

Supplement for: An Investigation of Universal Background Sparse Coding Based Speaker Verification on TIMIT

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A. Supplementary DET curves

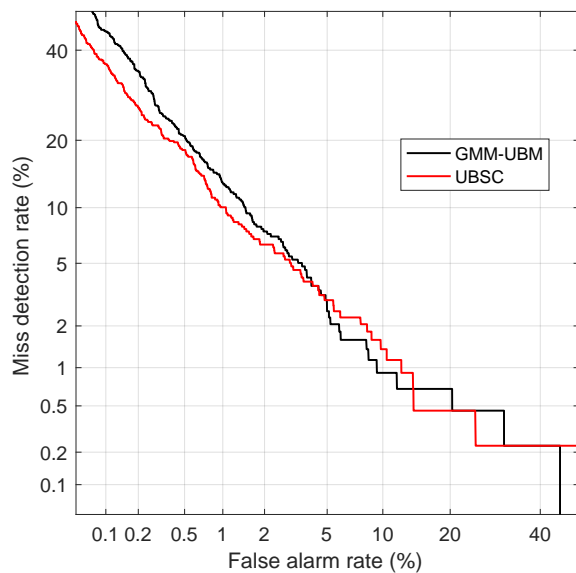


Fig. S1. DET curves produced by GMM-UBM and UBSC in the Male experiment, with the cosine similarity scoring method.

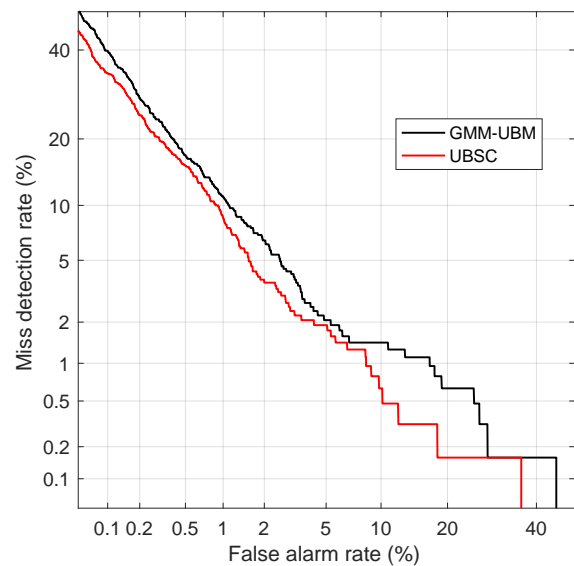


Fig. S2. DET curves produced by GMM-UBM and UBSC in the Male+Female experiment, with the cosine similarity scoring method.

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B. Supplementary EER curves produced by the UBSC w.r.t. hyperparameters

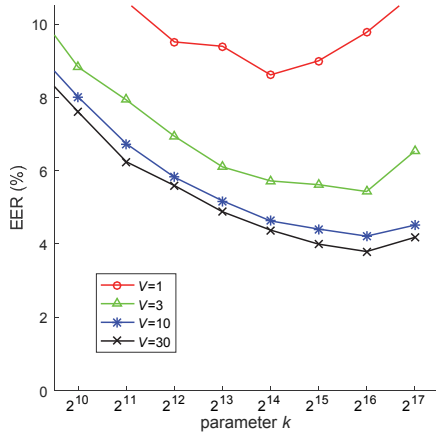


Fig. S3. EER curves produced by the UBSC with the cosine similarity scoring method with respect to parameters V and k in the Male experiment.

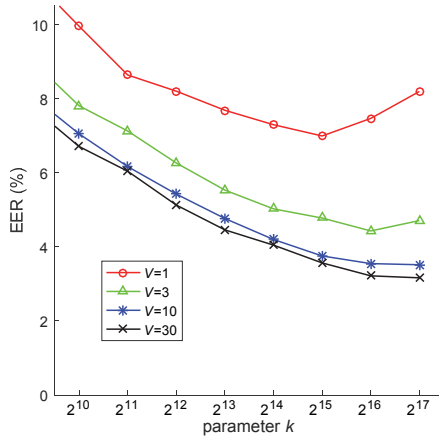


Fig. S4. EER curves produced by the UBSC with the cosine similarity scoring method with respect to parameters V and k in the Male+Female experiment.

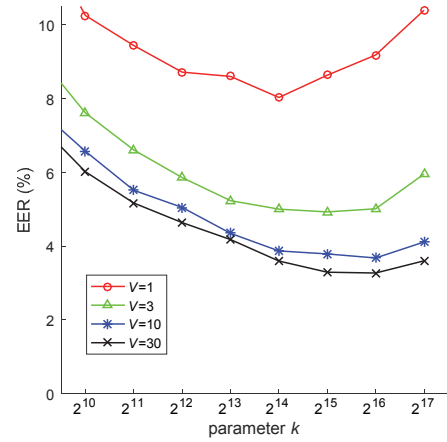


Fig. S5. EER curves produced by the UBSC with the inner product similarity scoring method with respect to parameters V and k in the Male experiment.

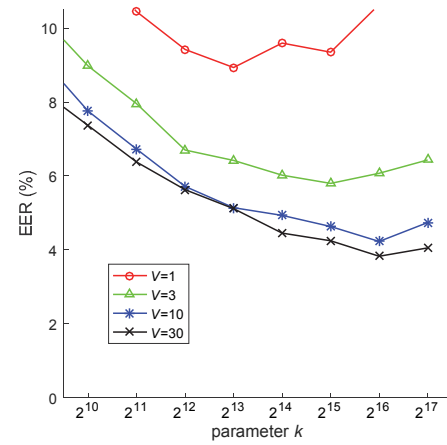


Fig. S6. EER curves produced by the UBSC with the inner product similarity scoring method with respect to parameters V and k in the Female experiment.

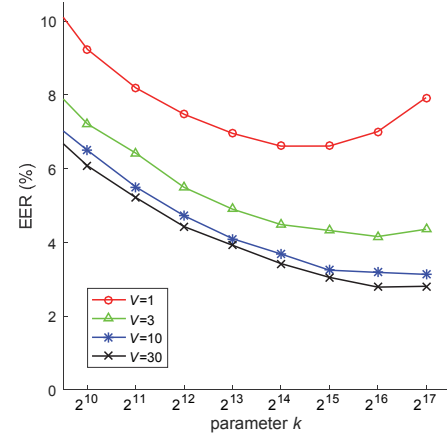


Fig. S7. EER curves produced by the UBSC with the inner product similarity scoring method with respect to parameters V and k in the Male+Female experiment.

C. Supplementary results of GMM-UBM in the Male experiment

TABLE S1

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 10 MALE SPEAKERS. THE VALUES IN BRACKETS ARE STANDARD DEVIATIONS. THE NUMBER IN BOLD DENOTES THE BEST RESULT.

#EM iter. #mix	2	5	10	20	30
2 ¹	20.61 (6.51)	20.89 (12.28)	13.78 (5.17)	12.33 (6.34)	9.61 (4.83)
2 ²	17.33 (6.32)	14.67 (6.60)	12.39 (3.59)	14.11 (5.40)	11.89 (5.76)
2 ³	15.44 (7.92)	10.83 (3.83)	9.89 (7.69)	8.06 (3.89)	10.89 (6.44)
2 ⁴	13.78 (7.48)	8.39 (3.56)	8.94 (2.27)	7.94 (4.42)	8.50 (4.52)
2 ⁵	14.67 (7.57)	7.50 (5.25)	5.44 (4.62)	3.06 (3.82)	6.72 (5.48)
2 ⁶	13.61 (4.09)	8.28 (5.56)	5.94 (3.65)	5.72 (6.92)	4.56 (4.16)
2 ⁷	12.33 (5.77)	5.72 (5.08)	6.17 (4.36)	3.89 (4.30)	7.67 (5.66)
2 ⁸	13.72 (6.54)	6.06 (5.84)	7.39 (2.94)	8.11 (3.00)	4.50 (4.04)
2 ⁹	11.11 (5.74)	10.11 (4.63)	6.06 (3.80)	7.17 (5.85)	5.56 (3.72)
2 ¹⁰	18.72 (3.69)	7.72 (7.68)	4.94 (3.64)	5.28 (5.09)	6.11 (3.85)
2 ¹¹	10.72 (4.50)	8.28 (5.95)	5.39 (4.23)	7.22 (6.02)	6.67 (3.89)

TABLE S2

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 30 MALE SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	23.34 (3.67)	16.36 (3.45)	13.78 (4.14)	14.11 (2.94)	17.83 (5.55)
2 ²	21.25 (4.00)	14.45 (3.27)	12.42 (3.91)	12.17 (2.39)	15.07 (3.86)
2 ³	17.74 (4.98)	9.32 (2.63)	11.49 (3.83)	9.43 (2.16)	9.13 (2.47)
2 ⁴	15.64 (4.55)	8.91 (2.49)	6.79 (2.89)	6.12 (1.40)	6.55 (2.74)
2 ⁵	14.20 (4.90)	7.00 (2.96)	6.09 (1.93)	5.36 (1.58)	6.21 (3.08)
2 ⁶	13.21 (3.44)	6.37 (1.73)	5.25 (2.35)	4.91 (1.70)	5.51 (1.76)
2 ⁷	11.12 (2.85)	4.56 (1.95)	5.05 (2.54)	6.53 (2.73)	4.84 (2.54)
2 ⁸	11.32 (3.77)	4.75 (1.52)	4.84 (2.24)	5.44 (2.79)	5.10 (2.75)
2 ⁹	11.92 (3.21)	5.84 (2.00)	4.93 (1.60)	4.97 (1.65)	5.52 (2.52)
2 ¹⁰	11.08 (4.00)	5.07 (1.60)	4.93 (1.30)	5.85 (2.14)	5.75 (2.17)
2 ¹¹	11.56 (1.82)	5.10 (2.39)	3.82 (1.14)	4.73 (1.68)	5.11 (1.81)

