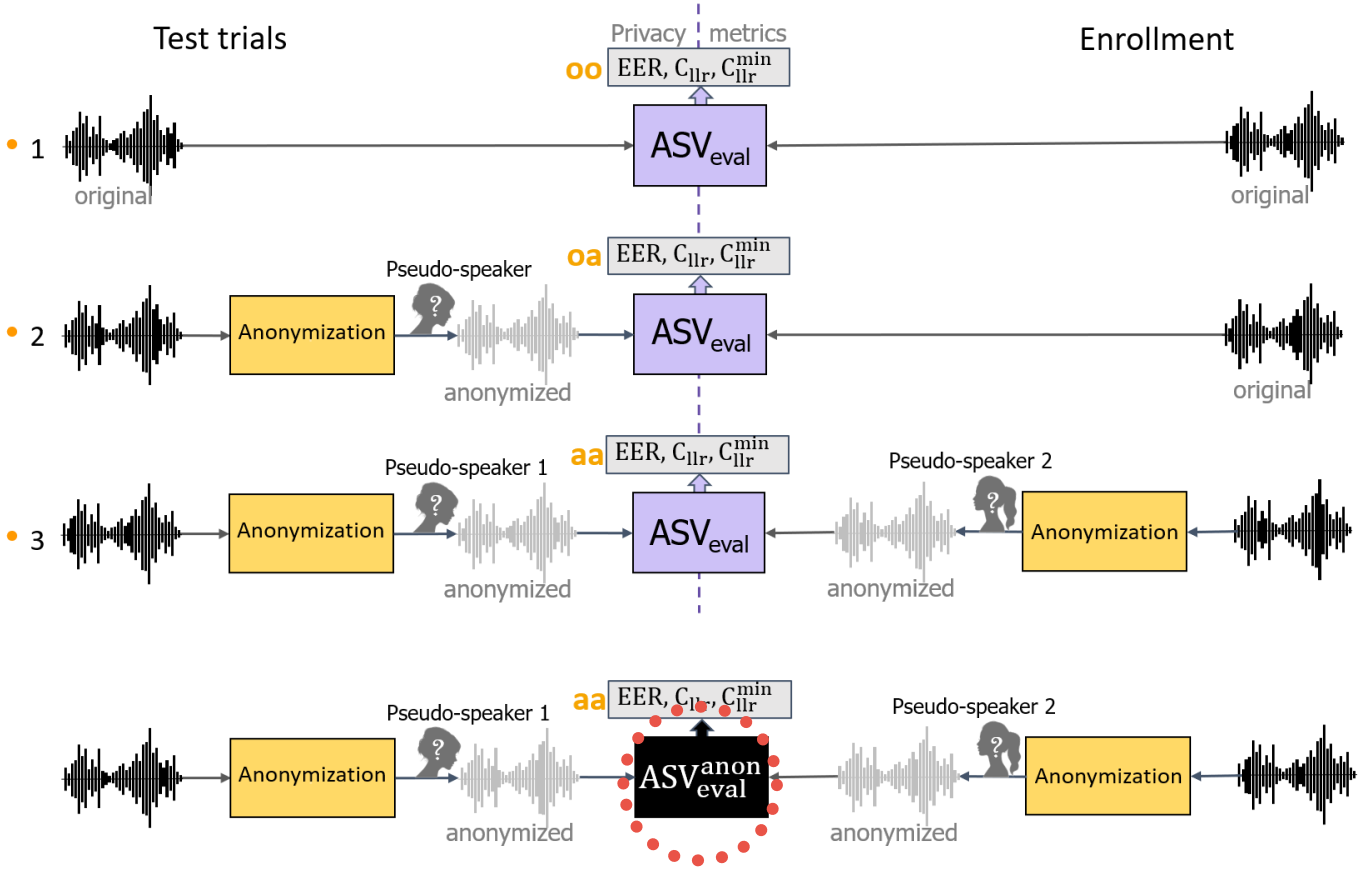
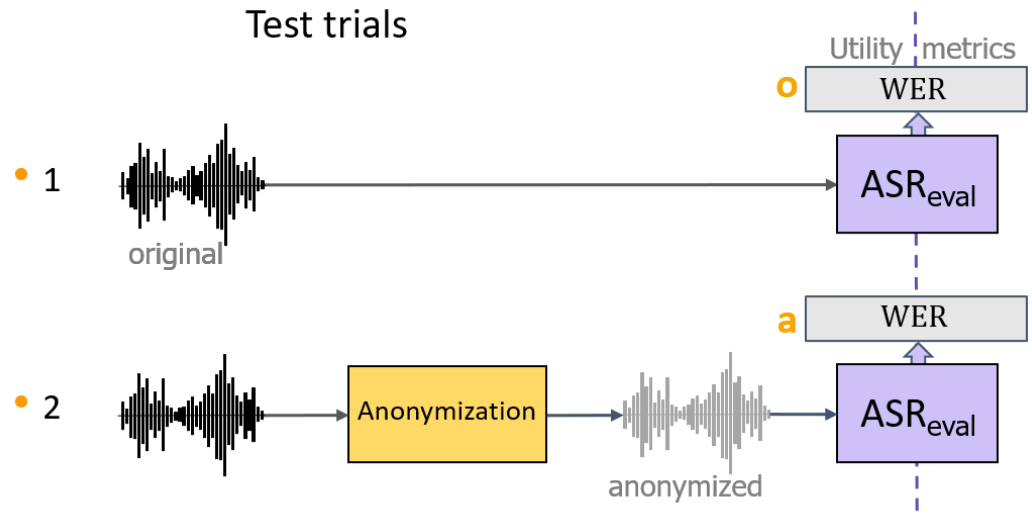


