Homework 1

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1 Supervised Learning

Problem A: Feature Representation

Solution A:

The matrix representing the four commit messages is as follows:

$$\begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Based on the bag-of-words representation, each row in the matrix is a feature vector for the corresponding sentence. In each vector, there is a feature per word in the dictionary (bug, fix, correct, error, wrong), and the binary value for each feature represents whether the word is present in the sentence.

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Problem B: Logistic Regression

Solution B:

There log(v) as la(v), there exp(x) as
$$e^{x}$$
:

$$\frac{\partial L}{\partial w_{j}} = -\sum_{i=1}^{N} \frac{\partial}{\partial w_{j}} \left(y^{i} \log(f(x^{0})) + (1-y^{i}) \log(1-f(x^{i})) \right)$$

$$= -\sum_{i=1}^{N} \frac{g^{i}}{f(x^{i})}, \frac{\partial}{\partial w_{j}} f(x^{i}) + \frac{1-g^{i}}{1-f(x^{i})}, \frac{\partial}{\partial w_{j}} (1-f(x^{i}))$$

$$= -\sum_{i=1}^{N} \left(\frac{y^{i}}{f(x^{i})} - \frac{1-y^{i}}{1-f(x^{i})} \right) \cdot \frac{\partial}{\partial w_{j}} f(x^{i})$$

$$= -\sum_{i=1}^{N} \left(\frac{y^{i}}{f(x^{i})} - \frac{1-y^{i}}{1-f(x^{i})} \right) \cdot \frac{\partial}{\partial w_{j}} f(x^{i})$$

$$= \frac{y^{i}(1-f(x^{i})) - f(x^{i}) + y^{i}(f(x^{i}))}{f(x^{i})(1-f(x^{i}))}$$

$$= \frac{y^{i}-f(x^{i})}{f(x^{i})(1-f(x^{i}))}$$

$$= \frac{y^{i}-f(x^{i})}{f(x^{i})(1-f(x^{i}))}$$

$$= -\sum_{i=1}^{N} \left(\frac{y^{i}-f(x^{i})}{f(x^{i})-g^{i}} \right) x_{j}^{i}$$

$$= -\sum_{i=1}^{N} \left(\frac{y^{i}-f(x^{i})}{f(x^{i})-g^{i}} \right) x_{j}^{i}$$

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2 Multi-Layer Perceptron

Problem A: Title

i. Title

Solution A.i: Your solution here

ii. Title

Solution A.ii: Your solution here