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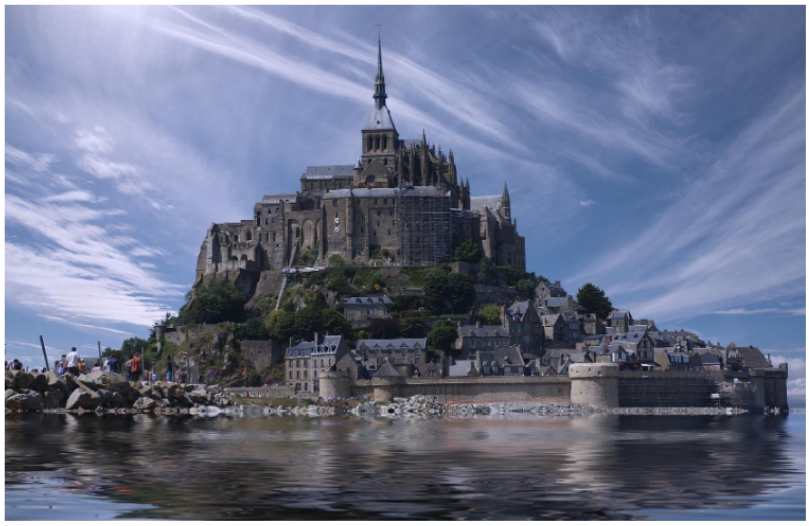
1. Problem Statement 1 / 1 point

This example is adapted from a real production application, but with details disguised to protect confidentiality.



You are a famous researcher in the City of Peacetopia. The people of Peacetopia have a common characteristic: they are afraid of birds. To save them, you have **to build an algorithm that will detect any bird flying over Peacetopia** and alert the population.

The City Council gives you a dataset of 10,000,000 images of the sky above Peacetopia, taken from the city's security cameras. They are labeled:

- y = 0: There is no bird on the image
- y = 1: There is a bird on the image

Your goal is to build an algorithm able to classify new images taken by security cameras from Peacetopia.

There are a lot of decisions to make:

- What is the evaluation metric?
- How do you structure your data into train/dev/test sets?

Metric of success

The City Council tells you that they want an algorithm that

1. Has high accuracy.
2. Runs quickly and takes only a short time to classify a new image.
3. Can fit in a small amount of memory, so that it can run in a small processor that the city will attach to many different security cameras.

Note: Having three evaluation metrics makes it harder for you to quickly choose between two different algorithms, and will slow down the speed with which your team can iterate. True/False?

- (•) True
- ( ) False

Expand

Correct

2. The city asks for your help in further defining the criteria for accuracy, runtime, and memory. How would you suggest they identify the criteria? **1 / 1 point**

- ○ Suggest that they purchase more infrastructure to ensure the model runs quickly and accurately.
- ○ Suggest to them that they focus on whichever criterion is important and then eliminate the other two.
- ◉ Suggest to them that they define which criterion is most important. Then, set thresholds for the other two.

Expand

Correct
Yes. The thresholds provide a way to evaluate models head to head.

3. The essential difference between an optimizing metric and satisficing metrics is the priority assigned by the stakeholders. True/False? **1 / 1 point**

- ○ True
- ◉ False

Expand

Correct
Yes. Satisficing metrics have thresholds for measurement and an optimizing metric is unbounded.

4. With 10,000,000 data points, what is the best option for train/dev/test splits? **1 / 1 point**

- ○ train - 60%, dev - 10%, test - 30%
- ◉ train - 95%, dev - 2.5%, test - 2.5%
- ○ train - 33.3%, dev - 33.3%, test - 33.3%
- ○ train - 60%, dev - 30%, test - 10%

Expand

Correct
Yes. The size of the data set allows for bias and variance evaluation with smaller data sets.

5. Now that you've set up your train/dev/test sets, the City Council comes across another 1,000,000 images from social media and offers them to you. These images are different from the distribution of images the City Council had originally given you, but you think it could help your algorithm. Which of the following is the best use of that additional data? **1 / 1 point**

- ○ Do not use the data. It will change the distribution of any set it is added to.
- ○ Add it to the dev set to evaluate how well the model generalizes across a broader set.
- ○ Split it among train/dev/test equally.
- ◉ Add it to the training set.

Expand

Correct
Yes. It is not a problem to have different training and dev distributions. Different dev and test distributions would be an issue.

6. One member of the City Council knows a little about machine learning and thinks you should add the 1,000,000 citizens' data images proportionately to the train/dev/test sets. You object because: **1 / 1 point**

- The 1,000,000 citizens' data images do not have a consistent x-->y mapping as the rest of the data.
- If we add the images to the test set then it won't reflect the distribution of data expected in production.
- The additional data would significantly slow down training time.
- The training set will not be as accurate because of the different distributions.

Expand

Correct
Yes. Using the data in the training set could be beneficial, but you wouldn't want to include such images in your test set as they are not from the expected distribution of data you'll see in production.