Trained on anonymized data

Objective evaluation: automatic speech recognition (ASR_{eval})



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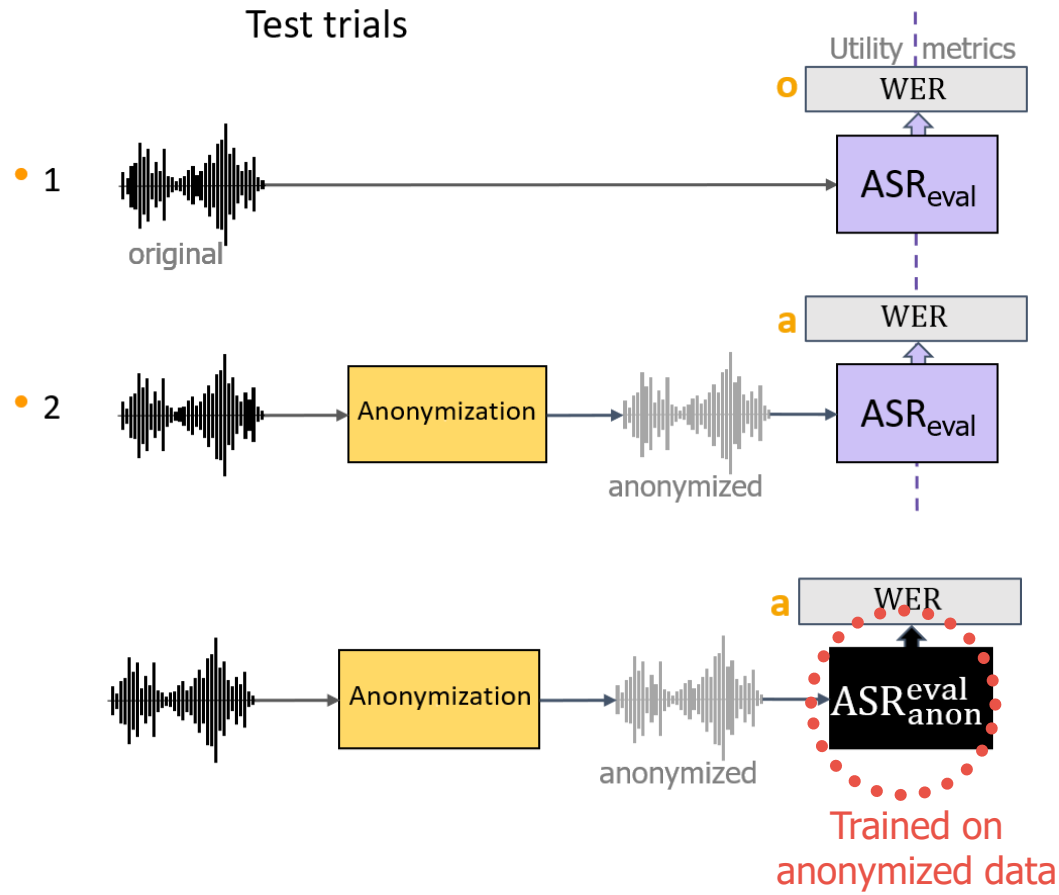
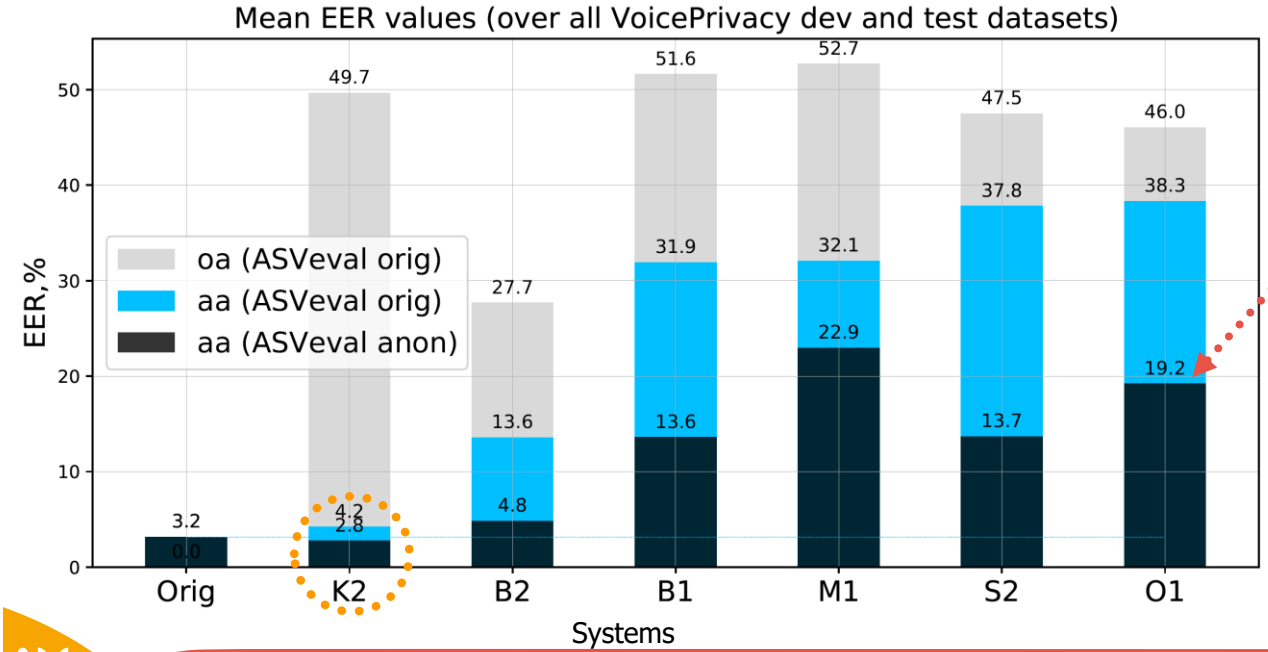


