Characterizing Users by Their Voices

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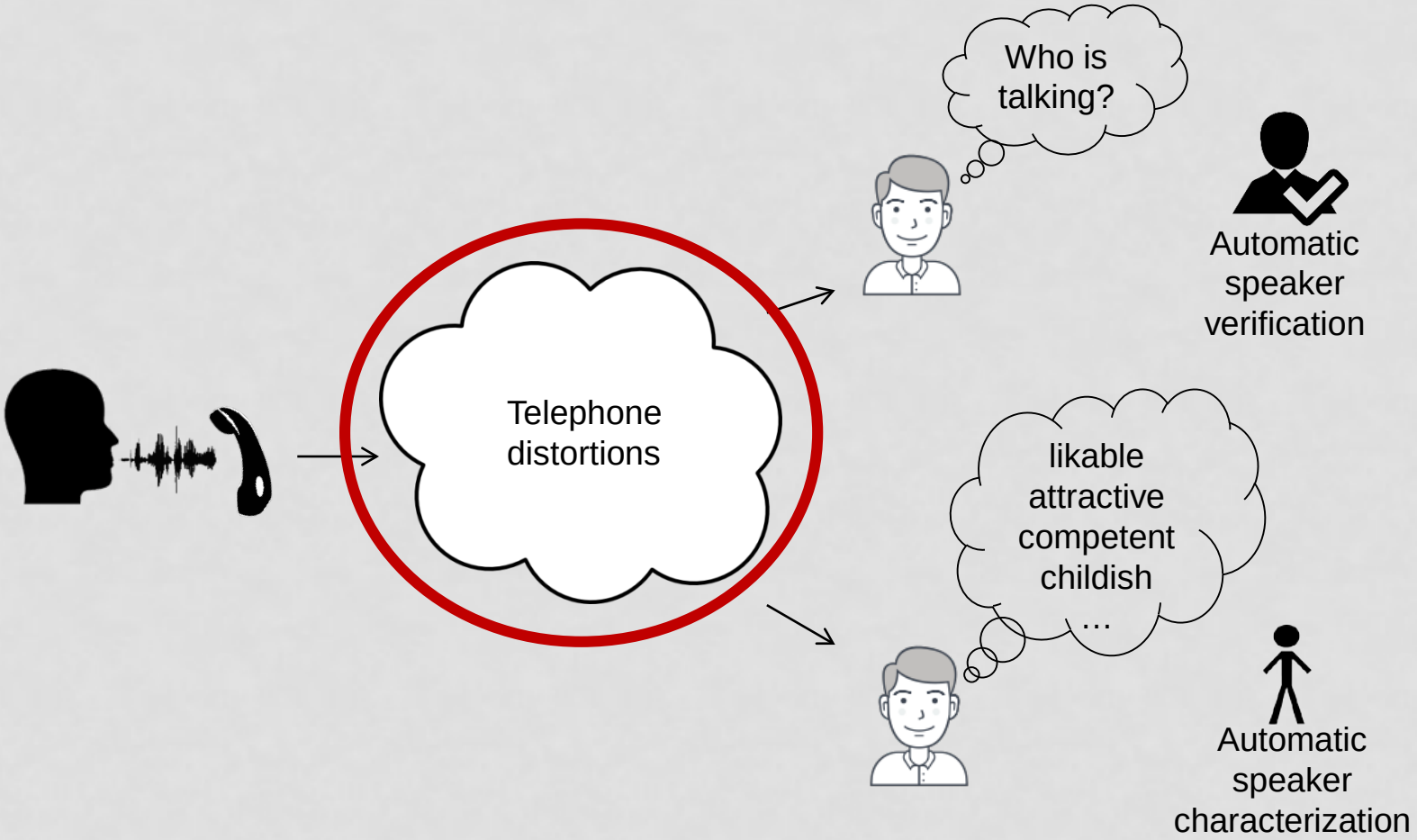
Who I am

Laura Fernández Gallardo

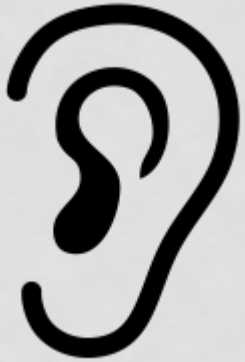
- 2005 – 2011: MSc. Telecommunications Engineering (University of Granada, Spain)
- 2012 – 2015: PhD in Computer Science (University of Canberra, Australia)
- 2015 – 2018: Postdoc Researcher (Technische Universität Berlin, Germany)
- 2018 onwards: Data Scientist @ areto consulting gmbh

Outline


Who is talking?
Automatic speaker verification
Telephone distortions
likable
attractive
competent
childish
…
Automatic speaker characterization

?

