Sparse Coding for Dictionary Learning in Context of Image De-noising

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Abstract

Abstract - Dictionary learning involves solving the following optimization problem: in ——x —— ————m D, D 22+ 1 where is the input signal, is the dictionary and is the sparse representation of the signal. x D The problem of image restoration has been addressed with a multitude of approaches. All the approaches to solve the optimisation problem fall under the 3 broad categories of Relaxation (Basis Pursuit), Greedy approach(Matching Pursuit) or Hybrid methods. Our project primarily focuses on the Relaxation methodology. Here, both and are unknown. Mairal, Julien, et al, 2009 present an online learning D algorithm[1] which involves two optimization problem. First, assumes the to be available and D minimizes over . This is known as the sparse coding problem. Second, updates the after D obtaining . Mairal, Julien, et al, 2009 use LARS[2] to solve the sparse coding problem. We propose to compare the performance of the online dictionary learning algorithm by solving the sparse coding problem using methods[1][5] like featuresign [3], FISTA[4], Interior point, Sequential Shrinkage or Iterative Shrinkage methods and Stochastic Gradient Descent in the context of image restoration.

1 Introduction

1 Introduction : Problem of Image denoising

2 Intro to Dictionary learning

2 Intro to Dictionary learning - KSVD- general KSVD explaination - Online Dictionary Learning

3 KSVD

3 KSVD for learning dictionaries

4 Sparse Coding

4 Sparse coding problem explained in deep and ways to approximate the sparse code - Basis pursuit - Matching pursuit

5 Summary of sparse coding techniques used:

4.1 FISTA

- FISTA

4.2 MP

- MP

4.3 OMP

- OMP

4.4 ALM

- ALM

4.5 Feature Sign

- Feature Sign

4.6 L1LS

- L1LS

5 Experimental Setup

6 Experimental setup

6 Findings

7 Findings

7 Analysis

8 Analysis

8 Conclusion

9 Conclusion

10 References Yang, Allen Y., et al. "Fast l1-minimization algorithms for robust face recognition." arXiv preprint arXiv:1007.3753 (2010). Lee, Honglak, et al. "Efficient sparse coding algorithms." Advances in neural information processing systems 19 (2007): 801. Mallat, Stphane G., and Zhifeng Zhang. "Matching pursuits with time-frequency dictionaries." Signal Processing, IEEE Transactions on 41.12 (1993): 3397-3415. Pati, Yagyensh Chandra, Ramin Rezaiifar, and P. S. Krishnaprasad. "Orthogonal matching pursuit: Recursive function approximation with applications to wavelet decomposition." Signals, Systems and Computers, 1993. 1993 Conference Record of The Twenty-Seventh Asilomar Conference on. IEEE, 1993. Aharon, Michal, Michael Elad, and Alfred Bruckstein. "-svd: An algorithm for designing overcomplete dictionaries for sparse representation." Signal Processing, IEEE Transactions on 54.11 (2006): 4311-4322.

9 Appendix

9.1 Appendix-1

9.2 Appendix2