TABLE S3

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 100 MALE SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	21.57 (3.84)	15.38 (4.89)	14.68 (1.32)	14.53 (1.54)	13.30 (1.12)
2 ²	20.11 (3.14)	14.26 (1.77)	14.57 (2.34)	13.60 (1.06)	14.04 (1.51)
2 ³	17.81 (1.05)	10.39 (1.59)	9.77 (1.78)	10.31 (2.30)	9.66 (1.72)
2 ⁴	14.43 (1.80)	9.32 (0.94)	7.49 (1.33)	8.08 (1.04)	8.89 (1.26)
2 ⁵	13.40 (1.80)	7.17 (0.99)	6.17 (0.68)	6.42 (1.52)	6.14 (1.04)
2 ⁶	12.72 (1.31)	6.50 (1.03)	5.28 (1.15)	5.28 (1.26)	4.79 (0.76)
2 ⁷	11.71 (1.21)	5.51 (0.90)	5.16 (0.97)	4.27 (0.83)	4.47 (0.90)
2 ⁸	10.91 (2.11)	5.74 (0.68)	4.35 (0.86)	4.51 (1.05)	3.79 (0.90)
2 ⁹	10.90 (2.00)	5.22 (0.79)	4.62 (0.98)	3.94 (1.10)	4.01 (0.90)
2 ¹⁰	11.04 (1.99)	5.17 (1.03)	4.49 (0.79)	3.81 (0.88)	3.48 (1.02)
2 ¹¹	10.09 (1.74)	4.71 (1.00)	5.13 (1.19)	4.60 (0.72)	3.79 (0.67)

TABLE S4

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 300 MALE SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	21.39 (3.54)	13.49 (0.56)	13.79 (0.69)	14.03 (0.67)	13.57 (0.63)
2 ²	19.15 (2.04)	13.57 (1.63)	13.80 (1.17)	14.26 (1.70)	13.51 (1.15)
2 ³	17.59 (1.41)	11.53 (2.89)	9.92 (1.01)	10.04 (1.67)	12.03 (3.44)
2 ⁴	15.42 (1.09)	8.99 (1.25)	7.94 (0.50)	8.05 (0.73)	8.22 (0.78)
2 ⁵	13.42 (1.03)	7.05 (0.54)	6.89 (0.62)	6.46 (0.56)	6.08 (0.47)
2 ⁶	12.43 (0.66)	6.05 (0.51)	5.63 (0.85)	5.42 (0.50)	5.23 (0.37)
2 ⁷	11.87 (1.01)	5.71 (0.44)	4.83 (0.32)	4.99 (0.46)	4.75 (0.39)
2 ⁸	11.26 (0.59)	5.35 (0.53)	4.78 (0.27)	4.26 (0.36)	4.71 (0.43)
2 ⁹	10.80 (0.54)	5.11 (0.52)	4.53 (0.43)	4.29 (0.32)	4.11 (0.55)
2 ¹⁰	10.89 (0.81)	4.98 (0.33)	4.73 (0.44)	4.05 (0.24)	3.87 (0.23)
2 ¹¹	10.51 (0.64)	5.68 (1.01)	4.58 (0.58)	4.06 (0.39)	3.94 (0.49)

TABLE S5

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON ALL 438 MALE SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	21.41 (2.71)	14.17 (0.99)	13.89 (0.04)	13.91 (0.00)	13.91 (0.00)
2 ²	19.24 (0.87)	13.83 (0.55)	14.30 (1.52)	13.60 (0.83)	13.85 (1.05)
2 ³	16.48 (1.14)	11.35 (1.07)	9.98 (0.69)	10.14 (1.68)	10.70 (2.33)
2 ⁴	14.95 (1.65)	8.31 (0.23)	8.15 (0.70)	7.81 (0.39)	8.00 (0.24)
2 ⁵	13.92 (0.93)	7.50 (0.46)	6.75 (0.39)	6.18 (0.25)	6.18 (0.32)
2 ⁶	12.82 (0.64)	6.08 (0.45)	5.79 (0.36)	5.16 (0.31)	5.34 (0.28)
2 ⁷	11.38 (0.65)	5.76 (0.44)	4.95 (0.30)	4.80 (0.32)	4.68 (0.29)
2 ⁸	11.23 (0.73)	5.02 (0.40)	4.73 (0.26)	4.56 (0.23)	4.31 (0.15)
2 ⁹	11.10 (0.75)	4.92 (0.49)	4.66 (0.22)	4.28 (0.29)	4.13 (0.31)
2 ¹⁰	10.26 (0.46)	5.26 (0.34)	4.63 (0.35)	4.12 (0.25)	3.92 (0.26)
2 ¹¹	10.37 (0.83)	5.08 (0.71)	4.62 (0.46)	4.11 (0.35)	4.13 (0.27)

D. Supplementary results of GMM-UBM in the Female experiment

TABLE S6
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM
WITH THE COSINE SIMILARITY SCORING METHOD ON 10 FEMALE
SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	28.28 (8.90)	15.78 (6.15)	15.33 (4.96)	14.83 (8.71)	16.83 (7.85)
2 ²	17.33 (4.62)	16.67 (7.81)	18.17 (7.61)	15.06 (4.86)	14.50 (7.08)
2 ³	17.28 (7.82)	11.50 (6.75)	15.00 (5.94)	20.17 (9.69)	17.33 (7.88)
2 ⁴	16.83 (7.12)	11.89 (6.34)	9.72 (2.58)	7.94 (3.20)	8.67 (5.58)
2 ⁵	18.50 (5.02)	8.17 (5.09)	10.44 (4.61)	7.89 (2.97)	8.72 (4.46)
2 ⁶	16.17 (7.81)	11.00 (4.00)	8.83 (5.23)	7.06 (4.56)	8.33 (2.24)
2 ⁷	15.67 (4.43)	5.72 (2.76)	9.72 (7.95)	8.61 (5.05)	7.39 (5.68)
2 ⁸	15.28 (5.73)	9.28 (3.47)	7.94 (3.63)	6.06 (4.46)	5.56 (4.05)
2 ⁹	17.06 (5.49)	8.17 (3.57)	7.00 (3.63)	9.39 (6.08)	9.44 (4.63)
2 ¹⁰	16.94 (6.10)	10.72 (7.33)	8.00 (3.76)	8.06 (4.51)	6.56 (5.52)
2 ¹¹	16.78 (5.81)	10.50 (4.77)	8.89 (5.02)	8.56 (5.13)	5.50 (3.92)

TABLE S7
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM
WITH THE COSINE SIMILARITY SCORING METHOD ON 30 FEMALE
SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	19.60 (3.58)	17.04 (2.69)	14.21 (3.03)	18.37 (1.95)	16.56 (3.71)
2 ²	19.51 (1.44)	18.28 (4.41)	17.22 (2.49)	16.97 (2.49)	16.31 (3.27)
2 ³	17.72 (3.94)	15.37 (4.90)	13.44 (2.81)	16.60 (3.45)	16.82 (3.76)
2 ⁴	19.80 (3.00)	10.73 (2.69)	8.37 (2.13)	11.02 (2.74)	9.61 (3.09)
2 ⁵	18.19 (4.18)	9.72 (2.39)	6.83 (2.95)	7.11 (1.51)	7.63 (2.08)
2 ⁶	16.11 (3.62)	7.36 (2.70)	7.07 (2.63)	6.26 (2.36)	5.78 (1.31)
2 ⁷	16.77 (4.43)	7.50 (3.30)	6.24 (1.39)	6.86 (2.06)	6.79 (2.19)
2 ⁸	15.52 (3.09)	8.11 (2.39)	5.39 (1.93)	5.75 (1.89)	5.85 (2.24)
2 ⁹	16.44 (3.32)	6.56 (2.08)	7.62 (2.16)	6.01 (3.56)	7.14 (2.36)
2 ¹⁰	13.47 (2.52)	6.82 (1.37)	6.71 (2.03)	7.08 (1.91)	6.32 (1.50)
2 ¹¹	14.93 (3.70)	6.45 (1.65)	7.16 (2.14)	6.88 (1.16)	6.37 (3.23)

TABLE S8
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM
WITH THE COSINE SIMILARITY SCORING METHOD ON 100 FEMALE
SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	21.82 (4.79)	16.85 (3.41)	16.35 (0.89)	16.55 (1.43)	15.52 (0.78)
2 ²	20.12 (2.09)	16.56 (1.85)	16.36 (2.14)	17.48 (1.21)	16.57 (1.48)
2 ³	19.36 (2.88)	15.18 (1.63)	13.29 (3.62)	14.20 (3.28)	13.51 (4.63)
2 ⁴	18.82 (2.94)	11.76 (1.62)	8.92 (1.44)	9.18 (1.20)	10.22 (1.86)
2 ⁵	16.49 (2.82)	9.74 (1.94)	7.62 (0.96)	7.54 (1.01)	7.18 (0.83)
2 ⁶	16.63 (2.55)	8.09 (1.91)	6.23 (1.03)	6.37 (0.86)	6.49 (0.68)
2 ⁷	16.60 (2.17)	6.79 (1.25)	6.70 (1.07)	6.30 (0.77)	5.53 (0.92)
2 ⁸	15.14 (1.89)	6.60 (0.92)	5.77 (0.60)	5.82 (0.96)	5.61 (1.06)
2 ⁹	14.73 (2.47)	6.52 (1.21)	6.10 (1.49)	5.54 (0.70)	5.91 (0.77)
2 ¹⁰	14.83 (0.75)	6.89 (0.68)	5.76 (0.92)	6.21 (0.71)	6.40 (1.21)
2 ¹¹	13.27 (1.23)	7.06 (1.25)	6.98 (1.28)	6.55 (1.36)	6.35 (0.74)

TABLE S9
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM
WITH THE COSINE SIMILARITY SCORING METHOD ON ALL 192 FEMALE
SPEAKERS.

