Machine Learning System Design

LATEST SUBMISSION GRADE

80%

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1. You are working on a spam classification system using regularized logistic regression.   **1 / 1 point**
    "Spam" is a positive class (y = 1) and "not spam" is the negative class (y = 0). You have
    trained your classifier and there are m = 1000 examples in the cross-validation set. The
    chart of predicted class vs. actual class is:

	Actual Class: 1	Actual Class: 0
Predicted Class: 1	85	890
Predicted Class: 0	15	10

    For reference:

    - Accuracy = (true positives + true negatives) / (total examples)

    - Precision = (true positives) / (true positives + false positives)

    - Recall = (true positives) / (true positives + false negatives)

    - F_1 score = (2 * precision * recall) / (precision + recall)

    What is the classifier's precision (as a value from 0 to 1)?

    Enter your answer in the box below. If necessary, provide at least two values after the
    decimal point.

    > .09

    ✓ **Correct**

There are 85 true positives and 890 false positives, so precision is 85 / (85 + 890) = 0.087.

2. Suppose a massive dataset is available for training a learning algorithm. Training on a lot of data is likely to give good performance when two of the following conditions hold true.

                                                              1 / 1 point

Which are the two?

- ☑ We train a learning algorithm with a

    large number of parameters (that is able to

    learn/represent fairly complex functions).

    ✓ **Correct**

    You should use a "low bias" algorithm with many parameters, as it will be able to make use of the large dataset provided. If the model has too few parameters, it will underfit the large training set.

- ☑ The features x contain sufficient

    information to predict y accurately. (For example, one

    way to verify this is if a human expert on the domain

    can confidently predict y when given only x).

    ✓ **Correct**

    It is important that the features contain sufficient information, as otherwise no amount of data can solve a learning problem in which the features do not contain enough information to make an accurate prediction.

- ☐ We train a learning algorithm with a

    small number of parameters (that is thus unlikely to

    overfit).

☐ When we are willing to include high

order polynomial features of x (such as x_1^2, x_2^2,

x_1x_2, etc.).

3. Suppose you have trained a logistic regression classifier which is outputing $h_\theta(x)$.   **1 / 1 point**

Currently, you predict 1 if $h_\theta(x) \geq \text{threshold}$, and predict 0 if $h_\theta(x) < \text{threshold}$, where currently the threshold is set to 0.5.

Suppose you **decrease** the threshold to 0.3. Which of the following are true? Check all that apply.

☑ The classifier is likely to now have higher recall.

✓ **Correct**
Lowering the threshold means more y = 1 predictions. This will increase the number of true positives and decrease the number of false negatives, so recall will increase.

☐ The classifier is likely to have unchanged precision and recall, but

higher accuracy.

☐ The classifier is likely to have unchanged precision and recall, but

lower accuracy.

☐ The classifier is likely to now have higher precision.

4. Suppose you are working on a spam classifier, where spam   **0 / 1 point**

emails are positive examples ($y = 1$) and non-spam emails are

negative examples ($y = 0$). You have a training set of emails

in which 99% of the emails are non-spam and the other 1% is

spam. Which of the following statements are true? Check all

that apply.

☐ If you always predict non-spam (output

$y = 0$), your classifier will have 99% accuracy on the

training set, but it will do much worse on the cross

validation set because it has overfit the training

data.

☑ If you always predict non-spam (output

$y = 0$), your classifier will have 99% accuracy on the

training set, and it will likely perform similarly on

the cross validation set.

✓ **Correct**

    The classifier achieves 99% accuracy on the training set because of how skewed
the classes are. We can expect that the cross-validation set will be skewed in the
same fashion, so the classifier will have approximately the same accuracy.

☐ If you always predict non-spam (output

$y = 0$), your classifier will have an accuracy of

99%.

☑ A good classifier should have both a

high precision and high recall on the cross validation

set.

✓ **Correct**

    For data with skewed classes like these spam data, we want to achieve a high
F_1 score, which requires high precision and high recall.

    You didn't select all the correct answers

5.   Which of the following statements are true? Check all that apply.

☑   Using a **very large** training set

      makes it unlikely for model to overfit the training

      data.

      ✓   **Correct**
          A sufficiently large training set will not be overfit, as the model cannot overfit
          some of the examples without doing poorly on the others.

☐   After training a logistic regression

      classifier, you **must** use 0.5 as your threshold

      for predicting whether an example is positive or

      negative.

☑   The "error analysis" process of manually

      examining the examples which your algorithm got wrong

      can help suggest what are good steps to take (e.g.,

      developing new features) to improve your algorithm's

      performance.

      ✓   **Correct**
          This process of error analysis is crucial in developing high performance learning
          systems, as the space of possible improvements to your system is very large,
          and it gives you direction about what to work on next.

- [ ] It is a good idea to spend a lot of time

  collecting a **large** amount of data before building

  your first version of a learning algorithm.

- [ ] If your model is underfitting the

  training set, then obtaining more data is likely to

  help.