

The VoicePrivacy 2020 Challenge

Objective evaluation-ZEBRA

Presenter: Andreas Nautsch

Natalia Tomashenko¹

Brij M.L. Srivastava²

Xin Wang³

Emmanuel Vincent⁴

Andreas Nautsch⁵

Junichi Yamagishi^{3,6}

Nicholas Evans⁵

Jose Patino⁵

Jean-François Bonastre¹

Paul-Gauthier Noé¹

Massimiliano Todisco⁵

Mohamed Maouche²

Benjamin O'Brien⁷

Anais Chanclu¹

¹ LIA – University of Avignon – France

² Inria – France

³ NII – Tokyo – Japan

⁴ Inria – France

⁵ Audio Security and Privacy Group, EURECOM – France

⁶ University of Edinburgh – UK

⁷ Aix-Marseille University – France

4th November 2020

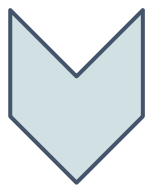
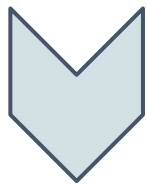
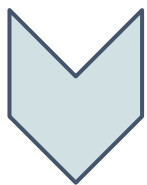
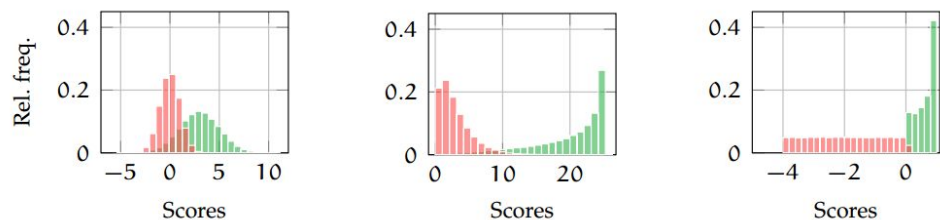
Odyssey 2020



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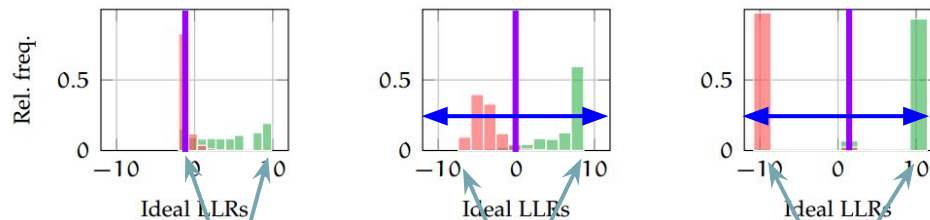


Recap: EER, min Cllr & ZEBRA's "worst case"



Ideal score calibration:

1. identify bins with same ratios of errors
2. map scores to unified scale



ZEBRA worst-case:
 $\max(\text{abs}(\text{LLR}))$

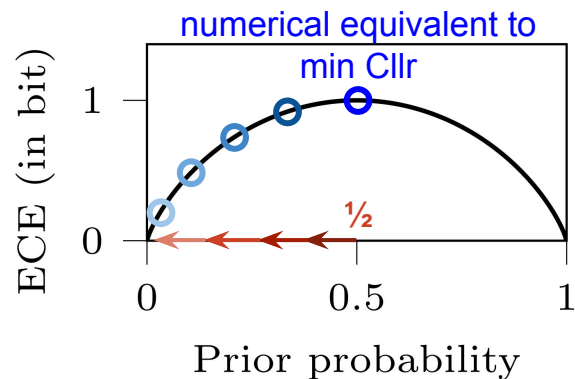
EER: one threshold, varies on "unified scale"

min Cllr: generalised class discrimination

Figures from Nautsch: "Speaker Recognition in Unconstrained Environments," PhD thesis, TU Darmstadt, 2019.

Recap: min Cllr & ZEBRA's "expectation"

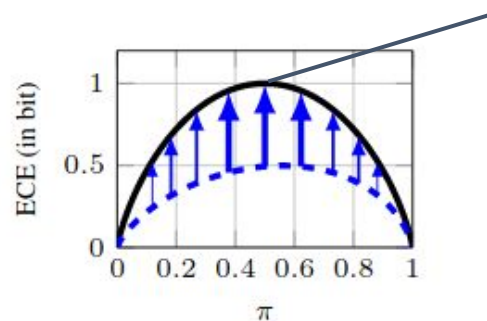
$$\frac{\pi}{|\mathcal{S}_A|} \sum_{a \in \mathcal{S}_A} \log_2 \left(1 + \frac{1 - \pi}{a\pi} \right) + \frac{1 - \pi}{|\mathcal{S}_B|} \sum_{b \in \mathcal{S}_B} \log_2 \left(1 + \frac{b\pi}{1 - \pi} \right)$$



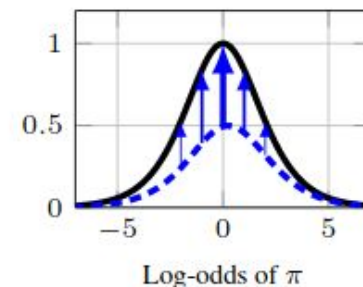
Prior: chosen by adversary
 \Rightarrow *inaccessible to us,*
 but we can simulate :)

If perfect privacy, then must:

- a) min Cllr is upper bound
- b) profile is symmetric



(a) ZEBRA idea

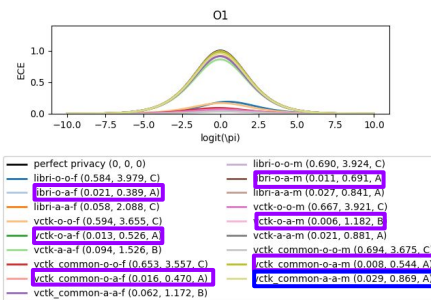
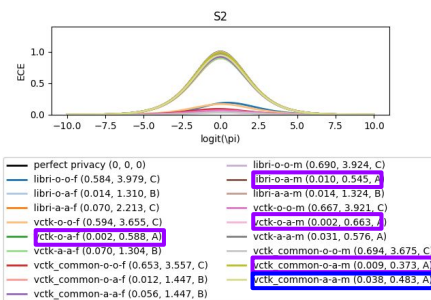
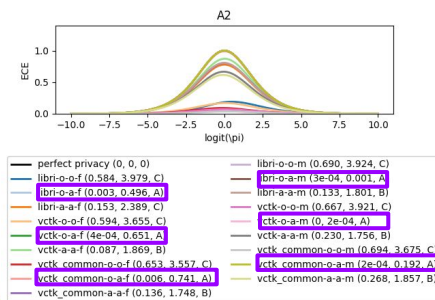
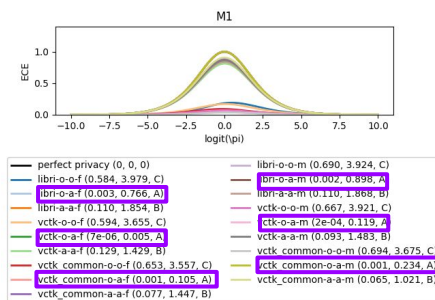
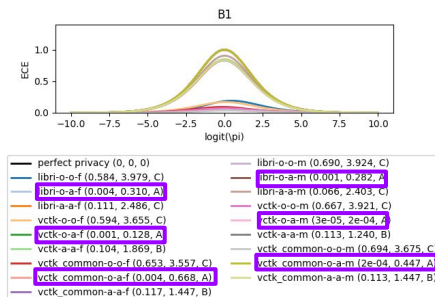


(b) ECE plot

Empirical observations:

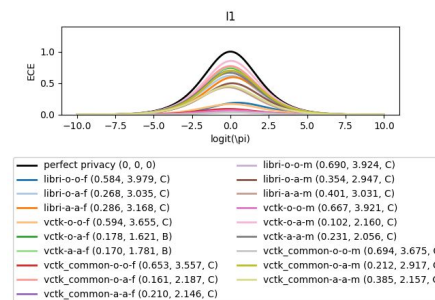
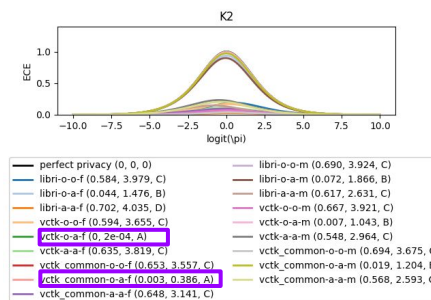
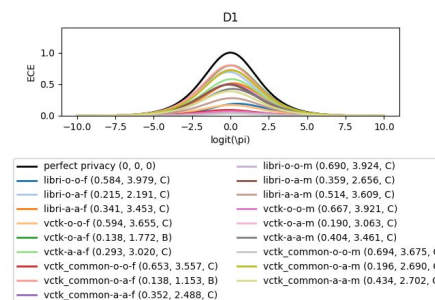
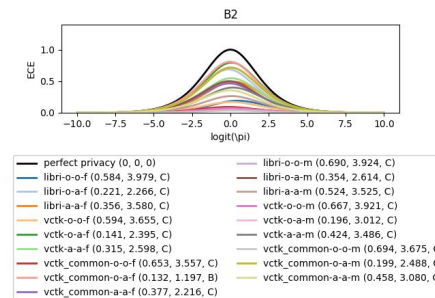
- i) min Cllr often close to upper bound
- ii) lots of symmetries