#EM iter. #mix	2	5	10	20	30
2 ¹	24.35 (2.40)	16.04 (0.30)	16.12 (0.00)	16.12 (0.00)	16.12 (0.00)
2 ²	21.26 (3.16)	16.72 (1.17)	17.07 (0.56)	16.57 (0.44)	16.81 (0.32)
2 ³	20.34 (1.65)	14.80 (2.80)	14.65 (3.56)	12.86 (2.91)	14.98 (3.29)
2 ⁴	18.57 (1.61)	10.78 (1.16)	9.67 (0.79)	9.33 (0.54)	9.18 (0.54)
2 ⁵	17.96 (1.14)	8.71 (0.68)	7.98 (0.78)	7.15 (0.48)	7.35 (0.75)
2 ⁶	17.03 (1.81)	8.06 (0.56)	6.35 (0.59)	6.45 (0.31)	6.29 (0.47)
2 ⁷	16.09 (1.45)	6.58 (0.59)	6.16 (0.46)	5.64 (0.50)	5.49 (0.38)
2 ⁸	14.90 (0.87)	6.76 (0.55)	5.73 (0.57)	5.46 (0.55)	5.54 (0.55)
2 ⁹	14.03 (1.12)	6.68 (0.48)	5.61 (0.50)	5.53 (0.57)	5.56 (0.49)
2 ¹⁰	13.49 (0.63)	6.80 (0.48)	6.10 (0.50)	5.86 (0.40)	5.70 (0.39)
2 ¹¹	13.30 (0.50)	7.37 (0.73)	6.61 (0.62)	6.16 (0.93)	6.00 (0.48)

E. Supplementary results of GMM-UBM in the Male+Female experiment

TABLE S10
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 10 SPEAKERS.

#mix \ #EM iter.	2	5	10	20	30
2 ¹	17.94 (7.23)	10.06 (1.62)	12.11 (4.72)	12.56 (5.83)	11.83 (3.95)
2 ²	20.56 (6.88)	10.28 (4.29)	11.06 (4.60)	10.50 (4.82)	8.00 (2.82)
2 ³	9.83 (3.00)	10.89 (5.64)	12.06 (5.54)	8.89 (2.48)	13.39 (7.91)
2 ⁴	15.22 (5.07)	9.17 (6.72)	7.17 (4.53)	5.78 (3.89)	9.56 (8.38)
2 ⁵	13.61 (6.84)	7.39 (5.93)	5.67 (5.67)	6.28 (3.37)	6.67 (5.28)
2 ⁶	11.94 (5.15)	6.72 (5.24)	4.94 (3.87)	6.06 (5.15)	5.89 (5.93)
2 ⁷	11.22 (8.49)	4.67 (4.70)	5.00 (3.61)	6.50 (6.14)	6.11 (4.96)
2 ⁸	9.67 (5.44)	7.11 (7.02)	7.17 (5.90)	8.22 (2.91)	7.11 (3.67)
2 ⁹	10.33 (4.87)	6.00 (3.77)	6.00 (3.69)	6.39 (6.05)	4.50 (3.45)
2 ¹⁰	12.50 (4.50)	6.33 (5.16)	9.06 (6.85)	5.22 (3.71)	4.33 (3.73)
2 ¹¹	11.33 (5.53)	6.11 (5.00)	7.17 (4.39)	7.22 (4.68)	6.67 (4.36)

TABLE S11
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 30 SPEAKERS.

#mix \ #EM iter.	2	5	10	20	30
2 ¹	17.62 (3.91)	13.95 (3.72)	11.16 (2.07)	12.49 (3.44)	11.94 (2.59)
2 ²	15.66 (2.68)	10.32 (3.05)	11.21 (2.27)	11.63 (3.68)	12.73 (2.92)
2 ³	14.61 (1.91)	10.78 (3.09)	10.76 (4.07)	7.98 (3.33)	12.15 (4.07)
2 ⁴	13.24 (2.66)	6.17 (3.11)	7.54 (1.90)	6.28 (2.25)	6.18 (2.69)
2 ⁵	13.30 (4.60)	6.75 (1.35)	4.52 (1.53)	4.85 (1.68)	6.49 (2.17)
2 ⁶	11.59 (3.60)	5.16 (2.11)	4.04 (2.58)	4.84 (1.62)	5.15 (1.92)
2 ⁷	9.96 (3.25)	5.05 (1.95)	4.67 (1.65)	3.83 (1.83)	3.98 (1.04)
2 ⁸	9.67 (3.67)	4.94 (1.51)	5.08 (2.71)	4.91 (2.34)	3.41 (2.41)
2 ⁹	7.94 (2.70)	5.02 (1.82)	5.40 (2.27)	3.85 (2.05)	4.81 (2.26)
2 ¹⁰	10.03 (3.55)	5.22 (2.85)	4.19 (1.81)	4.84 (2.54)	4.39 (1.37)
2 ¹¹	9.03 (2.49)	5.91 (2.47)	4.27 (1.75)	5.05 (2.82)	3.96 (2.10)

TABLE S12
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 100 SPEAKERS.

#mix \ #EM iter.	2	5	10	20	30
2 ¹	18.07 (3.37)	12.96 (1.94)	12.25 (1.58)	12.10 (2.12)	12.19 (1.71)
2 ²	14.89 (2.21)	11.83 (1.30)	12.22 (2.39)	12.62 (1.97)	12.61 (1.95)
2 ³	13.51 (1.46)	9.65 (1.90)	8.52 (1.36)	8.93 (1.77)	9.79 (3.01)
2 ⁴	12.11 (2.10)	8.31 (1.12)	7.69 (1.89)	6.70 (1.12)	6.47 (1.04)
2 ⁵	10.50 (2.05)	6.56 (0.65)	5.68 (1.15)	5.29 (0.88)	5.91 (1.30)
2 ⁶	10.07 (1.64)	5.43 (1.62)	4.77 (1.11)	4.12 (0.95)	4.53 (0.79)
2 ⁷	9.53 (1.77)	5.41 (1.41)	3.95 (0.28)	3.72 (0.52)	4.38 (1.15)
2 ⁸	8.12 (1.18)	3.96 (0.66)	4.07 (0.99)	3.74 (0.89)	3.57 (0.86)
2 ⁹	9.27 (1.64)	4.15 (0.77)	3.71 (0.76)	4.09 (0.90)	3.51 (1.05)
2 ¹⁰	8.34 (1.23)	4.82 (1.45)	4.26 (0.42)	3.58 (0.96)	4.01 (0.84)
2 ¹¹	8.14 (0.91)	4.95 (0.59)	3.70 (1.20)	3.71 (0.96)	3.36 (0.98)

TABLE S13
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON 300 SPEAKERS.

#mix \ #EM iter.	2	5	10	20	30
2 ¹	18.79 (2.32)	12.48 (0.81)	12.45 (0.81)	12.76 (0.69)	12.75 (0.97)
2 ²	18.87 (2.59)	12.34 (0.97)	11.77 (1.12)	11.63 (0.64)	11.45 (0.47)
2 ³	12.87 (1.56)	10.05 (1.64)	9.49 (1.66)	10.00 (1.65)	10.29 (2.47)
2 ⁴	11.96 (1.54)	8.06 (0.68)	7.07 (0.73)	6.96 (0.57)	6.83 (0.58)
2 ⁵	10.74 (0.77)	6.87 (0.47)	5.82 (0.69)	5.33 (0.50)	5.26 (0.59)
2 ⁶	10.19 (1.11)	5.46 (0.63)	4.73 (0.43)	4.59 (0.66)	4.57 (0.44)
2 ⁷	9.60 (0.83)	4.65 (0.54)	4.42 (0.48)	4.07 (0.52)	4.38 (0.48)
2 ⁸	9.36 (1.07)	4.66 (0.35)	3.99 (0.31)	3.73 (0.30)	3.46 (0.49)
2 ⁹	8.77 (0.65)	4.28 (0.52)	3.71 (0.58)	3.37 (0.37)	3.45 (0.41)
2 ¹⁰	8.23 (0.66)	4.54 (0.43)	3.79 (0.38)	3.46 (0.31)	3.43 (0.40)
2 ¹¹	8.33 (0.74)	4.48 (0.63)	3.90 (0.59)	3.56 (0.48)	3.41 (0.33)

TABLE S14
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE GMM-UBM WITH THE COSINE SIMILARITY SCORING METHOD ON ALL 620 SPEAKERS.

#mix \ #EM iter.	2	5	10	20	30
2 ¹	19.68 (2.79)	12.73 (0.11)	12.85 (0.00)	12.85 (0.00)	12.85 (0.00)
2 ²	16.37 (1.77)	12.05 (0.46)	12.30 (0.67)	12.15 (0.56)	12.39 (0.80)
2 ³	13.69 (1.25)	10.12 (2.20)	9.22 (0.68)	9.44 (1.85)	10.10 (2.11)
2 ⁴	11.57 (0.87)	7.93 (0.66)	7.66 (0.85)	7.00 (0.46)	6.71 (0.37)
2 ⁵	10.53 (0.66)	6.43 (0.46)	5.89 (0.24)	5.61 (0.55)	5.36 (0.37)
2 ⁶	9.63 (0.50)	5.62 (0.31)	5.12 (0.35)	4.45 (0.19)	4.38 (0.25)
2 ⁷	9.10 (0.51)	4.92 (0.27)	4.22 (0.22)	4.06 (0.20)	4.00 (0.25)
2 ⁸	8.85 (0.61)	4.27 (0.33)	3.91 (0.22)	3.78 (0.13)	3.75 (0.23)
2 ⁹	8.55 (0.48)	4.34 (0.26)	3.76 (0.32)	3.47 (0.18)	3.38 (0.24)
2 ¹⁰	8.36 (0.37)	4.28 (0.35)	3.91 (0.27)	3.40 (0.19)	3.45 (0.31)
2 ¹¹	8.56 (0.47)	4.62 (0.37)	3.96 (0.47)	3.52 (0.26)	3.35 (0.24)

F. Supplementary results of the UBSC with the cosine similarity scoring method in the Male experiment

TABLE S15

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 10 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.94 (11.61)	37.22 (7.59)	43.11 (8.85)	37.17 (8.07)
2^2	39.89 (7.85)	33.56 (7.98)	30.06 (8.90)	32.00 (5.61)
2^3	35.33 (7.07)	35.78 (6.51)	25.33 (7.32)	23.33 (4.91)
2^4	29.61 (7.18)	23.50 (11.49)	20.17 (6.81)	18.89 (6.42)
2^5	23.61 (6.73)	17.44 (7.05)	19.17 (4.48)	14.50 (4.65)
2^6	22.00 (8.97)	13.56 (4.74)	11.44 (3.81)	14.22 (5.36)
2^7	14.61 (7.51)	10.00 (3.70)	11.61 (6.90)	10.83 (5.28)
2^8	11.17 (5.88)	6.06 (4.27)	8.00 (5.51)	7.50 (5.43)
2^9	7.50 (4.24)	7.06 (3.91)	5.72 (3.95)	4.28 (3.41)
2^{10}	10.50 (6.30)	6.22 (5.33)	3.61 (3.64)	3.83 (4.10)
2^{11}	5.67 (4.22)	5.11 (4.82)	5.00 (5.62)	6.89 (3.81)
2^{12}	8.22 (4.53)	4.67 (3.84)	3.72 (4.50)	2.89 (3.16)
2^{13}	4.11 (3.70)	4.56 (4.17)	4.83 (4.16)	2.67 (2.97)
2^{14}	6.83 (5.34)	6.00 (4.26)	5.50 (6.07)	4.56 (3.50)

