← 뒤로 **Autonomous Driving (Case Study)**
학점 평가 퀴즈 • 1 시간 15 분

국어 ⌵ 만료 년 10월 8일 오후 11:59 KST

축하합니다! 통과하셨습니다!

받은 학점 80% **최신 제출물 학점** 80% **통과 점수:** 80% 이상

다음 항목으로 이동 23 시간 54 분 후에 과제를 다시 풀어보세요.

1. To help you practice strategies for machine learning, this week we'll present another scenario and ask how you would act. We think this "simulator" of working in a machine learning project will give an idea of what leading a machine learning project could be like!

0 / 1점

You are employed by a startup building self-driving cars. You are in charge of detecting road signs (stop sign, pedestrian crossing sign, construction ahead sign) and traffic signals (red and green lights) in images. The goal is to recognize which of these objects appear in each image. As an example, this image contains a pedestrian crossing sign and red traffic lights.

$$y^{(i)} = \begin{bmatrix} 0 \\ 1 \\ 0 \\ 1 \\ 0 \end{bmatrix} \begin{array}{l} \text{"stop sign"} \\ \text{"pedestrian crossing sign"} \\ \text{"construction ahead sign"} \\ \text{"red traffic light"} \\ \text{"green traffic light"} \end{array}$$

Your 100,000 labeled images are taken using the front-facing camera of your car. This is also the distribution of data you care most about doing well on. You think you might be able to get a much larger dataset off the internet, which could be helpful for training even if the distribution of internet data is not the same.

You are getting started with this project. What is the first thing you do? Assume each of the steps below would take about an equal amount of time (a few days).

○ Spend some time searching the internet for the data most similar to the conditions you expect on production.

● Invest a few days in thinking on potential difficulties, and then some more days brainstorming about possible solutions, before training any model.

○ Train a basic model and do error analysis.

○ Spend a few days collecting more data using the front-facing camera of your car, to better understand how much data per unit time you can collect.

⤢ 더 보기

ⓧ 틀립니다

Applied ML is highly iterative. Having a basic model to do an error analysis can point you in the most promising direction with a lot of certainties.

2. Your goal is to detect road signs (stop sign, pedestrian crossing sign, construction ahead sign) and traffic signals (red and green lights) in images. The goal is to recognize which of these objects appear in each image. You plan to use a deep neural network with ReLU units in the hidden layers. For the output layer, a softmax activation would be a good choice for the output layer because this is a multi-task learning problem. True/False?

1 / 1점

● False

○ True

더 보기

✓ 맞습니다
Softmax would be a good choice if one and only one of the possibilities (stop sign, speed bump, pedestrian crossing, green light and red light) was present in each image.

3. You are working out error analysis and counting up what errors the algorithm makes. Which of the following do you think you should manually go through and carefully examine, one image at a time?

0 / 1점

● 500 images of the test set, on which the algorithm made a mistake.

○ 500 images of the train set, on which the algorithm made a mistake.

○ 500 images of the dev set, on which the algorithm made a mistake.

○ 500 images of the training-dev set, on which the algorithm made a mistake.

더 보기

⊗ 틀립니다
We should avoid this since we might overfit the test set.

4. After working on the data for several weeks, your team ends up with the following data:

1 / 1점

- 100,000 labeled images taken using the front-facing camera of your car.

- 900,000 labeled images of roads downloaded from the internet.
- Each image's labels precisely indicate the presence of any specific road signs and traffic signals or combinations of them. For example, $y^{(i)} = \begin{bmatrix}1\\0\\0\\1\\0\end{bmatrix}$ means the image contains a stop sign and a red traffic light.

Because this is a multi-task learning problem, when an image is not fully labeled (for example: $\begin{pmatrix}0\\?\\?\\1\\0\end{pmatrix}$) we can use it if we ignore those entries when calculating the loss function. True/False?

○ False

● True

⤢ 더 보기

✓ 맞습니다
Correct. We can't use the components of the labels that are missing but we can use the ones we have to train the model.

5. The distribution of data you care about contains images from your car's front-facing camera; which comes from a different distribution than the images you were able to find and download off the internet. How should you split the dataset into train/dev/test sets?

1 / 1점

○ Mix all the 100,000 images with the 900,000 images you found online. Shuffle everything. Split the 1,000,000 images dataset into 980,000 for the training set, 10,000 for the dev set and 10,000 for the test set.

○ Choose the training set to be the 900,000 images from the internet along with 20,000 images from your car's front-facing camera. The 80,000 remaining images will be split equally in dev and test sets.