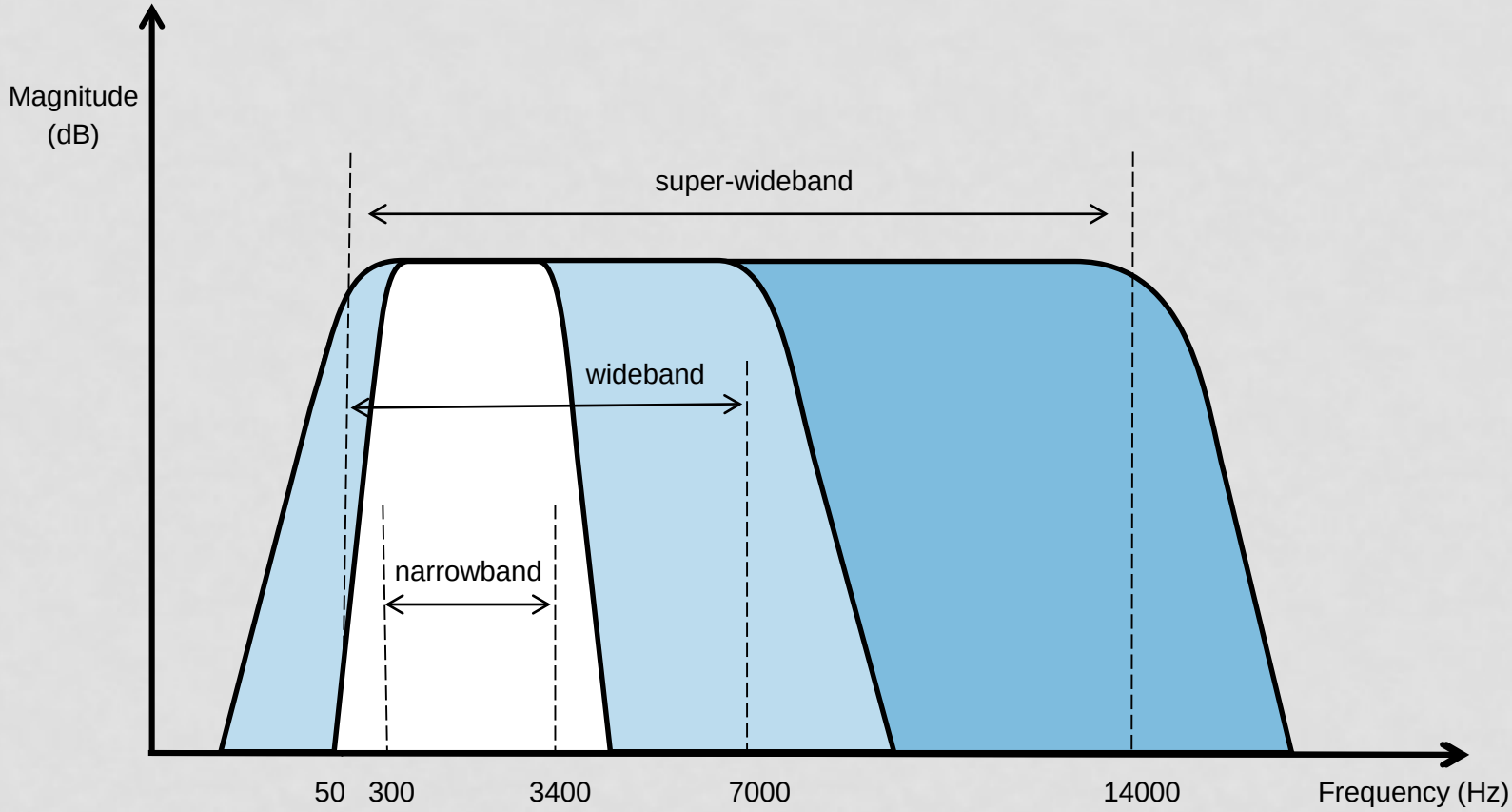
20 - 20000 Hz



?

