2025 USA-NA-AIO Round 1, Problem 3, Part 17

USAAIO 🛡   **Mar 2025**

Part 17 (15 points, coding task)

Construct a class called `My_Log_Reg` whose objects are logistic regression models.

- Method `__init__`

  - Inputs

    - `solver` : The value must be `GD` or `Newton`. Otherwise, it raises an error message `Invalid solver`.

    - `lr` : The learning rate.

    - `num_iter` : The total number of iterations.

  - Attributes

    - `solver`

    - `lr`

    - `num_iter`

    - `coef_` : β in our theoretical model. It shall be a 1-dim numpy array with shape `(d,)`.

- Method `fit`

  - Inputs

    - `X` : Features in a training dataset. The shape is `(N_train,d)`.

- - - `y` : Ground-truth labels in a training dataset. The shape is `(N_train,)`

  - In the body of this method

    - Use the configured solver to compute `coef_` .

    - Do whole-batch iteration.

    - After finishing training `coef_` , generate a plot about the loss function vs iteration.

      - The x-label is `iter` .

      - The y-label is `loss` .

      - The title is the optimization method: either `GD` or `Netwon` .

    - **The only loop that you can use is the whole-batch iteration. Within each iteration, when you update `coef_` by applying either `GD` or `Newton` , you are not allowed to use any loop.**

  - Output

    - None

- Method `predict`

  - Input

    - `X` : Features in a test dataset. The shape is `(N_test,d)` .

  - Output

    - `y_pred` : Predicted labels in the test dataset. The shape is `(N_test,)` .

- Method `score`

- Input

  - `X` : Features in a test dataset. The shape is `(N_test,d)`.

  - `y` : Ground-truth labels in the test dataset. The shape is `(N_test,)`.

- Output

  - `accuracy_score` : The accuracy score of the prediction of `y` .

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