ZEBRA: by system for all VoicePrivacy test data sets (primary)

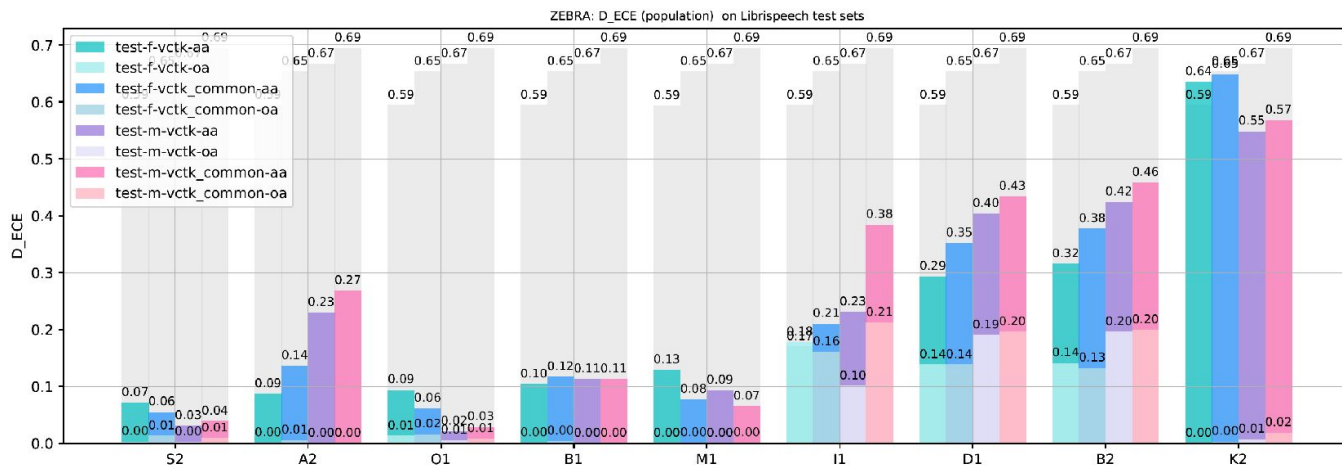


Categorical tags of worst-case privacy disclosure

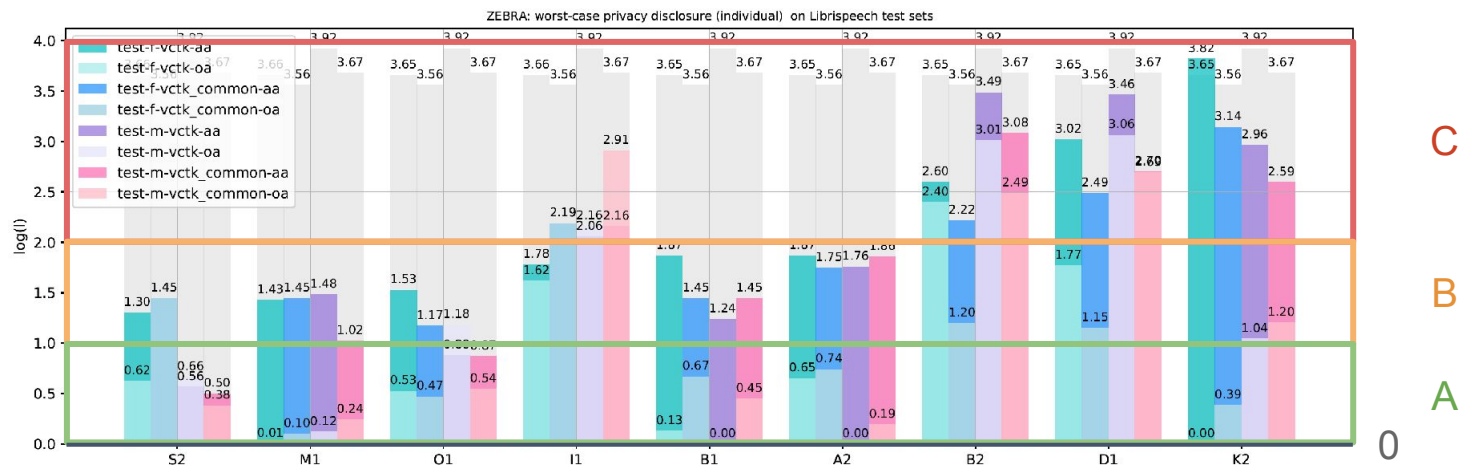
Tag	Category	Posterior odds ratio (flat prior)
0	$l = 1 = 10^0$	50 : 50 (flat posterior)
A	$10^0 < l < 10^1$	more disclosure than 50 : 50
B	$10^1 \leq l < 10^2$	one wrong in 10 to 100
C	$10^2 \leq l < 10^4$	one wrong in 100 to 10 000
D	$10^4 \leq l < 10^5$	one wrong in 10 000 to 100 000
E	$10^5 \leq l < 10^6$	one wrong in 100 000 to 1 000 000
F	$10^6 \leq l$	one wrong in at least 1 000 000



ZEBRA: D_ECE (population) on VCTK-test

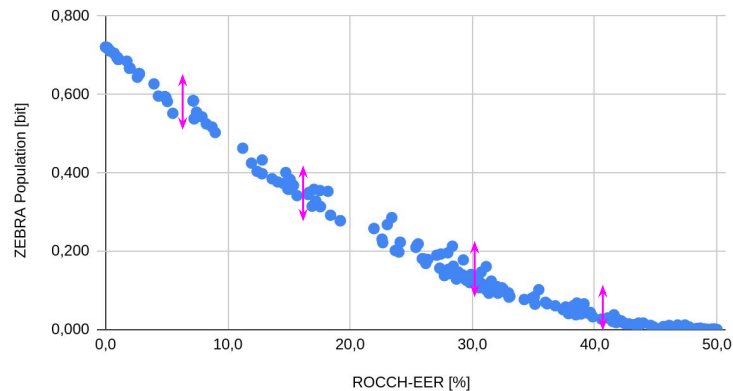


ZEBRA: worst-case privacy disclosure (individual) on VCTK-test

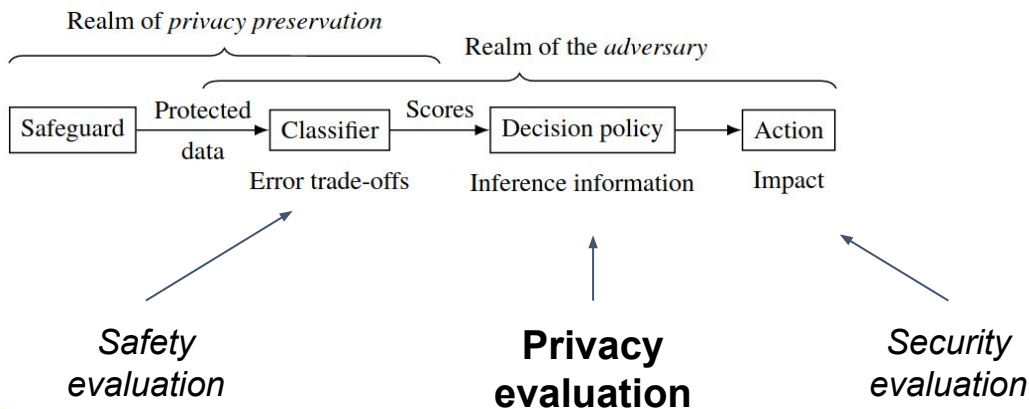
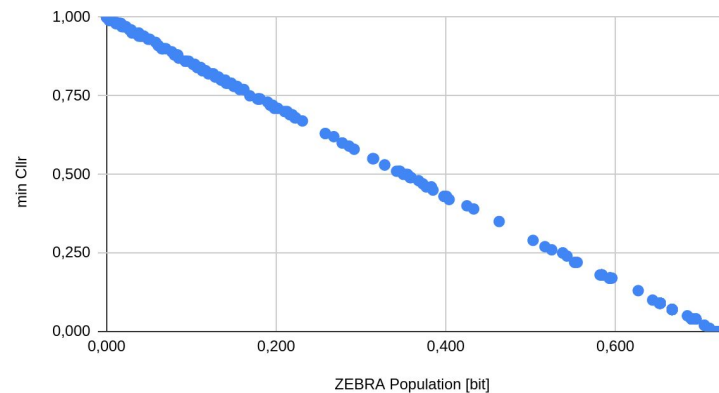