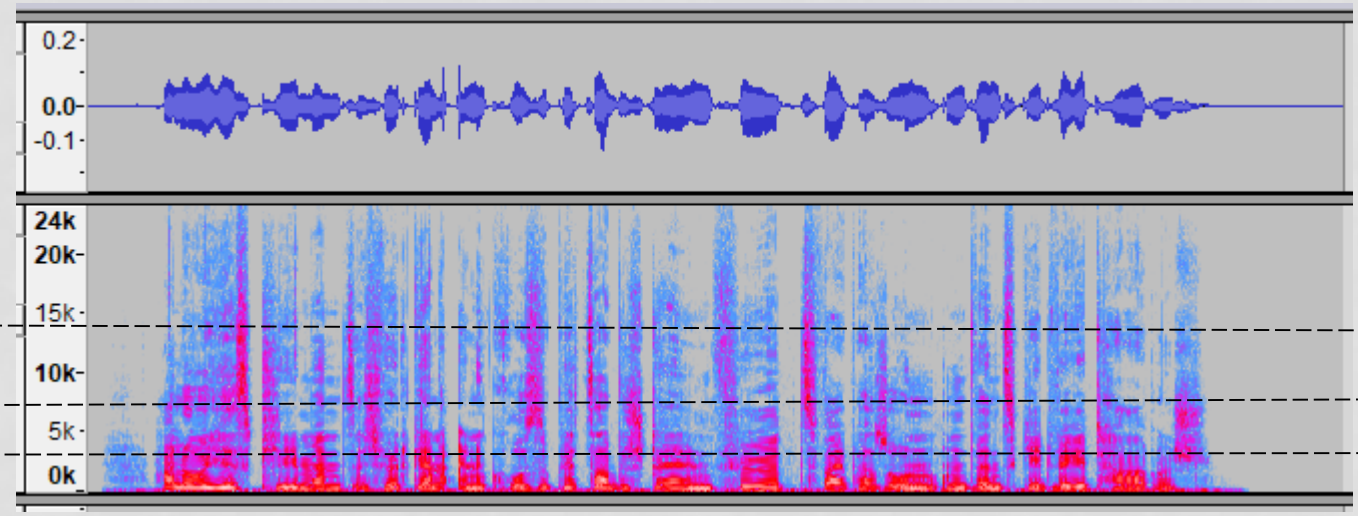
300 - 3400 Hz

Telephone distortions



Telephone distortions

Clean

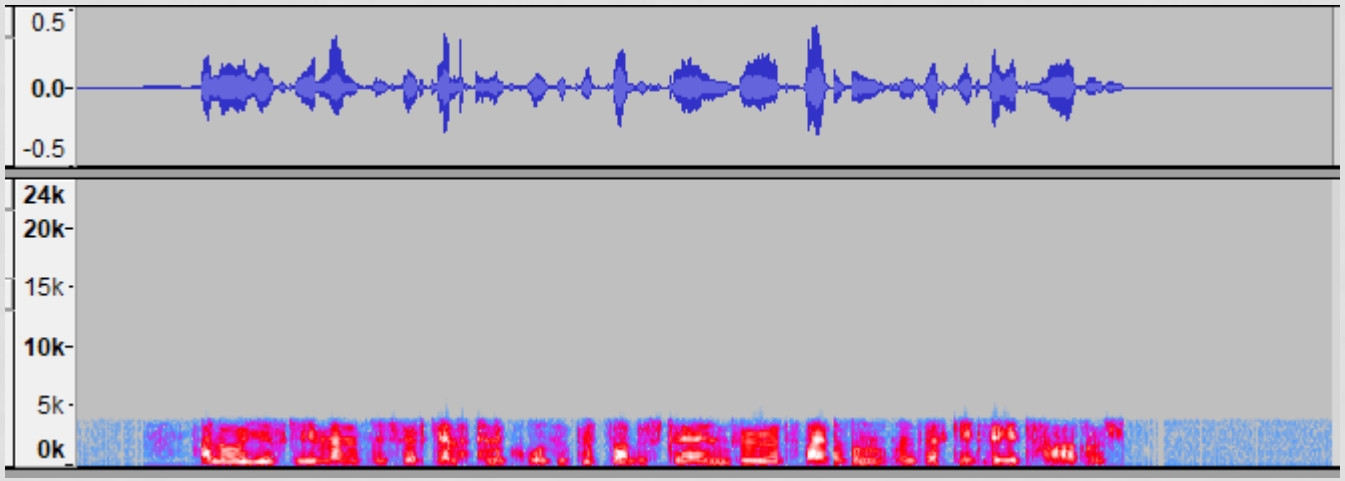


SWB

WB

NB

Narrowband,
AMR-NB@4,75,
packet loss 10%,
jitter 10ms



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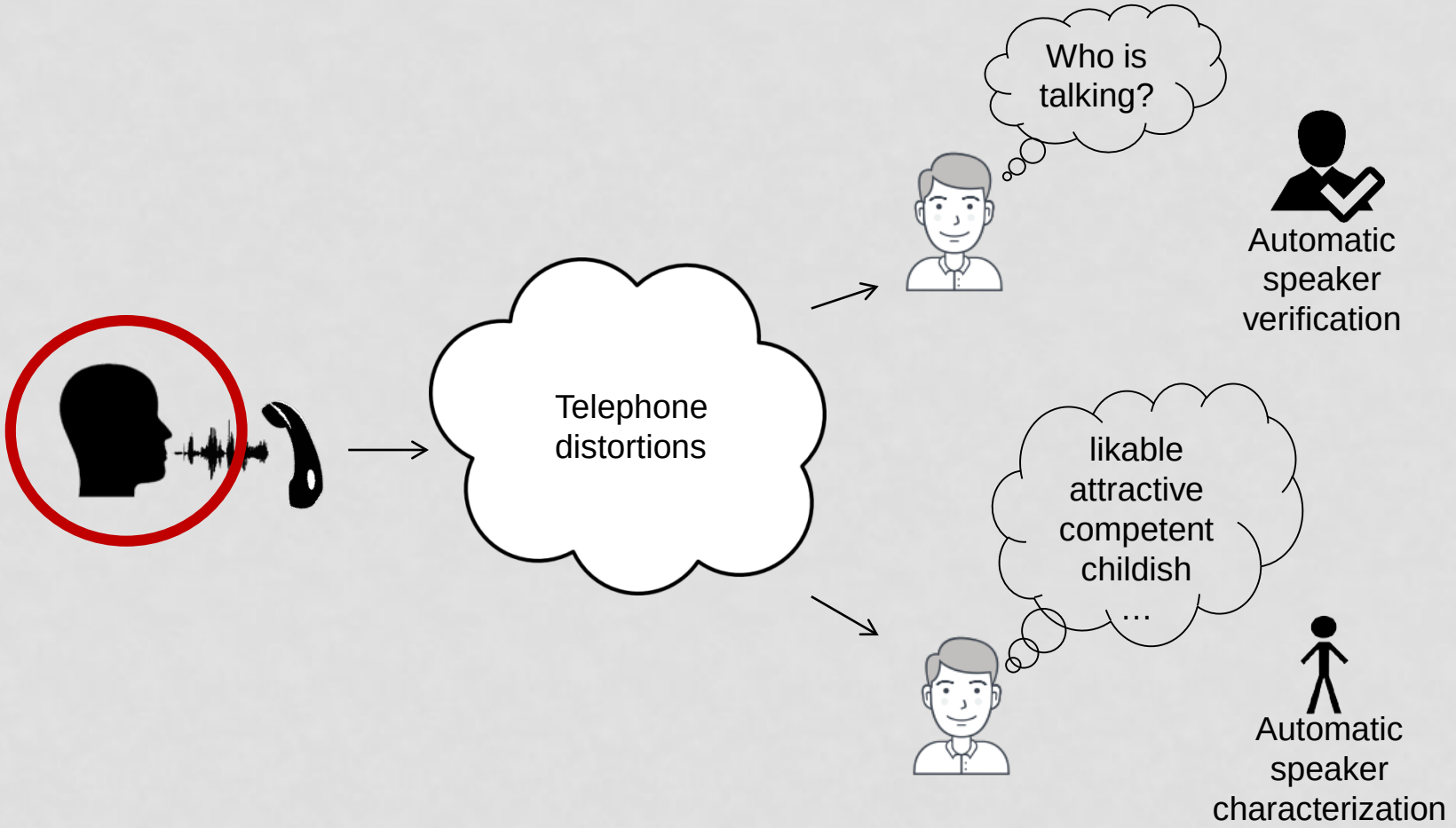
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Nautilus Speaker Characterization (NSC) Corpus