Post-evaluation analysis

Using anonymized speech data to train $\mathbf{ASV_{eval}}$

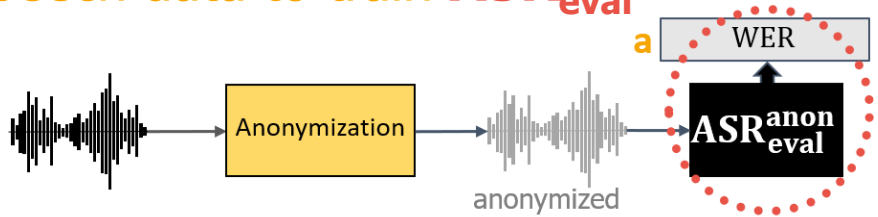


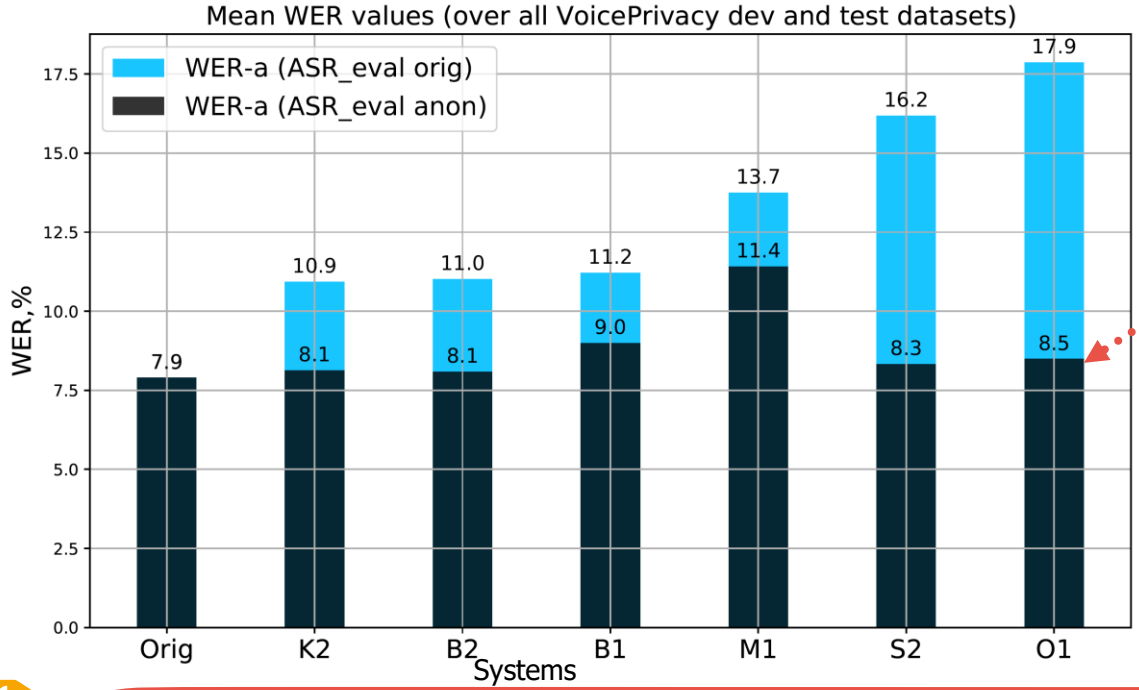
More advanced attack model

Training $\mathbf{ASV_{eval}^{anon}}$ on **anonymized data** rather than original data leads to significant **EER reduction** for all systems in the case when the enrollment and trial data are anonymized