TABLE S16

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 30 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	46.57 (5.96)	40.54 (3.56)	38.87 (5.88)	33.93 (7.20)
2^2	44.61 (4.32)	35.20 (5.27)	33.30 (4.26)	30.93 (6.18)
2^3	37.90 (5.48)	31.64 (5.79)	30.30 (5.83)	28.41 (3.18)
2^4	29.09 (4.67)	25.11 (5.69)	22.22 (3.98)	23.79 (4.88)
2^5	26.29 (4.92)	22.55 (2.78)	17.03 (3.35)	18.67 (4.15)
2^6	20.76 (2.69)	16.40 (4.63)	16.43 (2.76)	11.87 (1.42)
2^7	16.99 (2.02)	14.09 (2.21)	10.67 (2.66)	12.28 (2.23)
2^8	16.11 (2.75)	9.55 (2.77)	8.21 (1.25)	8.88 (2.31)
2^9	11.69 (2.32)	8.60 (2.82)	8.01 (2.77)	6.68 (2.23)
2^{10}	8.66 (2.89)	5.02 (2.70)	6.43 (1.71)	5.98 (2.01)
2^{11}	8.11 (2.77)	6.13 (1.37)	3.88 (1.17)	3.41 (1.50)
2^{12}	6.83 (2.17)	3.96 (1.27)	2.94 (0.73)	3.32 (1.75)
2^{13}	7.05 (1.97)	4.68 (2.23)	3.73 (2.07)	3.44 (0.87)
2^{14}	6.32 (2.30)	4.01 (1.32)	3.80 (1.85)	3.40 (1.04)
2^{15}	6.70 (2.63)	5.06 (2.25)	4.49 (2.03)	4.88 (2.53)
2^{16}	9.80 (2.91)	7.05 (2.34)	5.71 (2.05)	6.25 (1.68)

TABLE S17

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 100 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	44.21 (5.01)	41.56 (3.37)	38.77 (3.69)	38.45 (2.01)
2^2	41.33 (5.09)	35.85 (2.86)	33.73 (3.12)	31.69 (3.05)
2^3	37.14 (4.31)	31.94 (3.51)	28.61 (1.88)	28.27 (1.69)
2^4	32.45 (3.13)	26.99 (3.00)	24.75 (2.70)	22.06 (1.62)
2^5	24.89 (3.24)	22.98 (1.39)	21.45 (1.86)	19.02 (2.25)
2^6	23.01 (1.83)	17.68 (1.06)	16.87 (2.65)	15.75 (1.10)
2^7	18.63 (1.94)	15.95 (2.21)	12.67 (1.92)	12.70 (1.60)
2^8	14.23 (1.66)	12.12 (1.37)	10.21 (0.99)	10.51 (1.61)
2^9	12.37 (1.87)	10.90 (1.96)	8.56 (1.23)	8.59 (1.32)
2^{10}	11.10 (1.73)	8.39 (0.85)	7.45 (1.42)	7.30 (1.42)
2^{11}	9.47 (2.44)	7.25 (1.02)	5.77 (1.13)	6.01 (1.09)
2^{12}	7.96 (1.54)	5.47 (1.69)	4.68 (0.72)	4.50 (1.16)
2^{13}	8.17 (1.08)	4.67 (1.42)	4.02 (0.37)	4.61 (1.14)
2^{14}	7.67 (1.04)	5.04 (0.94)	4.11 (0.75)	3.84 (0.81)
2^{15}	8.32 (1.60)	5.19 (1.50)	3.96 (0.73)	3.52 (1.20)
2^{16}	9.32 (2.07)	5.23 (1.32)	4.04 (1.07)	3.59 (0.61)
2^{17}	9.03 (1.38)	6.09 (0.90)	5.90 (1.34)	4.98 (1.06)

TABLE S18

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 300 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	45.25 (3.88)	44.76 (3.17)	38.86 (3.32)	36.81 (2.13)
2^2	38.69 (4.83)	35.35 (4.17)	33.53 (1.83)	32.24 (1.61)
2^3	35.73 (3.39)	30.90 (2.46)	29.14 (1.64)	28.20 (1.22)
2^4	30.33 (2.74)	27.01 (1.88)	24.73 (0.71)	23.23 (0.80)
2^5	25.74 (2.10)	22.44 (1.14)	20.67 (1.41)	19.41 (0.38)
2^6	21.28 (1.76)	18.79 (1.25)	16.64 (0.53)	16.09 (0.82)
2^7	19.29 (1.28)	15.09 (0.72)	13.75 (0.72)	13.62 (0.81)
2^8	15.24 (1.02)	12.11 (0.57)	11.29 (0.54)	10.68 (0.68)
2^9	13.17 (0.73)	10.54 (0.99)	9.60 (0.35)	9.33 (0.55)
2^{10}	11.53 (0.61)	9.25 (0.73)	8.12 (0.46)	7.25 (0.35)
2^{11}	9.85 (0.66)	8.07 (0.80)	6.88 (0.54)	6.11 (0.61)
2^{12}	9.03 (0.75)	6.65 (0.67)	5.74 (0.35)	5.50 (0.40)
2^{13}	8.98 (0.90)	5.81 (0.74)	4.85 (0.69)	4.78 (0.27)
2^{14}	8.34 (0.74)	5.61 (0.50)	4.76 (0.46)	4.16 (0.39)
2^{15}	8.71 (0.90)	5.26 (0.50)	3.90 (0.62)	3.79 (0.31)
2^{16}	8.54 (0.81)	5.70 (0.46)	3.93 (0.30)	3.70 (0.34)
2^{17}	10.60 (1.15)	5.77 (0.69)	4.45 (0.46)	4.02 (0.52)

TABLE S19

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON ALL 438 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.02 (2.60)	42.53 (5.14)	38.38 (3.56)	36.63 (1.48)
2^2	39.21 (2.95)	37.16 (2.79)	32.61 (2.13)	32.50 (1.34)
2^3	34.46 (1.82)	32.18 (1.96)	29.17 (1.53)	28.06 (0.86)
2^4	31.04 (1.85)	26.37 (1.00)	24.36 (1.21)	23.26 (0.69)
2^5	26.20 (1.97)	23.12 (1.16)	20.41 (0.87)	19.47 (0.52)
2^6	23.66 (1.43)	18.66 (0.75)	17.03 (0.63)	16.72 (0.62)
2^7	19.27 (1.18)	15.50 (0.64)	13.93 (0.60)	13.90 (0.32)
2^8	15.65 (0.68)	12.64 (0.34)	11.25 (0.29)	10.80 (0.24)
2^9	13.62 (0.82)	10.59 (0.35)	9.43 (0.41)	9.00 (0.30)
2^{10}	11.60 (0.51)	8.82 (0.49)	8.01 (0.45)	7.60 (0.26)
2^{11}	10.61 (0.46)	7.93 (0.46)	6.73 (0.32)	6.24 (0.21)
2^{12}	9.52 (0.69)	6.94 (0.37)	5.82 (0.31)	5.59 (0.21)
2^{13}	9.40 (0.79)	6.10 (0.35)	5.17 (0.25)	4.88 (0.20)
2^{14}	8.61 (0.64)	5.72 (0.35)	4.63 (0.13)	4.38 (0.17)
2^{15}	9.00 (0.59)	5.62 (0.45)	4.40 (0.25)	3.99 (0.27)
2^{16}	9.78 (0.49)	5.43 (0.31)	4.21 (0.26)	3.79 (0.28)
2^{17}	10.84 (0.54)	6.53 (0.66)	4.51 (0.25)	4.18 (0.22)

G. Supplementary results of the UBSC with the cosine similarity scoring method in the Female experiment

TABLE S20

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 10 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	45.56 (7.50)	42.61 (8.94)	41.06 (7.65)	36.11 (12.86)
2^2	46.06 (5.95)	37.17 (6.17)	31.89 (9.54)	29.61 (6.49)
2^3	37.67 (7.83)	33.56 (6.18)	32.22 (8.00)	29.89 (6.28)
2^4	34.17 (7.80)	27.72 (9.06)	24.89 (7.48)	21.94 (5.39)
2^5	25.56 (9.60)	17.89 (9.65)	20.56 (8.41)	22.17 (3.94)
2^6	20.78 (10.96)	14.33 (4.65)	18.11 (5.83)	19.56 (7.54)
2^7	15.28 (6.60)	11.78 (5.18)	12.00 (6.30)	10.72 (4.63)
2^8	13.61 (4.34)	10.50 (5.75)	10.61 (4.22)	9.83 (3.05)
2^9	11.56 (5.76)	7.94 (5.87)	8.22 (2.95)	7.06 (3.59)
2^{10}	11.50 (5.81)	8.78 (5.10)	4.89 (3.66)	5.61 (3.61)
2^{11}	8.61 (3.27)	6.83 (3.00)	6.00 (4.53)	5.50 (4.49)
2^{12}	8.28 (2.61)	4.06 (3.67)	4.44 (4.57)	6.28 (5.08)
2^{13}	5.61 (3.70)	5.56 (3.49)	5.56 (4.00)	3.72 (3.11)
2^{14}	7.83 (2.56)	6.94 (4.26)	4.33 (3.74)	5.28 (3.33)