300 speakers
(126 m, 174 f)
Native German

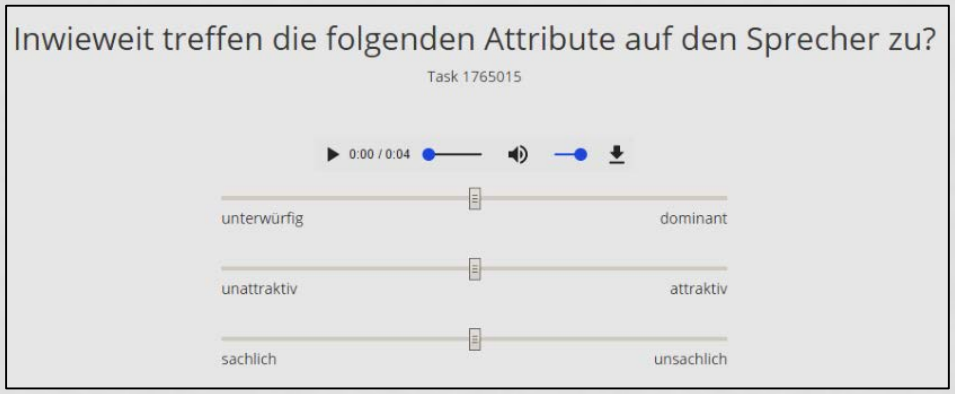
acoustically-isolated room

AKG C 414B-XLS
microphone

Scripted, semi-spontaneous and spontaneous conversational speech
Fs = 48 kHz

Released for non-commercial research and teaching purposes only

Speaker characteristics

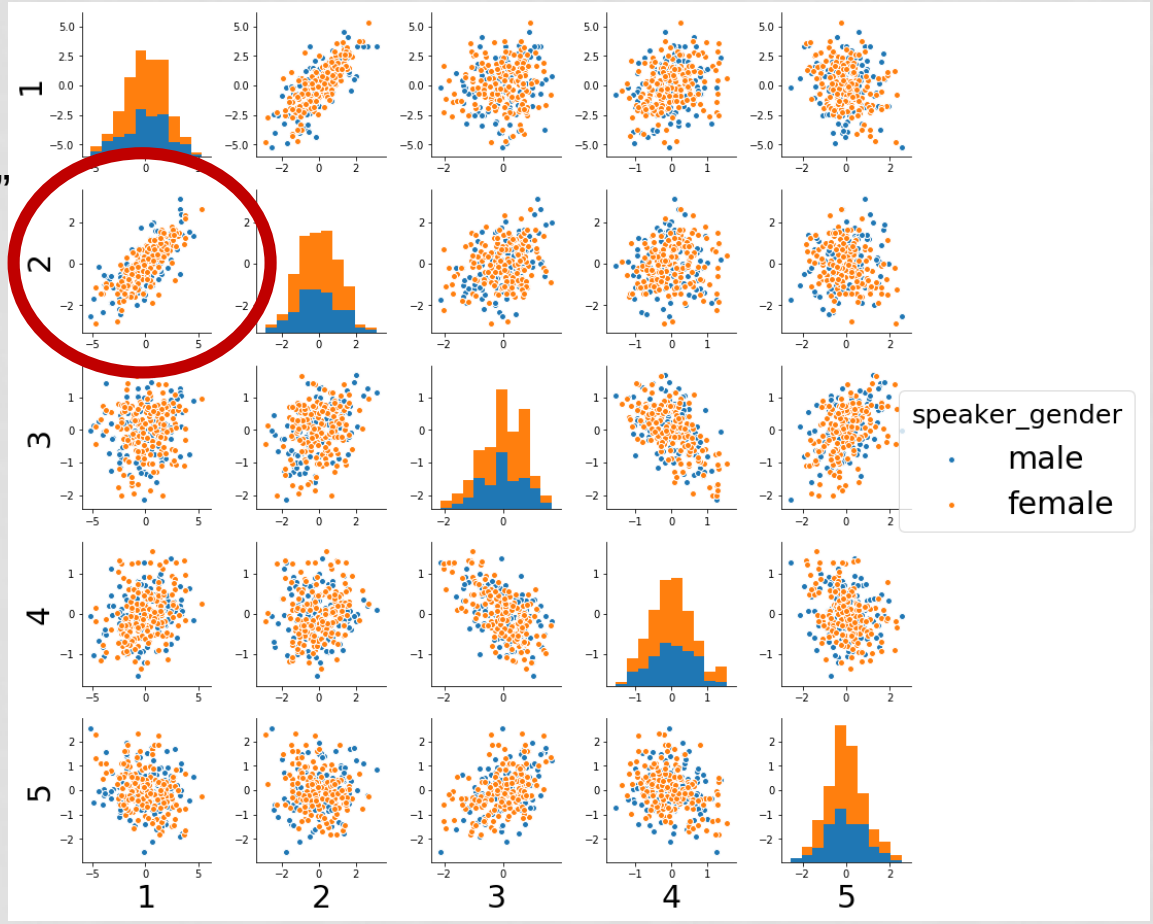


item	Antonyms (German)	
1	sympathisch	unsympathisch
2	unsicher	sicher
3	unattraktiv	attraktiv
4	verständnisvoll	verständnislos
5	entschieden	unentschieden
6	aufdringlich	unaufdringlich
7	nah	distanziert
8	interessiert	gelangweilt
9	emotionslos	emotional
10	genervt	nicht genervt
11	passiv	aktiv
12	unangenehm	angenehm
13	charaktervoll	charakterlos
14	reserviert	gesellig
15	nervös	entspannt
16	distanziert	mitfühlend
17	unterwürfig	dominant
18	affektiert	unaffektiert
19	gefühlskalt	herzlich
20	jung	alt
21	sachlich	unsachlich
22	aufgeregt	ruhig
23	kompetent	inkompetent
24	schön	hässlich
25	unfreundlich	freundlich
26	weiblich	männlich
27	provokativ	gehorsam
28	engagiert	gleichgültig
29	langweilig	interessant
30	folgsam	zynisch
31	unaufgesetzt	aufgesetzt
32	dumm	intelligent
33	erwachsen	kindlich
34	frech	bescheiden

The space of perceptual traits

“WAAT”