Post-evaluation analysis

Using anonymized speech data to train $\mathbf{ASR_{eval}}$



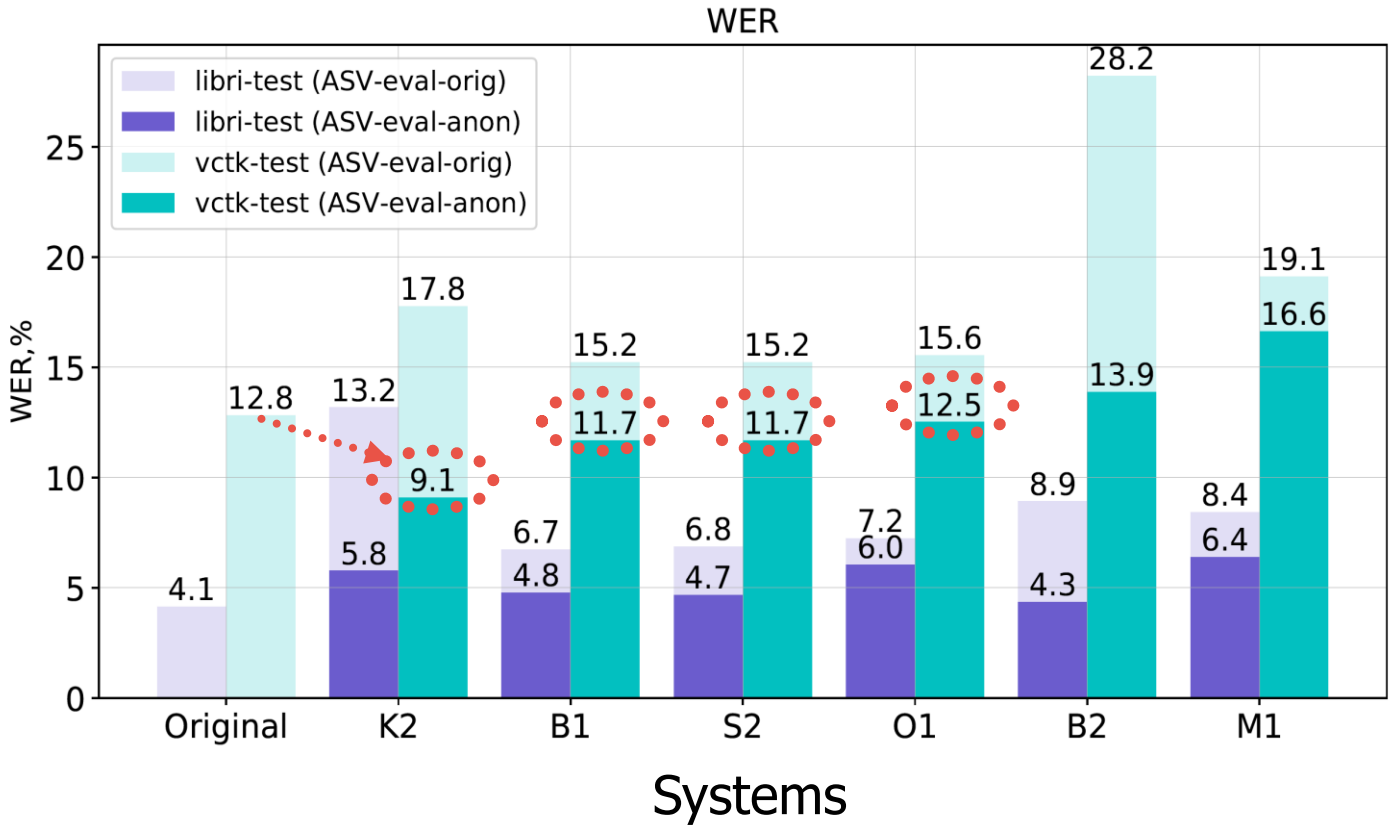


Efficient ASR training

Training $\mathbf{ASR_{eval}^{anon}}$ on **anonymized data** significantly **decreases WER**

Post-evaluation analysis

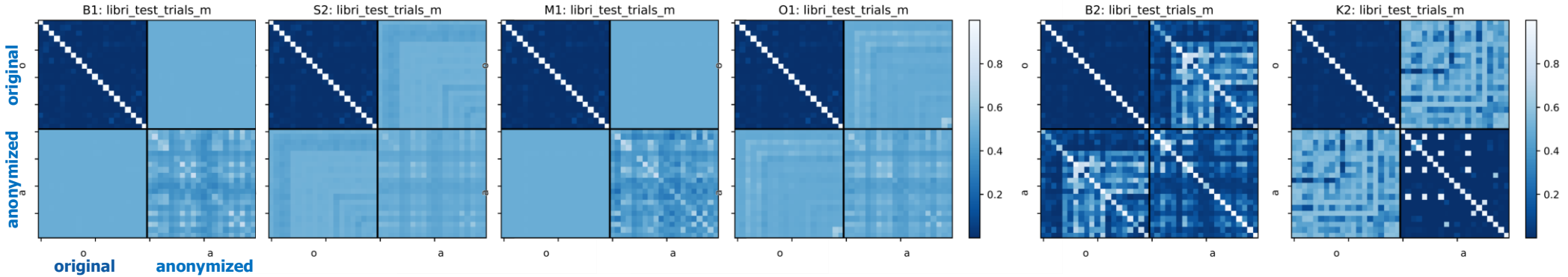
Using anonymized speech data to train $\mathbf{ASR_{eval}}$



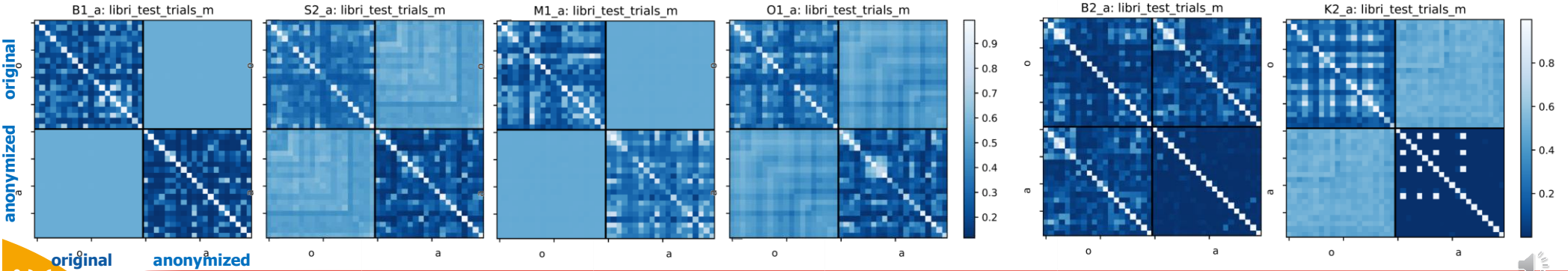
Voice similarity matrices: LibriSpeech-test-male