TABLE S21

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 30 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	46.03 (3.15)	44.27 (3.67)	41.95 (4.06)	35.02 (6.65)
2^2	39.16 (5.53)	34.55 (4.32)	31.45 (4.36)	32.68 (5.39)
2^3	36.82 (5.77)	31.53 (3.17)	29.48 (4.06)	26.13 (3.02)
2^4	32.16 (4.49)	29.07 (4.52)	25.64 (5.49)	26.71 (4.07)
2^5	26.60 (3.90)	23.67 (3.70)	22.76 (5.12)	21.13 (2.98)
2^6	22.50 (3.52)	18.47 (3.52)	16.03 (2.46)	16.41 (3.63)
2^7	18.92 (3.00)	14.79 (3.10)	14.37 (1.67)	13.87 (3.38)
2^8	14.72 (1.53)	12.24 (2.39)	9.89 (2.47)	11.17 (2.15)
2^9	13.52 (2.44)	9.91 (3.79)	9.61 (1.05)	8.16 (2.92)
2^{10}	10.19 (2.84)	10.01 (2.46)	7.21 (2.85)	7.23 (2.86)
2^{11}	8.79 (2.53)	6.93 (2.35)	6.99 (2.22)	6.11 (2.25)
2^{12}	9.82 (3.82)	6.74 (2.14)	5.29 (1.49)	5.80 (1.85)
2^{13}	8.52 (2.64)	6.06 (2.33)	5.47 (2.05)	4.86 (1.79)
2^{14}	8.76 (3.65)	5.18 (2.05)	4.07 (2.01)	4.62 (1.35)
2^{15}	8.20 (2.94)	6.59 (1.90)	4.52 (2.11)	4.45 (1.33)
2^{16}	9.83 (3.59)	8.19 (1.83)	7.53 (3.49)	7.36 (3.25)

TABLE S22

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 100 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	46.10 (4.60)	43.09 (2.85)	38.87 (3.33)	36.02 (3.30)
2^2	39.98 (3.15)	36.69 (2.33)	34.14 (2.37)	32.23 (2.49)
2^3	37.45 (3.67)	33.23 (1.65)	30.31 (3.31)	30.20 (1.55)
2^4	31.70 (2.31)	28.80 (3.02)	27.30 (2.87)	25.70 (1.57)
2^5	28.15 (1.43)	23.15 (1.92)	22.26 (1.67)	20.98 (2.54)
2^6	23.16 (1.71)	19.47 (0.94)	18.53 (1.96)	17.29 (1.53)
2^7	19.90 (2.02)	16.05 (1.84)	15.17 (1.26)	15.14 (0.88)
2^8	16.24 (1.11)	12.76 (1.23)	12.17 (1.16)	11.85 (1.11)
2^9	15.26 (2.10)	11.97 (1.20)	10.72 (1.32)	10.40 (1.69)
2^{10}	13.31 (1.96)	10.17 (1.51)	8.96 (1.50)	8.91 (1.15)
2^{11}	11.82 (1.58)	7.76 (1.04)	7.77 (1.17)	7.35 (0.83)
2^{12}	10.07 (1.22)	7.37 (0.77)	6.72 (0.67)	5.49 (0.74)
2^{13}	9.68 (0.77)	6.76 (0.71)	5.21 (0.74)	5.08 (1.14)
2^{14}	9.85 (1.08)	6.17 (1.32)	5.25 (0.41)	4.59 (0.85)
2^{15}	9.92 (1.55)	6.56 (0.76)	4.58 (0.93)	4.35 (0.68)
2^{16}	9.73 (2.15)	6.82 (1.56)	4.41 (0.76)	4.65 (0.75)
2^{17}	11.88 (1.54)	8.12 (1.06)	5.92 (0.89)	5.81 (0.80)

TABLE S23

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON ALL 168 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	46.27 (2.86)	40.96 (3.91)	40.24 (2.79)	38.20 (2.43)
2^2	41.41 (5.43)	36.83 (2.91)	33.59 (2.36)	31.66 (1.37)
2^3	36.46 (2.74)	33.34 (2.55)	30.22 (0.87)	29.86 (1.42)
2^4	33.39 (2.24)	29.05 (1.88)	27.10 (1.55)	26.73 (0.93)
2^5	27.38 (2.12)	24.11 (2.48)	22.33 (1.17)	22.18 (0.63)
2^6	23.36 (1.80)	20.80 (1.30)	18.65 (0.70)	18.36 (0.80)
2^7	19.94 (1.55)	16.27 (0.81)	15.15 (0.42)	14.89 (0.54)
2^8	17.79 (0.79)	14.31 (0.78)	12.60 (0.70)	12.63 (0.51)
2^9	15.05 (0.94)	12.23 (0.71)	10.45 (0.48)	10.25 (0.53)
2^{10}	13.52 (0.88)	10.61 (0.72)	9.33 (0.51)	8.83 (0.50)
2^{11}	12.23 (0.64)	9.12 (0.92)	8.20 (0.39)	8.00 (0.35)
2^{12}	10.55 (0.93)	7.93 (0.36)	6.85 (0.50)	6.46 (0.28)
2^{13}	9.93 (0.83)	7.44 (0.49)	6.06 (0.37)	5.83 (0.45)
2^{14}	10.38 (0.82)	6.42 (0.56)	5.35 (0.48)	4.89 (0.43)
2^{15}	10.34 (0.81)	6.36 (0.79)	5.06 (0.50)	4.48 (0.27)
2^{16}	11.66 (1.25)	6.47 (0.70)	4.94 (0.40)	3.99 (0.23)
2^{17}	12.72 (1.46)	7.32 (0.88)	5.32 (0.45)	4.60 (0.28)

H. Supplementary results of the UBSC with the cosine similarity scoring method in the Male+Female experiment

TABLE S24
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 10 SPEAKERS.

$k \backslash V$	1	3	10	30
2 ¹	46.72 (6.54)	39.83 (8.96)	29.67 (9.16)	27.33 (7.63)
2 ²	42.33 (6.12)	29.22 (5.01)	26.39 (8.20)	20.78 (5.74)
2 ³	31.83 (8.04)	27.56 (4.89)	21.67 (8.01)	20.89 (3.70)
2 ⁴	29.83 (8.85)	19.28 (7.35)	19.44 (7.00)	15.11 (5.51)
2 ⁵	20.94 (6.86)	14.89 (5.12)	13.28 (4.94)	11.61 (4.36)
2 ⁶	17.50 (7.43)	14.78 (4.37)	10.11 (4.50)	9.67 (4.94)
2 ⁷	9.78 (3.79)	9.00 (2.38)	8.44 (3.54)	7.56 (5.71)
2 ⁸	9.50 (4.03)	6.22 (3.68)	5.83 (4.60)	8.11 (5.46)
2 ⁹	7.17 (5.36)	6.22 (3.95)	4.06 (4.17)	4.50 (3.60)
2 ¹⁰	5.61 (3.11)	3.94 (3.28)	2.22 (3.01)	4.72 (3.91)
2 ¹¹	2.89 (2.35)	3.28 (2.79)	2.39 (2.87)	1.83 (1.87)
2 ¹²	4.94 (4.37)	3.89 (3.26)	4.56 (4.79)	2.44 (3.35)
2 ¹³	5.67 (5.02)	2.50 (3.16)	2.33 (3.06)	4.67 (3.76)
2 ¹⁴	3.33 (2.21)	5.50 (3.82)	5.61 (4.08)	3.83 (3.66)

TABLE S25
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 30 SPEAKERS.

$k \backslash V$	1	3	10	30
2 ¹	46.07 (4.56)	37.25 (3.94)	37.91 (6.97)	30.86 (3.61)
2 ²	37.86 (8.30)	33.88 (8.22)	24.85 (4.49)	23.67 (4.38)
2 ³	31.86 (4.95)	26.68 (3.27)	22.35 (4.02)	21.85 (2.51)
2 ⁴	25.52 (4.31)	21.55 (5.37)	18.30 (4.61)	16.81 (3.28)
2 ⁵	19.59 (5.07)	17.53 (4.20)	14.84 (1.82)	14.92 (3.82)
2 ⁶	17.82 (3.73)	14.11 (3.22)	12.60 (1.85)	10.99 (2.19)
2 ⁷	13.10 (2.81)	10.03 (1.42)	9.43 (2.44)	9.83 (2.61)
2 ⁸	12.08 (2.66)	9.44 (2.65)	6.79 (2.93)	8.05 (2.72)
2 ⁹	9.00 (2.91)	7.01 (2.21)	6.98 (1.87)	5.24 (1.91)
2 ¹⁰	6.70 (1.63)	5.79 (1.92)	4.79 (2.37)	5.26 (1.62)
2 ¹¹	6.28 (1.57)	5.53 (2.55)	4.29 (1.92)	3.90 (1.74)
2 ¹²	5.41 (1.53)	3.94 (1.73)	3.59 (1.20)	3.88 (2.04)
2 ¹³	5.13 (1.49)	3.71 (1.31)	2.95 (1.05)	3.01 (1.61)
2 ¹⁴	4.01 (1.52)	2.34 (1.14)	3.10 (1.30)	2.82 (0.80)
2 ¹⁵	5.13 (2.51)	4.67 (1.83)	3.36 (1.59)	3.28 (1.06)
2 ¹⁶	7.34 (1.73)	5.38 (2.16)	6.57 (2.89)	6.94 (2.88)

TABLE S26
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 100 SPEAKERS.

$k \backslash V$	1	3	10	30
2 ¹	44.51 (5.24)	41.28 (6.57)	33.96 (3.40)	31.30 (5.21)
2 ²	37.02 (5.96)	31.58 (3.79)	27.15 (3.04)	27.51 (2.62)
2 ³	31.62 (3.51)	25.68 (2.49)	21.83 (1.97)	22.14 (1.52)
2 ⁴	25.72 (2.74)	22.49 (2.23)	19.82 (2.06)	17.68 (1.83)
2 ⁵	23.18 (2.52)	17.08 (1.58)	15.99 (1.74)	14.84 (1.59)
2 ⁶	17.87 (2.17)	14.60 (1.17)	13.14 (1.92)	12.94 (1.86)
2 ⁷	15.12 (1.97)	12.05 (1.31)	10.75 (1.04)	10.74 (1.50)
2 ⁸	11.95 (1.47)	10.05 (1.26)	8.72 (1.34)	7.89 (1.57)
2 ⁹	10.42 (1.57)	8.55 (1.25)	7.56 (1.54)	7.79 (1.50)
2 ¹⁰	9.42 (1.76)	6.77 (0.74)	5.83 (0.70)	5.59 (1.34)
2 ¹¹	7.71 (1.29)	5.32 (0.98)	5.73 (0.93)	4.22 (0.88)
2 ¹²	6.34 (0.88)	5.44 (0.93)	4.00 (0.91)	3.69 (1.03)
2 ¹³	6.00 (0.94)	4.98 (0.98)	3.27 (0.73)	3.24 (0.71)
2 ¹⁴	5.37 (0.86)	4.38 (0.92)	3.27 (0.71)	2.93 (0.66)
2 ¹⁵	5.60 (1.05)	4.10 (1.18)	3.23 (0.84)	2.99 (0.57)
2 ¹⁶	5.77 (1.52)	4.03 (0.90)	2.88 (0.99)	3.31 (0.70)
2 ¹⁷	7.34 (1.87)	4.40 (0.47)	4.81 (1.11)	4.28 (0.81)

TABLE S27
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON 300 SPEAKERS.