○ Mix all the 100,000 images with the 900,000 images you found online. Shuffle everything. Split the 1,000,000 images dataset into 600,000 for the training set, 200,000 for the dev set and 200,000 for the test set.

● Choose the training set to be the 900,000 images from the internet along with 80,000 images from your car's front-facing camera. The 20,000 remaining images will be split equally in dev and test sets.

⤢ 더 보기

✓ 맞습니다
Yes. As seen in the lecture, it is important that your dev and test set have the closest possible distribution to "real" data. It is also important for the training set to contain enough "real" data to avoid having a data-mismatch problem.

6. Assume you've finally chosen the following split between the data:

0 / 1점

Dataset:	Contains:	Error of the algorithm:
Training	940,000 images randomly picked from (900,000 internet images + 60,000 car's front-facing camera images)	12%
Training-Dev	20,000 images randomly picked from (900,000 internet images + 60,000 car's front-facing camera images)	15.1%
Dev	20,000 images from your car's front-facing camera	12.6%
Test	20,000 images from the car's front-facing camera	15.8%

You also know that human-level error on the road sign and traffic signals classification task is around 0.5%. Which of the following is True?

● You have a large data-mismatch problem.

○ You have a high bias.

○ You have a too low avoidable bias.

○ You have a high variance problem.

⤢ 더 보기

⊗ 틀립니다
The training-dev error and the dev error are not that different to come to this conclusion.

7. Assume you've finally chosen the following split between the data:

1 / 1점

Dataset:	Contains:	Error of the algorithm:
Training	940,000 images randomly picked from (900,000 internet images + 60,000 car's front-facing camera images)	2%
Training-Dev	20,000 images randomly picked from (900,000 internet images + 60,000 car's front-facing camera images)	2.3%

Dev	20,000 images from your car's front-facing camera	1.3%
Test	20,000 images from the car's front-facing camera	1.1%

You also know that human-level error on the road sign and traffic signals classification task is around 0.5%. Based on the information given you conclude that the Bayes error for the dev/test distribution is probably higher than for the train distribution. True/False?

○ True

● False

⤢ 더 보기

✓ 맞습니다

8. You decide to focus on the dev set and check by hand what the errors are due to. Here is a table summarizing your discoveries:

1 / 1점

Overall dev set error	15.3%
Errors due to incorrectly labeled data	4.1%
Errors due to foggy pictures	2.0%
Errors due to partially occluded elements.	8.2%
Errors due to other causes	1.0%

In this table, 4.1%, 8.2%, etc. are a fraction of the total dev set (not just examples of your algorithm mislabeled). For example, about 8.2/15.3 = 54% of your errors are due to partially occluded elements in the image.

Which of the following is the correct analysis to determine what to prioritize next?

○ You should prioritize getting more foggy pictures since that will be easier to solve.

● You should weigh how costly it would be to get more images with partially occluded elements, to decide if the team should work on it or not.

○ Since there is a high number of incorrectly labeled data in the dev set, you should prioritize fixing the labels on the whole training set.

○ Since 8.2 > 4.1 + 2.0 + 1.0, the priority should be to get more images with partially occluded elements.

⤢ 더 보기

✓ 맞습니다
Correct. You should consider the tradeoff between the data accessibility and potential improvement of your model trained on this additional data.

9. You decide to focus on the dev set and check by hand what the errors are due to. Here is a table summarizing your discoveries:

1 / 1점

Overall dev set error	15.3%
Errors due to incorrectly labeled data	4.1%
Errors due to foggy pictures	3.0%
Errors due to partially occluded elements.	7.2%
Errors due to other causes	1.0%

In this table, 4.1%, 7.2%, etc. are a fraction of the total dev set (not just examples of your algorithm mislabeled). For example, about 7.2/15.3 = 47% of your errors are due to partially occluded elements.

You find out that there is an anti-reflective film guarantee to eliminate the sun reflection, but it is quite costly. Which of the following gives the best description of what the investment in the film can do to the model?

● The film will reduce the dev set error with 7.2% at the most.

○ The film will reduce at least 7.2% of the dev set error.