1: warmth
2: attractiveness
3: confidence
4: compliance
5: maturity



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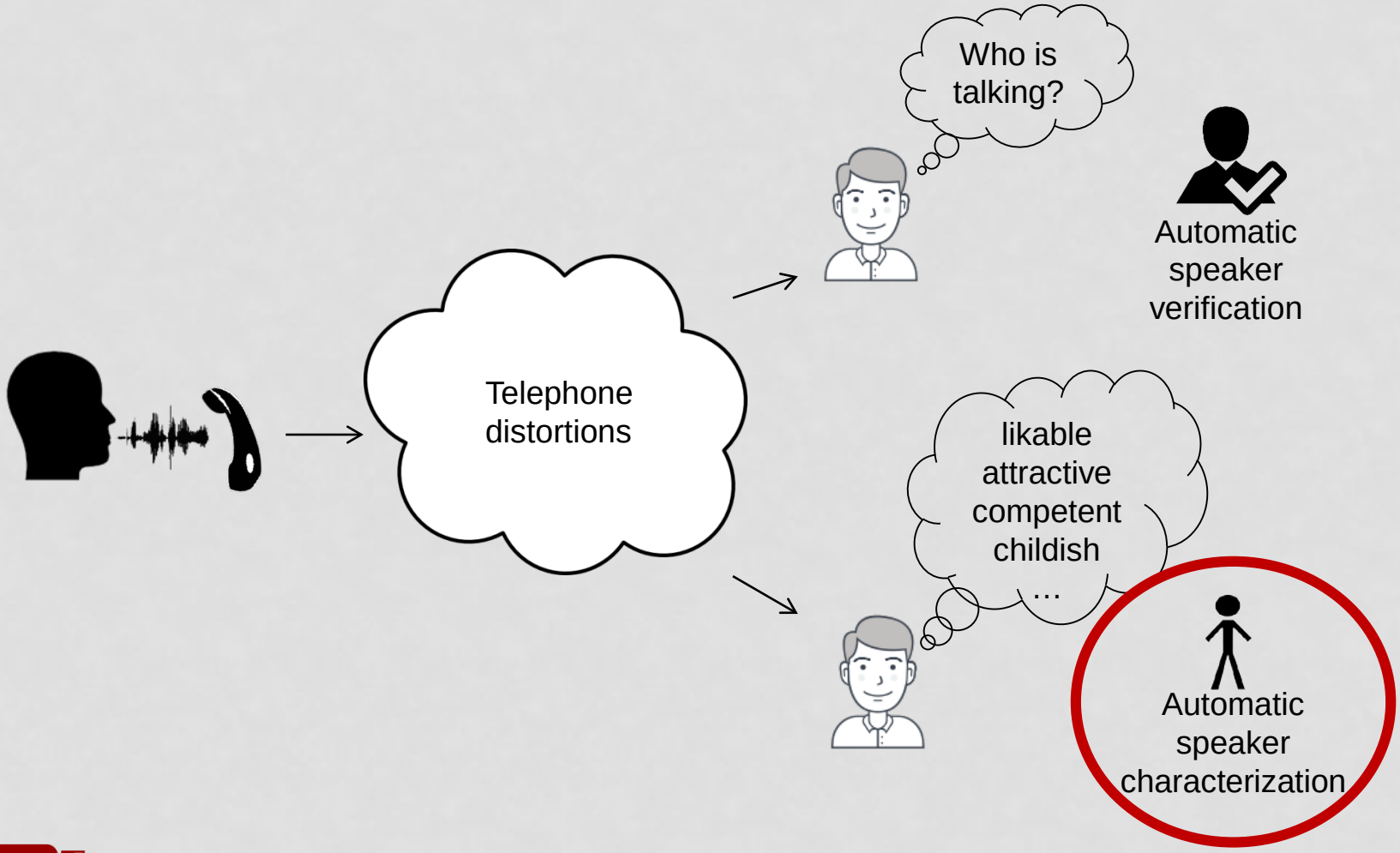
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Machine learning (tools)

openSMILE:)
by audEERING™

eGeMAPS:

- Frequency
- Energy
- Spectral
- Temporal

(88)

caret
mlr

Machine learning (labels)

300 x 34 item ratings

1: non likable
2: secure
3: attractive
4: unsympathetic
5: indecisive
6: unobtrusive
7: distant
8: bored
9: emotional
10: not irritated
11: active
12: pleasant
(…)

