

The Use of Dictionary Learning Approach for Robustness

Speech Recognition

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(Automatic Speech Recognition, ASR)

(Mismatch)[1]

[3]

(Modulation Spectrum)

[2]

(1Hz 16Hz)

(Dictionary Learning)

[4]

(Dictionary)

(Atoms)

[5]

(Method of Optimal Directions)[6] K-
(Stochastic Gradient Descent)[8]

(K-SVD)[7]
(Online Dictionary

Learning)[9]

Learning) K- (K-SVD (Dictionary
(Magnitude)

[10] K-SVD

Aurora-2
(Mel-Frequency Cepstral Coefficient, MFCC)

(Advanced Front-End, AFE)
(Cepstral Mean and Variance Normalization, CMVN)
(Histogram Equalization, HEQ)

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- [1] J. Tabrikian, G. S. Fostek and H. Messer, “Detection of environmental mismatch in a shallow water waveguide,” IEEE Transactions on Signal Processing, 47(8), pp. 2181–2190, 1999.
- [2] C.P. Chen and J.A. Bilmes, “MVA processing of speech features,” IEEE Transactions on Audio Speech and Language Processing, 15(1), pp. 257–270, 2007.
- [3] J. Li, L. Deng, Y. Gong and R. Haeb-Umbach, “An overview of noise-robust automatic speech recognition,” IEEE/ACM Transactions on Audio, Speech and Language Processing, 22(4), pp. 745–777, 2014.
- [4] C. Lu, J. Shi and J. Jia, “Online robust dictionary learning,” in Proc. of CVPR, pp. 415–422, 2013.
- [5] J. F. Gemmeke, T. Viratnen and A. Hurmalainen, “Exemplar-based sparse representations for noise robust automatic speech recognition,” IEEE Transactions on Audio, Speech and Language Processing, 19(7), pp. 2067–2080,

2011.

- [6] K. Engan, S. O. Aase and J. Hakon Husoy, “Method of optimal directions for frame design,” in Proc. of IEEE International Conference of Acoustic, Speech, and Signal Processing, 5, pp. 2443–2446.
- [7] M. Aharon, M. Elad and A. M. Bruckstein, “The KSVD: An algorithm for designing of overcomplete dictionaries for sparse representations.” IEEE Transactions on Signal Processing, 54, pp. 4311–4322, 2006
- [8] L. Bottou, “Online algorithms and stochastic approximations.” in D. Saad (Ed.), Online learning and neural networks.
- [9] J. Mairal, F. Bach, J. Ponce and G. Sapiro, “Online learning for matrix factorization and sparse coding,” Journal of Machine Learning Research, 11, pp. 19–60, 2010.
- [10] P. O. Hoyer, “Non-negative matrix factorization with sparseness constraints.” Journal of machine learning research 5.Nov (2004): 1457-1469.