Welcome Tutorial :-)

Tutorial 6

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1. Let $l(\theta)$ be log-likelihood. When there is not closed-form for equation $\bigtriangledown l(\theta) = 0$, i.e., $\frac{dl(\theta)}{d\theta} = 0$, please write down your pseudocode to find the MLE via employing batch gradient ascent procedures.
2. Given a set of n points $(\mathbf{x}_i, y_i)$, where $\mathbf{x}_i \in \mathbb{R}^p$ and $y_i \in \mathbb{R}$, linear regression is to find $\beta_i, i = 0, 1, \cdots, p$, s.t., $\min_\beta J = \frac{1}{2}\sum_{i=1}^n \|y_i - \mathbf{X}_i^T\beta\|^2$, where $\mathbf{X}_i^T = (1\ x_{i1}\ \cdots\ x_{ip})$. To avoid overfitting, please estimation β via minimizing the penalized residual sum of squares (adding a term of regularization) $\min_\beta \widehat{J} = \sum_{i=1}^n \|y_i - \mathbf{X}_i^T\beta\|^2 + \frac{1}{2}\|\beta\|^2$.
3. Given an undirected graph G of n vertices associated with adjacency matrix A, please prove the following conclusions:
   - # triangles $= \frac{1}{6} Trace(A^3)$.
   - # triangles $= \frac{1}{6}\sum_{i=1}^n \lambda_i^3$, where λ_i is the eigenvalue of A.