$k \backslash V$	1	3	10	30
2 ¹	44.89 (5.22)	40.27 (6.08)	34.98 (3.58)	32.23 (3.64)
2 ²	39.83 (3.84)	32.90 (3.34)	27.39 (2.14)	25.97 (1.69)
2 ³	31.93 (2.95)	25.05 (1.91)	23.33 (1.35)	22.24 (1.06)
2 ⁴	28.38 (3.00)	22.19 (1.73)	19.30 (0.88)	18.77 (0.81)
2 ⁵	21.94 (1.14)	17.84 (1.57)	16.14 (1.11)	16.18 (1.14)
2 ⁶	18.22 (1.21)	14.84 (0.84)	13.60 (0.71)	13.02 (0.78)
2 ⁷	15.52 (0.82)	12.46 (0.61)	11.22 (0.72)	10.91 (0.58)
2 ⁸	13.24 (0.65)	10.03 (0.80)	10.03 (0.50)	9.34 (0.54)
2 ⁹	10.60 (1.09)	8.93 (0.72)	8.06 (0.65)	7.24 (0.56)
2 ¹⁰	9.73 (0.61)	7.94 (0.50)	6.69 (0.50)	6.28 (0.55)
2 ¹¹	8.74 (0.85)	6.27 (0.48)	5.78 (0.66)	5.83 (0.39)
2 ¹²	7.45 (0.54)	5.84 (0.60)	5.32 (0.44)	4.71 (0.42)
2 ¹³	7.04 (0.54)	5.25 (0.51)	4.24 (0.52)	3.97 (0.37)
2 ¹⁴	6.53 (0.52)	4.77 (0.38)	4.04 (0.36)	3.73 (0.39)
2 ¹⁵	6.52 (0.74)	4.33 (0.53)	3.39 (0.44)	3.26 (0.44)
2 ¹⁶	6.61 (0.62)	4.31 (0.69)	3.49 (0.51)	3.27 (0.40)
2 ¹⁷	7.96 (0.89)	4.57 (0.38)	3.25 (0.33)	3.15 (0.32)

TABLE S28
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE COSINE SIMILARITY SCORING METHOD ON ALL 620 SPEAKERS.

$k \backslash V$	1	3	10	30
2 ¹	44.29 (6.03)	40.40 (5.63)	33.24 (2.17)	32.79 (2.95)
2 ²	37.57 (4.88)	33.76 (3.66)	29.58 (1.63)	26.61 (1.20)
2 ³	31.21 (2.59)	26.48 (1.91)	23.47 (1.24)	22.65 (0.99)
2 ⁴	26.73 (1.82)	22.33 (1.41)	19.98 (0.76)	18.44 (0.37)
2 ⁵	21.68 (1.03)	18.12 (0.91)	16.39 (0.69)	15.97 (0.21)
2 ⁶	17.95 (1.50)	14.77 (0.56)	13.66 (0.41)	13.42 (0.25)
2 ⁷	15.08 (0.80)	12.24 (0.60)	11.53 (0.50)	11.13 (0.21)
2 ⁸	12.61 (0.48)	10.42 (0.32)	9.53 (0.28)	9.23 (0.25)
2 ⁹	11.30 (0.59)	9.06 (0.41)	8.10 (0.22)	7.80 (0.19)
2 ¹⁰	9.95 (0.39)	7.80 (0.23)	7.05 (0.21)	6.71 (0.25)
2 ¹¹	8.64 (0.25)	7.13 (0.21)	6.16 (0.18)	6.04 (0.12)
2 ¹²	8.20 (0.22)	6.26 (0.36)	5.42 (0.18)	5.13 (0.16)
2 ¹³	7.68 (0.31)	5.53 (0.20)	4.76 (0.11)	4.46 (0.19)
2 ¹⁴	7.29 (0.43)	5.02 (0.34)	4.20 (0.13)	4.05 (0.12)
2 ¹⁵	6.99 (0.42)	4.78 (0.27)	3.75 (0.15)	3.57 (0.13)
2 ¹⁶	7.47 (0.42)	4.43 (0.19)	3.55 (0.15)	3.22 (0.17)
2 ¹⁷	8.19 (0.60)	4.71 (0.40)	3.52 (0.21)	3.16 (0.16)

I. Supplementary results of the UBSC with the inner product similarity scoring method in the Male experiment

TABLE S29

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 10 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	50.06 (7.94)	46.28 (5.65)	43.89 (3.99)	44.28 (6.40)
2^2	43.78 (5.49)	40.67 (8.98)	34.56 (7.01)	35.22 (4.87)
2^3	40.06 (4.09)	36.56 (9.24)	29.50 (6.52)	27.06 (7.22)
2^4	35.33 (7.60)	26.78 (5.88)	21.28 (4.99)	21.67 (7.12)
2^5	26.94 (7.69)	20.94 (8.10)	18.22 (4.05)	16.94 (4.56)
2^6	23.00 (9.16)	12.67 (3.38)	11.50 (4.70)	12.33 (4.52)
2^7	12.83 (5.79)	8.22 (2.03)	10.22 (7.31)	6.67 (3.30)
2^8	11.67 (2.68)	5.72 (4.70)	4.89 (4.27)	4.56 (4.16)
2^9	6.06 (3.33)	4.94 (4.23)	2.11 (1.45)	3.94 (3.57)
2^{10}	8.00 (5.74)	3.61 (3.81)	1.78 (1.79)	2.44 (2.86)
2^{11}	4.00 (3.85)	2.28 (3.00)	1.39 (2.20)	3.28 (1.88)
2^{12}	6.28 (4.02)	2.61 (2.28)	0.72 (1.02)	1.33 (1.29)
2^{13}	4.06 (3.85)	2.83 (2.80)	2.39 (2.91)	2.17 (2.24)
2^{14}	5.06 (5.62)	4.56 (3.93)	4.67 (5.36)	3.28 (2.83)

TABLE S30

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 30 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	46.16 (2.91)	44.74 (4.23)	43.37 (5.03)	40.93 (3.94)
2^2	44.93 (2.37)	41.49 (3.08)	37.74 (3.63)	33.74 (2.40)
2^3	40.42 (4.40)	37.55 (5.03)	32.00 (5.02)	27.39 (4.40)
2^4	34.99 (4.14)	30.84 (4.80)	25.08 (4.47)	24.50 (4.27)
2^5	28.75 (5.17)	22.66 (3.36)	19.28 (2.42)	17.36 (4.06)
2^6	21.80 (2.32)	17.45 (3.91)	14.22 (3.15)	13.13 (3.11)
2^7	17.60 (1.99)	12.99 (2.31)	9.93 (2.51)	9.81 (1.82)
2^8	15.16 (2.60)	8.93 (2.25)	8.23 (1.71)	6.87 (1.55)
2^9	9.71 (1.40)	7.91 (1.54)	6.01 (1.75)	5.92 (2.13)
2^{10}	8.31 (2.69)	4.51 (2.04)	4.89 (1.63)	4.06 (1.36)
2^{11}	7.51 (2.56)	5.04 (1.63)	3.08 (0.56)	2.83 (0.76)
2^{12}	6.11 (1.25)	2.90 (1.06)	2.89 (1.10)	2.26 (1.14)
2^{13}	5.75 (2.07)	4.14 (1.33)	2.52 (1.53)	3.01 (1.52)
2^{14}	5.41 (2.19)	3.58 (1.39)	3.35 (2.04)	2.28 (1.18)
2^{15}	6.91 (1.84)	4.49 (2.32)	3.01 (1.22)	3.70 (1.44)
2^{16}	9.37 (3.10)	7.05 (3.16)	5.19 (1.36)	5.32 (1.65)

TABLE S31

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 100 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.42 (2.60)	46.65 (1.29)	45.13 (2.61)	42.27 (2.71)
2^2	43.91 (4.28)	41.10 (2.87)	37.45 (3.52)	35.63 (2.28)
2^3	41.04 (2.74)	36.10 (3.54)	31.12 (2.74)	28.82 (2.49)
2^4	37.17 (2.85)	30.36 (3.35)	27.21 (2.38)	23.38 (2.04)
2^5	27.98 (3.03)	24.66 (1.69)	21.41 (1.10)	19.86 (1.65)
2^6	24.77 (2.90)	19.06 (1.22)	16.00 (1.95)	14.76 (1.64)
2^7	19.77 (2.55)	14.67 (2.16)	11.88 (1.63)	10.46 (1.22)
2^8	13.57 (0.95)	11.15 (1.82)	8.98 (0.90)	8.09 (1.05)
2^9	11.25 (0.91)	9.19 (1.21)	7.31 (1.35)	6.76 (0.94)
2^{10}	9.69 (1.71)	7.21 (0.81)	5.94 (1.19)	5.75 (1.43)
2^{11}	8.06 (1.62)	5.81 (1.07)	4.51 (0.89)	4.93 (1.08)
2^{12}	7.00 (1.57)	4.96 (1.19)	4.09 (1.06)	4.19 (0.89)
2^{13}	7.45 (1.14)	4.21 (0.99)	3.63 (0.63)	3.40 (0.75)
2^{14}	7.53 (1.38)	4.37 (1.02)	3.44 (0.94)	3.43 (0.72)
2^{15}	7.36 (1.55)	4.41 (0.81)	3.48 (0.67)	3.09 (0.81)
2^{16}	8.56 (2.33)	4.64 (1.47)	3.55 (0.94)	3.16 (0.79)
2^{17}	8.55 (1.45)	5.73 (0.97)	5.60 (1.34)	4.73 (1.01)

