

Multiband with contaminated training data

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Multiband architecture - main conclusions

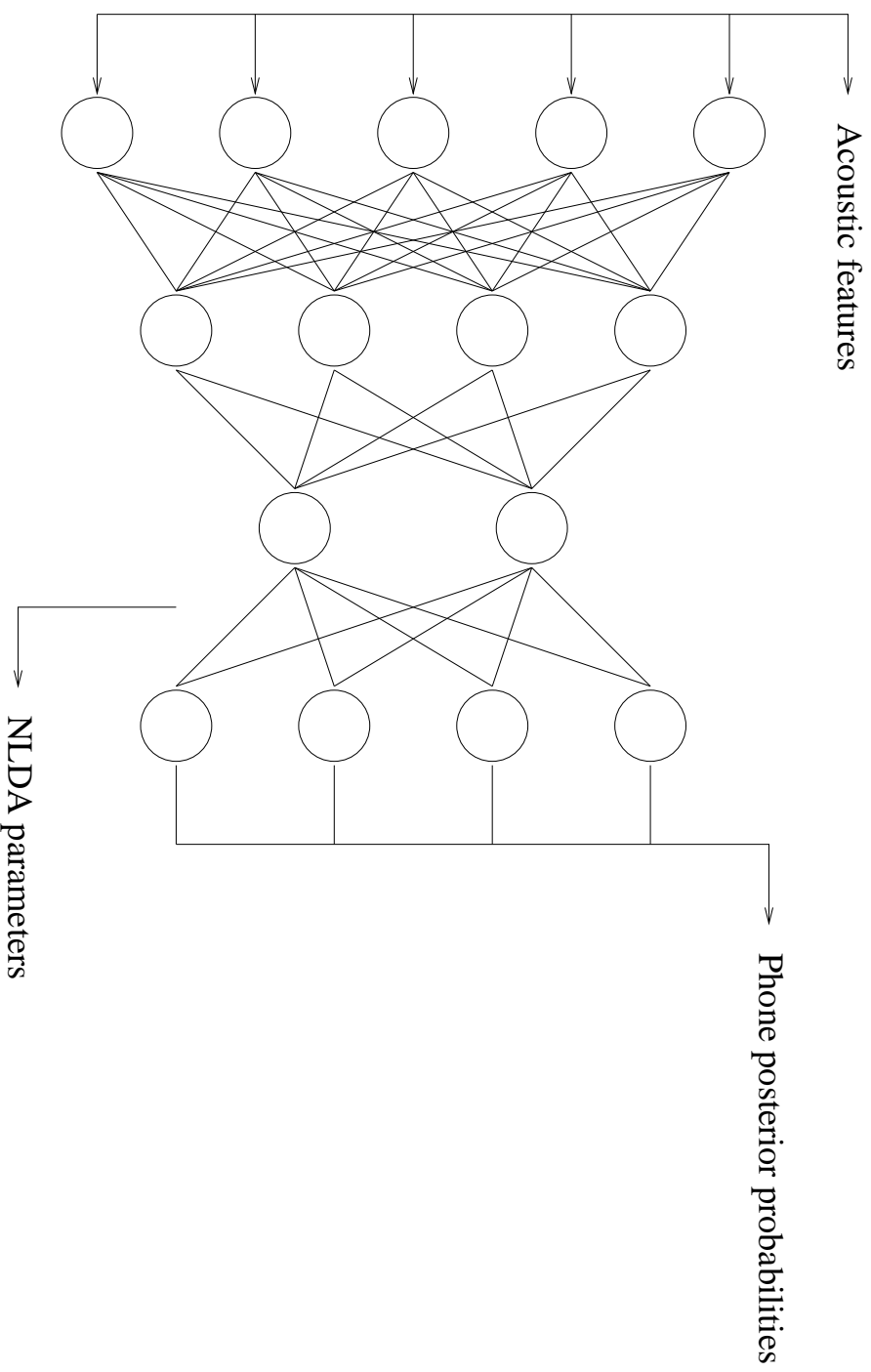
- the multiband paradigm outperforms other noise robust methods for narrow band noises,
- for large band noises, classical methods such as spectral subtraction perform better,
- the multiband paradigm can easily be combined with other noise robust approaches such as J-rasta, spectral subtraction, ...
- the best subband recombination method is based on ANN.

