Total number of flops of basic operations with vectors and matrices

1) Dot product of two N x 1 vectors

$$N + (N-1) = 2N-1$$

multiplications

additions

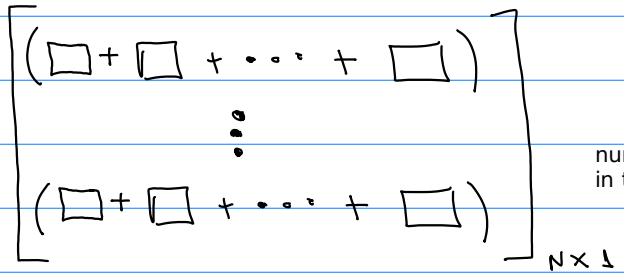
2) Hadamard product of two N x 1 vectors

N multiplications

3) Outer product of an N x 1 vector and an M x 1 vector

NM multiplications

4) Product of an N x M matrix and an M x 1 vector



$N \times 1$

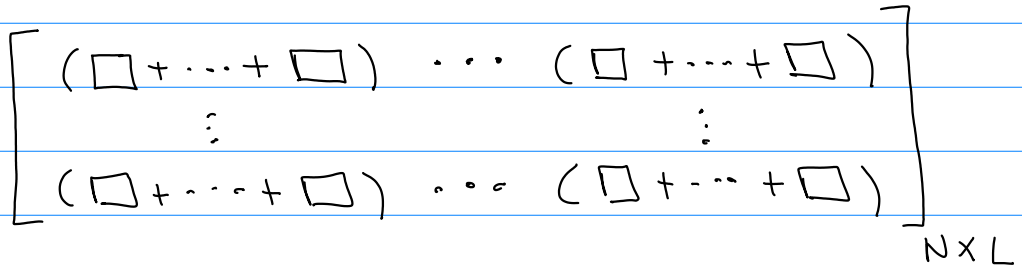
multiplications

$N\left(M + M-1\right)$

additions

number of elements in the resultant vector

5) Product of an N x M matrix and an M x L matrix



$N \times L$

$NL\left(M + M-1\right)$

number of elements in the resultant matrix

multiplications

additions

6) Product ABC, where A, B and C are N x M, M x L and L x P matrices

$(AB)C = A(BC)$

approach 1 ↓ ↓ approach 2

Approach 1

$f_{AB} = NL(2M-1)$

$AB = D_{NXL}$

$f_{DC} = NP(2L-1)$

$f_1 = f_{AB} + f_{DC}$

Approach 2

$f_{BC} = MP(2L-1)$

$BC = E_{MXP}$

$f_{AE} = NP(2M-1)$

$f_2 = f_{BC} + f_{AE}$