Shashank Shekhar **ECE542_Lobaton**
Assignment Homework1 due 01/17/2019 at 08:00pm EST

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1. (1 point) If we were to increase the degrees of freedom (DoF) for a machine learning model (e.g. by increasing the number of parameters, or decreasing the effect of regularization). What do we expected for the training error?

- **A**. It would increase as DoF increases.
- **B**. It would decrease and then increases.
- **C**. It would decrease as DoF increases.
- **D**. It would increase and then decrease.
- **E**. None of these

Answer(s) submitted:

- C

(correct)

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2. (1 point) If we were to increase the degrees of freedom (DoF) for a machine learning model (e.g. by increasing the number of parameters, or decreasing the effect of regularization). What do we expected for the validation error?

- **A**. It would increase as DoF increases.
- **B**. It would decrease and then increases.
- **C**. It would decrease as DoF increases.
- **D**. It would increase and then decrease.
- **E**. None of these

Answer(s) submitted:

- B

(correct)

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3. (3 points) Given that you split a dataset into training, validation and testing sets, and have a model that requires a regularization coefficient α (e.g. a penalty on the magnitude of the parameters) and the number of optimization steps N to be specified.

1. Is α considered a hyper-parameter?

- **A**. Yes
- **B**. No
- **C**. Sometimes

2. Is N considered a hyper-parameter?

- **A**. Yes
- **B**. No
- **C**. Sometimes

3. What split would you use to fit the model when looking for an appropriate value of α?

- **A**. Training
- **B**. Validation
- **C**. Testing
- **D**. Training and Validation
- **E**. Training and Testing
- **F**. Validation and Testing
- **G**. All

4. What split would you use to to evaluate the model when looking for an appropriate value of α?

- **A**. Training
- **B**. Validation
- **C**. Testing
- **D**. Training and Validation
- **E**. Training and Testing
- **F**. Validation and Testing
- **G**. All

5. What split would you use to to fit the model after you have identified appropriate values of α and N?

- **A**. Training
- **B**. Validation
- **C**. Testing
- **D**. Training and Validation
- **E**. Training and Testing
- **F**. Validation and Testing
- **G**. All

6. What split would you use to to evaluate the model after you have identified appropriate values of α and N?

- **A**. Training
- **B**. Validation
- **C**. Testing
- **D**. Training and Validation
- **E**. Training and Testing
- **F**. Validation and Testing
- **G**. All

Answer(s) submitted:

- A
- A
- A
- B
- D
- C

(correct)

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4. (1 point) Given that x_1 and x_2 are conditionally independent given x_3. Then which expression is equivalent to $p(x_1|x_2,x_3)$?

- **A**. $p(x_1|x_2)$
- **B**. $p(x_1|x_3)$
- **C**. $p(x_1)$
- **D**. $p(x_1|x_2)p(x_1|x_3)$
- **E**. $p(x_1|x_3)p(x_1)$
- **F**. $p(x_1|x_2)p(x_1)$
- **G**. All
- **H**. None

Answer(s) submitted:

- B

(correct)

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5. (1 point) Given random variables x_1, x_2 and x_3 where x_1 and x_2 are independent. Then what is an equivalent expression for $p(x_1,x_2,x_3)$?

- **A**. $p(x_1)p(x_2)p(x_3)$
- **B**. $p(x_1|x_3)p(x_2|x_3)p(x_3)$
- **C**. $p(x_3|x_1,x_2)p(x_1)p(x_2)$
- **D**. $p(x_3|x_1)p(x_1)p(x_2)$
- **E**. $p(x_3|x_2)p(x_1)p(x_2)$

Answer(s) submitted:

- C

(correct)

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6. (3 points) What are the gradients of following functions:
e.x. $f(x,y) = x^2 + y^2$, $\nabla f(x) = [2x, 2y]^T$.
$f(x,y) = x^7y + 7y$, $\nabla f(x) = [$_____$]^T$ help (formulas)
$f(x,y) = x^9e^{6x} + \ln y$, $\nabla f(x) = [$_____$]^T$ help (formulas)
Answer(s) submitted:

- `7*x^6*y, x^7+7`
- `6*e^(6*x)*x^9 + 9*x^8*e^(6*x), 1/y`

(correct)