Using **original** speech data to train $\mathbf{ASV_{eval}}$

[Noe 2020]



Using **anonymized** speech data to train $\mathbf{ASV_{eval}^{anon}}$



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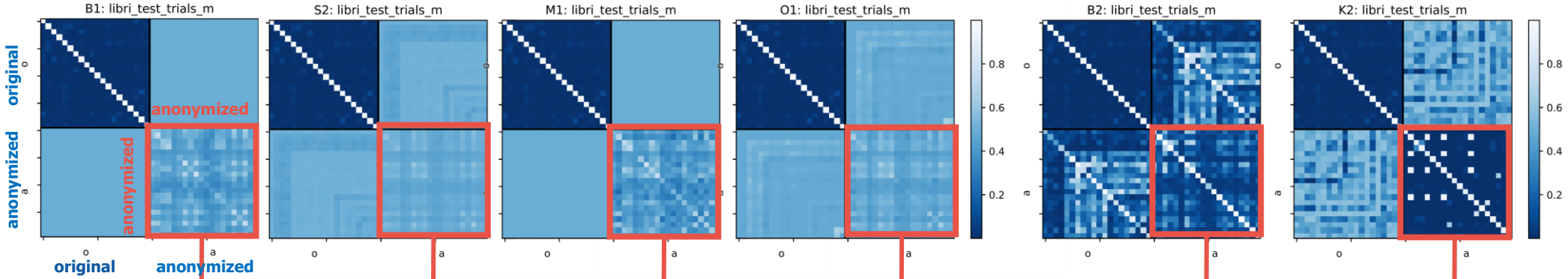

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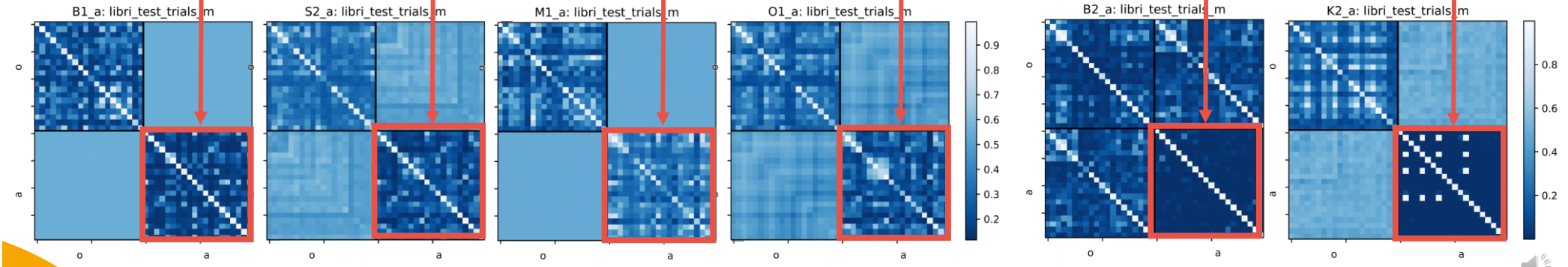
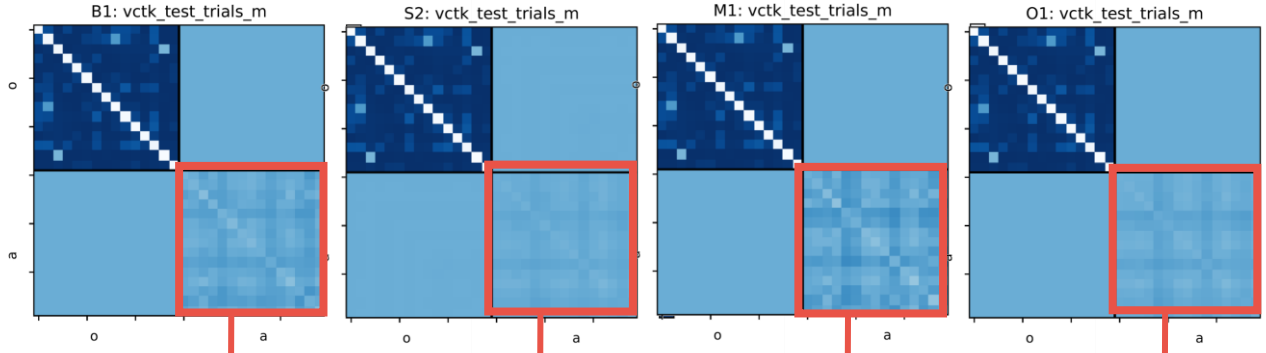
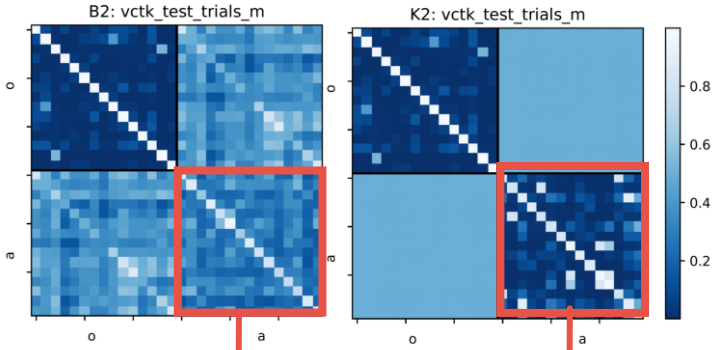