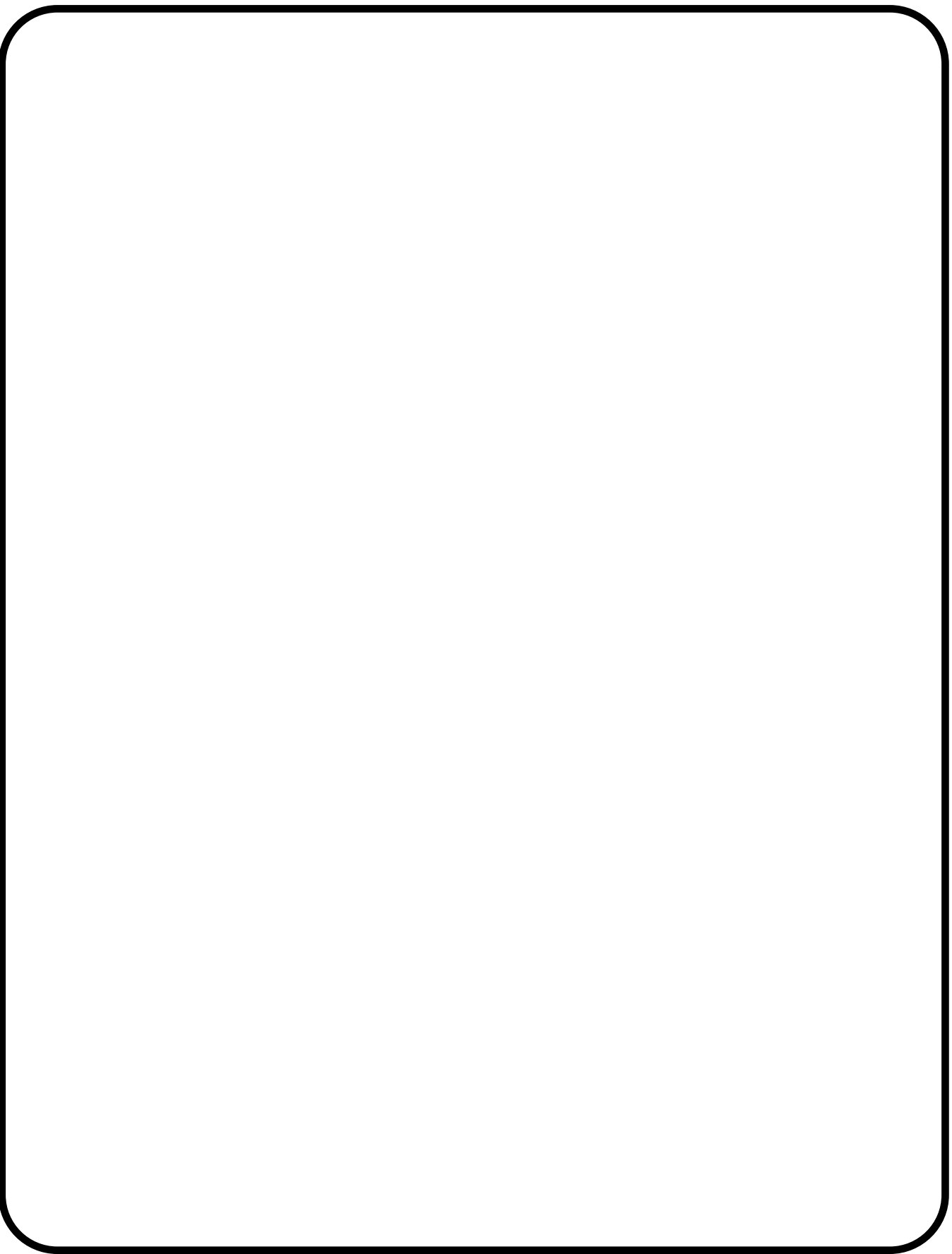
Noise contamination of speech corpus - main conclusions

