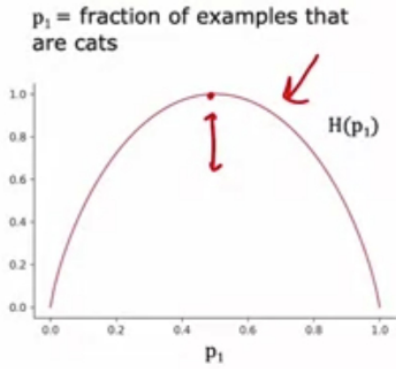✔ **Congratulations! You passed!**

Grade received 100%   Latest Submission Grade 100%   To pass 80% or higher

[Go to next item]

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1.   1 / 1 point

Entropy as a measure of impurity

p_i = fraction of examples that are cats

$$p_0 = 1 - p_1$$

$$H(p_1) = -p_1 log_2(p_1) - p_0 log_2(p_0)$$
$$= -p_1 \, log_2(p_1) - (1 - p_1)log_2(1 - p_1)$$

Note: "0 log(0)" = 0

Recall that entropy was defined in lecture as H(p_1) = - p_1 log_2(p_1) - p_0 log_2(p_0), where p_1 is the fraction of positive examples and p_0 the fraction of negative examples.

At a given node of a decision tree, , 6 of 10 examples are cats and 4 of 10 are not cats. Which expression calculates the entropy $H(p_1)$ of this group of 10 animals?

◉ $-(0.6)log_2(0.6) - (0.4)log_2(0.4)$

○ $(0.6)log_2(0.6) + (1 - 0.4)log_2(1 - 0.4)$

○ $(0.6)log_2(0.6) + (0.4)log_2(0.4)$

○ $-(0.6)log_2(0.6) - (1 - 0.4)log_2(1 - 0.4)$

✔ **Correct**
Correct. The expression is $-(p_1)log_2(p_1) - (p_0)log_2(p_0)$

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2.   1 / 1 point

Information gain

$$= H(p_1^{root}) - \left(w^{left} H\left(p_1^{left}\right) + w^{right} H\left(p_1^{right}\right) \right)$$

Recall that information was defined as follows:

$$H(p_1^{root}) - \left(w^{left} H(p_1^{left}) + w^{right} H(p_1^{right}) \right)$$

Before a split, the entropy of a group of 5 cats and 5 non-cats is $H(5/10)$. After splitting on a particular feature, a group of 7 animals (4 of which are cats) has an entropy of $H(4/7)$. The other group of 3 animals (1 is a cat) and has an entropy of $H(1/3)$. What is the expression for information gain?

○ $H(0.5) - (\frac{4}{7} * H(4/7) + \frac{4}{7} * H(1/3))$

○ $H(0.5) - (H(4/7) + H(1/3))$

○ $H(0.5) - (7 * H(4/7) + 3 * H(1/3))$

$\odot$ $H(0.5) - \left(\frac{7}{10}H(4/7) + \frac{3}{10}H(1/3)\right)$

3.

One hot encoding

Ear shape	Pointy ears	Floppy ears	Oval ears	Face shape	Whiskers	Cat
Pointy	1	0	0	Round	Present	1
Oval	0	0	1	Not round	Present	1
Oval	0	0	1	Round	Absent	0
Pointy	1	0	0	Not round	Present	0
Oval	0	0	1	Round	Present	1
Pointy	1	0	0	Round	Absent	1
Floppy	0	1	0	Not round	Absent	0
Oval	0	0	1	Round	Absent	1
Floppy	0	1	0	Round	Absent	0
Floppy	0	1	0	Round	Absent	0

To represent 3 possible values for the ear shape, you can define 3 features for ear shape: pointy ears, floppy ears, oval ears. For an animal whose ears are not pointy, not floppy, but are oval, how can you represent this information as a feature vector?
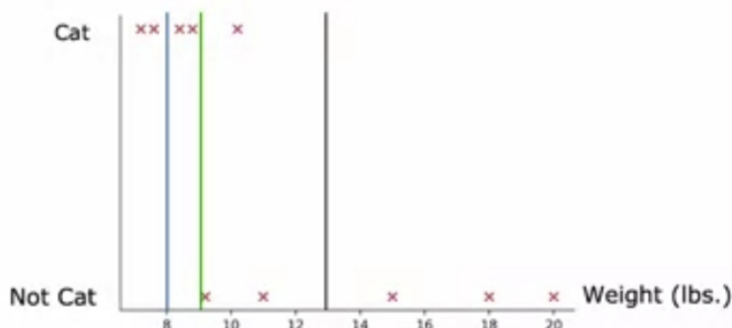
○ [1,0,0]

○ [0, 1, 0]

○ [1, 1, 0]

◉ [0, 0, 1]

4.

Splitting on a continuous variable

$$H(0.5) - \left(\frac{2}{10}H\left(\frac{2}{2}\right) + \frac{8}{10}H\left(\frac{3}{8}\right)\right) = 0.24$$

$$H(0.5) - \left(\frac{4}{10}H\left(\frac{4}{4}\right) + \frac{6}{10}H\left(\frac{1}{6}\right)\right) = 0.61$$

$$H(0.5) - \left(\frac{7}{10}H\left(\frac{5}{7}\right) + \frac{3}{10}H\left(\frac{0}{3}\right)\right) = 0.40$$

For a continuous valued feature (such as weight of the animal), there are 10 animals in the dataset. According to the lecture, what is the recommended way to find

the best split for that feature?

○ Use a one-hot encoding to turn the feature into a discrete feature vector of 0's and 1's, then apply the algorithm we had discussed for discrete features.

○ Use gradient descent to find the value of the split threshold that gives the highest information gain.

⦿ Choose the 9 mid-points between the 10 examples as possible splits, and find the split that gives the highest information gain.

○ Try every value spaced at regular intervals (e.g., 8, 8.5, 9, 9.5, 10, etc.) and find the split that gives the highest information gain.

✓ **Correct**
Correct. This is what is proposed in the lectures.

5.

1 / 1 point

Which of these are commonly used criteria to decide to stop splitting? (Choose two.)

☑ When the tree has reached a maximum depth

✓ **Correct**
Yes!

☑ When the number of examples in a node is below a threshold

✓ **Correct**
Yes!

☐ When the information gain from additional splits is too large

☐ When a node is 50% one class and 50% another class (highest possible value of entropy)