**[Skip to main content](https://www.coursera.org/learn/machine-learning-projects/exam/9QaQK/autonomous-driving-case-study/view-attempt" \l "main)**

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* **Error Analysis**
* **Mismatched Training and Dev/Test Set**
* **Learning from Multiple Tasks**
* **End-to-end Deep Learning**
* **Lecture Notes (Optional)**
* **Machine Learning Flight Simulator (Quiz)**

**[Quiz:](https://www.coursera.org/learn/machine-learning-projects/exam/9QaQK/autonomous-driving-case-study)**[Autonomous Driving (Case Study)](https://www.coursera.org/learn/machine-learning-projects/exam/9QaQK/autonomous-driving-case-study)

[Submitted](https://www.coursera.org/learn/machine-learning-projects/exam/9QaQK/autonomous-driving-case-study)

* **Heroes of Deep Learning (Optional)**
* **Acknowledgments**

1. [Week 2](https://www.coursera.org/learn/machine-learning-projects/home/week/2)
2. [Autonomous Driving (Case Study)](https://www.coursera.org/learn/machine-learning-projects/exam/9QaQK/autonomous-driving-case-study/view-attempt)

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**Autonomous Driving (Case Study)**

**Submit your assignment**

DueDecember 4, 11:59 PM CSTDec 4, 11:59 PM CST

Attempts3 every 8 hours

Try again

**Receive grade**

To Pass80% or higher

**Your grade**

80%

View Feedback

We keep your highest score

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**Autonomous Driving (Case Study)**

Graded Quiz. • 1h 15m

English

DueDec 4, 11:59 PM CST

**Congratulations! You passed!**

Grade received 80%

Latest Submission Grade 80%

To pass 80% or higher

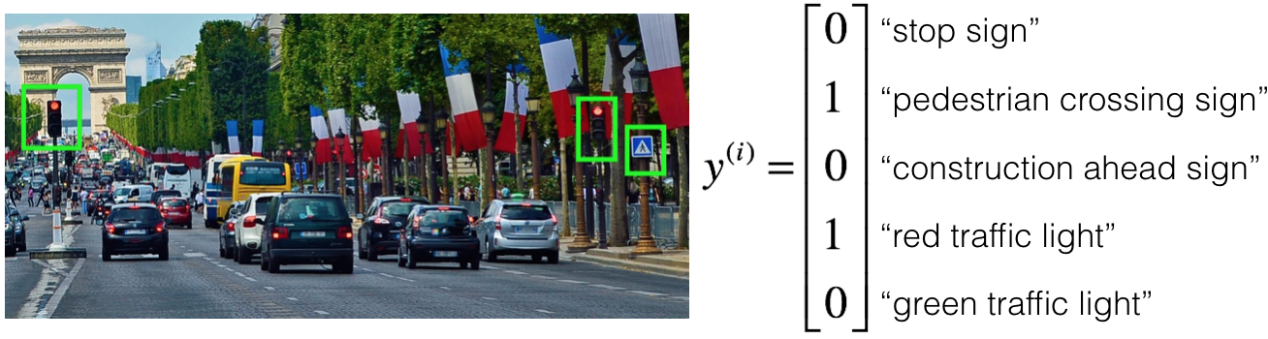
Go to next item

**1.**

Question 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 you an idea of what leading a machine learning project could be like!

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.



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.

Suppose that you came from working with a project for human detection in city parks, so you know that detecting humans in diverse environments can be a difficult problem. What is the first thing you do? Assume each of the steps below would take about an equal amount of time (a few days).

Status: [object Object]

0 / 1 point

Expand

Incorrect

Notice that this is a case where multi-task learning can be applied, thus the pedestrian detection might benefit from the other tasks, and also the other way around.

**2.**

Question 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, which of the following gives you the most appropriate activation function?

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. This works well since the output would be valued between 0 and 1 which represents the probability that one of the possibilities is present in an image.

**3.**

Question 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?

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. We focus on images that the algorithm got wrong from the dev set. That is the one we use to make choices between different iterations of the system.

**4.**

Question 4

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

* 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)=[10010]*y*(*i*)=⎣⎢⎢⎢⎢⎢⎡​10010​⎦⎥⎥⎥⎥⎥⎤​ means the image contains a stop sign and a red traffic light.

When using a non fully labeled image such as y(i)=[0?1?1]*y*(*i*)=⎣⎢⎢⎢⎢⎢⎡​0?1?1​⎦⎥⎥⎥⎥⎥⎤​, which of the following strategies is most appropriate to calculate the loss function to train as a multi-task learning problem?

Status: [object Object]

1 / 1 point

Expand

Correct

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.**

Question 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. The best way to split the data is using the 900,000 internet images to train, and divide the 100,000 images from your car's front-facing camera between dev and test sets. True/False?

Status: [object Object]

0 / 1 point

Expand

Incorrect

100,000 images are too many to use in dev and test. A better distribution would be to use 80,000 of those images to train, and split the rest between dev and test.

**6.**

Question 6

Assume you’ve finally chosen the following split between the data:

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| **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) | 1% |
| Training-Dev | 20,000 images randomly picked from (900,000 internet images + 60,000 car’s front-facing camera images) | 5.1% |
| Dev | 20,000 images from your car’s front-facing camera | 5.6% |
| Test | 20,000 images from the car’s front-facing camera | 6.8% |

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?

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. Since the difference between the training-dev error and the training error is high.