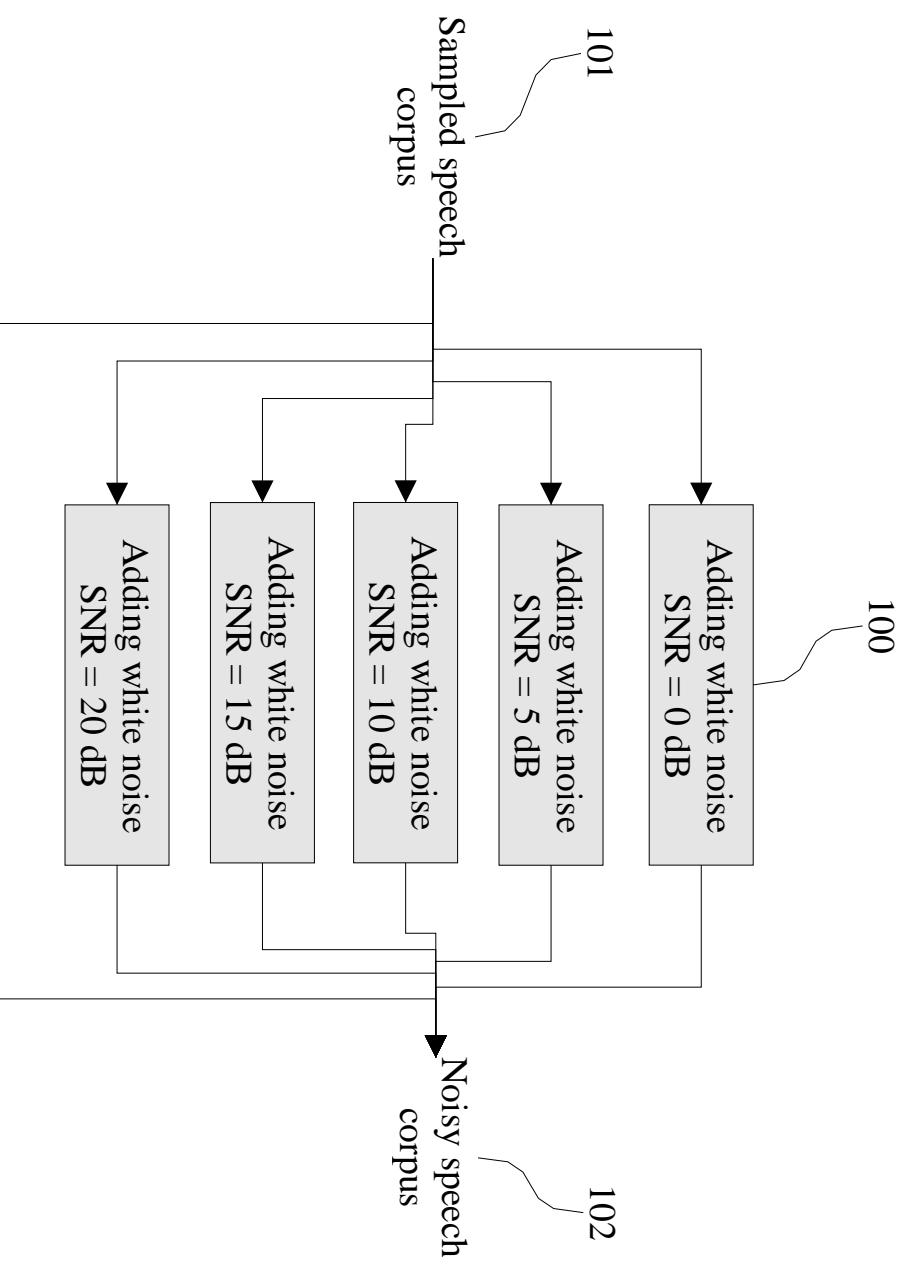
- quasi-optimal performance when noise conditions during test are similar to the contamination noise,
- no interest in case of different noises