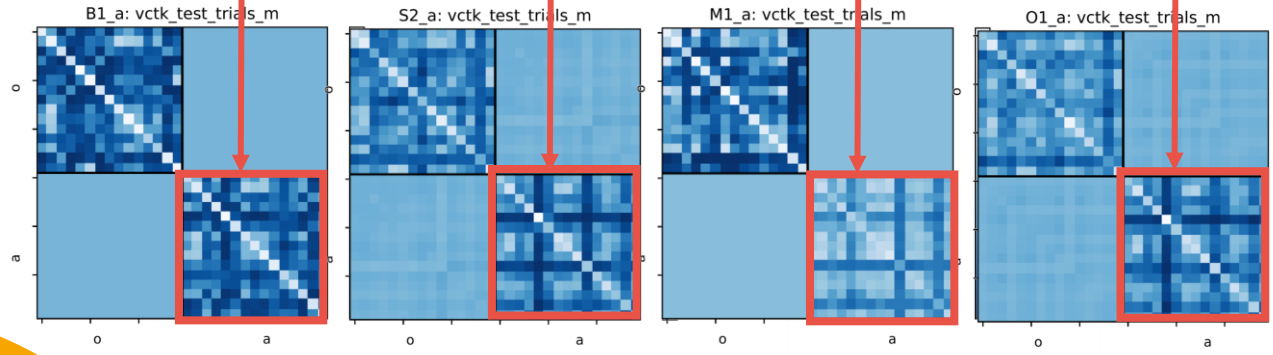
Voice similarity matrices: VCTK-test-male

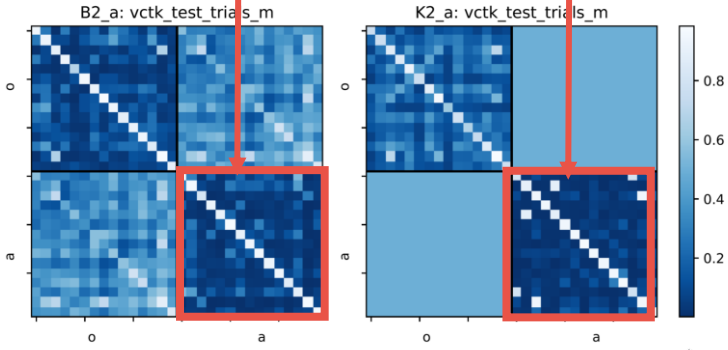
Using **original** speech data to train $\mathbf{ASV_{eval}}$





Using **anonymized** speech data to train $\mathbf{ASV_{eval}^{anon}}$





Conclusions

- A strong attack model can be developed when an attacker has access to anonymized speech data
- Anonymized data can be successfully used in training ASR systems

References VoicePrivacy challenge

- VoicePrivacy site: https://www.voiceprivacychallenge.org/
- Baseline software: https://github.com/Voice-Privacy-Challenge/Voice-Privacy-Challenge-2020
- Evaluation plan: https://www.voiceprivacychallenge.org/docs/VoicePrivacy_2020_Eval_Plan_v1_3.pdf

- [Tomashenko 2020] Introducing the VoicePrivacy initiative. Natalia Tomashenko, Brij Mohan Lal Srivastava, Xin Wang, Emmanuel Vincent, Andreas Nautsch, Junichi Yamagishi, Nicholas Evans, Jose Patino, Jean-François Bonastre, Paul-Gauthier Noé, Massimiliano Todisco

Alternative anonymization metrics:

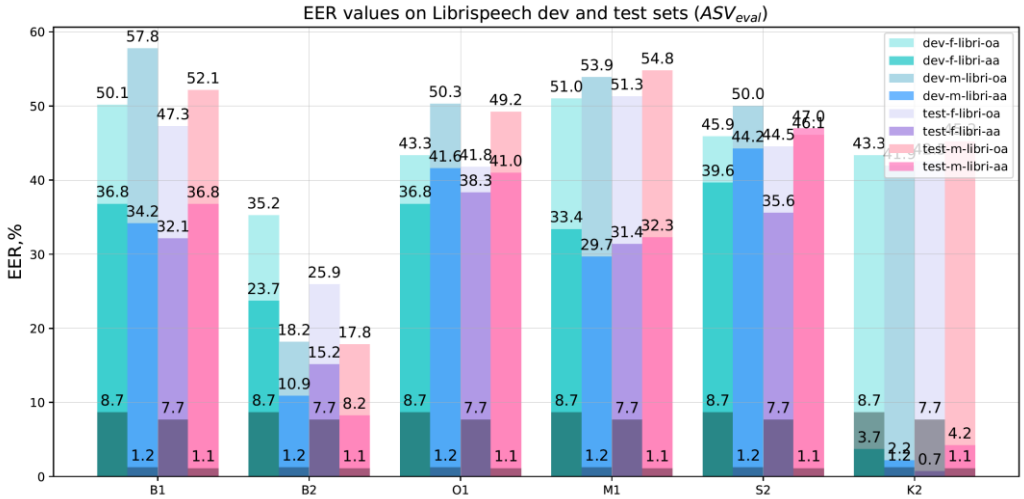
- [Noe 2020] Speech Pseudonymisation Assessment Using Voice Similarity Matrices. Paul-Gauthier Noe, Jean-Francois Bonastre, Driss Matrouf, Natalia Tomashenko, Andreas Nautsch and Nicholas Evans
- [Nautsch 2020] The Privacy ZEBRA: Zero Evidence Biometric Recognition Assessment. Andreas Nautsch, Jose Patino, Natalia Tomashenko, Junichi Yamagishi, Paul-Gauthier Noe, Jean-Francois Bonastre, Massimiliano Todisco, Nicholas Evans
- [Maouche 2020] A comparative study of speech anonymization metrics. Mohamed Maouche, Brij Mohan Lal Srivastava, Nathalie Vauquier, Aurélien Bellet, Marc Tommasi, Emmanuel Vincent