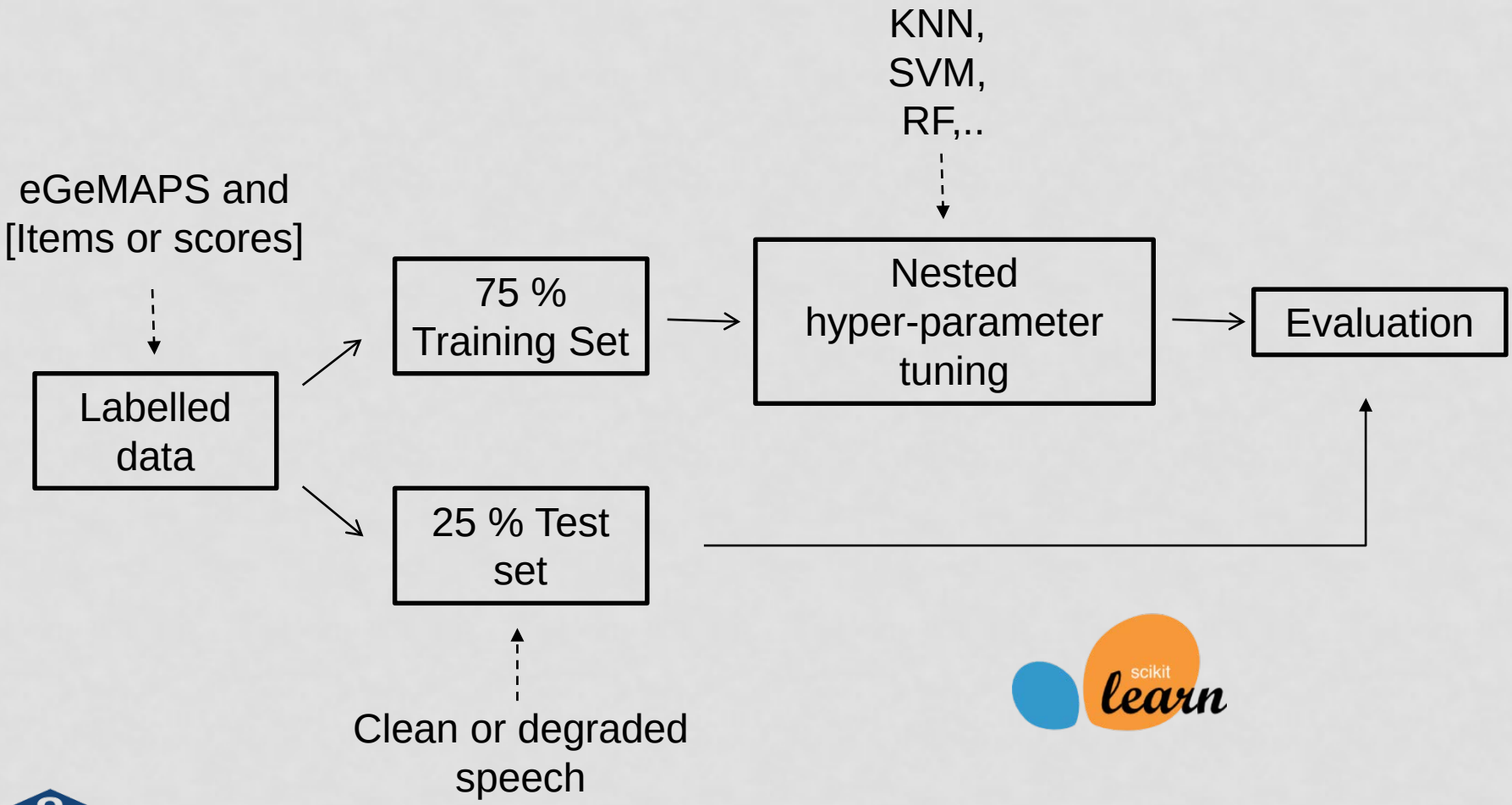
300 x 5 trait scores

1: warmth
2: attractiveness
3: confidence
4: compliance
5: maturity

Evaluation metrics:

- Average per-class accuracy (cls)
- RMSE (reg)

Machine learning (pipeline)

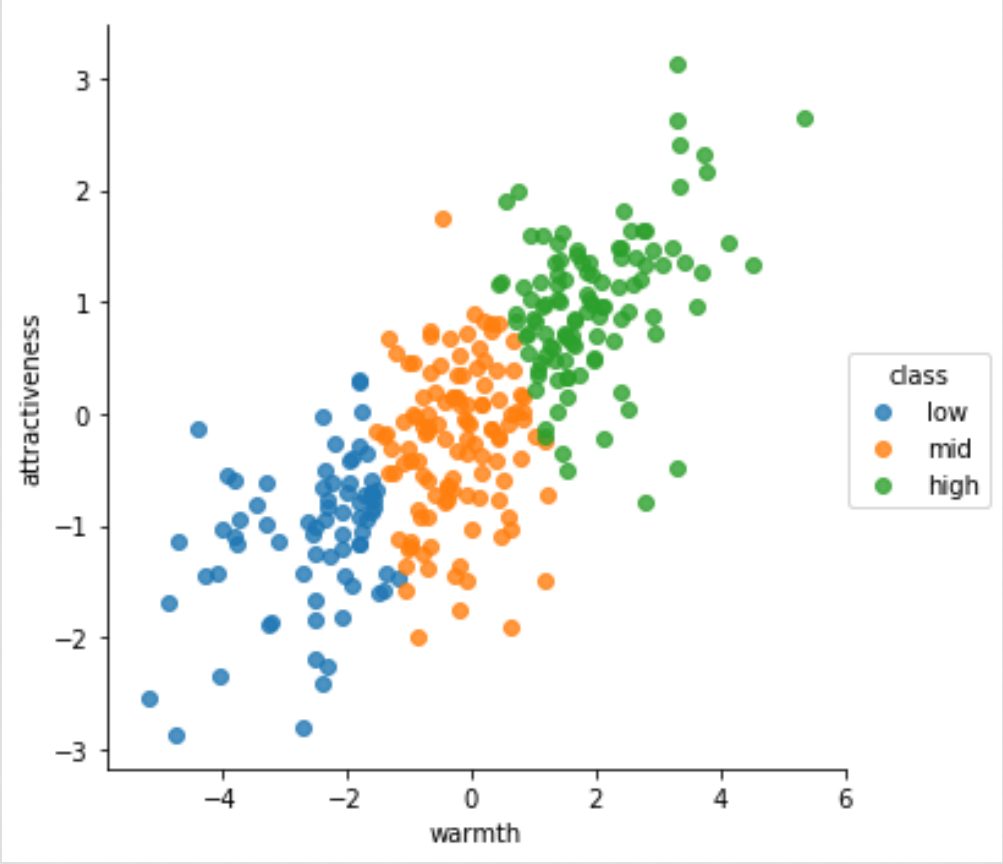


Machine learning (pipeline)

Nested hyperparameter tuning

- Split train data into A (80%) and B (20%) sets
- For each model:
  - RandomizedSearchCV on hyperparameters and on SelectKBest (Cross-validation)
  - Evaluate performance on B
- Choose best model based on performance on B
- Train best model with all train data