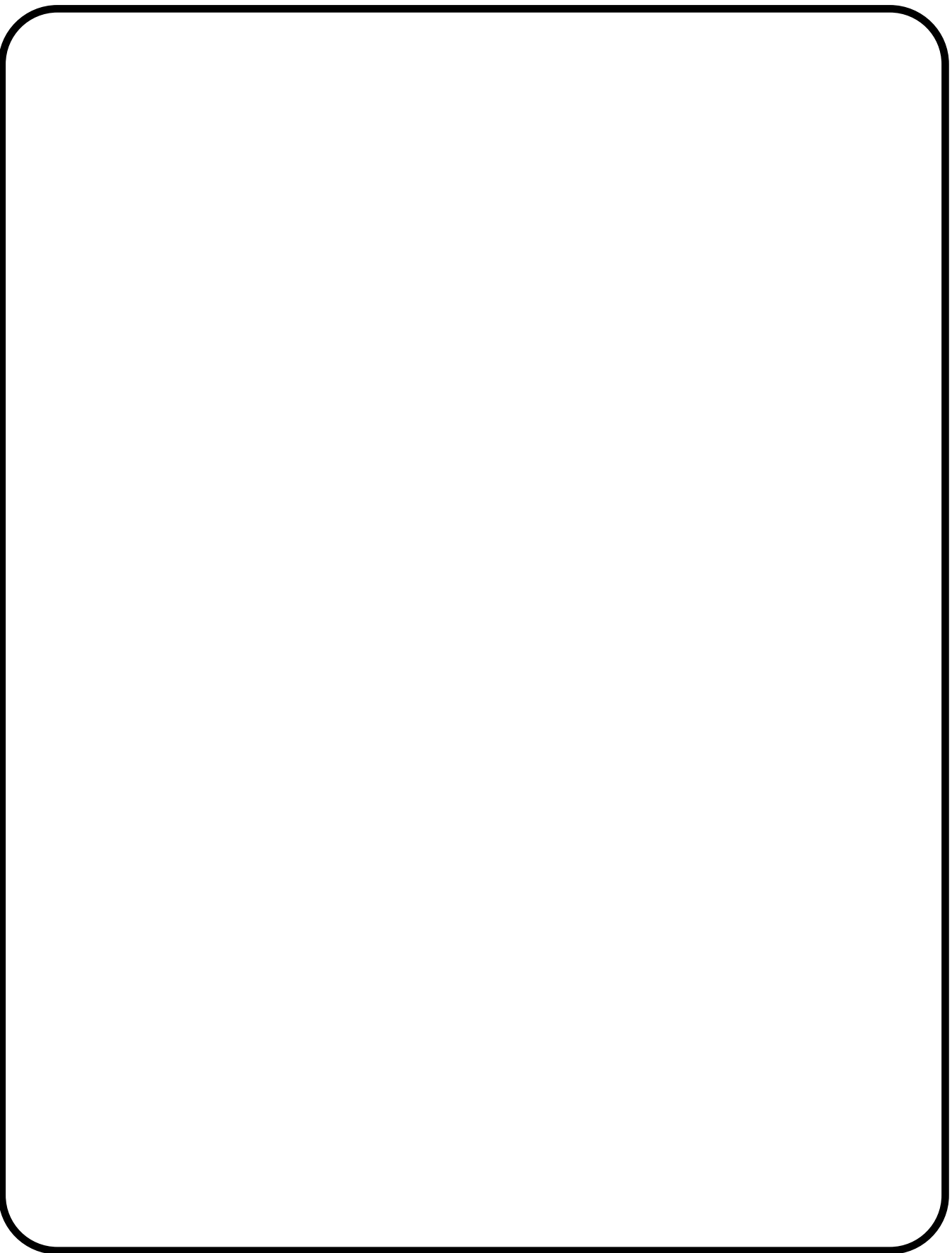
Multiband with contaminated data

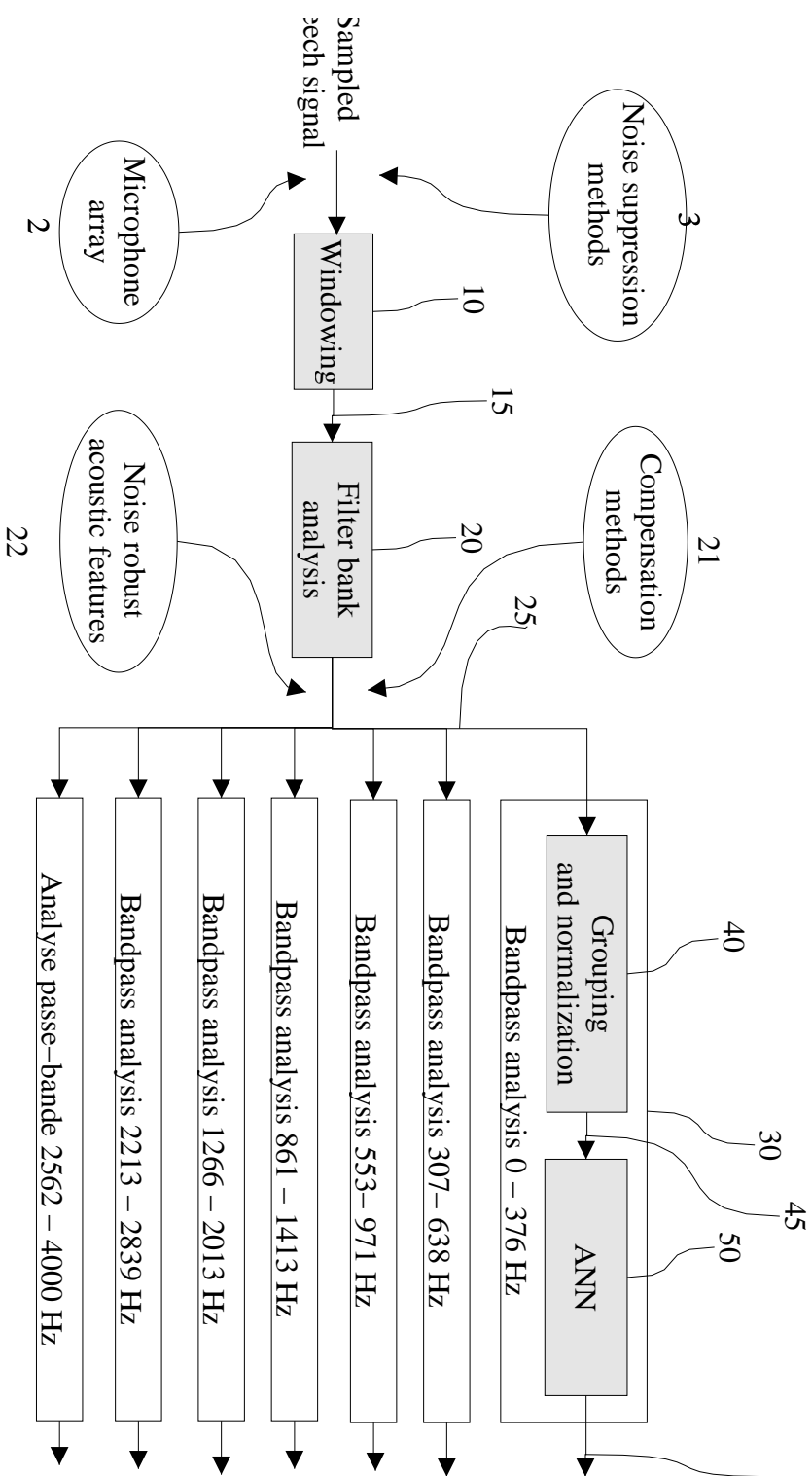
- We observe that, in narrow frequency bands, the noise characteristics basically differs by their level only.
- We can train models in each frequency band with data contaminated with any noise. The models should stay robust to other kinds of noise.
- Our approach consists in computing noise robust parameters in each subband based on data corrupted by white noise at different SNR. The parameters are computed by the non-linear discriminant analysis method.