Metric correlation — NOT CAUSALITY

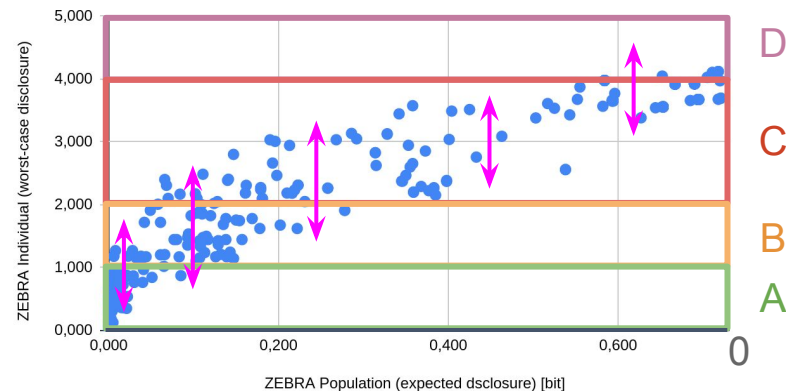
ZEBRA Population [bit] vs. ROCCH-EER [%]



ZEBRA Population [bit] vs. min ClIr

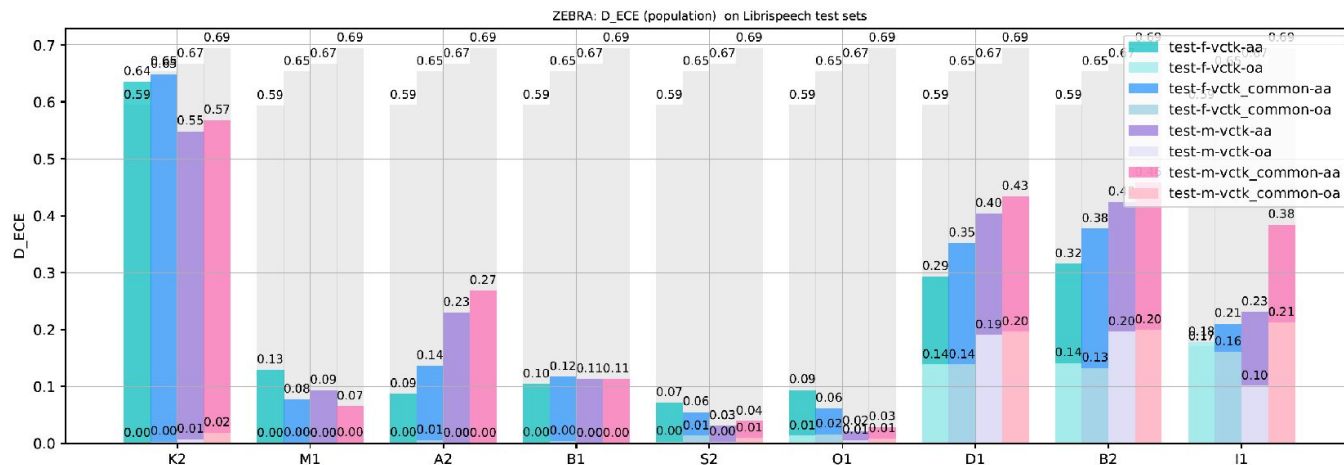


ZEBRA expected disclosure [bit] vs. worst-case disclosure

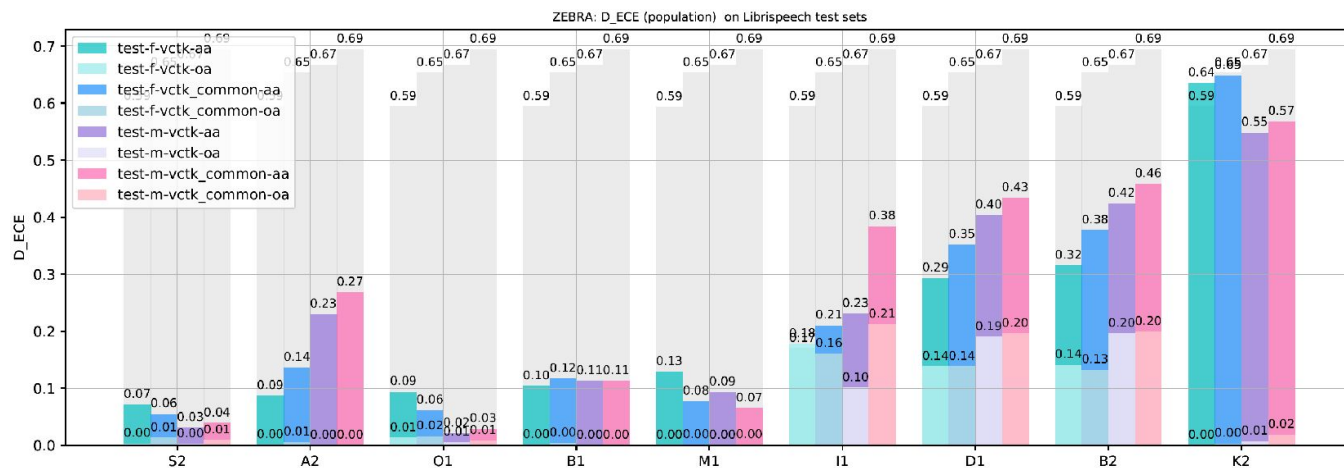




ZEBRA: D_ECE (population) on VCTK-test

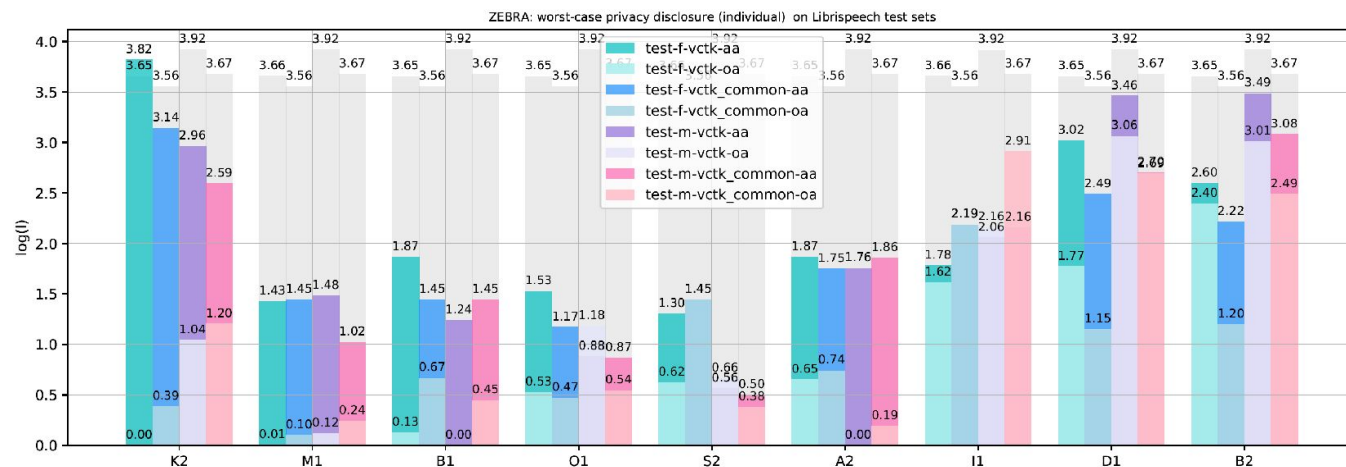


Sorted by oa f-test-vctk

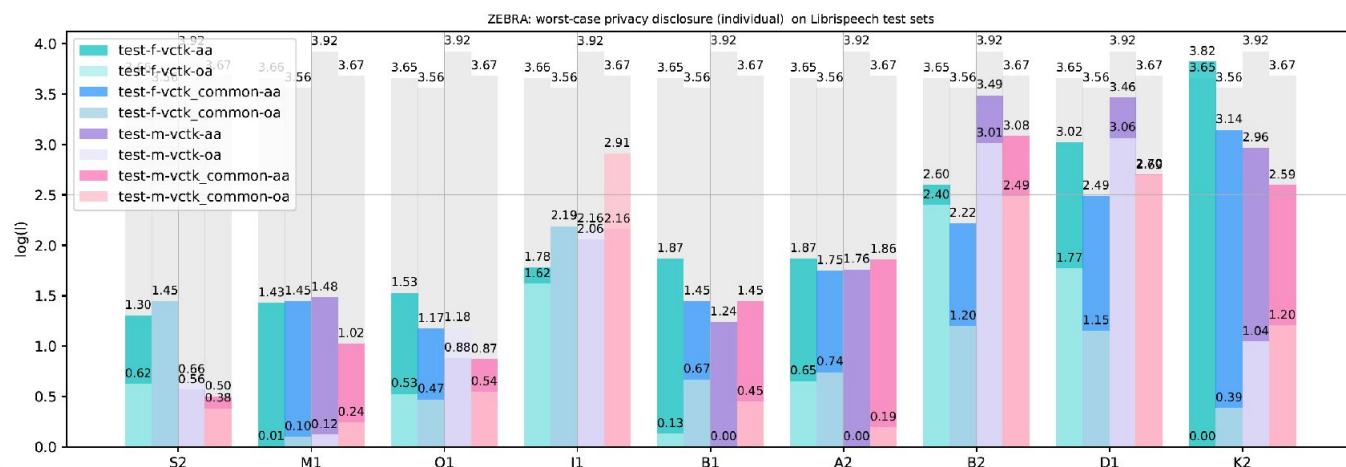


Sorted by aa f-test-vctk

ZEBRA: worst-case privacy disclosure (individual) on VCTK-test



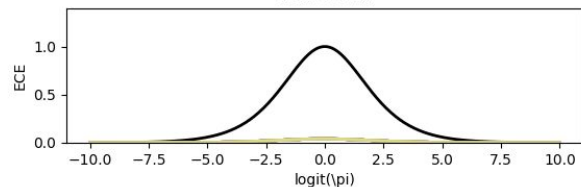
Sorted by oa f-test-vctk



Sorted by aa f-test-vctk

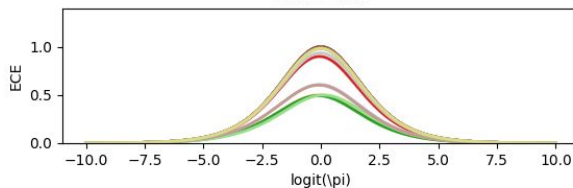
ZEBRA: LibriSpeech (all systems)

libri-o-o-m



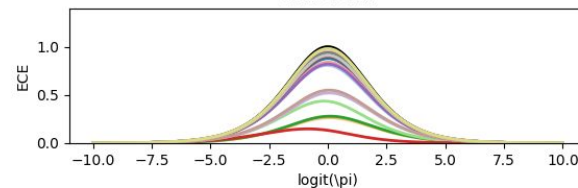
perfect privacy (0, 0, 0)	M1c2 (0.690, 3.924, C)
A1 (0.690, 3.924, C)	M1c3 (0.690, 3.924, C)
A2 (0.690, 3.924, C)	M1c4 (0.690, 3.924, C)
B1 (0.690, 3.924, C)	O1 (0.690, 3.924, C)
B2 (0.690, 3.924, C)	O1c1 (0.690, 3.924, C)
D1 (0.690, 3.924, C)	S1 (0.690, 3.924, C)
I1 (0.690, 3.924, C)	S1c1 (0.690, 3.924, C)
K2 (0.690, 3.924, C)	S2 (0.690, 3.924, C)
M1 (0.690, 3.924, C)	S2c1 (0.690, 3.924, C)
M1c1 (0.690, 3.924, C)	

libri-a-a-m



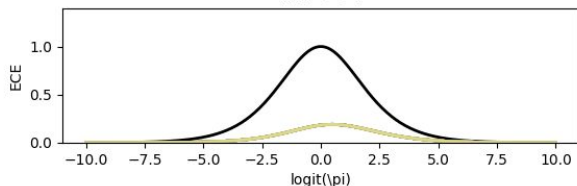
perfect privacy (0, 0, 0)	M1c2 (0.273, 1.969, B)
A1 (0.002, 0.202, A)	M1c3 (0.001, 0.263, A)
A2 (3e-04, 0.001, A)	M1c4 (0.277, 1.909, B)
B1 (0.001, 0.282, A)	O1 (0.011, 0.691, A)
B2 (0.354, 2.614, C)	O1c1 (0.012, 1.022, B)
D1 (0.359, 2.656, C)	S1 (0.012, 0.710, A)
I1 (0.354, 2.947, C)	S1c1 (0.045, 1.230, B)
K2 (0.072, 1.866, B)	S2 (0.010, 0.545, A)
M1 (0.002, 0.898, A)	S2c1 (0.013, 0.675, A)
M1c1 (0.001, 0.670, A)	

libri-a-a-m



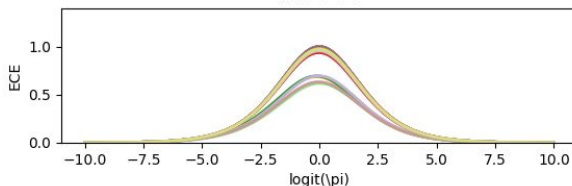
perfect privacy (0, 0, 0)	M1c2 (0.335, 2.936, C)