Binary classification

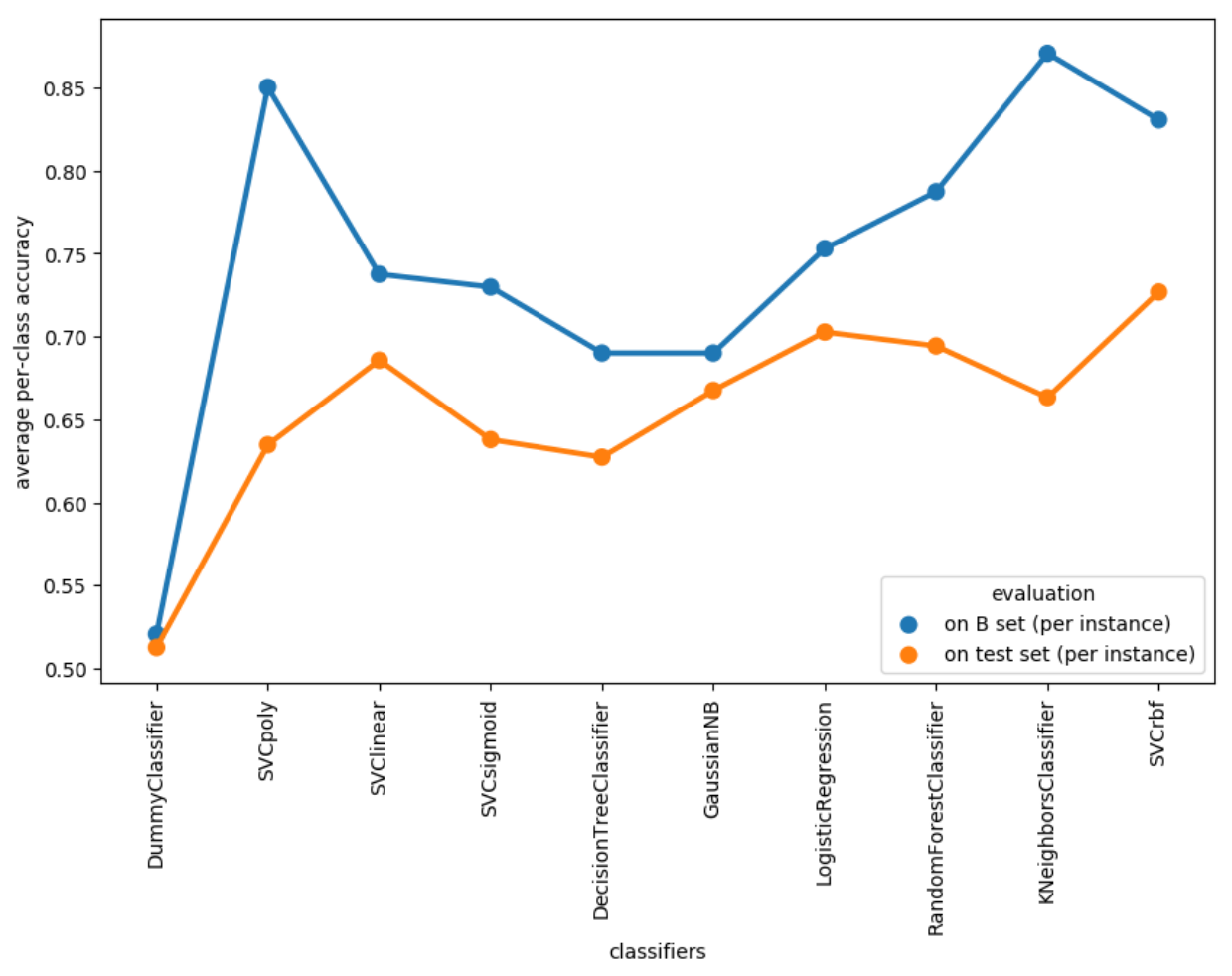


- WAAT
- K-means: 3 classes
- Binary: ”low” / “high”