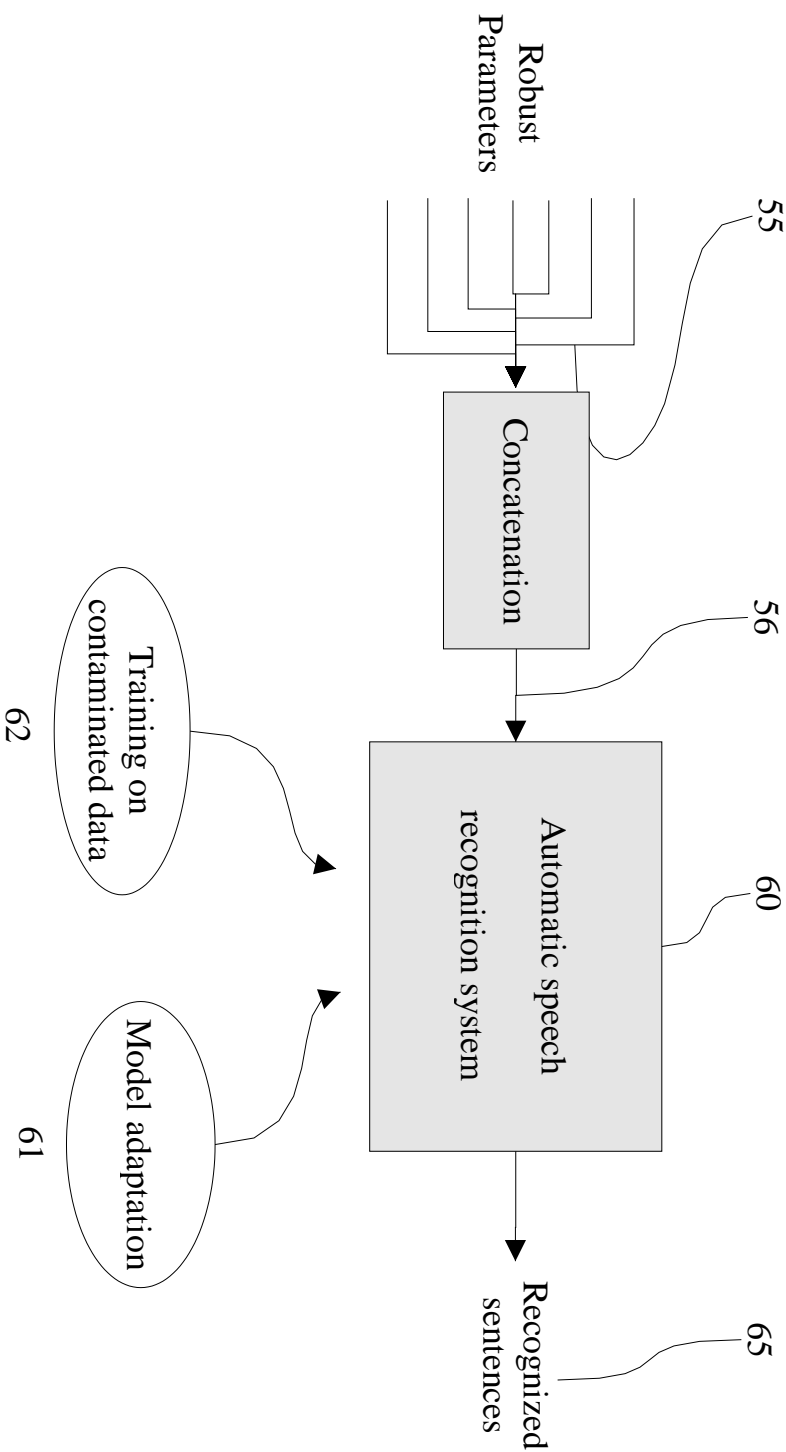












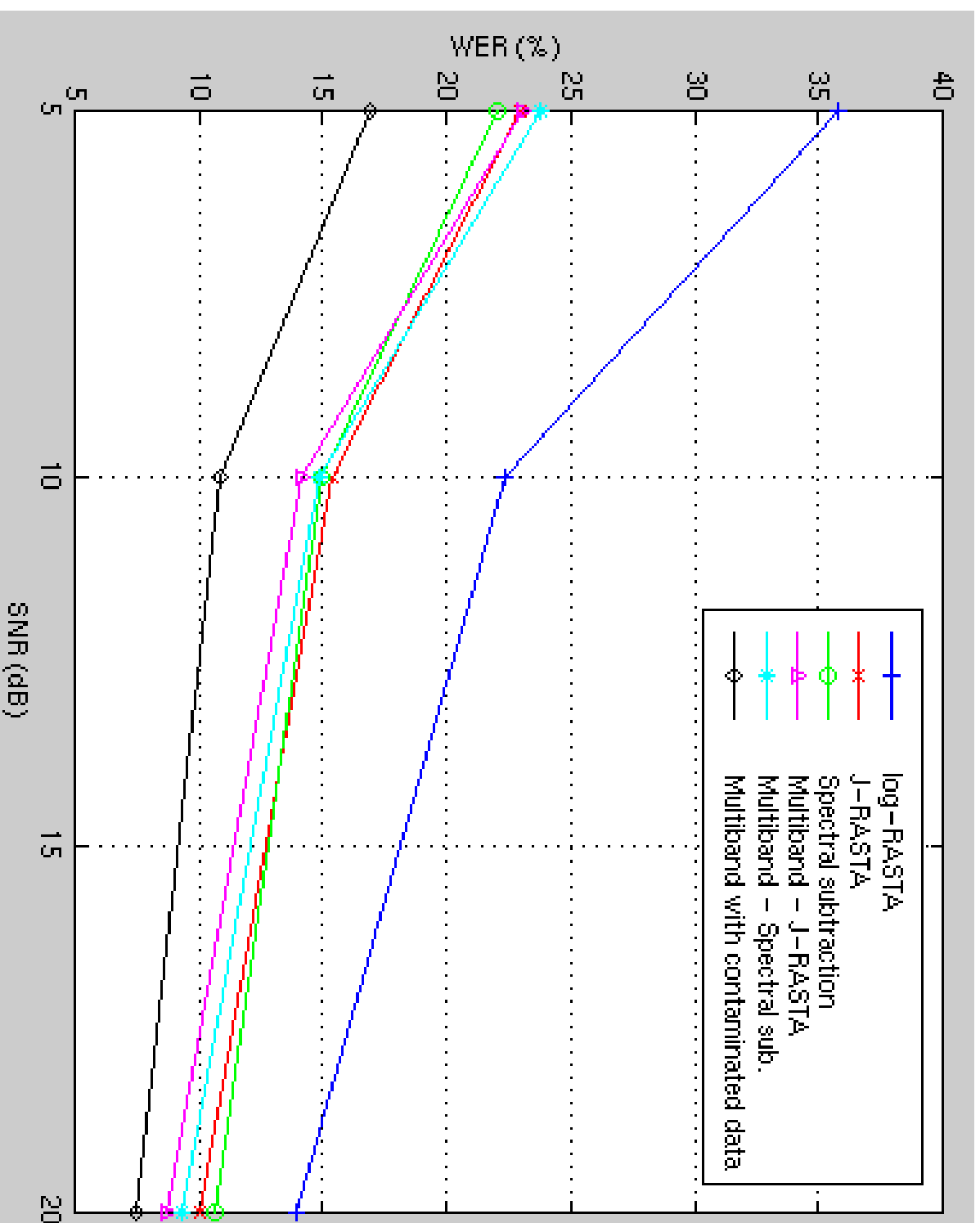
Evaluation

Comparison of different noise robust approaches:

- Log-rasta PLP coefficients
- J-rasta PLP coefficients
- Spectral subtraction (cf. Berouti and al.)
- multiband (4 bands) with J-rasta parameters
- multiband (4 bands) with spectral subtraction
- multiband (7 bands) with contaminated training data

Tested on NUMBERS'95 with 6 different kinds of additive noise:

- White noise, Helicopter noise (Noisex), Street noise (Madras), In-car noise (Daimler), Public hall and Shopping mall (Babel).