TABLE S32

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 300 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.14 (2.76)	45.54 (3.07)	42.80 (2.55)	38.96 (3.94)
2^2	44.12 (3.50)	38.93 (2.99)	33.23 (3.23)	29.38 (2.23)
2^3	38.52 (3.72)	32.38 (2.38)	26.55 (2.27)	24.62 (1.77)
2^4	35.12 (3.83)	26.19 (2.20)	21.98 (1.30)	20.31 (0.51)
2^5	26.11 (1.81)	20.26 (1.95)	18.00 (1.00)	16.61 (0.77)
2^6	20.93 (1.75)	16.13 (1.16)	14.23 (0.90)	13.56 (0.66)
2^7	16.10 (1.13)	12.44 (0.71)	11.62 (0.52)	10.64 (0.53)
2^8	13.47 (0.82)	10.12 (0.81)	9.05 (0.54)	8.61 (0.40)
2^9	10.40 (0.72)	8.46 (0.70)	7.55 (0.34)	6.96 (0.45)
2^{10}	9.33 (0.46)	7.15 (0.50)	6.10 (0.31)	5.63 (0.38)
2^{11}	8.34 (0.72)	5.86 (0.40)	5.12 (0.46)	5.13 (0.36)
2^{12}	7.10 (0.58)	5.36 (0.47)	4.73 (0.28)	4.27 (0.37)
2^{13}	6.42 (0.68)	4.69 (0.31)	3.74 (0.39)	3.50 (0.58)
2^{14}	6.27 (0.52)	4.45 (0.39)	3.35 (0.39)	3.30 (0.23)
2^{15}	5.95 (0.55)	3.91 (0.41)	3.05 (0.44)	2.84 (0.47)
2^{16}	6.66 (0.53)	3.85 (0.67)	3.29 (0.43)	2.81 (0.33)
2^{17}	7.62 (0.54)	4.28 (0.49)	2.92 (0.40)	2.75 (0.29)

TABLE S33

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON ALL 438 MALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	48.15 (1.86)	45.91 (2.75)	43.96 (2.87)	42.26 (1.24)
2^2	43.29 (2.92)	42.90 (2.08)	37.29 (2.91)	35.19 (1.96)
2^3	39.29 (2.98)	37.40 (1.96)	31.62 (1.32)	28.68 (0.43)
2^4	34.93 (2.07)	30.41 (1.86)	26.51 (1.74)	24.26 (0.69)
2^5	30.15 (2.43)	25.47 (1.64)	20.82 (1.17)	19.40 (0.83)
2^6	25.68 (1.47)	19.34 (0.68)	16.50 (0.72)	15.35 (0.54)
2^7	19.28 (1.26)	14.50 (1.03)	12.34 (0.51)	11.75 (0.23)
2^8	15.01 (0.77)	11.62 (0.34)	9.59 (0.42)	9.03 (0.25)
2^9	12.65 (0.79)	9.22 (0.26)	7.74 (0.27)	7.36 (0.18)
2^{10}	10.25 (0.38)	7.61 (0.35)	6.57 (0.30)	6.02 (0.20)
2^{11}	9.44 (0.55)	6.61 (0.26)	5.51 (0.32)	5.17 (0.18)
2^{12}	8.72 (0.50)	5.86 (0.30)	5.05 (0.24)	4.64 (0.21)
2^{13}	8.60 (0.53)	5.23 (0.22)	4.35 (0.29)	4.18 (0.14)
2^{14}	8.03 (0.57)	5.00 (0.20)	3.87 (0.26)	3.60 (0.13)
2^{15}	8.63 (0.50)	4.93 (0.34)	3.79 (0.18)	3.29 (0.22)
2^{16}	9.18 (0.26)	5.01 (0.34)	3.68 (0.28)	3.27 (0.21)
2^{17}	10.40 (0.69)	5.95 (0.44)	4.11 (0.29)	3.60 (0.16)

J. Supplementary results of the UBSC with the inner product similarity scoring method in the Female experiment

TABLE S34
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 10 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	48.89 (4.68)	47.83 (3.54)	45.94 (6.79)	42.67 (7.62)
2^2	44.56 (4.43)	40.33 (6.46)	38.67 (7.49)	37.94 (6.25)
2^3	47.39 (8.06)	37.61 (5.10)	37.11 (6.51)	31.22 (6.78)
2^4	38.11 (6.18)	30.44 (8.86)	27.83 (7.75)	23.50 (5.02)
2^5	31.28 (8.30)	20.00 (6.07)	19.67 (6.04)	21.28 (4.12)
2^6	24.44 (5.56)	15.22 (5.34)	15.61 (4.80)	15.17 (6.98)
2^7	16.44 (6.81)	10.50 (2.79)	8.61 (2.36)	9.50 (3.27)
2^8	11.72 (3.47)	7.89 (4.22)	8.22 (4.13)	10.28 (4.37)
2^9	8.78 (4.84)	6.78 (4.52)	6.44 (4.03)	7.06 (5.53)
2^{10}	8.72 (5.15)	4.50 (3.72)	3.06 (3.17)	5.28 (5.56)
2^{11}	6.89 (5.08)	4.06 (4.28)	4.06 (3.53)	3.78 (3.52)
2^{12}	6.72 (3.41)	3.11 (3.92)	3.94 (4.46)	3.33 (3.76)
2^{13}	4.56 (4.15)	3.56 (1.93)	5.44 (4.02)	1.83 (1.53)
2^{14}	6.94 (2.64)	6.11 (4.06)	3.83 (3.98)	3.89 (2.96)

TABLE S35
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 30 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	48.67 (2.00)	47.89 (4.22)	46.58 (2.20)	43.28 (2.89)
2^2	44.80 (5.08)	41.78 (4.80)	36.70 (4.60)	38.53 (3.93)
2^3	39.70 (2.94)	36.83 (4.04)	34.17 (3.22)	28.41 (3.40)
2^4	35.29 (4.59)	32.98 (2.42)	27.49 (4.04)	29.17 (4.35)
2^5	29.67 (4.69)	25.72 (3.70)	21.56 (3.74)	20.33 (2.07)
2^6	23.49 (3.82)	19.36 (3.55)	16.67 (1.78)	16.81 (1.73)
2^7	19.44 (3.16)	15.37 (2.26)	12.54 (2.47)	13.61 (3.96)
2^8	14.48 (3.25)	11.63 (3.03)	9.42 (2.12)	9.95 (2.08)
2^9	12.53 (2.09)	8.56 (2.72)	8.39 (1.72)	6.67 (2.73)
2^{10}	9.26 (2.56)	7.72 (2.41)	5.40 (1.75)	5.97 (2.05)
2^{11}	8.10 (1.90)	5.42 (1.93)	4.78 (1.82)	4.40 (1.49)
2^{12}	7.74 (3.38)	5.06 (2.39)	4.11 (2.01)	4.03 (1.39)
2^{13}	6.34 (1.67)	4.80 (1.73)	4.23 (1.78)	4.09 (1.89)
2^{14}	6.98 (2.00)	4.52 (1.85)	3.49 (1.77)	3.32 (1.61)
2^{15}	7.49 (2.81)	5.19 (1.53)	3.83 (1.14)	3.68 (0.74)
2^{16}	8.76 (3.39)	6.93 (2.43)	6.55 (2.42)	6.52 (3.89)

TABLE S36
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 100 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	46.27 (2.63)	46.18 (2.06)	45.58 (2.02)	43.58 (2.15)
2^2	44.77 (3.08)	42.25 (2.58)	40.68 (1.97)	36.94 (3.34)
2^3	42.36 (3.30)	38.89 (3.08)	34.76 (1.48)	32.26 (1.68)
2^4	37.23 (2.61)	32.35 (3.59)	29.67 (2.55)	25.74 (1.24)
2^5	32.88 (3.34)	26.71 (2.80)	23.33 (1.87)	21.83 (1.43)
2^6	26.52 (2.05)	20.96 (2.34)	18.49 (1.50)	16.12 (1.02)
2^7	20.76 (2.10)	16.44 (1.57)	12.93 (0.49)	12.77 (0.59)
2^8	16.43 (1.84)	11.85 (1.36)	10.02 (1.09)	9.30 (0.71)
2^9	14.73 (1.06)	10.00 (1.47)	9.31 (1.05)	8.42 (0.95)
2^{10}	12.16 (1.80)	8.87 (0.78)	7.41 (1.22)	7.26 (1.05)
2^{11}	9.98 (1.43)	6.85 (0.83)	6.15 (1.82)	6.27 (0.71)
2^{12}	8.95 (1.08)	6.61 (0.52)	5.73 (1.25)	4.98 (0.62)
2^{13}	8.40 (0.92)	6.02 (0.87)	5.11 (1.17)	4.62 (0.85)
2^{14}	9.08 (1.08)	5.59 (1.27)	4.63 (0.92)	3.86 (0.55)
2^{15}	8.99 (1.63)	5.61 (1.10)	3.84 (0.56)	3.77 (0.43)
2^{16}	9.19 (2.09)	6.18 (1.27)	4.07 (0.81)	3.83 (0.83)
2^{17}	11.36 (1.15)	7.21 (1.24)	5.84 (1.08)	5.37 (0.73)

TABLE S37
DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON ALL 168 FEMALE SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.98 (1.96)	47.01 (3.45)	45.78 (2.40)	44.47 (2.14)
2^2	45.06 (3.70)	42.71 (2.75)	40.57 (2.47)	37.76 (2.24)
2^3	41.49 (3.05)	39.73 (2.97)	33.35 (1.97)	32.71 (1.64)
2^4	38.27 (2.62)	32.16 (2.63)	29.11 (2.10)	26.97 (0.88)
2^5	32.12 (1.78)	26.88 (1.62)	22.70 (1.62)	21.81 (0.94)
2^6	26.09 (1.68)	21.01 (2.15)	17.82 (0.82)	16.66 (0.93)
2^7	21.19 (2.35)	16.14 (0.55)	13.96 (0.61)	13.11 (0.58)
2^8	16.87 (1.16)	12.95 (0.75)	11.06 (0.41)	10.07 (0.45)
2^9	13.77 (0.70)	10.38 (0.66)	9.24 (0.80)	8.35 (0.23)
2^{10}	11.91 (0.88)	8.97 (0.62)	7.75 (0.50)	7.36 (0.38)
2^{11}	10.44 (0.53)	7.95 (0.46)	6.72 (0.75)	6.38 (0.38)
2^{12}	9.42 (0.79)	6.70 (0.54)	5.72 (0.45)	5.63 (0.28)
2^{13}	8.93 (1.07)	6.42 (0.48)	5.14 (0.31)	5.12 (0.40)
2^{14}	9.59 (0.64)	6.02 (0.41)	4.93 (0.38)	4.45 (0.36)
2^{15}	9.35 (0.46)	5.80 (0.50)	4.63 (0.38)	4.25 (0.17)
2^{16}	10.64 (1.52)	6.07 (0.69)	4.23 (0.39)	3.83 (0.26)
2^{17}	11.82 (1.23)	6.43 (0.81)	4.74 (0.44)	4.05 (0.32)