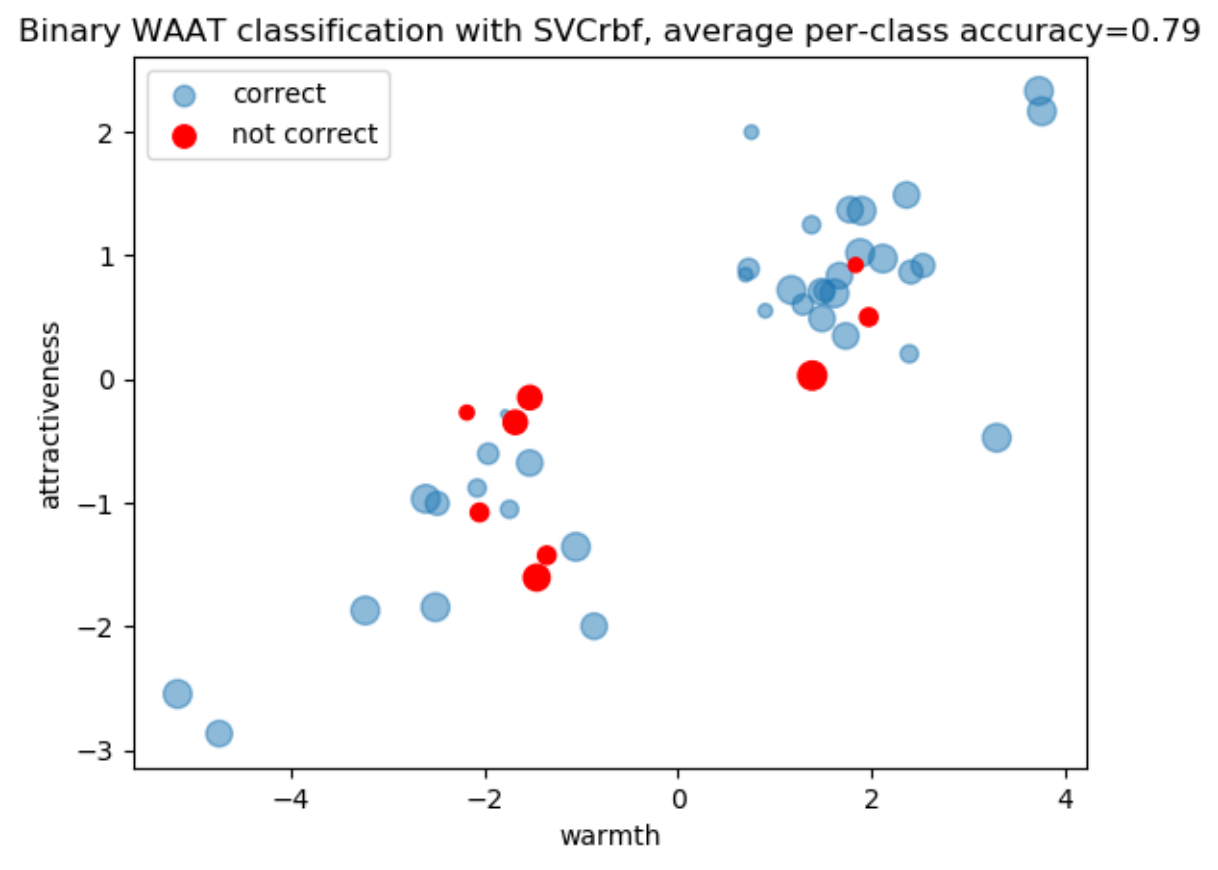
Binary classification

- Logistic Regression
- Naive Bayes
- K-Nearest Neighbors
- Decision Tree
- Random Forest
- Support Vector Machines

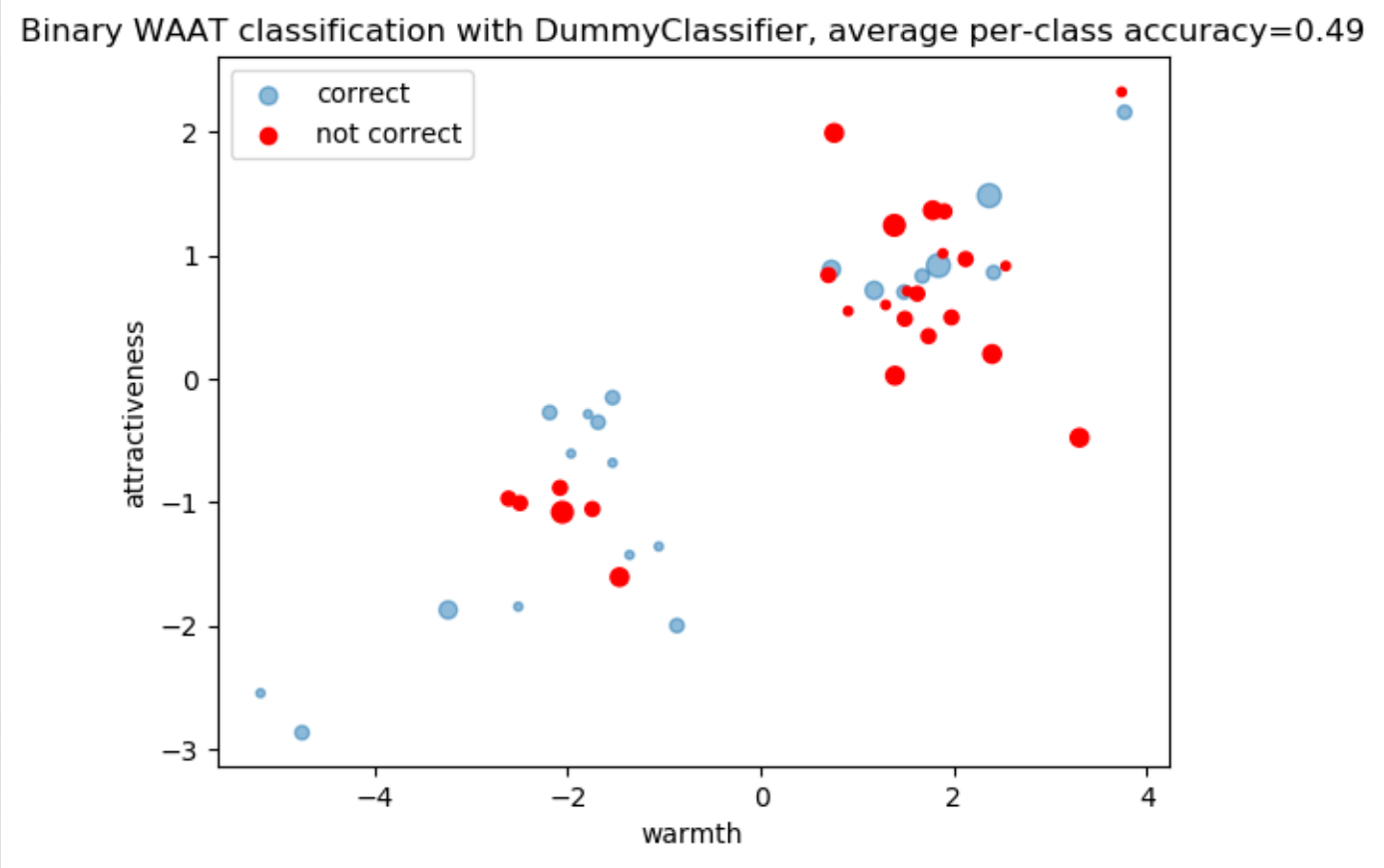
Binary classification



Binary classification



Binary classification



My Postdoc: contributions

- ✓ New labelled speech database (much needed)

- ✓ Main traits of speakers' characteristics
- ✓ Speech quality ↔ speaker characteristics
- ✓ Subjective voice descriptions ↔ speaker characteristics

Automatic speaker characterization

- ✓ Important features for speaker characterization
- ✓ Open-source pipeline for classification and regression
- ✓ Effects of degraded test speech on performance

Thank you for your attention!

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