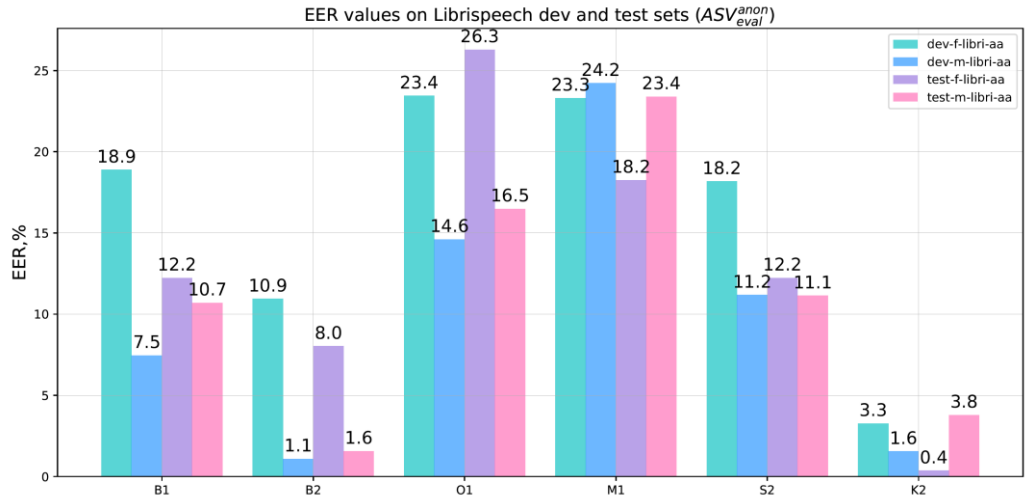
References: participants' papers

- **A:** [Mawalim 2020] X-Vector Singular Value Modification and Statistical-Based Decomposition with Ensemble Regression Modeling for Speaker Anonymization System. Candy Olivia Mawalim, Kasorn Galajit, Jessada Karnjana, Masashi Unoki
- **D:** [Gupta 2020] Design of Voice Privacy System using Linear Prediction. Priyanka Gupta, Gauri P. Prajapati, Shrishti Singh, Madhu R. Kamble, Hemant A. Patil
- **I:** [Dubagunta 2020] Adjustable Deterministic Pseudonymisation of Speech: Idiap-NKI's submission to VoicePrivacy 2020 Challenge. S. Pavankumar Dubagunta, Rob J.J.H. van Son and Mathew Magimai.-Doss
- **K:** [Han 2020] System Description for Voice Privacy Challenge. Yaowei Han, Sheng Li, Yang Cao, Masatoshi Yoshikawa
- **M:** [Champion 2020] Speaker information modification in the VoicePrivacy 2020 toolchain. Pierre Champion, Denis Jouvet, Anthony Larcher.
- **O:** [Turner 2020] Speaker Anonymization with Distribution-Preserving X-Vector Generation for the VoicePrivacy Challenge 2020. Henry Turner, Giulio Lovisotto, Ivan Martinovic
- **S:** [Espinoza-Cuadros 2020] Speaker De-identification System using Autoencoders and Adversarial Training. Fernando M. Espinoza-Cuadros, Juan M. Perero-Codosero, Javier Anton-Martın, Luis A. Hernandez-Gomez
- [Chien-Lin Huang 2020] Analysis of PingAn Submission in the VoicePrivacy 2020 Challenge. Chien-Lin Huang

