Week 5 Exercises

The questions below are due on Tuesday October 10, 2017; 11:00:00 PM.

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- Videos
  - Week 5, Lecture 1 (https:///introml.mit.edu/lecture_videos/lec_week5.mp4)
- Class Notes for Week 5 (https://introml.mit.edu/__STATIC__/fall17/exercises/ex05/Wk5_notes.pdf)
- Required Exercises

  We will consider the problem of low-rank matrix factorization, which aims to minimize

$$J(U,V) = \frac{1}{2}\sum_{(a,i)\in D}(Y_{ai} - [UV^T]_{ai})^2 + \frac{\lambda}{2}\sum_{a=1}^{n}\sum_{j=1}^{k}U_{aj}^2 + \frac{\lambda}{2}\sum_{i=1}^{m}\sum_{j=1}^{k}V_{ij}^2$$

  Let Y be defined as

$$Y = \begin{bmatrix} 5 & ? & 7 \\ ? & 2 & ? \\ 4 & ? & ? \\ ? & 3 & 6 \end{bmatrix}$$

  and let $k = \lambda = 1$.

  Assume U and V are initialized as $U^{(0)} = [6, 0, 3, 6]^T$, and $V^{(0)} = [4, 2, 1]^T$.

  1) Compute X, the matrix of predicted rankings given these values.

  Enter it as a list of lists of integers (representing the rows of the matrix).

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[[24, 12,  6],[ 0,  0,  0],[12,  6,  3],[24, 12,  6]])
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  2) Compute the squared error for the current estimate X:

Enter the answer as a number or a Python numerical expression.

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511
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3) Compute the total regularization term for the current values of U, V and λ.

Enter the answer as a number or a Python numerical expression.

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850.5
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