# Question: 3. Jensen-Shannon Divergence between two distributions f a...

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3. Jensen-Shannon Divergence between two distributions $f$ and $g$ is defined as

$$\mathrm{D}_{JS}(f\|g) = \frac{1}{2}\mathrm{D}_{\mathrm{KL}}\left(f\|\frac{f+g}{2}\right) + \frac{1}{2}\mathrm{D}_{\mathrm{KL}}\left(g\|\frac{f+g}{2}\right)$$

. Show that it is symmetric and zero only of $p = q$.

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## Expert Answer

Anonymous answered this
34 answers

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```
from numpy import zeros, array
from math import sqrt, log


class JSD(object):
    def __init__(self):
        self.log2 = log(2)


    def KL_divergence(self, p, q):
        """ Compute KL divergence of two vectors, K(p || q)."""
        return sum(p[x] * log((p[x]) / (q[x])) for x in range(len(p)) if p[x] != 0.0 or p[x] != 0)

    def Jensen_Shannon_divergence(self, p, q):
        """ Returns the Jensen-Shannon divergence. """
        self.JSD = 0.0
        weight = 0.5
        average = zeros(len(p)) #Average
        for x in range(len(p)):
            average[x] = weight * p[x] + (1 - weight) * q[x]
            self.JSD = (weight * self.KL_divergence(array(p), average)) + ((1 - weight) *
self.KL_divergence(array(q), average))
        return 1-(self.JSD/sqrt(2 * self.log2))

if __name__ == '__main__':
    J = JSD()
    p = [1.0/10, 9.0/10, 0]
    q = [0, 1.0/10, 9.0/10]
    print J.Jensen_Shannon_divergence(p, q)
```

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Q: Consider the BiGAN and its loss function. Show that, in order to fool a perfect discriminator D, BiGAN encoder E and generator G must invert each other. That is, G(E(x)) = x and E(G(z)) = z

A: See answer

Q: As KL divergence is not necessarily symmetric on distributions p and g, one naturally attempt to symmetrize it by introducing DSKL (pllg) (DKL (plla) DKL (gllp)) Accordingly, we can use it to define a new notion of mutual information over two random variables X and Y: Construct a joint distribution on (X,Y) where both X and Y are valued in f0, 11, such that the following analogue of...

A: See answer

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