A1 (0.084, 2.169, C)	M1c3 (0.070, 2.102, C)
A2 (0.133, 1.801, B)	M1c4 (0.314, 2.829, C)
B1 (0.066, 2.403, C)	O1 (0.027, 0.841, A)
B2 (0.524, 3.525, C)	O1c1 (0.023, 0.546, A)
D1 (0.514, 3.609, C)	S1 (0.042, 1.659, B)
I1 (0.401, 3.031, C)	S1c1 (0.061, 1.721, B)
K2 (0.617, 2.631, C)	S2 (0.014, 1.324, B)
M1 (0.110, 1.868, B)	S2c1 (0.015, 1.022, B)
M1c1 (0.124, 2.022, C)	

libri-o-o-f



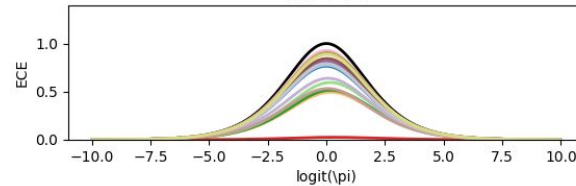
perfect privacy (0, 0, 0)	M1c2 (0.584, 3.979, C)
A1 (0.584, 3.979, C)	M1c3 (0.584, 3.979, C)
A2 (0.584, 3.979, C)	M1c4 (0.584, 3.979, C)
B1 (0.584, 3.979, C)	O1 (0.584, 3.979, C)
B2 (0.584, 3.979, C)	O1c1 (0.584, 3.979, C)
D1 (0.584, 3.979, C)	S1 (0.584, 3.979, C)
I1 (0.584, 3.979, C)	S1c1 (0.584, 3.979, C)
K2 (0.584, 3.979, C)	S2 (0.584, 3.979, C)
M1 (0.584, 3.979, C)	S2c1 (0.584, 3.979, C)
M1c1 (0.584, 3.979, C)	

libri-o-a-f



perfect privacy (0, 0, 0)	M1c2 (0.214, 2.265, C)
A1 (0.004, 0.486, A)	M1c3 (0.009, 0.959, A)
A2 (0.003, 0.496, A)	M1c4 (0.258, 2.265, C)
B1 (0.004, 0.310, A)	O1 (0.021, 0.389, A)
B2 (0.221, 2.266, C)	O1c1 (0.018, 0.399, A)
D1 (0.215, 2.191, C)	S1 (0.017, 0.823, A)
I1 (0.268, 3.035, C)	S1c1 (0.031, 0.804, A)
K2 (0.044, 1.476, B)	S2 (0.014, 1.310, B)
M1 (0.003, 0.766, A)	S2c1 (0.019, 0.708, A)
M1c1 (0.002, 0.682, A)	

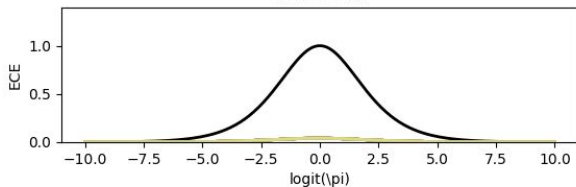
libri-a-a-f



perfect privacy (0, 0, 0)	M1c2 (0.251, 1.912, B)
A1 (0.162, 2.310, C)	M1c3 (0.107, 1.155, B)
A2 (0.153, 2.389, C)	M1c4 (0.328, 3.130, C)
B1 (0.111, 2.486, C)	O1 (0.058, 2.088, C)
B2 (0.356, 3.580, C)	O1c1 (0.049, 1.912, B)
D1 (0.341, 3.453, C)	S1 (0.068, 2.310, C)
I1 (0.286, 3.168, C)	S1c1 (0.147, 2.802, C)
K2 (0.702, 4.035, D)	S2 (0.070, 2.213, C)
M1 (0.110, 1.854, B)	S2c1 (0.078, 2.265, C)
M1c1 (0.128, 2.051, C)	