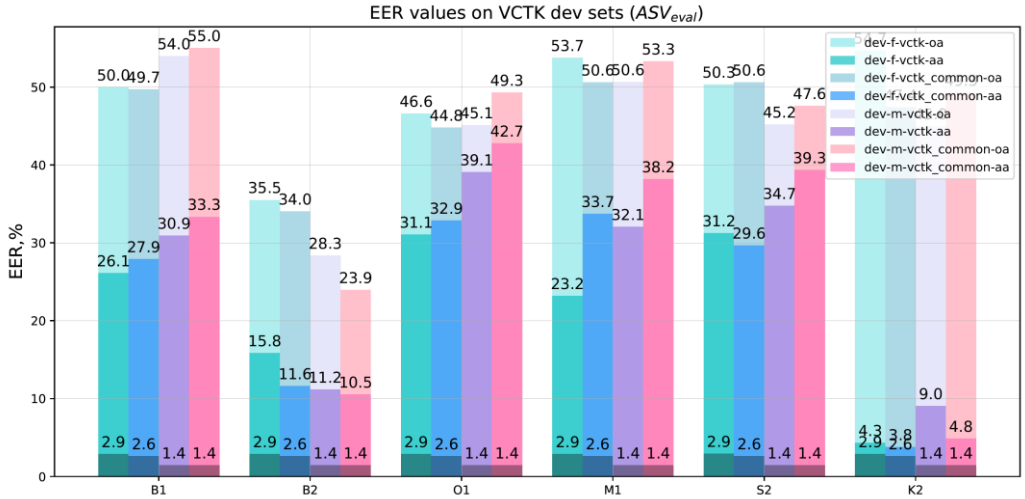
Other results

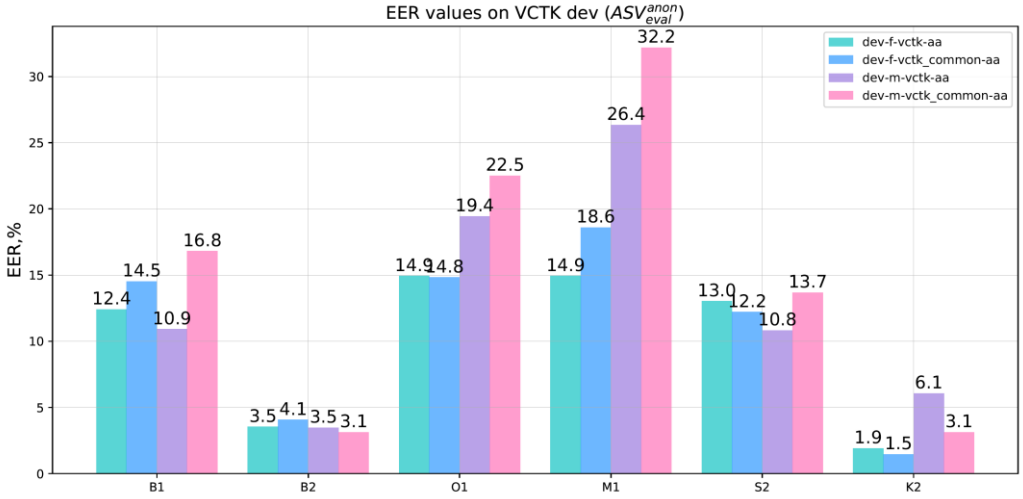
EER for ASR_{eval} trained on orig. and anon. data: LibriSpeech



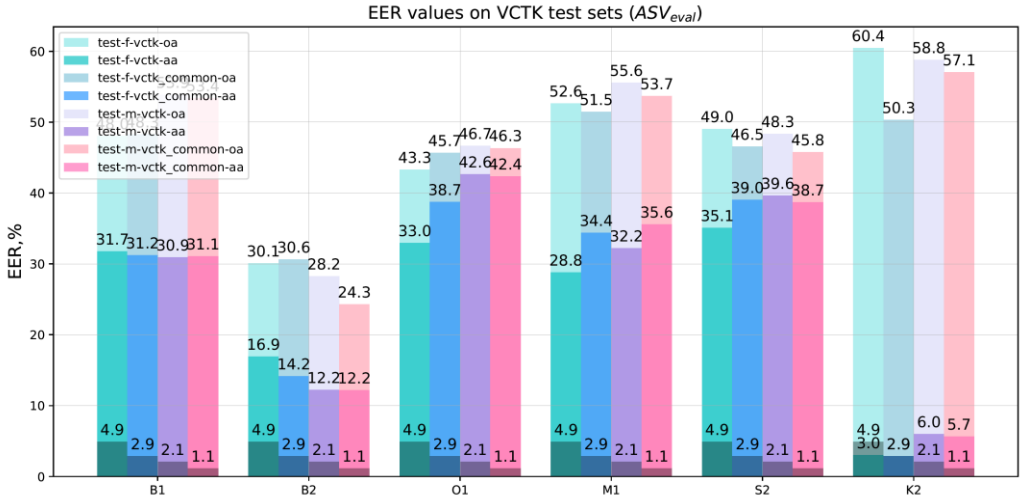


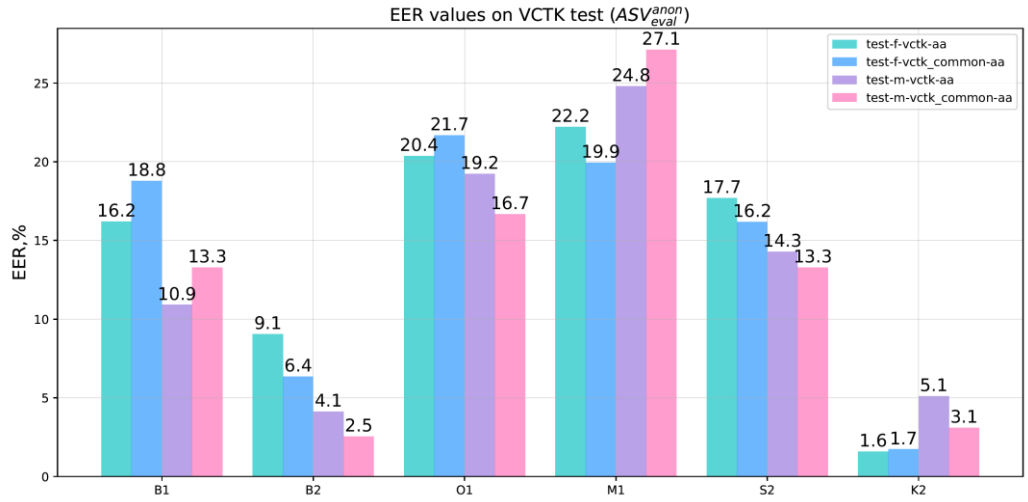
EER for ASR_{eval} trained on orig. and anon. data: VCTK dev





EER for ASR_{eval} trained on orig. and anon. data: VCTK test





The VoicePrivacy 2020 Challenge

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Thank you!

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