Biostat 216 Homework 3

Due Oct 18 @ 11:59pm

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1 Q1. Computational complexity of matrix multiplication

Let $\mathbf{A} \in \mathbb{R}^{m \times n}$, $\mathbf{B} \in \mathbb{R}^{n \times p}$. Consider four ways of computing the matrix product $\mathbf{C} = \mathbf{AB}$. Calculate the flop count (leading term) in each of these four algorithms.

1. (Inner products) Evaluate entries $c_{ij} = \mathbf{a}_i' \mathbf{b}_j$ for all i, j.
2. (Matrix vector products) Evaluate columns $\mathbf{c}_j = \mathbf{A}\mathbf{b}_j$ for all j.
3. (Vector matrix products) Evaluate rows $\mathbf{c}_i' = \mathbf{a}_i' \mathbf{B}$ for all i.
4. (Vector outer products) Evaluate $\mathbf{C}$ as the sum of outer prodcuts $\mathbf{a}_1 \mathbf{b}_1' + \cdots + \mathbf{a}_n \mathbf{b}_n'$.

2 BV exercises

7.12, 7.13, 7.14, 8.4, 8.5, 8.6, 8.9, 10.9 (also describe $\mathbf{C} = \mathbf{AD}$), 10.11, 10.19, 10.23, 10.36, 10.42, 10.43, 10.44