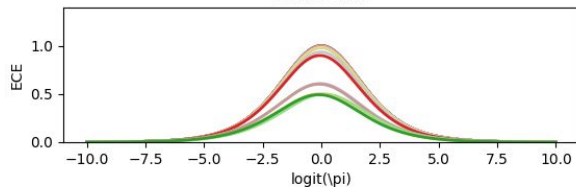
ZEBRA: LibriSpeech (all systems) ordered by performance

libri-o-o-m



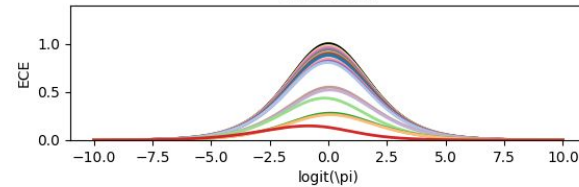
perfect privacy (0, 0, 0)	M1 (0.690, 3.924, C)
A1 (0.690, 3.924, C)	K2 (0.690, 3.924, C)
S1c1 (0.690, 3.924, C)	I1 (0.690, 3.924, C)
S1 (0.690, 3.924, C)	D1 (0.690, 3.924, C)
O1c1 (0.690, 3.924, C)	B2 (0.690, 3.924, C)
O1 (0.690, 3.924, C)	B1 (0.690, 3.924, C)
M1c4 (0.690, 3.924, C)	A2 (0.690, 3.924, C)
M1c3 (0.690, 3.924, C)	S2 (0.690, 3.924, C)
M1c2 (0.690, 3.924, C)	S2c1 (0.690, 3.924, C)
M1c1 (0.690, 3.924, C)	

libri-o-a-m



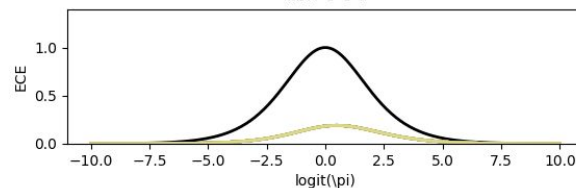
perfect privacy (0, 0, 0)	O1c1 (0.012, 1.022, B)
A2 (3e-04, 0.001, A)	S2c1 (0.013, 0.675, A)
M1c1 (0.001, 0.670, A)	S1c1 (0.045, 1.230, B)
M1c3 (0.001, 0.263, A)	K2 (0.072, 1.866, B)
B1 (0.001, 0.282, A)	M1c2 (0.273, 1.969, B)
A1 (0.002, 0.202, A)	M1c4 (0.277, 1.909, B)
M1 (0.002, 0.898, A)	I1 (0.354, 2.947, C)
S2 (0.010, 0.545, A)	B2 (0.354, 2.614, C)
O1 (0.011, 0.691, A)	D1 (0.359, 2.656, C)
S1 (0.012, 0.710, A)	

libri-a-a-m



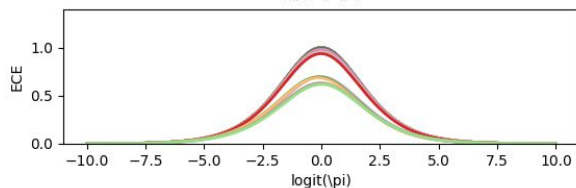
perfect privacy (0, 0, 0)	M1 (0.110, 1.868, B)
S2 (0.014, 1.324, B)	M1c1 (0.124, 2.022, C)
S2c1 (0.015, 1.022, B)	A2 (0.133, 1.801, B)
O1c1 (0.023, 0.546, A)	M1c4 (0.314, 2.829, C)
O1 (0.027, 0.841, A)	M1c2 (0.335, 2.936, C)
S1 (0.042, 1.659, B)	I1 (0.401, 3.031, C)
S1c1 (0.061, 1.721, B)	D1 (0.514, 3.609, C)
B1 (0.066, 2.403, C)	B2 (0.524, 3.525, C)
M1c3 (0.070, 2.102, C)	K2 (0.617, 2.631, C)
A1 (0.084, 2.169, C)	

libri-o-o-f



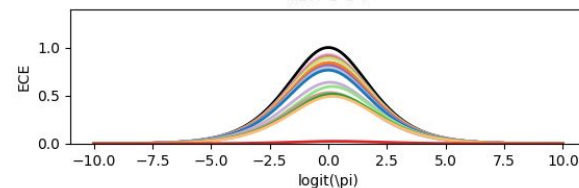
perfect privacy (0, 0, 0)	M1c1 (0.584, 3.979, C)
K2 (0.584, 3.979, C)	M1 (0.584, 3.979, C)
M1c2 (0.584, 3.979, C)	I1 (0.584, 3.979, C)
A1 (0.584, 3.979, C)	D1 (0.584, 3.979, C)
S1c1 (0.584, 3.979, C)	B2 (0.584, 3.979, C)
S1 (0.584, 3.979, C)	B1 (0.584, 3.979, C)
O1c1 (0.584, 3.979, C)	A2 (0.584, 3.979, C)
O1 (0.584, 3.979, C)	S2 (0.584, 3.979, C)
M1c4 (0.584, 3.979, C)	S2c1 (0.584, 3.979, C)
M1c3 (0.584, 3.979, C)	

libri-o-a-f



perfect privacy (0, 0, 0)	S2c1 (0.019, 0.708, A)
M1c1 (0.002, 0.682, A)	O1 (0.021, 0.389, A)
M1 (0.003, 0.766, A)	S1c1 (0.031, 0.804, A)
A2 (0.003, 0.496, A)	K2 (0.044, 1.476, B)
B1 (0.004, 0.310, A)	M1c2 (0.214, 2.265, C)
A1 (0.004, 0.486, A)	D1 (0.215, 2.191, C)
M1c3 (0.009, 0.959, A)	B2 (0.221, 2.266, C)
S2 (0.014, 1.310, B)	M1c4 (0.258, 2.265, C)
S1 (0.017, 0.823, A)	I1 (0.268, 3.035, C)
O1c1 (0.018, 0.399, A)	

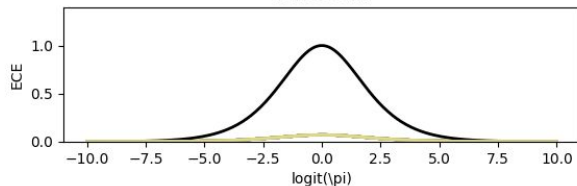
libri-a-a-f



perfect privacy (0, 0, 0)	S1c1 (0.147, 2.802, C)
O1c1 (0.049, 1.912, B)	A2 (0.153, 2.389, C)
O1 (0.058, 2.088, C)	A1 (0.162, 2.310, C)
S1 (0.068, 2.310, C)	M1c2 (0.251, 1.912, B)
S2 (0.070, 2.213, C)	I1 (0.286, 3.168, C)
S2c1 (0.078, 2.265, C)	M1c4 (0.328, 3.130, C)
M1c3 (0.107, 1.155, B)	D1 (0.341, 3.453, C)
M1 (0.110, 1.854, B)	B2 (0.356, 3.580, C)
B1 (0.111, 2.486, C)	K2 (0.702, 4.035, D)
M1c1 (0.128, 2.051, C)	

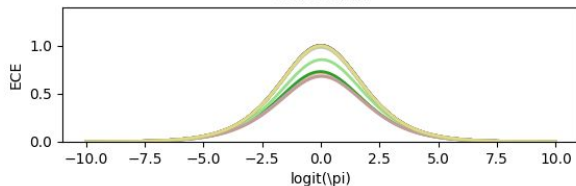
ZEBRA: VCTK-different (all systems)

vctk-o-o-m



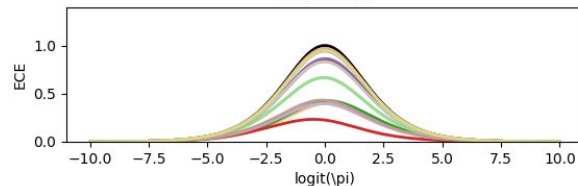
perfect privacy (0, 0, 0)	M1c2 (0.667, 3.921, C)
A1 (0.667, 3.921, C)	M1c3 (0.667, 3.921, C)
A2 (0.667, 3.921, C)	M1c4 (0.667, 3.921, C)
B1 (0.667, 3.921, C)	O1 (0.667, 3.921, C)
B2 (0.667, 3.921, C)	O1c1 (0.667, 3.921, C)
D1 (0.667, 3.921, C)	S1 (0.667, 3.921, C)
I1 (0.667, 3.921, C)	S1c1 (0.667, 3.921, C)
K2 (0.667, 3.921, C)	S2 (0.667, 3.921, C)
M1 (0.667, 3.921, C)	S2c1 (0.667, 3.921, C)
M1c1 (0.667, 3.921, C)	