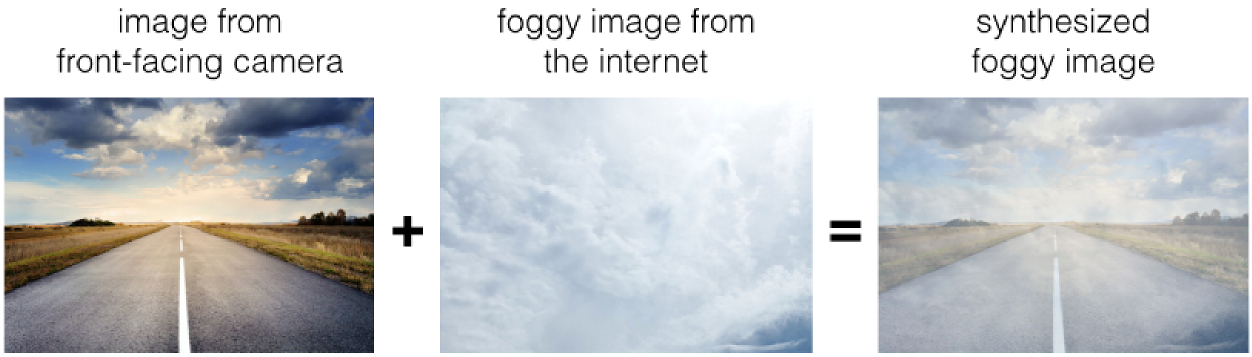
○ The overall test set error will be reduced by at most 7.2%.

⤢ 더 보기

✓ 맞습니다
Yes. Remember that this 7.2% gives us an estimate for the ceiling of how much the error can be reduced when the cause is fixed.

10. You decide to use data augmentation to address foggy images. You find 1,000 pictures of fog off the internet, and "add" them to clean images to synthesize foggy days, like this:

1 / 1점



We can't use this data since they have a different distribution from the ones we used (internet and front-facing camera). True/False?

○ True

● False

⤢ 더 보기

✓ 맞습니다
Correct. The new synthesized images are added to the training set and as long as they look realistic to the human eye this will be useful data to train the model.

11. After working further on the problem, you've decided to correct the incorrectly labeled data. Your team corrects the labels of the wrongly predicted images on the dev set.

1 / 1점

You have to correct the labels of the test so test and dev sets have the same distribution, but you won't change the labels on the train set because most models are robust enough they don't get severely affected by the difference in distributions. True/False?

● True, as pointed out, we must keep dev and test with the same distribution. And the labels at training should be fixed only in case of a systematic error.

○ False, the test set should be changed, but also the train set to keep the same distribution between the train, dev, and test sets.

○ False, the test set shouldn't be changed since we want to know how the model performs in real data.

⤢ 더 보기

✓ 맞습니다
Correct! To successfully train a model, the dev set and test set should come from the same distribution. Also, the deep learning models are robust enough to handle a small change in distributions, but if the errors are systematic they can significantly affect the training of the model.

12. Your client asks you to add the capability to detect dogs that may be crossing the road to the system. He can provide a relatively small set containing dogs. Which of the following do you agree most with?

1 / 1점

○ You will have to re-train the whole model now including the dogs' data.

○ Using pre-trained weights can severely hinder the ability of the model to detect dogs since they have too many learned features.

● You can use weights pre-trained on the original data, and fine-tune with the data now including the dogs.

○ You should train a single new model for the dogs' task, and leave the previous model as it is.

⤢ 더 보기

✓ 맞습니다
Correct. Since your model has learned useful low-level features to tackle the new task we can conserve those by using the pre-trained weights.

13. Another colleague wants to use microphones placed outside the car to better hear if there are other vehicles around you. For example, if there is a police vehicle behind you, you would be able to hear their siren. However, they don't have much to train this audio system. How can you help?

1 / 1점

○ Multi-task learning from your vision dataset could help your colleague get going faster. Transfer learning seems significantly less promising.

○ Either transfer learning or multi-task learning could help our colleague get going faster.

● Neither transfer learning nor multi-task learning seems promising.

○ Transfer learning from your vision dataset could help your colleague get going faster. Multi-task learning seems significantly less promising.

⤢ 더 보기

✓ 맞습니다
Yes. The problem he is trying to solve is quite different from yours. The different dataset structures make it probably impossible to use transfer learning or multi-task learning.

14. To recognize a stop sign you use the following approach: First, you use a neural network to predict bounding box co-ordinates around all traffic signs (if any) within an input image. You then pass the results to a different neural network to determine if the predicted traffic signs (if any) are a stop sign or not. We are using multi-task learning. True/False?

1 / 1점

● False

○ True

더 보기

✓ 맞습니다

Correct. Multi-task learning is about joining several tasks that can benefit from each other. Since there are 2 different neural networks being used here that do not share weights (i.e. structure), this problem has 2 single task learning neural networks and not a multi-task learning setup.

15. An end-to-end approach doesn't require that we hand-design useful features, it only requires a large enough model. True/False?

1 / 1점

● True

○ False

더 보기

✓ 맞습니다

Correct. This is one of the major characteristics of deep learning models, that we don't need to hand-design the features.