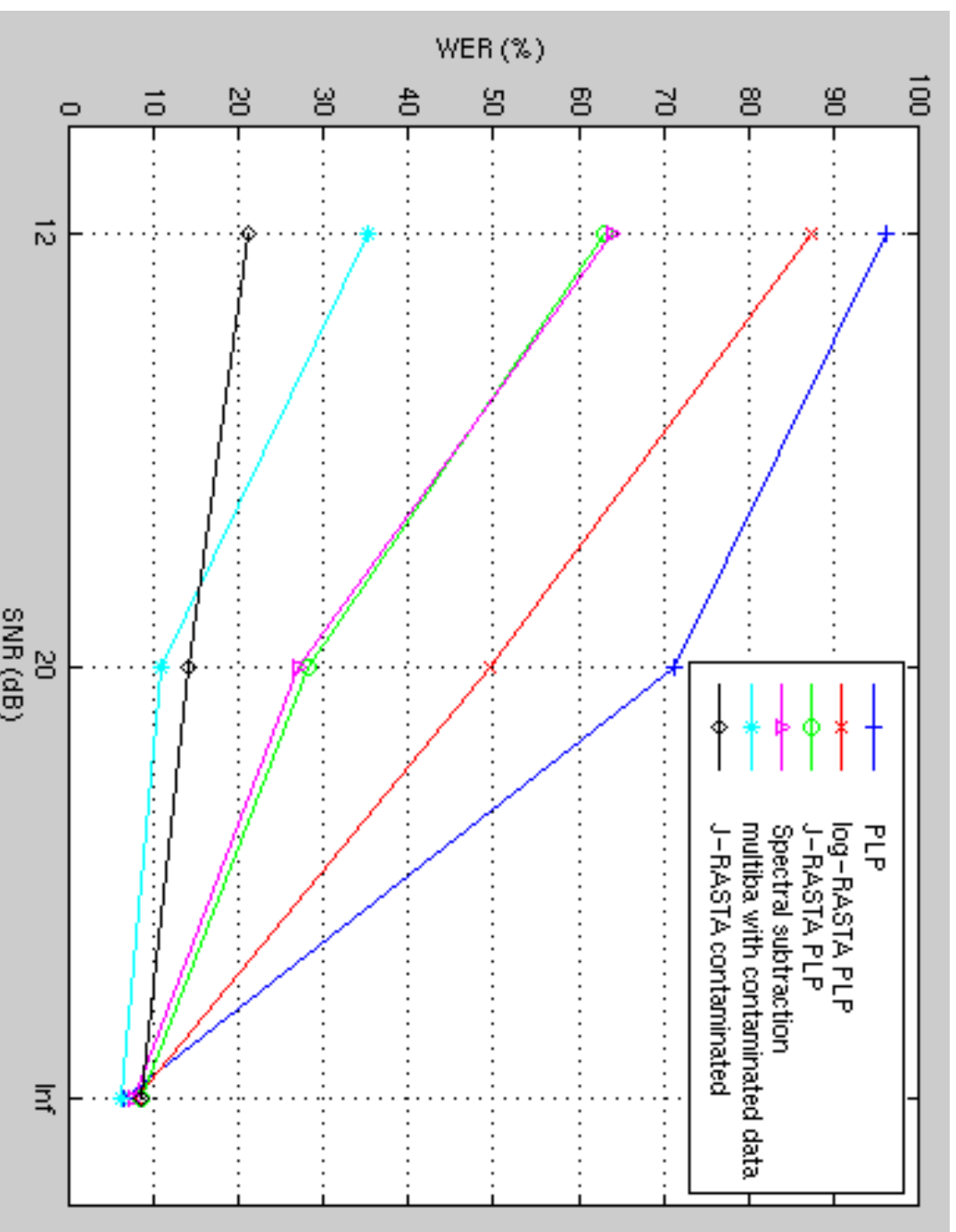


Increasing the number of subbands:

SNR (dB)	5	10	20	average
J-rasta	23.0%	15.4%	10.0%	16.1%
1 band	21.9%	15.1%	10.2%	15.9%
2 bands	18.1%	12.4%	9.1%	13.2%
4 bands	16.9%	11.9%	8.4%	12.4%
7 bands	16.9%	10.9%	7.5%	11.8%

WER on numbers'95. Average on 6 different kinds of noises.

Different techniques have been tested on RESOURCE MANAGEMENT with added noise (Noisex helicopter noise).



Conclusions

- we propose to estimate robust acoustic features using ANN (NLDA) trained on contaminated data,
- the use of a multiband approach makes those features independent from the noise spectrum,
- we assume the noise can be considered as white noise inside narrow frequency bands
- ANN are trained on speech contaminated by white noise at different SNR