vctk-o-a-m



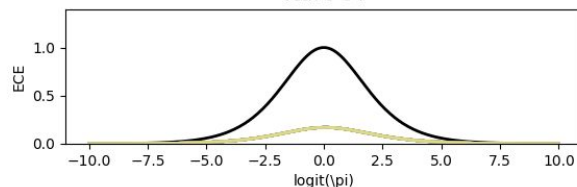
perfect privacy (0, 0, 0)	M1c2 (0.217, 2.373, C)
A1 (3e-05, 2e-04, A)	M1c3 (8e-05, 2e-04, A)
A2 (0, 2e-04, A)	M1c4 (0.223, 2.313, C)
B1 (3e-05, 2e-04, A)	O1 (0.006, 1.182, B)
B2 (0.196, 3.012, C)	O1c1 (0.006, 1.182, B)
D1 (0.190, 3.063, C)	S1 (0.003, 0.140, A)
I1 (0.102, 2.160, C)	S1c1 (0.012, 0.566, A)
K2 (0.007, 1.043, B)	S2 (0.002, 0.663, A)
M1 (2e-04, 0.119, A)	S2c1 (0.003, 0.663, A)
M1c1 (7e-05, 0.073, A)	

vctk-a-a-m



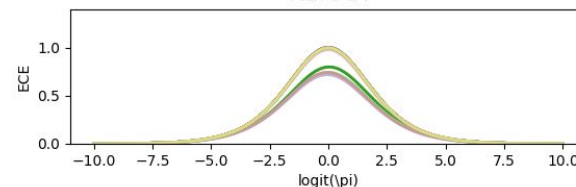
perfect privacy (0, 0, 0)	M1c2 (0.424, 2.627, C)
A1 (0.103, 1.124, B)	M1c3 (0.108, 1.337, B)
A2 (0.230, 1.756, B)	M1c4 (0.398, 2.373, C)
B1 (0.113, 1.240, B)	O1 (0.021, 0.881, A)
B2 (0.424, 3.486, C)	O1c1 (0.023, 0.685, A)
D1 (0.404, 3.461, C)	S1 (0.038, 1.359, B)
I1 (0.231, 2.056, C)	S1c1 (0.114, 1.480, B)
K2 (0.548, 2.964, C)	S2 (0.031, 0.576, A)
M1 (0.093, 1.483, B)	S2c1 (0.035, 1.182, B)
M1c1 (0.093, 1.359, B)	

vctk-o-o-f



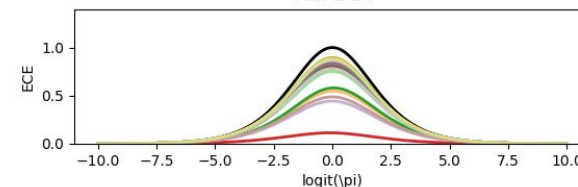
perfect privacy (0, 0, 0)	M1c2 (0.594, 3.655, C)
A1 (0.594, 3.655, C)	M1c3 (0.594, 3.655, C)
A2 (0.594, 3.655, C)	M1c4 (0.594, 3.655, C)
B1 (0.594, 3.655, C)	O1 (0.594, 3.655, C)
B2 (0.594, 3.655, C)	O1c1 (0.594, 3.655, C)
D1 (0.594, 3.655, C)	S1 (0.594, 3.655, C)
I1 (0.594, 3.655, C)	S1c1 (0.594, 3.655, C)
K2 (0.594, 3.655, C)	S2 (0.594, 3.655, C)
M1 (0.594, 3.655, C)	S2c1 (0.594, 3.655, C)
M1c1 (0.594, 3.655, C)	

vctk-o-a-f



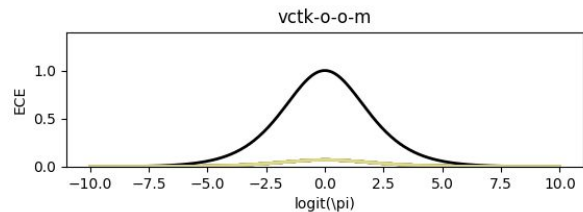
perfect privacy (0, 0, 0)	M1c2 (0.196, 2.304, C)
A1 (3e-04, 0.371, A)	M1c3 (0.005, 0.128, A)
A2 (4e-04, 0.651, A)	M1c4 (0.179, 2.258, C)
B1 (0.001, 0.128, A)	O1 (0.013, 0.526, A)
B2 (0.141, 2.395, C)	O1c1 (0.015, 0.371, A)
D1 (0.138, 1.772, B)	S1 (0.005, 0.485, A)
I1 (0.178, 1.621, B)	S1c1 (0.011, 0.859, A)
K2 (0, 2e-04, A)	S2 (0.002, 0.588, A)
M1 (7e-06, 0.005, A)	S2c1 (0.002, 0.827, A)
M1c1 (4e-04, 0.287, A)	

vctk-a-a-f

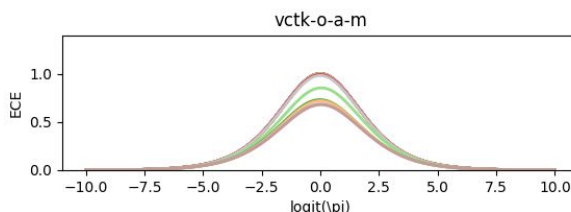


perfect privacy (0, 0, 0)	M1c2 (0.390, 2.318, C)
A1 (0.107, 1.429, B)	M1c3 (0.134, 1.672, B)
A2 (0.087, 1.869, B)	M1c4 (0.359, 2.196, C)
B1 (0.104, 1.869, B)	O1 (0.094, 1.526, B)
B2 (0.315, 2.598, C)	O1c1 (0.096, 1.781, B)
D1 (0.293, 3.020, C)	S1 (0.111, 1.429, B)
I1 (0.170, 1.781, B)	S1c1 (0.150, 1.702, B)
K2 (0.635, 3.819, C)	S2 (0.070, 1.304, B)
M1 (0.129, 1.429, B)	S2c1 (0.080, 1.128, B)
M1c1 (0.120, 1.827, B)	

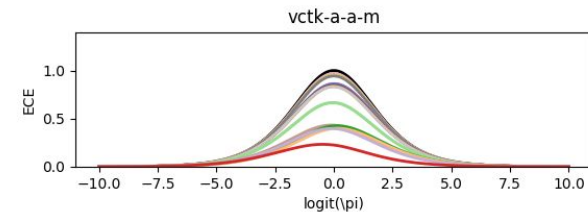
ZEBRA: VCTK-different (all systems) ordered by performance



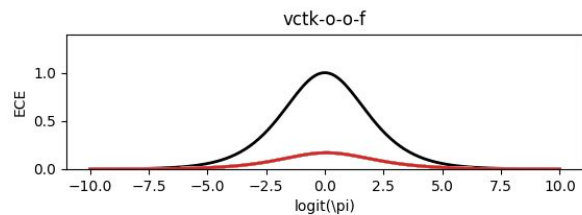
perfect privacy (0, 0, 0)	M1c1 (0.667, 3.921, C)
K2 (0.667, 3.921, C)	M1 (0.667, 3.921, C)
M1c2 (0.667, 3.921, C)	I1 (0.667, 3.921, C)
A1 (0.667, 3.921, C)	D1 (0.667, 3.921, C)
S1c1 (0.667, 3.921, C)	B2 (0.667, 3.921, C)
S1 (0.667, 3.921, C)	B1 (0.667, 3.921, C)
O1c1 (0.667, 3.921, C)	A2 (0.667, 3.921, C)
O1 (0.667, 3.921, C)	S2 (0.667, 3.921, C)
M1c4 (0.667, 3.921, C)	S2c1 (0.667, 3.921, C)
M1c3 (0.667, 3.921, C)	



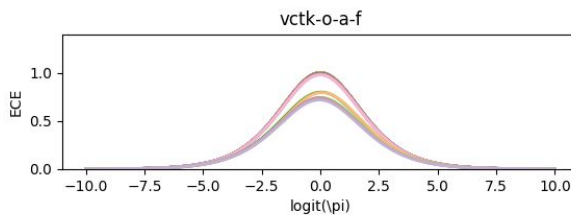
perfect privacy (0, 0, 0)	O1 (0.006, 1.182, B)
A2 (0, 2e-04, A)	O1c1 (0.006, 1.182, B)
B1 (3e-05, 2e-04, A)	K2 (0.007, 1.043, B)
A1 (3e-05, 2e-04, A)	S1c1 (0.012, 0.566, A)
M1c1 (7e-05, 0.073, A)	I1 (0.102, 2.160, C)
M1c3 (8e-05, 2e-04, A)	D1 (0.190, 3.063, C)
M1 (2e-04, 0.119, A)	B2 (0.196, 3.012, C)
S2 (0.002, 0.663, A)	M1c2 (0.217, 2.373, C)
S1 (0.003, 0.140, A)	M1c4 (0.223, 2.313, C)
S2c1 (0.003, 0.663, A)	