7. Human performance for identifying birds is < 1%, training set error is 5.2% and dev set error is 7.3%. Which of the options below is the best next step? **0 / 1 point**

- Try an ensemble model to reduce bias and variance.
- Get more data or apply regularization to reduce variance.
- Train a bigger network to drive down the >4.0% training error.
- Validate the human data set with a sample of your data to ensure the images are of sufficient quality.

Expand

Incorrect
No. We do not have test set accuracy.

8. You ask a few people to label the dataset so as to find out what is human-level performance. You find the following levels of accuracy: **1 / 1 point**

Bird watching expert #1	0.3% error
Bird watching expert #2	0.5% error
Normal person #1 (not a bird watching expert)	1.0% error
Normal person #2 (not a bird watching expert)	1.2% error

If your goal is to have "human-level performance" be a proxy (or estimate) for Bayes error, how would you define "human-level performance"?

- 0.3% (accuracy of expert #1)
- 0.75% (average of all four numbers above)
- 0.0% (because it is impossible to do better than this)
- 0.4% (average of 0.3 and 0.5)

Expand

Correct

9. A learning algorithm's performance can be better than human-level performance but it can never be better than Bayes error. True/False? **1 / 1 point**

- False.
- True.

Expand

Correct
Yes. By definition, human level error is worse than Bayes error.

10. After working on your algorithm you have to decide the next steps. Currently, human-level performance is 0.1%, training is at 2.0% and the dev set is at 2.1%. Which statement below best describes your thought process? **0 / 1 point**

- [x] Decrease regularization to boost smaller signals.

Correct
Yes. Bias is higher than variance.

- [x] Get a bigger training set to reduce variance.

This should not be selected
No. Bias is higher than variance.

- [ ] Decrease variance via regularization so training and dev sets have similar performance.
- [ ] Address bias first through a larger model to get closest to human level error.

Expand

Incorrect
You didn't select all the correct answers

11. You also evaluate your model on the test set, and find the following: **1 / 1 point**

Human-level performance	0.1%
Training set error	2.0%
Dev set error	2.1%
Test set error	7.0%

What does this mean? (Check the two best options.)

- [x] You should try to get a bigger dev set.

Correct

- [ ] You have underfitted to the dev set.
- [ ] You should get a bigger test set.
- [x] You have overfit to the dev set.

✓ Correct

Expand

✓ Correct
Great, you got all the right answers.

12. After working on this project for a year, you finally achieve: Human-level performance, 0.10%, Training set error, 0.05%, Dev set error, 0.05%. Which of the following are likely? (Check all that apply.) **1 / 1 point**

- [ ] This result is not possible since it should not be possible to surpass human-level performance.
- [x] The model has recognized emergent features that humans cannot. (Chess and Go for example)

✓ Correct
Yes. When Google beat the world Go champion, it was recognized that it was making deeper moves than humans.

- [ ] There is still avoidable bias.
- [x] Pushing to even higher accuracy will be slow because you will not be able to easily identify sources of bias.

✓ Correct
Yes. Exceeding human performance means you are close to Bayes error.

Expand

✓ Correct
Great, you got all the right answers.

13. It turns out Peacetopia has hired one of your competitors to build a system as well. You and your competitor both deliver systems with about the same running time and memory size. However, your system has higher accuracy! Still, when Peacetopia tries out both systems, they conclude they like your competitor's system better because, even though you have higher overall accuracy, you have more false negatives (failing to raise an alarm when a bird is in the air). What should you do? **1 / 1 point**

- (•) Brainstorm with your team to refine the optimizing metric to include false negatives as they further develop the model.
- ( ) Apply regularization to minimize the false negative rate.
- ( ) Pick false negative rate as the new metric, and use this new metric to drive all further development.
- ( ) Ask your team to take into account both accuracy and false negative rate during development.

Expand

✓ Correct
Yes. The target has shifted so an updated metric is required.

14. Over the last few months, a new species of bird has been slowly migrating into the area, so the performance of your system slowly degrades because your data is being tested on a new type of data. There are only 1,000 images of the new species. The city expects a better system from you within the next 3 months. Which of these should you do first? **0 / 1 point**

- ( ) Put the new species' images in training data to learn their features.
- ( ) Add pooling layers to downsample features to accommodate the new species.
- ( ) Augment your data to increase the images of the new bird

Augment your data to increase the images of the new bird.

Split them between dev and test and re-tune.

Expand

Incorrect
No. The First you'll need more data so augmenting the existing data to create more training examples would be the next step

15. The City Council thinks that having more Cats in the city would help scare off birds. They are so happy with your work on the Bird detector that they also hire you to build a Cat detector. You have a huge dataset of 100,000,000 cat images. Training on this data takes about two weeks. Which of the statements do you agree with? (Check all that agree.) **1 / 1 point**

- [ ] Reducing the model complexity will allow the use of the larger data set but preserve accuracy.
- [x] This significantly impacts iteration speed.

Correct
Yes. This training time is an absolute constraint on iteration.

- [x] Lowering the number of images will reduce training time and likely allow for an acceptable tradeoff between iteration speed and accuracy.

Correct
Yes. There is a sweet spot that allows development at a reasonable rate without significant accuracy loss.

Expand

Correct
Great, you got all the right answers.