1. Suppose you are running a sliding window detector to find text in images. Your input images are 1000x1000 pixels. You will run your sliding windows detector at two scales, 10x10 and 20x20 (i.e., you will run your classifier on lots of 10x10 patches to decide if they contain text or not; and also on lots of 20x20 patches), and you will "step" your detector by 2 pixels each time. About how many times will you end up running your classifier on a single 1000x1000 test set image?

1 / 1 point

- ○ 250,000
- ○ 100,000
- ○ 1,000,000
- ◉ 500,000

Correct
With a stride of 2, you will run your classifier approximately 500 times for each dimension. Since you run the classifier twice (at two scales), you will run it 2 * 500 * 500 = 500,000 times.

2. Suppose that you just joined a product team that has been developing a machine learning application, using $m = 1,000$ training examples. You discover that you have the option of hiring additional personnel to help collect and label data. You estimate that you would have to pay each of the labellers $10 per hour, and that each labeller can label 4 examples per minute. About how much will it cost to hire labellers to label 10,000 new training examples?

1 / 1 point

- ◉ $400
- ○ $600
- ○ $250
- ○ $10,000

Correct
On labeller can label $4 \times 60 = 240$ examples in one hour. It will thus take him $10,000/240 \approx 40$ hours to complete 10,000 examples. At $10 an hour, this is $400.

3. What are the benefits of performing a ceiling analysis? Check all that apply.

1 / 1 point

- [x] It can help indicate that certain components of a system might not be worth a significant amount of work improving, because even if it had perfect performance its impact on the overall system may be small.

Correct
An unpromising component will have little effect on overall performance when it is replaced with ground truth.

- [ ] A ceiling analysis helps us to decide what is the most promising learning algorithm (e.g., logistic regression vs. a neural network vs. an SVM) to apply to a specific component of a machine learning pipeline.

- [x] It gives us information about which components, if improved, are most likely to have a significant impact on the performance of the final system.

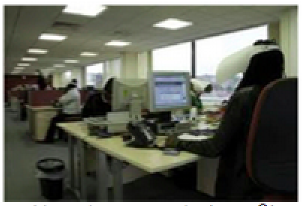
Correct
The ceiling analysis gives us this information by comparing the baseline overall system performance with ground truth results from each component of the pipeline.

- [ ] If we have a low-performing component, the ceiling analysis can tell us if that component has a high bias problem or a high variance problem.

4. Suppose you are building an object classifier, that takes as input an image, and recognizes that image as either containing a car ($y = 1$) or not ($y = 0$). For example, here are a positive example and a negative example:

1 / 1 point

Positive example ($y = 1$)



Negative example ($y = 0$)

After carefully analyzing the performance of your algorithm, you conclude that you need more positive ($y = 1$) training examples. Which of the following might be a good way to get additional positive examples?

- (selected) Apply translations, distortions, and rotations to the images already in your training set.
- Select two car images and average them to make a third example.
- Take a few images from your training set, and add random, gaussian noise to every pixel.
- Make two copies of each image in the training set; this immediately doubles your training set size.

Correct
These geometric distortions are likely to occur in real-world images, so they are a good way to generate additional data.

5. Suppose you have a PhotoOCR system, where you have the following pipeline:

1 / 1 point

You have decided to perform a ceiling analysis on this system, and find the following:

Component	Accuracy
Overall System	70%
Text Detection	72%
Character Segmentation	82%
Character Recognition	100%

Which of the following statements are true?

- [x] If the text detection system was trained using gradient descent, running gradient descent for more iterations is unlikely to help much.

Correct

Plugging in ground truth text detection improved the overall system by only 2%, so even if you could improve text detection performance with more gradient descent iterations, this would have minimal impact on the overall system performance.

- [x] If we conclude that the character recognition's errors are mostly due to the character recognition system having high variance, then it may be worth significant effort obtaining additional training data for character recognition.

Correct

Since the biggest improvement comes from character recognition ground truth, we would like to improve the performance of that system. It the character recognition system has high variance, additional data will improve its performance.

- [ ] We should dedicate significant effort to collecting additional training data for the text detection system.

- [ ] The least promising component to work on is the character recognition system, since it is already obtaining 100% accuracy.