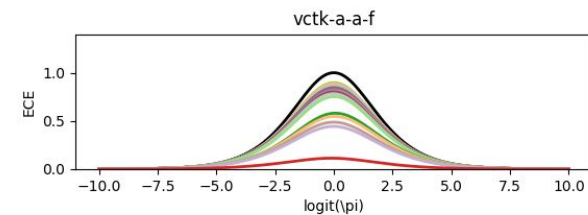
perfect privacy (0, 0, 0)	B1 (0.113, 1.240, B)
O1 (0.021, 0.881, A)	S1c1 (0.114, 1.480, B)
O1c1 (0.023, 0.685, A)	A2 (0.230, 1.756, B)
S2 (0.031, 0.576, A)	I1 (0.231, 2.056, C)
S2c1 (0.035, 1.182, B)	M1c4 (0.398, 2.373, C)
S1 (0.038, 1.359, B)	D1 (0.404, 3.461, C)
M1 (0.093, 1.483, B)	B2 (0.424, 3.486, C)
M1c1 (0.093, 1.359, B)	M1c2 (0.424, 2.627, C)
A1 (0.103, 1.124, B)	K2 (0.548, 2.964, C)
M1c3 (0.108, 1.337, B)	



perfect privacy (0, 0, 0)	I1 (0.594, 3.655, C)
A1 (0.594, 3.655, C)	D1 (0.594, 3.655, C)
S1c1 (0.594, 3.655, C)	B2 (0.594, 3.655, C)
S1 (0.594, 3.655, C)	B1 (0.594, 3.655, C)
O1c1 (0.594, 3.655, C)	A2 (0.594, 3.655, C)
O1 (0.594, 3.655, C)	M1 (0.594, 3.655, C)
M1c4 (0.594, 3.655, C)	S2c1 (0.594, 3.655, C)
M1c3 (0.594, 3.655, C)	M1c2 (0.594, 3.655, C)
S2 (0.594, 3.655, C)	K2 (0.594, 3.655, C)
M1c1 (0.594, 3.655, C)	



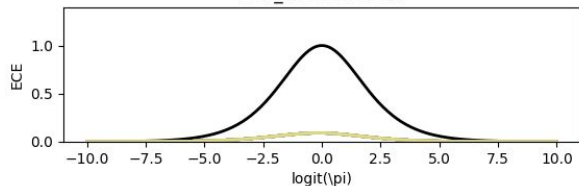
perfect privacy (0, 0, 0)	S1 (0.005, 0.485, A)
K2 (0, 2e-04, A)	S1c1 (0.011, 0.859, A)
M1 (7e-06, 0.005, A)	O1 (0.013, 0.526, A)
A1 (3e-04, 0.371, A)	O1c1 (0.015, 0.371, A)
M1c1 (4e-04, 0.287, A)	D1 (0.138, 1.772, B)
A2 (4e-04, 0.651, A)	B2 (0.141, 2.395, C)
B1 (0.001, 0.128, A)	I1 (0.178, 1.621, B)
S2c1 (0.002, 0.827, A)	M1c4 (0.179, 2.258, C)
S2 (0.002, 0.588, A)	M1c2 (0.196, 2.304, C)
M1c3 (0.005, 0.128, A)	



perfect privacy (0, 0, 0)	M1 (0.129, 1.429, B)
S2 (0.070, 1.304, B)	M1c3 (0.134, 1.672, B)
S2c1 (0.080, 1.128, B)	S1c1 (0.150, 1.702, B)
A2 (0.087, 1.869, B)	I1 (0.170, 1.781, B)
O1 (0.094, 1.526, B)	D1 (0.293, 3.020, C)
O1c1 (0.096, 1.781, B)	B2 (0.315, 2.598, C)
B1 (0.104, 1.869, B)	M1c4 (0.359, 2.196, C)
A1 (0.107, 1.429, B)	M1c2 (0.390, 2.318, C)
S1 (0.111, 1.429, B)	K2 (0.635, 3.819, C)
M1c1 (0.120, 1.827, B)	

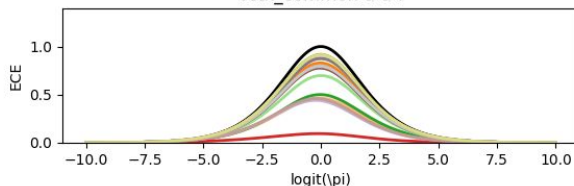
ZEBRA: VCTK-common (all systems)

vctk_common-o-o-f



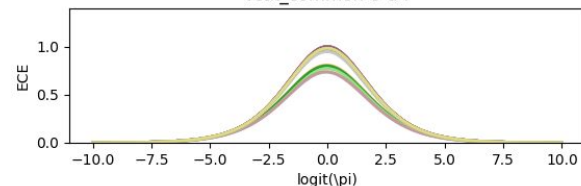
perfect privacy (0, 0, 0)	M1c2 (0.653, 3.557, C)
A1 (0.653, 3.557, C)	M1c3 (0.653, 3.557, C)
A2 (0.653, 3.557, C)	M1c4 (0.653, 3.557, C)
B1 (0.653, 3.557, C)	O1 (0.653, 3.557, C)
B2 (0.653, 3.557, C)	O1c1 (0.653, 3.557, C)
D1 (0.653, 3.557, C)	S1 (0.653, 3.557, C)
I1 (0.653, 3.557, C)	S1c1 (0.653, 3.557, C)
K2 (0.653, 3.557, C)	S2 (0.653, 3.557, C)
M1 (0.653, 3.557, C)	S2c1 (0.653, 3.557, C)
M1c1 (0.653, 3.557, C)	

vctk_common-a-a-f



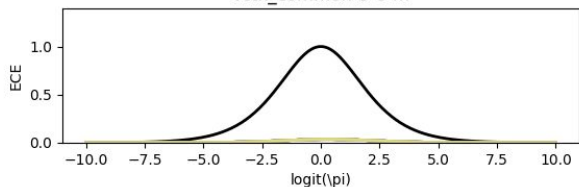
perfect privacy (0, 0, 0)	M1c2 (0.397, 2.266, C)
A1 (0.149, 1.447, B)	M1c3 (0.154, 1.748, B)
A2 (0.136, 1.748, B)	M1c4 (0.383, 2.269, C)
B1 (0.117, 1.447, B)	O1 (0.062, 1.172, B)
B2 (0.377, 2.216, C)	O1c1 (0.067, 1.208, B)
D1 (0.352, 2.488, C)	S1 (0.085, 0.845, A)
I1 (0.210, 2.146, C)	S1c1 (0.142, 1.227, B)
K2 (0.648, 3.141, C)	S2 (0.056, 1.447, B)
M1 (0.077, 1.447, B)	S2c1 (0.059, 1.447, B)
M1c1 (0.083, 1.172, B)	

vctk_common-o-a-f



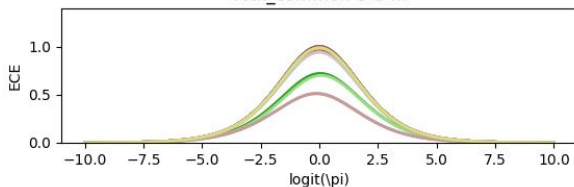
perfect privacy (0, 0, 0)	M1c2 (0.186, 2.187, C)
A1 (0.007, 0.423, A)	M1c3 (0.007, 0.367, A)
A2 (0.006, 0.741, A)	M1c4 (0.181, 2.100, C)
B1 (0.004, 0.668, A)	O1 (0.016, 0.470, A)
B2 (0.132, 1.197, B)	O1c1 (0.015, 0.559, A)
D1 (0.138, 1.153, B)	S1 (0.017, 0.706, A)
I1 (0.161, 2.187, C)	S1c1 (0.037, 1.124, B)
K2 (0.003, 0.386, A)	S2 (0.012, 1.447, B)
M1 (0.001, 0.105, A)	S2c1 (0.012, 1.146, B)
M1c1 (0.001, 0.098, A)	

vctk_common-o-o-m



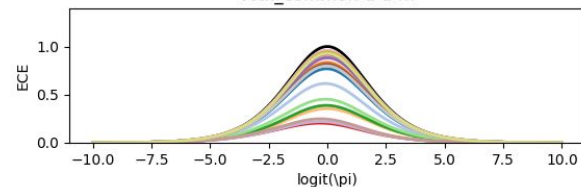
perfect privacy (0, 0, 0)	M1c2 (0.694, 3.675, C)
A1 (0.694, 3.675, C)	M1c3 (0.694, 3.675, C)
A2 (0.694, 3.675, C)	M1c4 (0.694, 3.675, C)
B1 (0.694, 3.675, C)	O1 (0.694, 3.675, C)
B2 (0.694, 3.675, C)	O1c1 (0.694, 3.675, C)
D1 (0.694, 3.675, C)	S1 (0.694, 3.675, C)
I1 (0.694, 3.675, C)	S1c1 (0.694, 3.675, C)
K2 (0.694, 3.675, C)	S2 (0.694, 3.675, C)
M1 (0.694, 3.675, C)	S2c1 (0.694, 3.675, C)
M1c1 (0.694, 3.675, C)	

vctk_common-o-a-m



perfect privacy (0, 0, 0)	M1c2 (0.342, 2.468, C)
A1 (0.001, 0.447, A)	M1c3 (3e-04, 0.544, A)
A2 (2e-04, 0.192, A)	M1c4 (0.346, 2.376, C)
B1 (2e-04, 0.447, A)	O1 (0.008, 0.544, A)
B2 (0.199, 2.488, C)	O1c1 (0.009, 1.146, B)
D1 (0.196, 2.690, C)	S1 (0.007, 0.669, A)
I1 (0.212, 2.917, C)	S1c1 (0.040, 0.778, A)
K2 (0.019, 1.204, B)	S2 (0.009, 0.373, A)
M1 (0.001, 0.234, A)	S2c1 (0.010, 0.392, A)
M1c1 (0.001, 0.171, A)	