K. Supplementary results of the UBSC with the inner product similarity scoring method in the Male+Female experiment

TABLE S38

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 10 SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	49.28 (5.61)	42.72 (6.28)	39.67 (8.06)	36.50 (4.66)
2^2	43.78 (5.58)	34.17 (6.06)	33.61 (4.64)	26.44 (3.72)
2^3	38.67 (3.81)	31.50 (7.72)	22.56 (7.73)	25.67 (6.01)
2^4	32.78 (9.08)	23.33 (5.17)	21.00 (4.45)	16.11 (5.83)
2^5	20.78 (4.37)	16.72 (4.25)	14.61 (4.32)	12.56 (2.53)
2^6	19.56 (4.44)	13.11 (4.15)	10.72 (2.96)	8.56 (2.61)
2^7	9.89 (2.82)	8.67 (4.91)	8.28 (3.81)	6.39 (5.08)
2^8	8.33 (3.04)	5.67 (3.70)	5.17 (5.13)	4.94 (3.70)
2^9	5.00 (3.22)	6.17 (3.58)	3.06 (3.39)	3.06 (2.47)
2^{10}	4.17 (3.23)	2.17 (2.99)	1.67 (2.01)	3.72 (3.93)
2^{11}	2.50 (1.02)	1.78 (1.36)	1.11 (1.39)	2.17 (2.41)
2^{12}	4.39 (3.99)	3.28 (3.23)	3.61 (4.52)	0.89 (0.91)
2^{13}	4.94 (4.43)	1.28 (1.78)	0.89 (1.55)	3.17 (3.22)
2^{14}	2.89 (2.45)	4.33 (3.69)	4.28 (4.06)	2.44 (3.13)

TABLE S39

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 30 SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	48.08 (3.13)	44.92 (3.42)	42.72 (3.04)	38.63 (3.73)
2^2	43.10 (5.97)	40.98 (3.58)	31.61 (3.65)	30.61 (2.95)
2^3	37.79 (4.80)	30.22 (3.65)	27.24 (4.38)	24.91 (2.26)
2^4	30.52 (4.06)	26.32 (3.50)	20.66 (3.05)	18.80 (3.08)
2^5	24.84 (5.29)	18.48 (2.50)	15.97 (3.00)	14.79 (2.34)
2^6	20.19 (3.27)	14.67 (2.20)	11.89 (1.49)	11.28 (2.50)
2^7	14.74 (2.28)	10.66 (1.55)	9.86 (2.74)	8.77 (1.81)
2^8	12.72 (2.46)	9.22 (2.73)	6.62 (1.33)	7.06 (2.42)
2^9	8.45 (2.19)	7.09 (1.89)	5.61 (1.48)	4.68 (1.23)
2^{10}	6.44 (1.37)	5.34 (1.32)	4.11 (1.99)	4.27 (1.10)
2^{11}	6.35 (1.47)	4.10 (0.94)	3.24 (1.28)	3.87 (1.33)
2^{12}	4.55 (1.38)	3.52 (1.47)	2.81 (1.02)	3.16 (1.45)
2^{13}	5.06 (2.11)	2.49 (1.81)	2.47 (0.93)	2.04 (1.30)
2^{14}	3.53 (1.17)	2.32 (0.81)	2.39 (1.04)	2.09 (1.13)
2^{15}	4.85 (2.14)	3.76 (1.38)	2.83 (1.41)	2.93 (1.41)
2^{16}	6.63 (1.72)	4.93 (1.43)	6.12 (2.86)	6.52 (2.80)

TABLE S40

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 100 SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	48.14 (0.79)	44.30 (4.56)	41.86 (2.42)	39.85 (3.66)
2^2	43.46 (4.90)	39.53 (3.84)	34.05 (3.28)	31.92 (3.07)
2^3	36.65 (5.88)	32.20 (3.86)	26.84 (2.48)	23.42 (2.08)
2^4	31.85 (2.56)	27.27 (2.88)	21.79 (2.59)	19.33 (1.70)
2^5	26.30 (3.48)	19.59 (1.67)	18.00 (1.18)	15.94 (1.95)
2^6	18.89 (2.74)	15.71 (1.18)	13.44 (1.35)	13.40 (0.68)
2^7	16.11 (1.19)	12.52 (1.40)	10.93 (0.77)	10.59 (1.22)
2^8	12.24 (0.58)	9.56 (0.95)	7.83 (0.88)	8.26 (1.35)
2^9	10.23 (1.39)	8.02 (1.07)	7.18 (1.10)	6.69 (1.09)
2^{10}	9.22 (2.20)	6.36 (0.47)	5.65 (0.92)	4.93 (0.97)
2^{11}	6.90 (0.88)	5.08 (0.78)	5.20 (0.69)	4.06 (0.85)
2^{12}	5.77 (1.13)	4.91 (0.96)	3.39 (0.70)	3.16 (0.84)
2^{13}	5.47 (0.72)	4.47 (1.06)	3.06 (0.62)	3.27 (0.68)
2^{14}	4.84 (0.61)	3.85 (0.71)	3.12 (0.57)	2.65 (0.72)
2^{15}	5.18 (1.12)	3.61 (1.33)	2.87 (0.55)	2.66 (0.47)
2^{16}	5.42 (1.13)	3.44 (0.91)	2.65 (0.86)	2.69 (0.65)
2^{17}	6.84 (1.83)	4.28 (0.84)	3.88 (0.85)	3.57 (0.66)

TABLE S41

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON 300 SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.14 (2.76)	45.54 (3.07)	42.80 (2.55)	38.96 (3.94)
2^2	44.12 (3.50)	38.93 (2.99)	33.23 (3.23)	29.38 (2.23)
2^3	38.52 (3.72)	32.38 (2.38)	26.55 (2.27)	24.62 (1.77)
2^4	35.12 (3.83)	26.19 (2.20)	21.98 (1.30)	20.31 (0.51)
2^5	26.11 (1.81)	20.26 (1.95)	18.00 (1.00)	16.61 (0.77)
2^6	20.93 (1.75)	16.13 (1.16)	14.23 (0.90)	13.56 (0.66)
2^7	16.10 (1.13)	12.44 (0.71)	11.62 (0.52)	10.64 (0.53)
2^8	13.47 (0.82)	10.12 (0.81)	9.05 (0.54)	8.61 (0.40)
2^9	10.40 (0.72)	8.46 (0.70)	7.55 (0.34)	6.96 (0.45)
2^{10}	9.33 (0.46)	7.15 (0.50)	6.10 (0.31)	5.63 (0.38)
2^{11}	8.34 (0.72)	5.86 (0.40)	5.12 (0.46)	5.13 (0.36)
2^{12}	7.10 (0.58)	5.36 (0.47)	4.73 (0.28)	4.27 (0.37)
2^{13}	6.42 (0.68)	4.69 (0.31)	3.74 (0.39)	3.50 (0.58)
2^{14}	6.27 (0.52)	4.45 (0.39)	3.35 (0.39)	3.30 (0.23)
2^{15}	5.95 (0.55)	3.91 (0.41)	3.05 (0.44)	2.84 (0.47)
2^{16}	6.66 (0.53)	3.85 (0.67)	3.29 (0.43)	2.81 (0.33)
2^{17}	7.62 (0.54)	4.28 (0.49)	2.92 (0.40)	2.75 (0.29)

TABLE S42

DETAILED EER RESULTS (IN PERCENT) PRODUCED BY THE UBSC WITH THE INNER PRODUCT SIMILARITY SCORING METHOD ON ALL 620 SPEAKERS.

$k \backslash V$	1	3	10	30
2^1	47.58 (3.90)	44.68 (3.73)	41.27 (2.09)	39.42 (2.14)
2^2	42.28 (3.93)	40.61 (3.15)	34.91 (2.00)	32.09 (2.16)
2^3	39.11 (3.37)	34.05 (3.37)	27.74 (1.72)	24.56 (1.83)
2^4	31.60 (2.33)	26.49 (2.19)	22.43 (1.03)	20.34 (0.85)
2^5	25.14 (2.51)	21.03 (0.85)	18.00 (1.01)	16.76 (0.50)
2^6	20.51 (2.36)	16.61 (0.80)	14.30 (0.29)	13.83 (0.37)
2^7	15.98 (1.11)	12.66 (0.40)	11.29 (0.32)	10.82 (0.23)
2^8	12.89 (0.66)	10.46 (0.47)	9.21 (0.19)	8.81 (0.26)
2^9	10.97 (0.34)	8.56 (0.39)	7.55 (0.31)	7.28 (0.16)
2^{10}	9.24 (0.40)	7.21 (0.22)	6.50 (0.19)	6.08 (0.10)
2^{11}	8.19 (0.41)	6.42 (0.36)	5.51 (0.18)	5.22 (0.18)
2^{12}	7.47 (0.23)	5.49 (0.17)	4.72 (0.14)	4.43 (0.19)
2^{13}	6.96 (0.36)	4.90 (0.17)	4.10 (0.17)	3.92 (0.14)
2^{14}	6.61 (0.35)	4.48 (0.23)	3.69 (0.09)	3.43 (0.16)
2^{15}	6.61 (0.23)	4.33 (0.31)	3.25 (0.14)	3.05 (0.12)
2^{16}	7.01 (0.36)	4.16 (0.20)	3.19 (0.14)	2.79 (0.18)
2^{17}	7.93 (0.43)	4.36 (0.32)	3.14 (0.18)	2.81 (0.08)