

Sparse gradient computation

only iterate through nonzero elems

$$\hat{V} \odot (U V^T - X) \quad \text{sum}(1)$$

$m \times n$
sparse

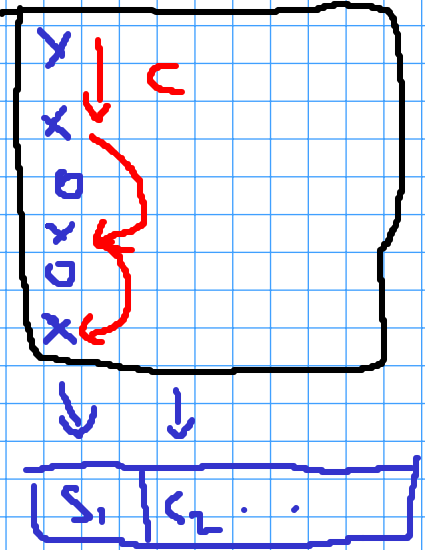
rows, cols = X.nonzero()
=> rows, cols = M.nonzero()

for ~~row~~ ^{col}
sum = 0
for ~~col~~ ^{row}

U, U

$\hat{V}[:, i]$

$$s += V[cols][U[row]] - X[r, c]$$



$$\sum_{r,c} (U_r V_c - X_{r,c}) V_{r,c}$$