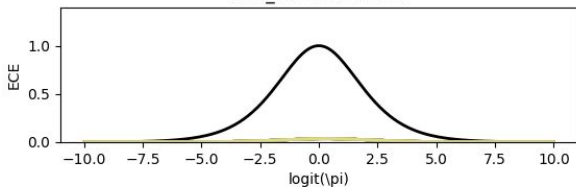
vctk_common-a-a-m



perfect privacy (0, 0, 0)	M1c2 (0.558, 2.909, C)
A1 (0.159, 1.447, B)	M1c3 (0.126, 1.176, B)
A2 (0.268, 1.857, B)	M1c4 (0.538, 2.561, C)
B1 (0.113, 1.447, B)	O1 (0.029, 0.869, A)
B2 (0.458, 3.080, C)	O1c1 (0.027, 1.146, B)
D1 (0.434, 2.702, C)	S1 (0.053, 1.146, B)
I1 (0.385, 2.157, C)	S1c1 (0.138, 1.447, B)
K2 (0.568, 2.593, C)	S2 (0.038, 0.483, A)
M1 (0.065, 1.021, B)	S2c1 (0.049, 0.614, A)
M1c1 (0.080, 1.447, B)	

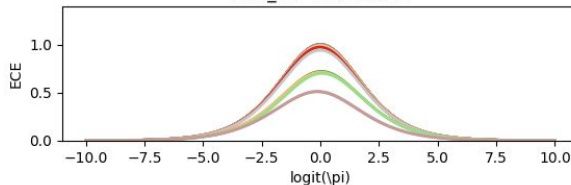
ZEBRA: VCTK-common (all systems) ordered by performance

vctk_common-o-o-m



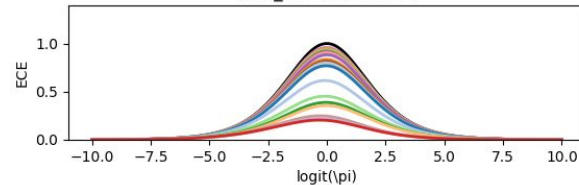
perfect privacy (0, 0, 0)	M1 (0.694, 3.675, C)
A1 (0.694, 3.675, C)	K2 (0.694, 3.675, C)
S1c1 (0.694, 3.675, C)	I1 (0.694, 3.675, C)
S1 (0.694, 3.675, C)	D1 (0.694, 3.675, C)
O1c1 (0.694, 3.675, C)	B2 (0.694, 3.675, C)
O1 (0.694, 3.675, C)	B1 (0.694, 3.675, C)
M1c4 (0.694, 3.675, C)	A2 (0.694, 3.675, C)
M1c3 (0.694, 3.675, C)	S2 (0.694, 3.675, C)
M1c2 (0.694, 3.675, C)	S2c1 (0.694, 3.675, C)
M1c1 (0.694, 3.675, C)	

vctk_common-o-a-m



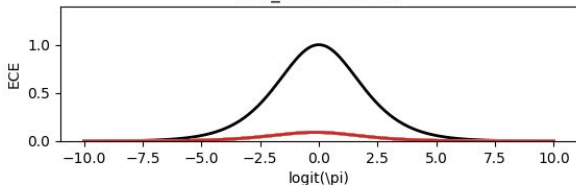
perfect privacy (0, 0, 0)	S2 (0.009, 0.373, A)
A2 (2e-04, 0.192, A)	S2c1 (0.010, 0.392, A)
B1 (2e-04, 0.447, A)	K2 (0.019, 1.204, B)
M1c3 (3e-04, 0.544, A)	S1c1 (0.040, 0.778, A)
A1 (0.001, 0.447, A)	D1 (0.196, 2.690, C)
M1c1 (0.001, 0.171, A)	B2 (0.199, 2.488, C)
M1 (0.001, 0.234, A)	I1 (0.212, 2.917, C)
S1 (0.007, 0.669, A)	M1c2 (0.342, 2.468, C)
O1 (0.008, 0.544, A)	M1c4 (0.346, 2.376, C)
O1c1 (0.009, 1.146, B)	

vctk_common-a-a-m



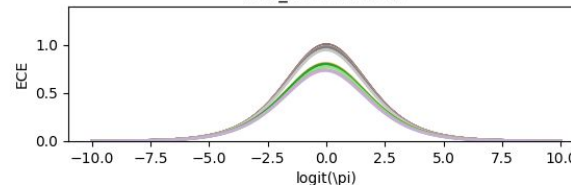
perfect privacy (0, 0, 0)	S1c1 (0.138, 1.447, B)
O1c1 (0.027, 1.146, B)	A1 (0.159, 1.447, B)
O1 (0.029, 0.869, A)	A2 (0.268, 1.857, B)
S2 (0.038, 0.483, A)	I1 (0.385, 2.157, C)
S2c1 (0.049, 0.614, A)	D1 (0.434, 2.702, C)
S1 (0.053, 1.146, B)	B2 (0.458, 3.080, C)
M1 (0.065, 1.021, B)	M1c4 (0.538, 2.561, C)
M1c1 (0.080, 1.447, B)	M1c2 (0.558, 2.909, C)
B1 (0.113, 1.447, B)	K2 (0.568, 2.593, C)
M1c3 (0.126, 1.176, B)	

vctk_common-o-o-f



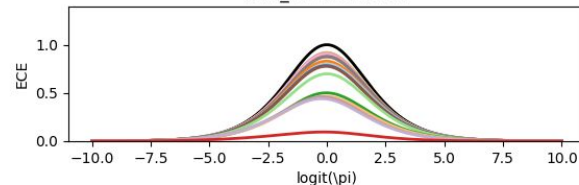
perfect privacy (0, 0, 0)	I1 (0.653, 3.557, C)
A1 (0.653, 3.557, C)	D1 (0.653, 3.557, C)
S1c1 (0.653, 3.557, C)	B2 (0.653, 3.557, C)
S1 (0.653, 3.557, C)	B1 (0.653, 3.557, C)
O1c1 (0.653, 3.557, C)	A2 (0.653, 3.557, C)
O1 (0.653, 3.557, C)	M1 (0.653, 3.557, C)
M1c4 (0.653, 3.557, C)	S2c1 (0.653, 3.557, C)
M1c3 (0.653, 3.557, C)	M1c2 (0.653, 3.557, C)
S2 (0.653, 3.557, C)	K2 (0.653, 3.557, C)
M1c1 (0.653, 3.557, C)	

vctk_common-o-a-f



perfect privacy (0, 0, 0)	O1c1 (0.015, 0.559, A)
M1 (0.001, 0.105, A)	O1 (0.016, 0.470, A)
M1c1 (0.001, 0.098, A)	S1 (0.017, 0.706, A)
K2 (0.003, 0.386, A)	S1c1 (0.037, 1.124, B)
B1 (0.004, 0.668, A)	B2 (0.132, 1.197, B)
A2 (0.006, 0.741, A)	D1 (0.138, 1.153, B)
M1c3 (0.007, 0.367, A)	I1 (0.161, 2.187, C)
A1 (0.007, 0.423, A)	M1c4 (0.181, 2.100, C)
S2c1 (0.012, 1.146, B)	M1c2 (0.186, 2.187, C)
S2 (0.012, 1.447, B)	

vctk_common-a-a-f



perfect privacy (0, 0, 0)	S1c1 (0.142, 1.227, B)
S2 (0.056, 1.447, B)	A1 (0.149, 1.447, B)
S2c1 (0.059, 1.447, B)	M1c3 (0.154, 1.748, B)
O1 (0.062, 1.172, B)	I1 (0.210, 2.146, C)
O1c1 (0.067, 1.208, B)	D1 (0.352, 2.488, C)
M1 (0.077, 1.447, B)	B2 (0.377, 2.216, C)
M1c1 (0.083, 1.172, B)	M1c4 (0.383, 2.269, C)
S1 (0.085, 0.845, A)	M1c2 (0.397, 2.266, C)
B1 (0.117, 1.447, B)	K2 (0.648, 3.141, C)
A2 (0.136, 1.748, B)	