**7.**

Question 7

Assume you’ve finally chosen the following split between the data:

|  |  |  |
| --- | --- | --- |
| **Dataset:** | **Contains:** | **Error of the algorithm:** |
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| Dev | 20,000 images from your car’s front-facing camera | 14.3% |
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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, a friend thinks that the training data distribution is much easier than the dev/test distribution. What do you think?

Status: [object Object]

1 / 1 point

Expand

Correct

The algorithm does better on the distribution of data it trained on. But you don’t know if it’s because it trained on that distribution or if it really is easier. To get a better sense, measure human-level error separately on both distributions.

**8.**

Question 8

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

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| Errors due to other causes | 1.0% |

In this table, 4.1%, 8.0%, etc. are a fraction of the total dev set (not just examples of your algorithm mislabeled). For example, about 8.0/15.3 = 52% of your errors are due to foggy pictures.

The results from this analysis implies that the team’s highest priority should be to bring more foggy pictures into the training set so as to address the 8.0% of errors in that category. True/False?

Additional note: there are subtle concepts to consider with this question, and you may find arguments for why some answers are also correct or incorrect. We recommend that you spend time reading the feedback for this quiz, to understand what issues that you will want to consider when you are building your own machine learning project.

Status: [object Object]

0 / 1 point

Expand

Incorrect

Incorrect. The choice should not be made on this argument.

**9.**

Question 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:

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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?

Status: [object Object]

1 / 1 point

Expand

Correct

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.**

Question 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:



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

Status: [object Object]

1 / 1 point

Expand

Correct

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.**

Question 11

After working further on the problem, you’ve decided to correct the incorrectly labeled data on the dev set. Which of these statements do you agree with? (Check all that apply).

Status: [object Object]

1 / 1 point

Expand

Correct

Great, you got all the right answers.

**12.**

Question 12

One of your colleagues at the startup is starting a project to classify road signs as stop, dangerous curve, construction ahead, dead-end, and speed limit signs. Given how specific the signs are, he has only a small dataset and hasn't been able to create a good model. You offer your help providing the trained weights (parameters) of your model to transfer knowledge.

But your colleague points out that his problem has more specific items than the ones you used to train your model. This makes the transfer of knowledge impossible. True/False?

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. The model can benefit from the pre-trained model since there are many features learned by your model that can be used in the new problem.

**13.**

Question 13

One of your colleagues at the startup is starting a project to classify stop signs in the road as speed limit signs or not. He has approximately 30,000 examples of each image and 30,000 images without a sign. He thought of using your model and applying transfer learning but then he noticed that you use multi-task learning, hence he can't use your model. True/False?

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. When using transfer learning we can remove the last layer. That is one of the aspects that is different from a binary classification problem.

**14.**

Question 14

To recognize red and green lights, you have been using this approach:

* **(A)** Input an image (x) to a neural network and have it directly learn a mapping to make a prediction as to whether there’s a red light and/or green light (y).

A teammate proposes a different, two-step approach:

* **(B)** In this two-step approach, you would first (i) detect the traffic light in the image (if any), then (ii) determine the color of the illuminated lamp in the traffic light.

Between these two, Approach B is more of an end-to-end approach because it has distinct steps for the input end and the output end. True/False?

Status: [object Object]

1 / 1 point

Expand

Correct

Yes. (A) is an end-to-end approach as it maps directly the input (x) to the output (y).

**15.**

Question 15

To recognize a stop sign you use the following approach:

First, we localize any traffic sign in an image. After that, we determine if the sign is a stop sign or not.

This is a better approach than an end-to-end model for which of the following cases? Choose the best answer.

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. This might be the most important factor when deciding whether to use an end-to-end approach.

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* **Heroes of Deep Learning (Optional)**
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**Submit your assignment**

DueDecember 4, 11:59 PM CSTDec 4, 11:59 PM CST

Attempts3 every 8 hours

Try again

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To Pass80% or higher

**Your grade**

80%

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We keep your highest score

Like

Dislike

Report an issue

Back

**Autonomous Driving (Case Study)**

Graded Quiz. • 1h 15m

English

DueDec 4, 11:59 PM CST

**Congratulations! You passed!**

Grade received 80%

Latest Submission Grade 80%

To pass 80% or higher

Go to next item

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路上有一些广告

描述已自动生成

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Status: [object Object]

0 / 1 point

Expand

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Question 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, which of the following gives you the most appropriate activation function?

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1 / 1 point

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图片包含 文本

描述已自动生成

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One of your colleagues at the startup is starting a project to classify road signs as stop, dangerous curve, construction ahead, dead-end, and speed limit signs. Given how specific the signs are, he has only a small dataset and hasn't been able to create a good model. You offer your help providing the trained weights (parameters) of your model to transfer knowledge.

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Status: [object Object]

1 / 1 point

Expand

Correct

Correct. When using transfer learning we can remove the last layer. That is one of the aspects that is different from a binary classification problem.

**14.**

Question 14

To recognize red and green lights, you have been using this approach:

* **(A)** Input an image (x) to a neural network and have it directly learn a mapping to make a prediction as to whether there’s a red light and/or green light (y).

A teammate proposes a different, two-step approach:

* **(B)** In this two-step approach, you would first (i) detect the traffic light in the image (if any), then (ii) determine the color of the illuminated lamp in the traffic light.

Between these two, Approach B is more of an end-to-end approach because it has distinct steps for the input end and the output end. True/False?

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1 / 1 point

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Correct

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**15.**

Question 15

To recognize a stop sign you use the following approach:

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This is a better approach than an end-to-end model for which of the following cases? Choose the best answer.

Status: [object Object]

1 / 1 point

Expand

Correct

Correct. This might be the most important factor when deciding whether to use an end-to-end approach.