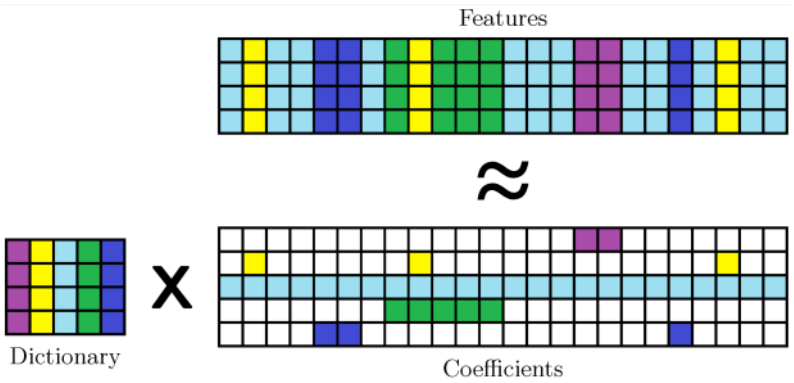
K-SVD

Monday, April 2, 2018 3:01 PM



Screen clipping taken: 4/2/2018 3:08 PM

coefficient matrix

$X \approx A D^T$

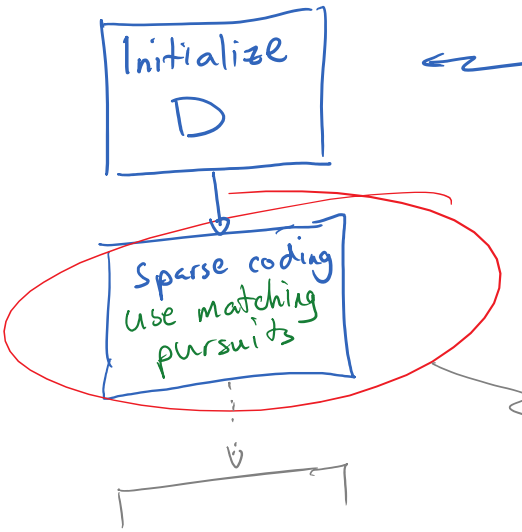
Data (features)

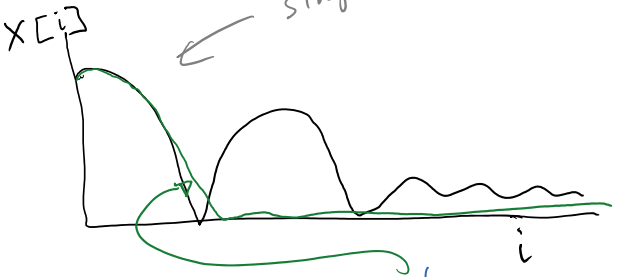
Dictionary matrix

we want the columns of A to be sparse

k-SVD steps

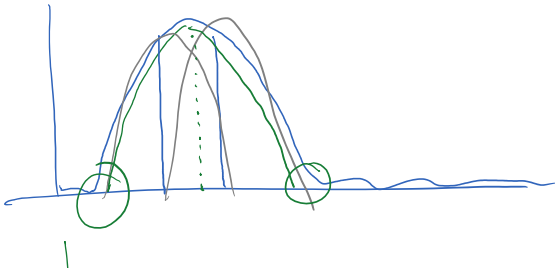
i) Assume that we have a dictionary

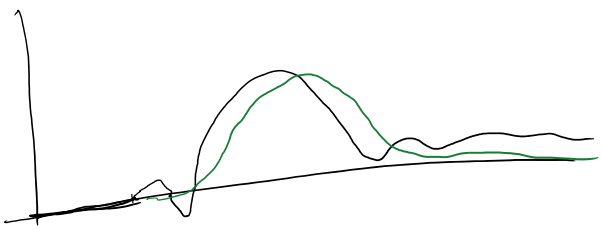




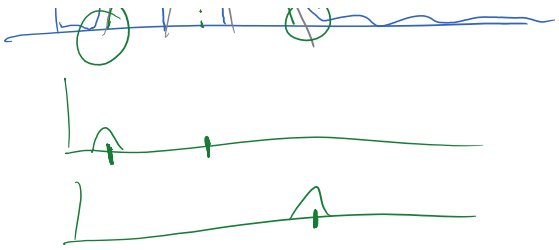
ⓐ find the vector in our dictionary that best matches the vector x
- subtract its contribution

Greed





ⓑ find the vector in D that best matches the



⑤ find the vector in D that best matches the residual

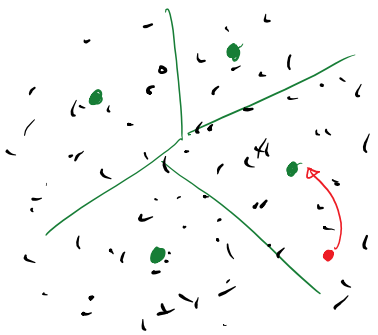
ⓒ repeat until done

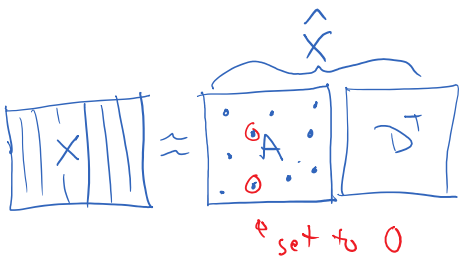
2) Based on the coefficients, update the dictionary

ⓐ for each dictionary vector, select only the training data that uses that vector

ⓑ for dictionary vector d_i
- fix all coefficients for the chosen data (training) vectors
- remove (or set to zero) just the coefficients for d_i
- find a new d_i and coefficient set to minimize the residual

Aside k-means

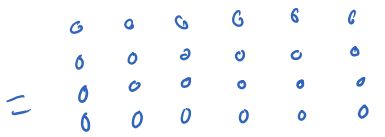




Define $E = X - \hat{X}$

minimize $\|\underline{\alpha}_i \underline{d}_i^T - E\|_F^2$
$\underline{d}_i, \underline{\alpha}_i$

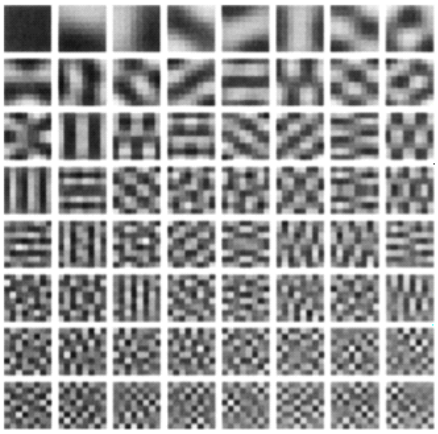
$\underline{\alpha}_i$

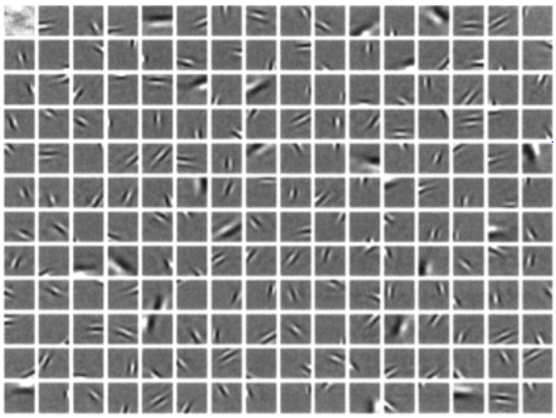


use SVD to find $\underline{\alpha}_i$ & $\underline{d}_i$

ⓒ repeat for each $\underline{d}_k$ in D

3) go back to step 1)





ksvd_dictionary